Knowledge Management and Diffusion

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Ali Almossawi
Genevieve Flanagan
Joshua Eaton
José Manuel Arias Calvo
Andres Kütt
Pankaj Kashyap

"The Knowledge Management (KM) craze has commenced!"
- Liebowitz 1999

1 Knowledge Management and Diffusion Introduction

Knowledge management and diffusion is becoming more of an important topic as organizations realize that their primary competitive advantage is in their people rather than in technologies or processes. In this collection of papers, we cover several of the most fundamental areas in this field and critically analyze the material wherever applicable. Since the literature on knowledge management does not always flow in the same direction, the intent of this document is not to have papers that seamlessly agree with each other, but rather ones that complement each other's primary focuses in a way that provides value to the reader.

In the first paper, we cover some of the common barriers to knowledge sharing and discuss why they exist and how managers may be able to mitigate it in their own organizations. Therein, we reference literature that challenges the widely-accepted belief that motivation is the primary source for lack of knowledge sharing in organizations and, wherever applicable, tie the discussion to anecdotes.

In the second paper, we look into how metrics and performance measures may be applied to knowledge management processes in order to gauge whether or not an organization has successfully implemented it. There, we present several models and then tie the discussion to case studies.

In the third paper, we look closely at the issue of diffusion and how knowledge can be effectively converted from tacit to explicit, thereby aiding its transfer within the organization. The paper discusses in some detail four conversion patterns that follow the SECI model. The model provides a framework for analyzing the interaction between explicit and tacit knowledge and the method in which knowledge is converted between individuals, groups and organizations.

In the fourth paper, we focus on information systems and how they can be used to facilitate knowledge sharing in organizations as well as form the foundation for a knowledge management system. The paper looks at how information systems can support the four patterns of the SECI model and reflects on the merits of implementing a well-thought out information system in an organization to support knowledge management.

The fifth paper looks at the issue of "organizational culture" and how it relates to knowledge management. It is constantly said that one needs to "get the culture right" to get KM right but

literature appears to be lacking when it comes to defining what "right" means. The paper proposes evolving knowledge management into the systems thinking-based concept of organizational learning that may also encompass the concept of culture.

In the sixth and final paper, we review various knowledge management practices and tools prevalent in 1999 and discuss the importance of ensuring that knowledge and corporate strategies are aligned in order to make said practices and tools relevant. The paper proposes different ways of categorizing knowledge and reflects on how that relates to the organization's overall state.

The papers provide a good overview of the theoretical groundwork in knowledge management and diffusion while at the same time reflecting on practical implementations of said groundwork. The latter ensures that critical analysis of the theory being presented is maintained throughout and thus allows the discussion to be pertinent to practitioners. Our primary goal is for this document is to contain a solid set of recommendations that practitioners may immediately implement in their respective organizations.

2 Barriers to Knowledge Sharing

Ali Almossawi

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1 Overview and motivation

As technologies, products and services become more commoditized due to fiercer global competition, organizations have realized that their intangible assets play an important part in giving them a competitive edge. For some organizations, intellectual capital is their life and soul, without which they would not be able to operate with much effectiveness. Thus, knowledge has become their only source of competitive advantage (Rosenthal, 2001). It is for that reason that the area of knowledge management has been receiving increasing interest, particularly since the seminal work by Nanoka and Takeuchi was published in 1995, which formalized a model for knowledge management in organizations. And yet we find that despite organizations' acknowledgement that knowledge management is a critical factor for their success, a sizable number of them appear to have issues implementing successful processes and frameworks. This chapter looks at some of the barriers to knowledge sharing that exist today, drawing from literature as well as anecdotes, and then discusses specific tactics that may be employed by practitioners to mitigate or overcome those barriers.

Section 2 presents a summary of some of the key barriers to knowledge sharing. Section 3 looks more closely at a subset of those concepts, tying the analysis to the author's industry experience wherever applicable. Finally, section 4 provides a set of recommendations for practitioners to overcome said barriers.

2 A summary of key concepts

In his work on knowledge sharing, Riege presents a classification of barriers to knowledge sharing, categorizing them into three main buckets: individual, organizational and technological (Riege, 2005). Other sources of literature make reference to several of those barriers but without considering their categorizations (e.g. Ichijo and Nonaka, 2007). Since considering the categories is

a valuable way of thinking about the set of barriers, Riege's classification shall be used as a guiding foundation for the discussion henceforth. A subset of Riege's potential barriers shall be discussed below and further analyzed in the next section.

Individual barriers are those that originate from individuals' behaviors, perceptions and actions. They include fears, uncertainties and deficiencies that exist in individuals at a personal level and influence, to varying degrees, their motivation to actively participate in knowledge sharing. Communication skills play a critical role in employees' abilities to share knowledge (Davenport and Prusak, 1998 via Riege, 2005) and hence, lack of communication skills presents one of the most fundamental impediments to knowledge sharing. A second dimension of communication is the level of intimacy between employees in the organization: knowledge sharing is less likely to happen in one were employees do not share healthy relationships (Szulanski, 1996).

Another individual barrier is culture, that is, wherever it is that employees come from and the ideals that end up being inculcated in them as a result. Riege references several sources (Ford and Chan, 2003; Michailova and Husted, 2003 and others) that have looked into the issue of culture as it relates to knowledge sharing and have reported that differences in culture do in many cases present obstacles that can affects organizations' abilities to implement knowledge sharing. This barrier leads to another important one, which is to do with how accepting managers in an organization are of people making mistakes, admitting them and then drawing lessons from them. Different cultures have different takes on the value of mistakes. For example, while the Japanese culture views mistakes in a positive light, believing that they allow organizations to learn and grow (Nonaka and Takeuchi, 1995), other cultures such as that of Russia prefer not to talk about mistakes (Michailova and Husted, 2003 via Riege 2005).

Job security is also an important barrier (Riege, 2005). A sizable number of people, a demographic that may be correlated to cultures, fear that revealing too much of their knowledge would put them at a disadvantage and reduce their worth to the company. Furthermore, reluctance may be due to one's fear of not being rewarded for sharing knowledge (Szulanski, 1996). Such fears ultimately lead to a major barrier in knowledge sharing that Management would have to effectively mitigate via education and direction.

Yet another important barrier is an employee's lack of solid understanding of why it is that what they do works the way it does. In his study of best practices in organizations, Szulanski concludes that one of three major barriers to knowledge transfer is causal ambiguity, that is, the inability of one to realize the successes or failures of a process due to limited understanding of how it works.

Organizational barriers are those that transcend the individual in an organization and exist at the overarching level of the organization. One of the most important organizational barriers is that of misalignment between a company's business strategies and their knowledge management strategy, where employees find no incentive to participate in knowledge sharing because of it being considered a periphery activity that has no impact on company goals, one's own career plan, etc. Another barrier noted by Riege is lack of resources, whether in the form of managerial leadership and drive or physical resources, i.e. dedicated spaces. Managerial direction is crucial since employees need to achieve buy-in of the concept and be aware of the merits of participating in it both for themselves and for others (Ichijo and Nonaka, 2007; Ives et al., 2000 via Riege, 2005).

Technology barriers are extremely important since knowledge sharing today tends to happen through the medium of information systems. Having technology that is not suitable, too complicated or ineffective can completely render an organization's attempts useless. For example, an organization requiring employees to create a new user account for the knowledge management system instead of using their corporate usernames and passwords is almost guaranteed to face challenges in their feat to encourage knowledge sharing because by doing that, they raise the cost to employees of participating in the process. The more seamless and less expensive, so to speak, it is for employees to share knowledge, the more likely they are to do so.

3 Looking more closely at the top barriers to knowledge sharing

In section 2, a subset of potential barriers to knowledge sharing drawn from literature was discussed. In this section, the barriers that Szulanski concluded were the top three barriers in knowledge sharing in his study of best practices in eight organizations will be analyzed and tied to anecdotal experiences. All three barriers fall into the "individual" category since they affect employees at the personal level and their relationships with each other. The main reason for focusing on these particular barriers is because they are a result of a systematic study and because they go against what one would expect to be the primary barrier to knowledge sharing: "lack of motivation". It is for that reason that I felt it of value to look at them more closely and consider how one may draw recommendations from them.

Recipient's lack of absorptive capacity - Absorptive capacity refers to an employee's ability to realize the value of knowledge that comes their way, appropriately assimilate it and then successfully implement it. In Szulanski's findings, lack of absorptive capacity was a top barrier to knowledge sharing. Anecdotally, this resonates well; at my former place of work, there was no formal training program or acclimation process in place for new recruits. So what ended up happening was that people would get hired and then learn most of the skills necessary to get by on-the-job. What that meant was that, ultimately, employees operated within silos of extremely idiosyncratic knowledge and were not prone to receiving further knowledge from others and reflecting on how that new knowledge could possibly help them become, say, more efficient. They exhibited a special kind of "not invented here" syndrome on a software module level. This behavior had wide-ranging implications by affecting the organization structure as well as the organization's effectiveness in responding to crises[1].

Causal ambiguity - What Szulanski calls "Causal ambiguity" refers to an employee's inability to distinguish cause from effect when it comes to some particular process. Put differently, it indicates the person's incomplete understanding of what it is that they are doing and hence cannot possibly codify it (that is, turn it into tacit knowledge) and share it with others. Again, this has clear anecdotal resonance. The majority of our senior software development team in my former place of work was made up of developers who although were hard-workers, were not fully aware of the technical landscape that we operated within and the best practices that were out there. As a result, a lot of what they did and what they knew had come about from a mixture of hand-waving, trial-and-error and hacks. In addition to that, they had a different national culture than the other half of employees, which appeared to see that type of learning as perfectly valid[2]. Therefore, getting the seniors to share their knowledge with the juniors was an immensely challenging feat because the former group 1) did not wish to make it apparent that much of their knowledge had been hacked together by experience and had no solid grounding, and 2) in some cases, they were simply unable to put their knowledge into words because they themselves had no clear picture of causality within their processes: they were doing something that was giving the desired result, but no one really knew what exactly that something was.

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[1] Employees were "hard-mapped" to specific modules in the enterprise software system being developed, meaning that an employee working on a particular module would be the only person who knew his or her way around it.

[2] I am not judging whether or not that is a good way of getting things done; despite its obvious flaws, it may well be when faced with immense pressure and tight deadlines.

Arduous relationships - Ease of communication and intimacy of relationships play a major role in facilitating knowledge sharing, as Szulanski points out, while referencing Nonaka and others. Indeed, it may seem too blazingly obvious a correlation that an organization made up of a strong social network of employees who share healthy relationships with each other is more likely to have people sharing knowledge with each other, helping each other out, etc. compared to an organization were relationships are unhealthy, that is to say, where employees mistrust each other, fear for their jobs, compete in a destructive manner, etc.

4 Recommendations for practitioners

Synthesizing the discussion in the previous sections, which have drawn from literature as well as anecdotes, it is fitting to suggest the following list of recommendations for practitioners:

- Incentives alone are unlikely to facilitate knowledge sharing since statistical findings suggest that motivation is not really one of the top barriers to knowledge sharing. It is worthwhile to look further into educating employees to ensure that they are all exposed to the same common fundamentals for the skills needed for the job.
- It is crucial for Management to align their corporate strategies with their knowledge management one. One way of doing this is to ensure that whatever overarching process is used in the organization has dedicated stages for knowledge sharing. In my former place of work, I modified our software development process by adding a "post-mortem" stage to end of each software release cycle that involved up to two days of knowledge sharing activities. Frameworks such as the People-CMMI already have such a dedicated step (Curtis et al., 2009)
- Management must ensure that employees in no way relate hoarding of knowledge with job security. One way of doing this is to make participation in knowledge sharing activities part of one's performance review.
- A cohesive team is fundamental to having an environment that affords knowledge sharing. Management must therefore realize that employee morale is tied to their willingness to, among other things, share knowledge, and must hence ensure that processes are in place to guarantee that morale remains high.
- Technology mustn't be used simply for the sake of using it. If a knowledge management process is to be supported by an information system, then it must take into consideration the organization's idiosyncrasies and be compatible with employees' experiences, abilities and tendencies. Information systems that integrate into existing enterprise suites are usually the best since they have a learning curve so small that it is usually negligible.

3 Applying Metrics to Knowledge Management Systems

Genevieve Flanagan

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1.0 Introduction

Knowledge Management (KM) is not a new concept given we learned the first journal publication documenting a topic was in about 1650 (Allen, 2011). Ironically, however, discussions around the topic of KM have only recently been documented in journals with most articles beginning to show up starting in 1996 based on a database search by Zhang and Zhao (2006). The documents emerging in this timeframe all stress the importance of KM and how best to promote it within organizations. One way to help promotion includes applying metrics to an organizations capability to manage their knowledge; as stated by Fairchild (2002) "Although the focus on corporate culture and organizational change may extend the timeframe for a knowledge management program, only measurable benefits justify increased duration and cost in the eyes of senior management" (p.244).

This chapter will first report some of the information gathered from various readings on metrics and performance measures in the area of KM. It will then present three cases I have been personally involved with that represent very different examples of KM implementation. The concepts found in the literature will then be applied to these cases to make recommendations on how to improve each case.

2.0 Discussion of KM Models for Metrics

The first conclusion I gained from the literature is that there are quite a number of ideas of how to measure KM and many different frameworks with which to do so. In fact, many of the references displayed their own summaries of their literature searches. As a result of the large number, three models will be discussed that represent increasing levels of complexity in metric frameworks and provide the groundwork for a discussion of metrics for KM. A few example metrics will be provided

as well; Bose (2004) noted that one study at Skandia AFS, by itself, identified 164 metric measures for KM, and therefore the sample presented will be only a fraction of the possibilities.

2.1 Womack's Participation then Business Value

One of the simplest examples of KM metrics was described by Womack (2001) as having two aspects: measuring the end-user participation and then measuring the value to the business. Womack's justification for this was "if enough momentum is gained in driving usage and participation up, we then have a foundation for measuring impacts on bottom line business performance" (p.371). Indicators of the former aspect were well characterized by O'Dell and Grayson (1998) as they were looking for a way to measure the effectiveness of KM. Some of their metrics included measuring the frequency of use of a KM system and the user satisfaction in using the system. Additionally, it was suggested an increase in networks within organizations as KM systems are deployed. Tom Allen (2011) has shown some results of studies he had done in the past that may be useful in applying a metric to internal networking.

Metrics around KM and its value to the business are extensive. Liebowitz and Wright (1999) have a number of metrics presented from various sources. A couple of relevance include "sales of new products less than five years old as a percent of total sales" (p. 5-2) and "Patent-to-stock price ratio:" (p. 5-5).

2.2 Beckman's Results, Processes, Resources

Another model of KM metrics presented by Beckman (1999) indicates how concentrating on different aspects of KM will help to focus on the various time prospects of KM. First, by looking at results of KM, the metrics are putting focus on what has been done, or in the past. Then, by applying metrics to the KM processes, the present situation can be evaluated. Finally, in order to understand the state of the future of KM in an organization, metrics can be applied to the resource investment in KM.

Metrics that match the results may include the number of reports generated by an organization, size of a KM database, or as suggested in an Canadian Management Accountant's report displayed by Bose (2004), the number of ideas used. These metrics will help an organization understand if the KM system has been successful.

To measure the process, my favorites include one listed from Dow Chemical by Liebowitz and Wright (1999): the percentage of people using a system. Another very good index was documented by Liebowitz and Suen (2000) from a report from Leif Edvinsson and Michael Malone for Skandia AFS: processing time to find information. These metrics are useful to understand how well the KM is currently working.

To measure resources, there are again numerous metrics to utilize. These could be monetary, such as the percentage of revenues invested back into the KM system as is done at Buckman Laboratories and presented by Liebowitz and Wright (1999). They could also be measures of potential knowledge in the company. Karl-Erik Svieby is referenced by Liebowitz and Wright (1999) with an example of measuring turnover. In this same publication by Liebowitz and Wright (1999), Nuala Beck recommends a "knowledge ratio: expresses the number of knowledge workers as a percentage of total employment in an … organization (measures the 'Corporate IQ')" (p. 5-5). These example metrics show how understanding the resources in an organization can help to position it well for future performance in KM.

2.3 ICM Group's Multi-aspect Model

The final model to discuss is more complex. It resembles what much of the work was referenced in many of the papers – that was introduced by Skandia AFS (Beckman, 1999; Bose, 2004; Fairchild, 2002; Liebowitz & Wright, 1999; Liebowitz & Suen, 2000; Roos & Roos, 1997). Attempting to align with the balanced scorecard approach (Fairchild, 2002; Roos & Roos, 1997), this model focuses on a holistic view of KM. I particularly liked a version discussed by Liebowitz and Suen (2000) that was put together by the ICM group. This model looked at five aspects of KM and the metrics that could be done on each. The list is shown below, with a couple of example metrics under each bullet, again provided in the Liebowitz and Suen (2000):

- Value Extraction: Revenues from new business, return on assets
- Customer Capital: Number of new customers, average time from contact to sale
- Structure Capital: IT investment, corporate quality performance
- Value Creation: Training expense / employee, R&D investments
- Human Capital: Average years of service, percent of company managers with advanced degrees, number of female managers

3.0 Discussion of Cases

Three cases are discussed below to illustrate some examples of KM in industry and to apply the models and metrics discussed above. Note that these cases focus on a KM database system and not other aspects of KM. Each of these cases represents a phase of KM transformation as presented by Womack (2001). The first stage is the initial adoption of KM, followed by a loyalty phase, and finishes with a true collaboration phase when KM has matured within an organization.

3.1 John Deere Power Systems

In the Power Systems organization at John Deere, there is a general lack of KM, only awareness – making this an example of the adoption phase in KM. Information is stored on individual network drives that are not organized or easily searchable. The best example of documented knowledge is PowerPoint presentations, which are stored in the same network drive system. When a colleague

responded to a question I had asked about KM, he responded that the system worked very well. He then proceeded to describe a recent example where he needed to know something from a program 10 years old. His solution was to go speak with the person who ran the data for the project. That contact then looked through his archived network drives to find the data, and he was then able to recall the project and discuss the details. This is a rare occurrence and in cases of high turnover, this would have been impossible.

As the organization begins to implement a KM system to better handle the above situation, it is critical to apply metrics in order to convince top management that the implementation is working and to encourage users to participate. The first model discussed above from Womack (2001) had two aspects of KM to measure: user-participation and business value. This model would apply well in this case.

The user-participation metrics could help determine the level of acceptance of the new system to see how it is progressing to the loyalty phase. The business value metrics would serve as justification to senior management as to the continued investment in this system. Besides these benefits, this model is very simple helping to prevent one of the pitfalls discussed by Womack (2001) in "using too many metrics" (p. 374) particularly at such a nascent stage.

3.2 Heavy Duty Engineering at Cummins, Inc.

The KM system in place in the heavy duty engine division at Cummins, Inc. (as of greater than five years ago), consisted of a technical library that had one to two employees, and was a simple PDF database containing technical documents and was representative of a system in the loyalty phase. There was a web-based user interface to search the database. Within the organization, participation to this library was encouraged against a single metric – a contribution to an employee's annual rating was based on the number of reports submitted throughout the year. This resulted in a database relatively rich in knowledge and simple to use and find reports.

The problem with this system was aligned with Moore (1999) who noted the importance of project management and quality control in the metrics; the former measures quantity, the latter measures defects and effectiveness. In this example, the quality control is missing in the metrics. Therefore, as Womack (2001) was quoted "we are what we measure" (p. 372), the metrics above typically result in over submission of reports. That is, breaking the reports into chapters and submitting them individually, or slapping a cover sheet on a meeting presentation in lieu of a report.

By applying Beckman's model discussed above, additional metrics may be useful to improve the quality of knowledge stored in the existing database. The results focusing on the past have an

existing measurement on the number of reports submitted. However, by changing this to the number of reports utilized is a more holistic measurement of quantity and quality. Adding measures to the process and resources can help to be sure to develop this system into the full collaboration phase. These metrics may involve analyzing the satisfaction in using the system for the process, and the knowledge ratio suggested earlier to understand the resources of knowledge.

3.3 MIT Libraries

The final KM case to discuss is that of the MIT Libraries. This system is clearly the most intricate of the three cases and is in the full collaboration phase. There are numerous resources that are at the fingertips of any MIT community member. This is driven by many metrics: tenure as a result of many peer-reviewed (aka quality control) publications, or graduation with a completed quality thesis.

With the high volume and quality system, however, comes incredible complexity. After attending an hour-long session given by one of the MIT Librarians, it was clear that learning the intricacies of using MIT's system takes many more sessions.

Because this system is mature, it can benefit greatly from a more complex set of metrics as presented by the ICM Group above. The idea would be to use these metrics to ensure maintaining quality while improving the holistic application such as knowledge retrieval efficiency.

4.0 Conclusions

As discussed in this paper and in the applications of the lessons, the advantages of KM metrics are clear as ways to promote a KM system and to help guide that system through its transformation from early beginnings to full collaboration.

However, there can be numerous drawbacks to metrics – some of which were covered above. Besides the obvious points of paralysis by analysis, Fahey and Prusak (1998) devoted one of their eleven sins of KM to metrics: "Seeking to Develop Direct Measures of Knowledge" (p. 273). They discuss the need to measure the flow of knowledge as opposed to its stocks. Additionally, Liebowitz and Suen (2000) identified an error in metrics without a point of reference: "how can we interpret what they mean? Are there baselines or benchmarks to measure against these numbers?" (p. 66).

With this in mind, it is important to choose metrics that are appropriate for an organization. Those metrics should place focus on not only the quantity, but quality of knowledge as well as monitoring the effectiveness of its flows.

4 Knowledge Management and Diffusion: Knowledge Conversion

Joshua Eaton

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1.0 Introduction

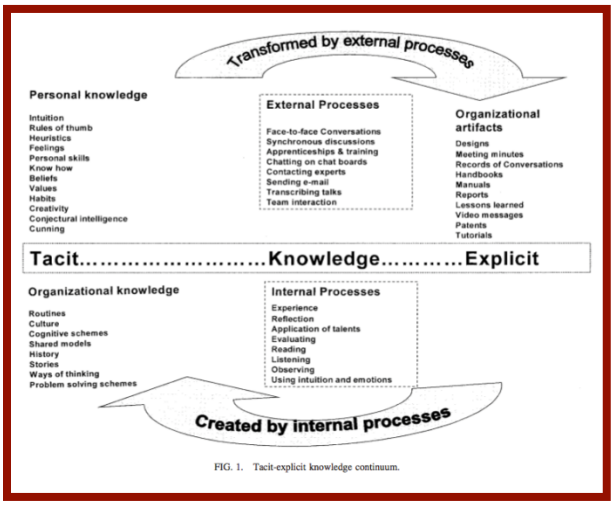
Companies and organizations are searching for a means to increase their competitiveness in the marketplace, which is placing significant emphasis on the way knowledge is captured, converted, stored and diffused. "In post-capitalism, power comes from transmitting information to make it productive, not from hiding it" (Drucker, 1995 located in Alavi, 2001, pg. 108). Knowledge conversion is a dynamic process between explicit and tacit knowledge, which leads to the creation of new knowledge. Knowledge is defined as "a justified belief that increases an entity's capacity for effective action" (Huber 1991; Nonaka 1994).

This chapter will define tacit and explicit knowledge and explore the four conversion patterns that follow the SECI Model, which includes Socialization, Externalization, Internalization and Combination (Nonaka et al., 1998). The model provides a framework for analyzing the interaction between explicit and tacit knowledge and the method in which knowledge is converted between individuals, groups and organizations (Nonaka et al., 1998). This chapter will also demonstrate the criticality of having an effective Knowledge Management System (KMS) that converts implicit knowledge to explicit knowledge using a case study that demonstrates a successful KMS that the Honeywell Corporation developed and implemented. An organization's ability to capture, convert and diffuse knowledge will directly impact their competitiveness in the marketplace, which is leading to the creation of systems such as the Process Knowledge System (PKS) in Honeywell.

2.0 Summary of Key Concepts

2.1 Knowledge Conversion: Tacit and Explicit Knowledge

Before we take an in-depth look into the SECI model, it is critical to define tacit and explicit knowledge and how this knowledge relates to knowledge conversion. Tacit knowledge is defined as knowledge that is derived through actions, procedures, routines, commitment, ideals, values, and emotions over a period of time (Nonaka et al. 1996, 2000a, b). Tacit knowledge is difficult to measure, quantify and transfer because it is based on one's personal experience. Tacit knowledge, arguably, is the most critical form of knowledge and is difficult to represent in language, writing or tools (Hildreth and Kimble, 2002). For this reason, the skill of an individual or organization to transfer tacit knowledge to explicit knowledge is absolutely critical to capturing and diffusing knowledge within an organization. The detailed diagram above does an adequate job outlining the differentiation between tacit and explicit knowledge along the continuum, which includes both personal and organizational knowledge.



Tacit and Explicit Knowledge Continuum

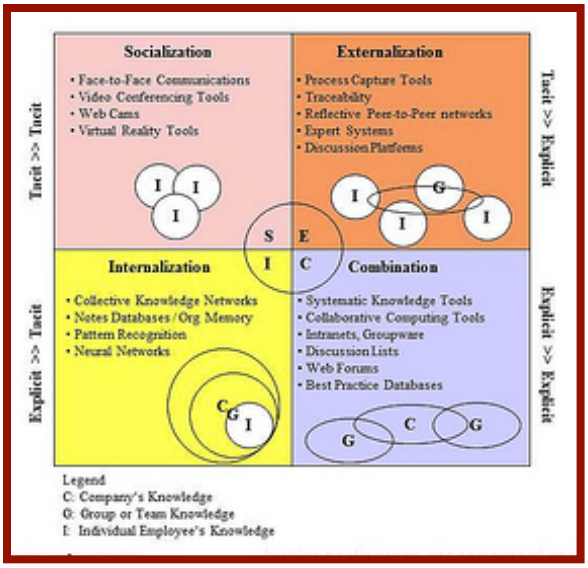
(McInerney, 2002, pg. 1015)

Explicit knowledge is knowledge that is explained, recorded or documented in a deliberate, systematic manner (McInerney, 2002). Examples of explicit knowledge include service manuals for an automobile, a military field manual outlining patrolling techniques or a technical report in a company aiming to capture expertise and lessons learned during a particular controlled experiment. An example of explicit knowledge may be a technical report on the load capacity of a John Deere tractor tire, which an engineer filed in order to document the results of the experiment for future designs. Now that we have defined and examined tacit and explicit knowledge, we will examine the SECI model as a key concept within knowledge conversion.

2.2 SECI Model

The first component of the SECI model is socialization, which is characterized as the sharing of knowledge between individuals through joint activities, such as spending time together, living in the same environment and taking part in social activities (Nonaka, 1998). An apprenticeship is a good example on how socialization takes part in an industry, allowing the newcomer an opportunity to learn from a more experienced expert in a particular field. This immersion allows the apprentice time to experience a "self-transcendence," which is a fundamental aspect in sharing an individual's tacit knowledge (Nonaka et al., 1998, pg. 42).

The second conversion pattern is through externalization, which is the transfer of tacit knowledge through translation into a form, which others can comprehend (Nonaka et al., 1998). During this process, the individual "commits to the group" and becomes "one with the group" (Nonaka et al., 1998, pg. 43-44). The summation of all the individuals' tacit knowledge is integrated into the group and builds up the knowledge of that group, therefore increasing the group's knowledge.



SECI Model (Nonaka et al., 1998, image from http://www.flickr.com/photos/drawpack

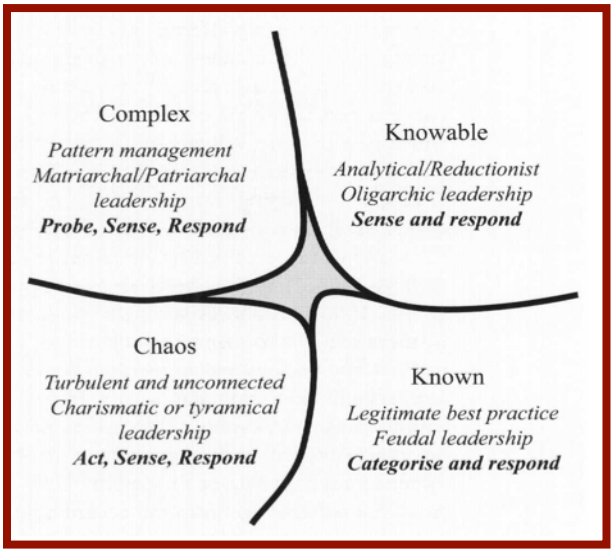
The third conversion pattern is combination, which "involves the conversion of explicit knowledge into more complex sets of explicit knowledge" (Nonaka et al., 1998, pg. 44-45). The SECI model captures this process, which illustrates multiple groups committing to the larger organization through the sharing of their explicit knowledge. In this conversion pattern, the groups aim to capture explicit knowledge so the organization can benefit from the aggregation of this knowledge.

The fourth conversion pattern is internalization, which is "the conversion of explicit knowledge into an organization's tacit knowledge" (Nonaka et al., 1998, pg. 45). Training programs are a prime means for an individual or "trainee" to understand the organization and themselves, therefore internalizing the strategies, tactics and methods of that organization in accomplishing tasks (Nonaka et al., 1998). Critical in the internalization is On the Job Training (OJT) or learning by doing, which ensures the explicit knowledge is turned into tacit knowledge that the organization will benefit from.[i]

3.0 Critical Analysis

3.1 David Snowden's Cynefin Model

David Snowden, author of "Complex Acts of Knowing: Paradox and Descriptive Self-Awareness," argues that KM and creation is divided into three generations, with the first generation focusing on timely information for decision support and in support of Business Process Re-engineering (BPR) initiatives (Snowden, 2002). The SECI model replaced the first generation; however, the model is no longer adequate in describing and explaining knowledge conversion and creation, as it is a too simplistic approach. Snowden argues that Nonaka's SECI model is a useful set of models and tools; however, Snowden rejects "the assumed universality of tacit-explicit conversion" (Snowden, 2002, pg. 100). He argues that knowledge is both a "thing" and a "flow" and models this relationship using the Cynefin Model above.[ii]



Cynefin Decision Making Model
(Snowden, 2002, pg. 106)

Snowden argues for the implementation of disparate tools, practices and conceptual understanding utilizing the four spaces of the Cynefin Model, which are known, knowable, complex and chaotic (Snowden, 2002). This model is drawn from the understanding of the science of complex adaptive systems, which is directly impacted by uncertainty (Snowden, 2002). He puts forth three concepts that demonstrate the change in thinking required to manage and convert knowledge, which include first, individuals and organizations have to volunteer knowledge and cannot be forced into providing that knowledge. Second, "we can always know more than we can tell, and we will always tell more than we can write down," and third, "we only know what we know when we need to know it" (Snowden, 2002, pg. 102). He argues knowledge is triggered by circumstance, which is difficult to replicate in an uncertain and dynamic environment.

The third generation is "complexity informed," not "complexity constrained" and synthesizes the first two generations by providing a framework to give "new meaning through the interaction of the informal and the formal in a complex ecology of knowledge" (Snowden, 2002, pg. 111). He definitively recognizes the criticality of capturing knowledge and converting knowledge in an

organization in order to make that organization better, which supports Nonaka's argument that knowledge conversion leads to increased competitiveness amongst other organizations. The Cynefin Model shows multiple contexts in which knowledge can "flow" within an organization and between organizations and shows the potential "flow between different states, with different rules, expectations and methods of management" (Snowden, 2002, pg. 110).

3.2 Knowledge Transfer Among Individuals in a Group: Alavi and Leidner

In Alavi and Leidner's article "Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," the authors argue that more than before, knowledge is becoming a significant organizational resource, which is introducing mechanisms to capture organizational knowledge through different Knowledge Management Systems (KMS). The objective of a KMS is to support the creation, transfer and application of knowledge in an organization in order to gain a competitive advantage and use an organization's knowledge to make sound decisions (Alavi, et al., 2001). The article discusses the differences between explicit and tacit knowledge and the criticality of both.

The article supports a number of conclusions addressed by Nonaka and provides an excellent organizational knowledge management process model, which effectively articulates the interaction between individuals and groups. The model, which is quite different than that of the SECI model, provides an explanation on how individuals transfer tacit knowledge between one another and how individuals within a group facilitate the transfer of implicit knowledge between groups, which are part of a larger organization.[iii] Aside from the model used in this article, the conclusions are very similar in the fact that a firm's ability to capture implicit and explicit knowledge, convert it and diffuse it will directly impact their competitive advantage in the marketplace (Alavi et al., 2001).

4.0 Recommendation for Implementation: Honeywell Corporation and the Process Knowledge System (PKS)

In order to gain a competitive advantage, Honeywell understands the criticality of having direct access to the best tools and knowledge in the industry. For this reason, Honeywell developed, implemented and effectively utilizes the Process Knowledge System (PKS), which effectively builds and fosters alliances and partnerships with those companies and organizations that have subject matter expertise in their particular field.[iv] For this reason, Honeywell is a leader in providing automation solutions in numerous industries, to include, but not limited to, the power, oil & gas, mining, minerals and materials and chemical industries.[v] Honeywell developed an effective KMS that captures this expertise and makes it readily available when developing innovative solutions for

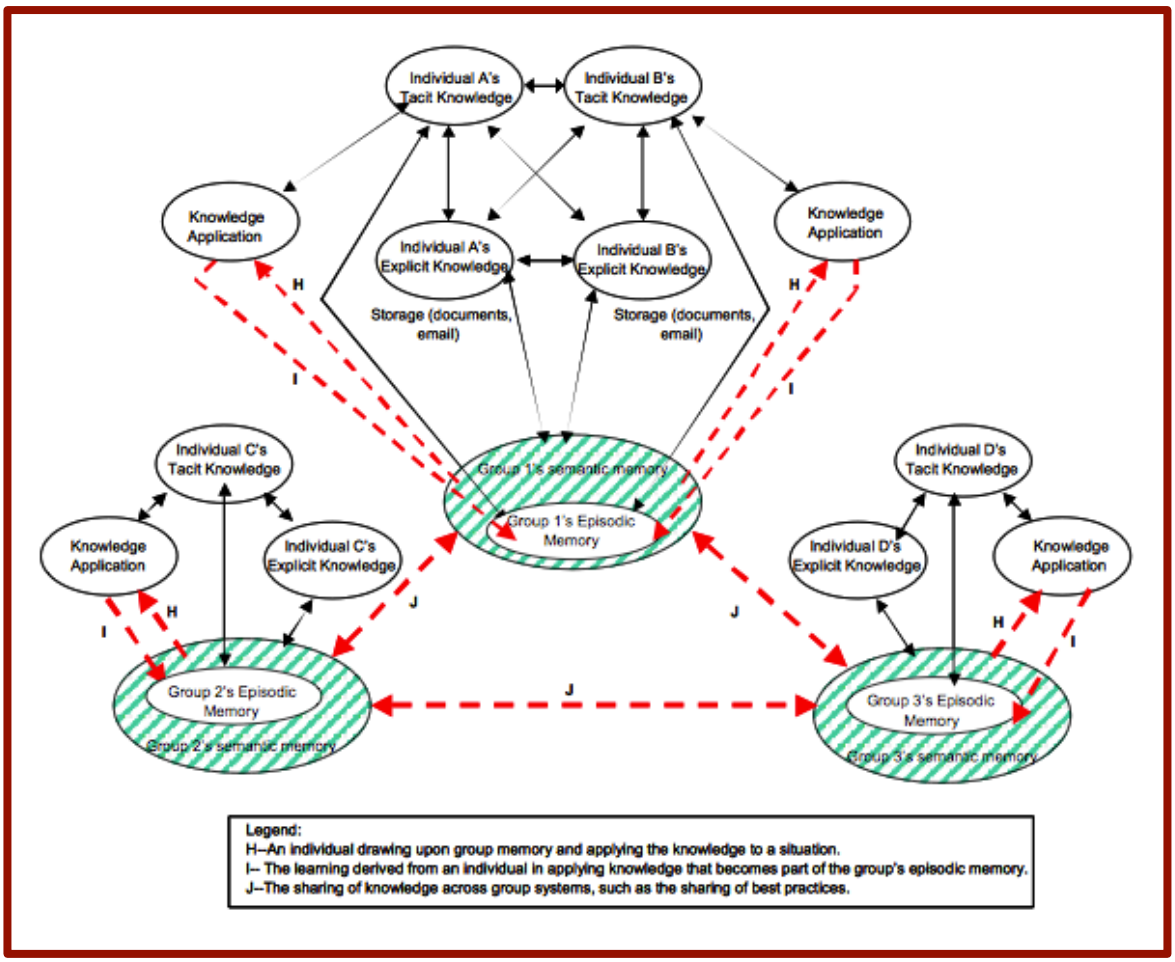
complex challenges. As a result of this collaborative effort and proven success, and based on the readings and understanding of knowledge conversion and the importance of capturing knowledge in a dynamic and mercurial environment, we recommend industry leaders encourage this collaborative and cooperative method with others in order to achieve mutually supporting goals.

5.0 Conclusion

Capturing knowledge is a dynamic process that requires a company or an organization to develop a system to capture, convert, store and diffuse knowledge in an effective and efficient manner. Because knowledge is dynamic in and of itself, an organization must recognize the criticality of developing a strategy to ensure knowledge conversion is a priority within the organization. A quotation that accurately depicts the importance of knowledge in an organization is the following: "Of central importance is the changing nature of competitive advantage - not based on market position, size and power as in times past, but on the incorporation of knowledge into all of an organization's activities" (Leif Edvinsson). The advantageous use of technology in the marketplace is an organization's "intellectual capital" and should be valued and utilized to achieve a company's objectives (Koenig, 1996; Stewart, 1998, 2001). In utilizing an effective KMS that ensures knowledge conversion, a company will meet its objectives and increase their competitive advantage in the marketplace.

[ii] Nonaka goes on to discuss the concept of "Ba," which means space in Japanese, and relates this theoretical concept to the SECI model and how the SECI model and "Ba" give insight into the dynamic process of knowledge conversion. To go into more detail on this theory will take a significant amount of space, which is better suited for the analysis of this concept and recommendation for future implementation. For more information on "Ba," see the article "The Concept of "Ba": Building a Foundation for Knowledge Creation.

[ii] "Cynefin is a Welsh word with no direct equivalent in English. As a noun, it is translated as habitat" (Snowden, 2002). "It describes that relationship: the place of your birth and your upbringing, the environment in which you live and to which you are naturally acclimated" (Sinclair, 1998).



[iii]

[iv] *Honeywell Process Solutions, a Honeywell Automation & Control Solutions Business*. 14 Apr. 2011. Web. 28 Apr. 2011. <http://hpsweb.honeywell.com/Cultures/en-US/default.htm>.

[v] Ibid.

5 Information Systems applied to Knowledge Management and Organizational Learning

José Manuel
Arias Calvo
29 April 2011

1.0 Basic Definitions

According to Laudon and Laudon (2006), "an information system can be defined technically as a set of interrelated components that collect (or retrieve), process, store and distribute information to support decision making and control in an organization." Within information systems, it can be found what Alavi and Leidner (2001) call "knowledge management systems", which "support creation, transfer, and application of knowledge in organizations." The word "support" here is important, because it is not acceptable that it is possible for a machine to create knowledge.

As McDermott (1999) puts it, knowledge is information with experience, and experience is intrinsically human, not possible for a computer. In this sense, Buckland (1991) identifies three kinds of information: "information-as-process", "information-as-knowledge" and "information-as-thing":

- Information-as-process: information is the act of informing. "When someone is informed, what they know is changed."
- Information-as-knowledge: information is used to describe what is perceived in "information-as-process". The word "perceived" here is important, and refers to what was mentioned before as experience.
- Information-as-thing: the word "information" is used for objects, like data and documents. This is because they are seen as informative.

2.0 Functions of an Information System

The concept of information system is related to the General System Theory, in the sense of feedback: "The system comprises, first, a receptor or "sense organ," be it a photoelectric cell, a radar screen, a thermometer, or a sense organ in the biological meaning. The message may be, in

technological devices, a weak current, or, in a living organism, represented by nerve conduction, etc. Then there is a center recombining the incoming messages and transmitting them to an effector, consisting of a machine like an electromotor, a heating coil or solenoid, or of a muscle which responds to the incoming message in such a way that there is power output of high energy. Finally, the functioning of the effector is monitored back to the receptor, and this makes the system self-regulating, i.e. guarantees stabilization or direction of action" (Von Bertalanffy, 1968).

Figure 1 represents the functions of an information system, which are consistent with the description of Von Bertalanffy (1968). According to Laudon and Laudon (2006), "feedback is output returned to appropriate people or activities on the organization to evaluate and refine the input."

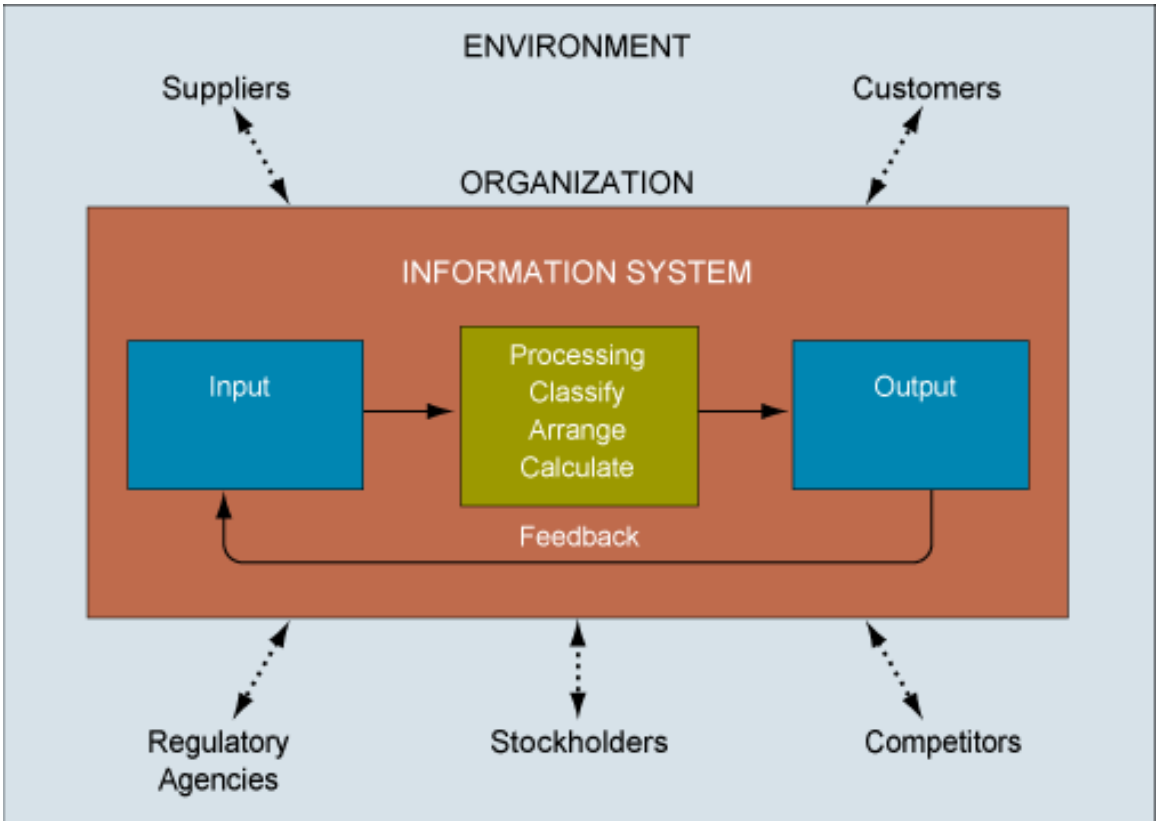


Figure 1: Functions of an information system (Laudon and Laudon, 2006).

3.0 Information Systems and Knowledge Management

According to Von Krogh, Ichijo, and Nonaka (2000), "information systems coupled with video and teleconferencing, for example, go beyond classic groupware solutions like Lotus Notes." This means that they are a little bit further from just explicit knowledge management.

However, "information systems are of limited usefulness in facilitating a group's commitment to a concept, sharing emotions tied to tacit experience, or embodying the knowledge related to a

certain task." This difficulty to capture tacit knowledge is what makes an information system incomplete in the process of knowledge creation.

According to Nonaka and Takeuchi (1995), "the assumption that knowledge is created through the interaction between tacit and explicit knowledge allows us to postulate four different modes of knowledge conversion." These are (see Table 1):

(1) Socialization: from tacit to tacit.
(2) Externalization: from tacit to explicit.
(3) Combination: from explicit to explicit.
(4) Internalization: from explicit to tacit.

		To	
		Tacit knowledge	Explicit knowledge
From	Tacit knowledge	**Socialization**	**Externalization**
	Explicit knowledge	**Internalization**	**Combination**

Table 1: Knowledge conversion modes (Nonaka and Takeuchi, 1995)

"Socialization is a process of sharing experiences and thereby creating tacit knowledge such as shared mental models and technical skills" (Nonaka and Takeuchi, 1995). Therefore, the role of an information system in the socialization process would be just a mediator in the communication process among the socializing parts. However, the video and teleconferencing solutions mentioned above can improve the transfer of knowledge.

Externalization is "a quintessential knowledge-creation process in that tacit knowledge becomes explicit, taking the shapes of metaphors, analogies, concepts, hypotheses, or models" (Nonaka and Takeuchi, 1995). In this process, the only role of an information system would be the capture of these metaphors and so on.

Regarding combination, "reconfiguration of existing information through sorting, adding, combining, and categorizing of explicit knowledge (as conducted in computer databases) can lead to new knowledge" (Nonaka and Takeuchi, 1995). An information system would be the perfect tool to perform this task.

Finally, internalization is related with "learning by doing" (Nonaka and Takeuchi, 1995). The role of an information system in this process would be related to the diffusion of knowledge.

Therefore, there is a natural match between knowledge conversion modes and information systems functions, as indicated in Table 2. Storage would be a supporting function for processing and distribution.

Knowledge conversion mode	Information systems function
Socialization	Distribution
Externalization	Collection
Combination	Processing
Internalization	Distribution

Table 2: Match between knowledge conversion modes and information systems functions

Therefore, it is clear that human intervention is always needed in knowledge. This means that knowledge per se cannot be captured in an information system, and that the term "knowledge management system" may be misleading.

On the other hand, according to Nonaka (1991), for knowledge creation to be possible, knowledge has to first be converted from explicit to tacit if it is not already tacit. It is only from internalized knowledge that new knowledge can be created.

4.0 Information Systems in the Organization

Taking the limitations above into account, "Information Systems, and Information Technologies as part of them, are proposed as support for the organizational change" (Orero et al. 1996). The relationship between Information Technology and Organization is depicted in Figure 2: "Information system (IS) is the interface for the Organization-IT interaction."

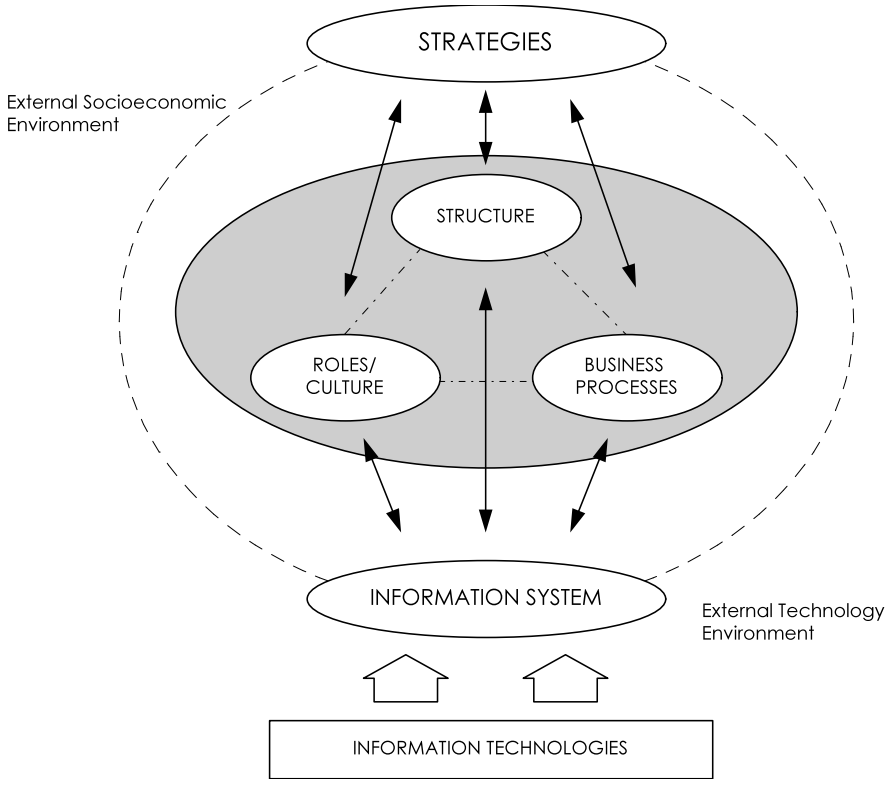


Figure 2: Management of the 1990s equilibrium model (Scott Morton, 1991)

Orero et al. (1996) propose "that analyzing one of the key dimensions of the organization –the information system–, the remaining dimensions –organizational structure, processes, culture, strategy– could be analyzed and diagnosed. This process is carried out through the analysis of the relationships of the information system with the other dimensions."

According to Scott Morton (1991), "IT offers the opportunity for organizations to react constructively," and "given what IT now allows an alert organization to do, an organization that merely works faster and harder will become uncompetitive in the global marketplace of the 1990s and beyond." This working faster and harder is related to the "organizational defenses" described by Argyris (1999): "An organizational defense is a policy, practice, or action that prevents the participants (at any level of any organization) from experiencing embarrassment or threat, and at the same time, prevents them from discovering the causes of the embarrassment or threat."

"Organizational learning involves the detection and correction of error. When the error detected and corrected permits the organization to carry on its present policies or achieve its present objectives, then that error-detection-and-correction process is single-loop learning" (Argyris and Schön, 1978). "Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies, and objectives."

Working faster and harder would just be single-loop learning. This would prevent the organization from reacting constructively, which in turn would be double-loop learning. This kind of learning is therefore related to the way organizations will be able to survive and prosper in the competitive environment. "It is conventional wisdom that business firms, governments, nongovernmental organizations, schools, health care systems, regions, even whole nations and supranational institutions need to adapt to changing environments, draw lessons from past successes and failures, detect and correct the errors of the past, anticipate and respond to impeding threats, conduct experiments, engage in continuing innovation, build and realize images of a desirable future" (Argyris and Schön, 1996).

It can be then hypothesized that necessary conditions for the matching of an organization to its contingency factors are the correct collection, processing, storage, and distribution of information. Collection of information from contingency factors needs to be accurate. Otherwise, it will not be representative. Processing is directly related to making decisions. Storage has to do with the concept of "organizational memory" (Scott Morton, 1991). And finally, distribution of information is necessary for a decision to be implemented in an organization. The quality of these processes is crucial if a natural configuration is to be adopted that fits the surrounding environment. Therefore, it is not possible for an organization to survive and prosper without the proper information system.

5.0 Critique of the literature

The literature reviewed is limited, taking into account the scarce space available for this article. Further investigation could lead to concepts treated in the Organizational Engineering Group of the Technical University of Madrid as part of its Information Systems PhD program. For example, the idea of virtual organizations as an application of information systems could be further developed.

6.0 Practical applications

Different information systems can be found in an enterprise related to its different activities. For example, an Enterprise Resource Planning system would differ from a Customer Relationship Management System or a Supply Chain Management system in that the first one would be devoted to the internal processes of the company, while the second one would relate the company to its contractors and the third one to its subcontractors.

6 Knowledge Management and Organizational Cultures

Andres Kütt
29 April 2011

1.0 Introduction

This paper seeks to provide insight about the relationships of knowledge management and organizational culture. The two concepts seem to be strongly and non-trivially interlinked with a certain organizational culture being beneficial for knowledge management. Firstly, an overview of the key concepts is given, it is followed by a critical analysis of literature and finally a set of recommendations is provided for practitioners. The paper is not intended for stand-alone use and will form the basis of a collaborative article as part of the 15.905 Knowledge Management Team efforts.

2.0 Overview of key concepts

To understand the interactions of knowledge management and organizational culture, a brief understanding of both of the concepts would be necessary; the following paragraphs seek to provide this.

Organizational culture can be defined as "a set of understandings and meanings shared by a group of people" (Louis, 1985, p. 74). This definition, albeit overlapping with several others, is not dominant and there is not even a common typology of the definitions with each author inventing their own. Trice and Beyer (1993) have integrated the majority of the work done to date and it is still one of the most comprehensive books on the subject. In the context of knowledge management, it is important to know that despite the lack of common definition, there are numerous instruments and typologies that allow measuring and managing this elusive phenomenon. They all provide a set of dimensions describing different components the culture of each organization is comprised of. The ones suggested by Handy (1978) and Harrison and Stokes (1992) are probably among the most popular ones.

While organizational cultures lack a common definition, most of the definitions overlap to a great extent and there is a solid body of research providing theoretical as well as empirical foundations for practical applications. The field of knowledge management, unfortunately, is not as well researched and understood. Knowledge management can be seen as part of a broader concept "intellectual capital" and has emerged as a business rather than academia driven field as a result of downsizing and technological development (Mårtensson, 2000). At the heart of the controversy, there are two main issues: the definition of knowledge and the understanding of its manageability. In literature, knowledge is defined in numerous ways ranging from information to a state of mind, Alavi and Leidner (2001) provide a good overview of the definitions. On a couple of aspects, however, there seems to be a general consensus:

- The concept of knowledge has at least two different manifestations: tacit and explicit
- For knowledge to be useful in the organization, it needs to change from tacit to explicit (and possibly back again)
- Knowledge is something that is explicitly created and not something that emerges as a result of the functioning of the organization (see section **Error! Reference source not found.** for a more thorough criticism)

The other controversial aspect of knowledge management is the question of manageability of knowledge. It depends on the definition of the subject but still provides a wide spectrum of thought from knowledge being unmanageable simply because it is the result of human thinking (McDermott, 1999) to explicit ways how knowledge can be guided through organization (for example Bhatt (2001)). The first approach warns against IT systems as knowledge management tools and the other assumes their usefulness.

While there are authors who suggest further research topics (Alavi & Leidner, 2001, p. 126), the attention of the community seems to have shifted towards the concept of a learning organization put forth in (Senge, 2006). Senge provides a model of dynamically interlinked balancing and reinforcing mechanisms that dynamically shape how organizations and people in the organizations behave providing a more comprehensive explanation to observed behavior than the body of research on knowledge management. Even further progress can be observed that seems to suggest that instead of learning organizations we should be talking about learning people forming adaptable organizations.

Organizational culture seems to be a key enabler for successful knowledge management (De Long & Fahey et al, 2000), the literature review shown in the following chapters provides an overview of the state of research in the field.

3.0 Literature review

3.1 Critical analysis of the literature

After reviewing the literature available on knowledge management and culture, several issues and observations arise.

Firstly, there seem to be two conflicting views of knowledge management: one that treats knowledge as an intrinsically intangible substance that only has meaning in relation to people (a state of mind, a condition of having access to information, a capability) and the other that treats knowledge as something that can be actively managed, stockpiled, transferred and analyzed (an object, a process)(Alavi & Leidner, 2001).

Secondly, while almost all sources emphasize the importance of culture in knowledge management and implementing a knowledge management system in particular, there has apparently been no research on what kind of culture might be beneficial for the knowledge management. Provided the extensive body of research covering different cultural typologies and their effects on various aspects of organizations, this is quite curious. Also, none of the sources place the two concepts into a wider context. Schwartz and Stanley point out that no organization will perform well in a competitive environment unless the four dimensions (structure, systems, people and culture) of organization are internally consistent and fit the strategy (Schwartz and Davis, 1981, p. 32). Knowledge management is probably part of the systems aspect and thus we must conclude that it is not about whether or not a particular culture supports knowledge management but how culture in combination with knowledge management, among other things, can contribute to implementation of a particular strategy of an organization.

Thirdly, almost all of the authors ignore a key property of organizational cultures: they cannot be studied objectively (Martin, 1992). Therefore, a researcher expressing particular views on the nature of knowledge is already implicitly assuming a certain kind of organizational culture. An author talking about knowledge as "residue of thinking" (McDermott, 1999) is already taking a very person-centric view of the culture in question, for example. This is probably the main reason the definitions of knowledge are so numerous.

Finally, knowledge is almost universally treated as a subject that needs explicit creation and management. While it is certainly true for certain types of knowledge, it is probably safe to argue that a large part of organizations' knowledge is neither explicitly created nor explicitly managed, it emerges as a natural consequence of organizational function. For example, a software developer creates knowledge of the internal workings of his or her code with every character they type, a knowledge that is both hard to extract and extremely valuable. To date, the only somewhat

functional method of managing that sort of knowledge the author is aware of is establishing routines to embed comments into the code itself, i.e. modifying work procedures to include knowledge conversion as opposed to establishing a separate knowledge management system. This shortcoming of the literature inevitably limits its practical usability as to large extent organizations struggle with implicitly and not explicitly created knowledge.

Despite the conflicts, the literature clearly supports the concept of knowledge management as an organizational phenomenon (Alavi & Leidner, 2001). Thus, if systems thinking can be applied to explaining how organizations function as it has in association with the concept of the learning organization, it can probably be used to explain how knowledge flows in the organization and what effects its creation, storage, transfer and usage have. Exploration of this fascinating area, however, falls outside of the scope of this paper.

3.2 Bibliography

3.3.1 Knowledge management in organizations: examining the interaction between technologies, techniques, and people

In his article, Bhatt (2001) gives an overview of the concept of knowledge management and emphasizes heavily that for it to be successful, the technologies supporting it, the techniques of its implementation and people affected must act in unison. He starts with an admission that there is no consensus on the topic neither in academia nor among practitioners. The author then proceeds to give the basic definitions and make the main point on the three aspects of knowledge management being interlinked. The main value of the relatively short architecture lies in how it hints at the higher abstraction approach given by Senge (2006), the clarity of basic definitions and a thorough bibliography. A systems thinking is implicitly referred to by firstly suggesting a multi-faceted interlinked approach indicative of systems thinking and also by bringing specific examples of feedback loops. In the context of culture and knowledge management, Bhatt, quite like other authors, points out that "(knowledge management) ... becomes as much a feat of developing technological solutions as working through the social and culture subsystems" suggesting a relationship between the two concepts. Unfortunately this link is not explored further: despite organizational cultures being well-researched (although controversial) field there are no references to types of cultures or cultural mechanisms that might be beneficial for knowledge management. Another critique towards the article might be that it assumes knowledge to be an object of management neglecting the fact that often crucial knowledge is created as a byproduct of main operations of an organization.

3.3.2 Why information technology inspired but cannot deliver knowledge management

McDermott (1999) starts his article by quoting Albert Einstein: “Knowledge is experience. Everything else is just information” and goes on to explain the importance of cultural transformation in knowledge management efforts. His main thesis is that technology just enforces existing behaviors and communication patterns: if these did not do a good job at knowledge management before, they will not do a good job now. Doing a wrong thing more thoroughly does not make it right. He argues that knowledge sharing is an act of thinking and can thus be undertaken only by a human. The author uses the metaphor of "knowledge junkyards" to illustrate how technology can help collect vast bodies of useless information. In addition McDermott brings an interesting (and different from others) definition of knowledge by stating among others its property of being "a residue of thinking" and "belonging to communities". By this he establishes a link with systems thinking (thinking is a human act and therefore a person is an integral part of the process) and establishes a link with social relationships between people that are a manifestation of culture. However, McDermott again falls short while building a bridge to organizational cultures. He clearly states eight guidelines to leverage knowledge five of which are either possible only in certain types of cultures or indicate the need for active management of culture and its change but does not go further than that. All in all, it’s an excellent article about the nature of knowledge, its management and the implications of it. It even manages to establish a link to popular culture by quoting Wallace Stevens saying “Thought is an infection, some thoughts are an epidemic” . This train of thought is thoroughly explored in a cyberpunk classic “Snow Crash” (Stephenson, 2000).

3.3.3 Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues

The article by Maryam Alavi (Alavi & Leidner, 2001) is one of the few articles attempting to organize the literature around knowledge management making a statement that “To be credible, KMS research and development should preserve and build upon the significant literature that exists in different but related fields.” As such, it proves a very lucrative source of bibliography. The author repeats the classical distinction between data, information and knowledge but quotes Fahey and Prusak (1998) who stipulates that knowledge management only becomes meaningful if distinction between information and knowledge can be made. This constitutes an interesting challenge to the entire concept of knowledge management. Another noteworthy point this article is about learning. Repeatedly knowledge is referred to as either the result of learning or inhibitor of it (if making mistakes is an important way of learning (Senge, 2006) then having information that prevents one

from making the mistakes inhibits learning), which, again brings in the concept of learning organization and systems thinking.

One aspect of knowledge management other articles do not mention but that is prominent here, is the question about potential negative effects knowledge can have. We already mentioned it as an inhibitor or learning but there is also the question of legacy (if we gather too much information, the entire body is rendered useless by the fact that people will not be able to find what they need) and the bug syndrome (the scientists know that according to known laws of physics, the bugs should not be able to fly but they do anyway). Perhaps the most valuable aspect of the article besides the comprehensive bibliography and the issue of negative effects of knowledge, are the research questions suggested by the author. Their breadth, diversity and importance are a clear indicator that the field of knowledge management is scientifically rather immature.

3.3.4 Diagnosing cultural barriers to knowledge management

The article intends to "provide managers and researchers with frameworks for understanding and diagnosing how and why organizational culture so often impedes attempts to generate and leverage knowledge" (De Long and Fahey, 2000, p. 114). The frameworks are the results of the author's ongoing research on the impact of Internet to knowledge management, investigation of knowledge management initiatives 24 companies, interviews with 12 chief knowledge officers and review of literature. The authors provide their own definition and classification of knowledge as well as stipulating that knowledge can indeed exist separate from humans. After giving a rudimentary definition of culture, four frameworks linking culture and knowledge are provided, each with managerial guidelines for practical applications. The four frameworks, that should perhaps rather be described as mechanisms or simply relationships, are as follows:

Culture shapes assumptions about which knowledge is important This means that if people do not consider something to be important, they will not actively take care or nurture it. Also, a point is made about different subcultures of the organizations could have different beliefs about importance of knowledge impacting knowledge transfer between the groups.

Culture mediates relationships between levels of knowledge The authors explain, that the extent to which an individual is willing to share his or her knowledge with the organization or a groups is wiling to share their knowledge with others is directly dependent on how strongly the culture supports collaboration.

Culture creates a context for social interaction Every culture imposes certain rules and beliefs that shape social interaction and thus knowledge sharing. For example, it might enforce hierarchy or declare social taboos. The stance towards solutions created outside of the group, readiness to acknowledge mistakes and attitude towards teaching also fall into this category.

Culture shapes creation and adoption of new knowledge This relationship implies that the culture affects, how an organization treats new internal and external inputs creating new

knowledge. Also the attitude towards strategic change and debate on strategic matters are covered here.

The article is a good source of practical advice but is lacking in the academic sense as it covers important impacts of organizational culture relying only on basic definitions from a few classical sources. For example, no attempt is made to relate the frameworks to cultural typologies or dimensions brought forward by Handy (1978) or Harrison and Stokes(1992).

4.0 Practical recommendations

Given the importance of both topics covered here, they have a profound impact on how modern organizations are led. In the following, the author brings forth a number of recommendations based on the literature reviewed

Think strategically Knowledge management and culture both need to support the organizational strategy and not each other. A culture of knowledge sharing and storage can be lethal for an organization whose strategy depends on secrecy. A bank whose strategy is to sell trust and has a strong culture around keeping financial secrets is unlikely to benefit from an extensive knowledge management system.

Exercise caution Knowledge management systems should be implemented very carefully. It is clear that the field of knowledge management requires much more research before we can claim an understanding of its nature. Also Senge (2006) clearly explains that in organizations, there are numerous mechanisms at work that are quite difficult to detect let alone understand. Finally, every organization creates, manages and transfers knowledge in some form and therefore must have some at least rudimentary functional infrastructure to do so. Thus, in terms of knowledge management, we are dealing with systems that already perform an important function and inner workings of which are both theoretically unclear and difficult to experience empirically. As implementing any information system inflicts a change in processes we must conclude that implementation of a knowledge management system can potentially be dangerous to the existing knowledge management infrastructure simply because the latter is very likely not to be understood. As knowledge and its maintenance are critical for an organizations' success (De Long & Fahey, 2000), a knowledge management system must yield positive results that clearly outweigh the potential damage to existing infrastructure.

Be critical of the sources The views on authors on fundamental concepts of knowledge management vary too greatly to conclude the existence of a solid scientific understanding. Combined with the industry-driven origins of the field, this leaves a lot of room for literature and assumptions of questionable quality. Thus, a practitioner seeking to solve a particular problem must exercise caution in choosing the sources to use and preferably rely on several.

Knowledge can have negative impact A practitioner should be aware of the potential negative effects a knowledge management system can bring by inhibiting learning and innovation or creating "information junkyards" that act as write-only sinks of knowledge.

Probably the single most important point a practitioner can take away from this paper is a call to caution: both organizational culture and knowledge management are too little understood and too important to tackle lightly.

7 Knowledge Strategy

Pankaj Kashyap

29 April 2011

1.0 Introduction

While doing the literature survey for knowledge management, I could broadly divide the subject into two categories. First was the knowledge strategy and the next was the knowledge management system to drive the strategy effectively in an organization. Knowledge strategy sets the direction of the organization and insures that it is on the right track. Knowledge management initiatives which are not tied to the overall organizational strategy result in ineffective results. To use the oft repeated cliché, it is great to have a good knowledge management system for a vacuum tube company in 1960s to effectively share knowledge, but it would not be of much help as transistor technology would eventually replace it.

The literature talks about many facets of knowledge management and there is no clear and coherent concurrence on definition of knowledge management. While no definition is perfect it can be easily seen that every topic discussed has some significance and importance. This brings us to the important conclusion that there is no one size fits all, definition and solution for knowledge management. It can clearly be seen that all the efforts on storing and sharing of knowledge are focused on the execution of a knowledge management solution. However, many of these activities are not tied to the business strategy and that the actions are taking place in silos. This may result in misdirected knowledge management solutions and could be detrimental to the organization's success.

The article during the literature survey that attracted my attention was "Developing a Knowledge Strategy" by Michael H. Zack (1999). He proposes knowledge strategy as key business strategy, which then should drive the knowledge management processes. It is imperative for an organization to "identify which knowledge based resource and capabilities are valuable, unique and inimitable as well as how those resources and capabilities support the product and market position of the organization" (p127, Zack 1999). This is an essential element of the knowledge strategy. This paper reviews and discusses the framework proposed by Zach and then links its relevance by sharing an example of electricity meters industry.

2.0 A strategic framework for mapping knowledge

Knowledge mapping of an organization is the process of identifying the current knowledge capabilities of an organization. The knowledge of an organization can be broadly categorized as "Core, Advanced & Innovative" (p133, Zack 1999).

2.1 Core

"It is the minimum scope and level of knowledge required just to play the game"(p133, Zack 1999). This capability does not ensure long term competitiveness of a firm, but poses a basic knowledge entry barrier. This is normally present in the core competitors and is not a differentiator.

2.2 Advanced

"Advanced knowledge enables a firm to be competitively viable. This knowledge starts to become a differentiator among the key competitors"(p133, Zack 1999).

2.3 Innovative

"Innovative knowledge is the knowledge that allows the firm to lead the industry and to significantly differentiate itself from the competition"(p133, Zack 1999). One of the key factors of knowledge is that it is not static and that the knowledge which is cutting edge and innovative becomes core in future. This drives the importance of continuous innovation as the integral strategy of a company. Figure 3 below shows a cycle of how knowledge and business strategy are intertwined. "*The gap between what a firm is currently doing and what it must do to succeed in the market place represents a knowledge gap*" (p135, Zack 1999). This exercise is very effective to find the critical gaps and then work on an action plan to build that knowledge or acquire it.

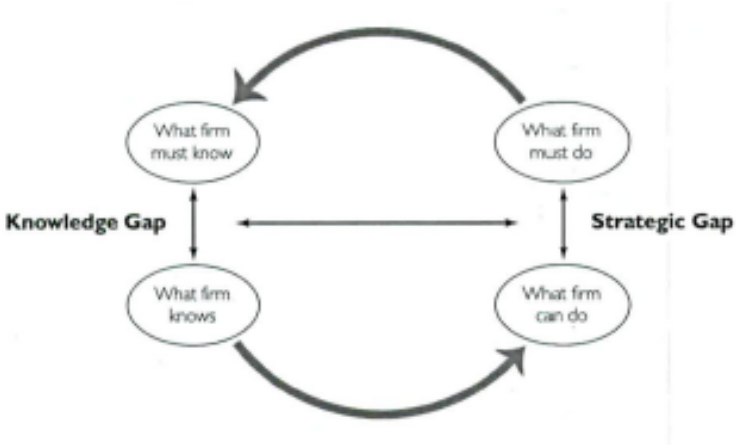


Figure 3: Intertwining of knowledge and business strategy (Zack, 1999)

3.0 The knowledge Strategy Framework

An organization after going through iterations of a knowledge gap identification exercise will next have to focus on bridging the knowledge gap. An organization is categorized as aggressive or conservative based on the firms' ability to create knowledge and the process which it uses to create it.

3.1 "Exploration Vs Exploitation" (p136, Zack 1999)

The process of bridging the knowledge gap identified, for any facet of the organization, be it technology, process, competitor knowledge, regulation etc. is known as exploration. This is akin to a continuous improvement process and effectively never ends. If an organization attains the desired knowledge in a given area/function and is the best in the market, then it is time for the company to exploit this knowledge to make innovative products and generate cash flow. This phase is known as exploitation.

Normally for an organization to be long term bet there has to be a *healthy balance between exploration and exploitation*. If it is doing too much of exploration then it implies that it does not have sources of revenue generation and might be the end of the organization and if it is just doing exploitation then it implies that the knowledge creation capabilities of the organization no longer exist and that the company will not be able to respond to the changing needs of the environment.

3.2 "Internal Vs External Knowledge" (p138, Zack 1999)

An organization's way of acquiring knowledge can be broadly classified in two categories:

1) Internal: Here the firm is constantly inward's focused and looks at internal knowledge base as the only way to have knowledge and is a champion of the philosophy "Not invented here".

2) External: In the external approach, an organization looks actively to the outside world like collaborations with universities, joint ventures, consultants, Publications and other mechanisms. These organizations are more in tune with the changing time and are better prepared for change.

3.3 "Aggressive Vs Conservative" (p139, Zack 1999)

We can now map the firm's exploration and exploitation tendencies with its ability to seek knowledge internally or externally. Firm's that tend to be focused internally for acquiring knowledge and are in exploitation mode, have a *conservative knowledge strategy* and may not be sustainable in the long run. Players, who actively seek the external world for knowledge and constantly benchmark themselves against the best in class and are innovators, have an *aggressive knowledge strategy* and they tend to be more successful organizations in the long run.

4.0 A case study – Electricity Meter Industry

The electricity meters industry is a good example of evolution of technology and how inability to change the knowledge strategy to the changing environment impacts the growth of a company. Traditionally the electricity meters design relied extensively on the expertise of experienced electrical engineers and highly skilled manufacturing capabilities to achieve high accuracy. GE was a leader with its electromechanical electricity meter range and yet floundered when it came to transitioning to the digital meters age. With digital age (the 1990s) came the realization that it just took a few good electronic engineers and some good current and voltage sensing schemes to make highly accurate meters, which until then was a highly specialized area. Inability of GE to sense this change and adapt to this environment led to its loss of significant market share in the North American metering industry.

The next age of the change in this industry was the automated meter reading. It was the communications technology which was now redefining the metering industry. The ability of the companies to accurately transmit the energy accumulations to a remote data center, helped utilities reduce significant costs from its operations.

Now we are in the third wave of technology revolutions in the electricity metering industry, which is the Smart Grid. This is now a very complex system of multiple technologies and cross functional dependencies and now to become an industry leader one has to have right alliances along with flagship products. One now has to deal with two way communications, with the utilities ability to remotely connect/disconnect supply to the customers. It also has a new dimension and that is of improving the efficiency of the grid, which now calls for a robust information technology

backbone that would facility huge analytics in the backend to facilitate decision making for improving grid efficiencies.

The electromechanical meters have been the dominant design for over 100 years and within a relatively short duration of 20 years the technology has improved drastically. Figure 4 below shows the evolution pictorially, which is based on my understanding and experience.

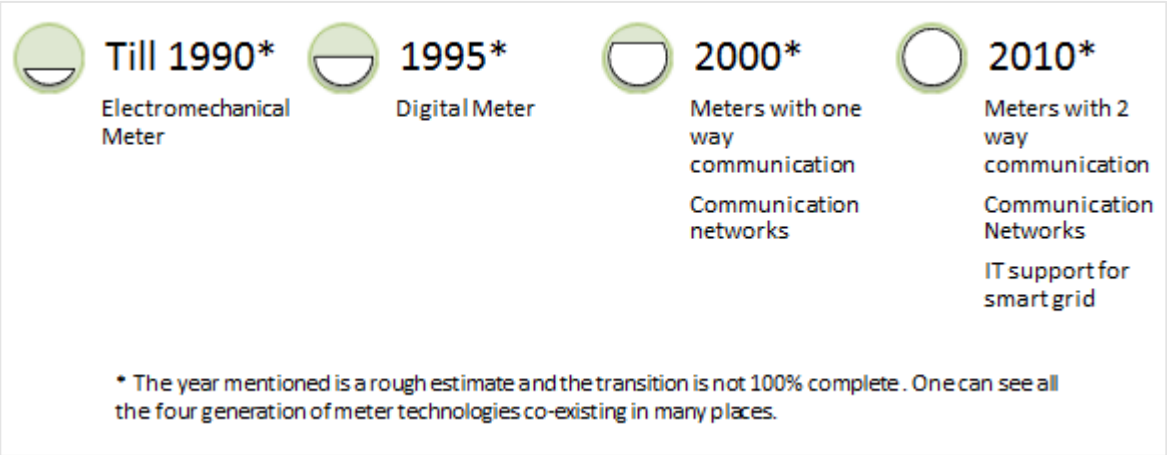


Figure 4: Electromechanical meters evolution

5.0 Conclusion

Knowledge strategy is the driver for effective knowledge management solutions in an organization. The organization has to be very nimble and proactive in seeing the evolving knowledge environment and quickly adapt itself to the changing needs. The above example clearly shows that company which does not constantly align its business strategy with the knowledge strategy cannot be successful in today's world. I have used the instance of technological knowledge as the gap in the case study; however knowledge about any other facet of business segments is equally important and can range from customer knowledge, process knowledge to products and services knowledge and more. It will be an understatement to say that many a time's companies fail due to their knowledge gap and the inability to catch up with the fast changing pace of market dynamics.

8 Knowledge Management and Diffusion Conclusion

In this document, the authors have explored several key aspects of knowledge management and have hopefully conveyed the enormous size and complexity of the topic. Two main factors seem to contribute to the difficulty in dealing with the area. Firstly, there is a clear lack of scientific foundation to the concept of knowledge management indicated by lack of empirical research and the amount of conflicting theories, definitions and notions. Secondly, the area is developing rapidly in several directions at once: only a few years between publication dates can mean important advancements and abandonment of entire theoretical areas. That said, several aspects of knowledge management have clear and apparently useful practical frameworks to support practitioners: there are ways to measure knowledge management, integrate it to the strategy and support it by information systems. The literature also points out that there are numerous, usually people-related, barriers to effective knowledge management. Recipient's lack of ability to absorb knowledge, limited view of cause-effect dependencies and arduous relationships as well as various cultural issues seem to be the main ones.

Thus, we have seen a number of theories as well as a number of practical tools that try to encapsulate and cover the issue of knowledge management. And yet, the essence of it remains elusive. As one of the authors put it: "One of the key points that is made is that the IT infrastructure and the organizational changes being driven in the organization can ensure the effective creation and sharing of knowledge, it cannot ensure that the efforts are being made to capture the right knowledge in the right way." We hope that this collection of papers helps the reader get closer to the answer to the latter part of the question.

9 Knowledge Management and Diffusion Joint Bibliography

Abar, S., Abe, T., & Kinoshita, T. (2004). A Next Generation Knowledge Management System Architecture. ***Proceedings of the 18th International Conference on Advanced Information Networking and Application (AINA'04)*****, *2*, 191-195. doi: 10.1109/AINA.2004.1283784 (Cited 15 times)**

This work presents "a generic knowledge management system architecture based on ADIPS (Agent-based Distributed Information Processing System) framework." This is a 3-layer model that begins with the user who interacts with the "interface layer" that serves the personalization of the system to the user. The "intelligence layer" is next which is the layer that makes decisions and takes actions. Finally, the "resource layer" is the database that contains the knowledge. Good graphic describing details of this on page 3 of the paper.

Alavi, M. and D. E. Leidner (2001). "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues." MIS Quarterly 25(1): 107-136. (Cited 3,042 times).

More than before, knowledge is becoming a significant organizational resource, which is introducing mechanisms to capture organizational knowledge through different Knowledge Management Systems (KMS). The objective of a KMS if to support the creation, transfer and application of knowledge in an organization in order to gain a competitive advantage and use an organization's knowledge to make sound decisions. The article discusses the differences between explicit and tacit knowledge and the criticality of both. This is a great article that gives a solid foundation on the subject of KM. The article has an excellent organizational knowledge management process model, which effectively articulates the interaction between individuals and groups.

Alavi. M. and D.E Leidner (1999). "Knowledge Management Systems: Issues, Challenges, and Benefits" Journal Communications of the AIS, Volume 1 Issue 2, Feb. 1999.

Considering the unanimous conclusion that knowledge is the key asset of an organization, the authors ventured to back this with practical data. Their key intention here was application of "knowledge management system" implementation in different companies. As part of this paper they survey 109 participants in an executive development program and derive conclusions from them.

Allen, T. J. (2011). Class 15.980 - Organizing for innovative new product development. Lecture, Cambridge, MA.

In Tom Allen's class, we are continually learning about the paths of knowledge through an organization – the presence of gatekeepers within organizations that maintain strong ties to the technology and disseminate that information throughout – the networks that emerge among people and how those can be exploited to try to increase the flow of knowledge.

Argote, L., S. Beckman, et al. (1990). "The Persistence and Transfer of Learning in Industrial Settings." Management Science 36(2): 140-154. (Cited 640 times).

The persistence of learning in an organization and the transfer of learning between different organizations are examined through multiple data sets collected from various organizations. The results suggest that knowledge acquired through production depreciates at a relatively high rate over time. This is a good article that examines early versus late entry into production and the relationship to learning in and between organizations. This article relates to knowledge management and diffusion as it discusses technology transfer within and between organizations and the method this knowledge is diffused.

Argyris, C. (1999): "On Organizational Learning," Second Edition, Blackwell Business.

This book introduces the concept of organizational defenses, as a means for individuals and organizations to inhibit double-loop learning. Organizational defenses reinforce single-loop learning loops and inhibit organizations to experiment the consequences of structural changes that can derive in the effective adaptation of the organization to a competitive environment. It includes a chapter on Organizational Learning and Management Information Systems.

Argyris, C. and Schön, D. A. (1978): "Organizational Learning," Addison-Wesley Publishing Company.

This book introduces the concept of organizational learning, as a means of organizations to improve the way they carry out the work they currently accomplish, and then it is called single-loop learning, or to carry out different things which produce better results, and then it is called double-loop learning. The book also mentions the concept of organizational defenses, as a means for individuals in an organization to cope with the uncomfortable fact of getting from single-loop to double-loop learning, which means recognizing the self-limitations.

Argyris, C. and Schön, D. A. (1996): "Organizational Learning II," Addison-Wesley Publishing Company.

This book is an update of the ideas of the previous book "Organizational Learning", by the same authors in 1978. The book addresses the following questions: 1. Why is an organization a learning environment? 2. Are real organizations able to learn? 3. What types of learning are desirable? 4. How can organizations develop their ability for desirable types of learning?

Beckman, T. J. (1999). The current state of knowledge management. In J. Liebowitz (Ed.), Knowledge management handbook (pp. 1-1-1-22). Boca Raton, FL: CRC Press.

"In bureaucratic organizations, employees and managers are discouraged from sharing knowledge and expertise. In fact, the opposite is often the case: knowledge is considered a source of power, and thus hoarding is not only expected but is often rewarded." Pg 1-16

In the first chapter, Thomas J. Beckman reviews "The Current State of Knowledge Management." In this section, he reviews the different sub-chapters in the books and begins to discuss. Specifically, the discussion of KM metrics began as the importance to measure the: Result (past), Process (present), and Resource (future). He cited two sources, Edvinsson and Sveiby, who have each done extensive work in developing metrics for KM.

Bhatt, G. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. Journal of Knowledge Management 5(1), 68–75. (Cited 390 times)

In addition to providing basic definitions of data, information and knowledge the paper provides insight into how technological and social systems interact in the context of creation, transfer and application of knowledge. The main benefit of the article is a good bibliography and coherent set of definitions

Bierly.P.E and Daly P.S.(2007), "Alternative knowledge strategies, competitive Environment, and organizational performance in small manufacturing firms", Entrepreneurship: Theory & Practice; Jul2007, Vol. 31 Issue 4, p493-516, 24p

The article discusses the two strategies exploration and exploitation and then refutes the belief that they are mutually exclusive. The authors sample small manufacturing firms and conclude that the relationship between and exploration and exploitation is linear and positive.

Bose, R. (2004). Knowledge management metrics. Industrial Management & Data Systems, 104(6), 457-468. doi: 10.1108/02635570410543771

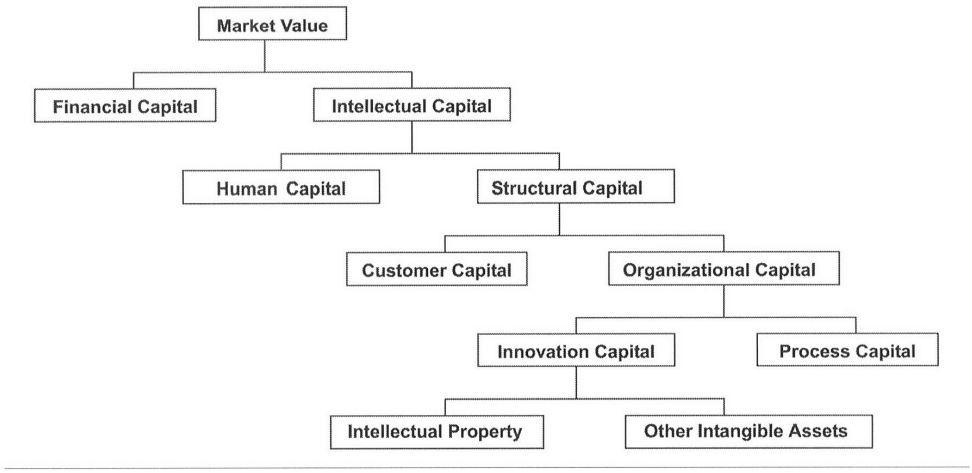
This paper begins with an introduction to knowledge management and how it's defined, its processes and enablers. The paper then displays a collection of sources' KM metrics methods. There are 4 sources displayed in the paper, each with extensive lists of items measured for KM (i.e. hours of training per employee, cycle / process times).

The paper then reviews the Skandia Navigator case, which has been referenced in many of the other literatures as well. The figure below gives a graphical representation of the "Skandia value scheme" which was provided in the article. This figure is meant to help visualize the changes in intellectual capital (IC). This diagram is a result of "164 metric measures (91 intellectually based and 73 traditional financed based metrics)" that are used to generate an Intellectual Capital Index that is used to measure the organization on their KM.

The rest of the paper discusses how an organization might go through a similar process as Skandia to

achieve useful metrics. This includes identifying 5 key focus areas to center attention on metric creation: Financial focus, customer focus, process focus, renewal focus, and human focus.

Figure 3 Skandia Navigator – IC value scheme and measurement tool



Buckland, M. (1991). "Information as a Thing." Journal of the American Society of Information Science 42(5): 10. (Cited 461 times).

This article examines information as a process, information as knowledge and information as a thing, which offers a basis on how to classify "disparate information-related activities." The article is a study on information and serves as an interesting read when dealing with the topic of knowledge management and diffusion, as information is knowledge imparted.

Curtis, B., Hefley, B. and Miller S. (2009), "People Capability Maturity Model (P-CMM) Version 2.0." Software Engineering Institute.

The technical report covers a framework developed by the world's premiere software engineering institute that is used in leading software companies to manage one of three critical assets: people. One component of the P-CMM deals with codifying, managing and disseminating knowledge, making its set of prescribed best practices highly useful to practitioners and particularly those in the software industry.

De Long, D. W. and L. Fahey (2000). Diagnosing cultural barriers to knowledge management. Academy of Management Executive 14(4), 113–127. (Cited by 695).

The article intends to "provide managers and researchers with frameworks for understanding and diagnosing how and why organizational culture so of- ten impedes attempts to generate and leverage knowledge". The frameworks offered are the results of the author's ongoing research on the impact of Internet to knowledge management, investigation of knowledge management initiatives 24 companies, interviews with 12 chief knowledge officers and review of literature. The authors provide their own definition and classification of knowledge as well as stipulating that knowledge can indeed exist separate from humans. After giving a rudimentary definition of culture, four frameworks linking culture and knowledge are provided, each with managerial guidelines for practical applications:

Culture shapes assumptions about which knowledge is important. This means that if people do not consider something to be important, they will not actively take care or nurture it. Also, a point is made about different subcultures of the organizations could have different beliefs about importance of knowledge impacting knowledge transfer between the groups.

Culture mediates relationships between levels of knowledge The authors explain, that the extent to which an individual or a group is willing to share his or her knowledge with the organization is directly dependent on how strongly the culture supports collaboration.

Culture creates a context for social interaction. Every culture imposes certain rules and beliefs that shape social interaction and thus knowledge sharing. For example, it might enforce hierarchy or declare social taboos. The stance towards solutions created outside of the group, readiness to acknowledge mistakes and attitude towards teaching also fall into this category.

Culture shapes creation and adoption of new knowledge This relationship implies that the culture affects, how an organization treats new internal and external inputs creating new knowledge. Also the attitude towards strategic change and debate on strategic matters are covered here.

The article is a good source of practical advice but is lacking in the academic sense as it covers important impacts of organizational culture relying only on basic definitions from a few classical sources. For example, no attempt is made to relate the frameworks to cultural typologies or dimensions brought

forward by Handy (Handy, C. B. (1978). Gods of Management: How They Work, and why They Will Fail. Souvenir Press.) or Harrison (Harrison, R. and H. Stokes (1992). Diagnosing Organizational Culture Instrument. Pfeiffer.).

Deng-Neng C and Ting-Peng L. (2011) "Knowledge evolution strategies and organizational performance: A strategic fit analysis." Electronic Commerce Research and Applications Volume 10 Issue 1

The article starts with a summary of how knowledge management has been discussed in literature and then does a literature survey on "knowledge evolutions" and try to measure its impact on organizational performance. It further tests the two well know evolution strategies "knowledge mutation" and "knowledge crossover" by conducting a survey research. One of their key conclusions is that "no single knowledge evolution strategy is capable of improving all aspect of organizational performance".

Drucker, P. F. (1988). "The Coming of the New Organization." Harvard Business Review January-February: 45-53.

This article analyzes the influence of information technology on the structure of organizations. The main effect information technology has on it is a flattening of the structure, eliminating the need for the middle management layer, and increasing communication among the different employees. According to the author, "the typical business will be knowledge-based."

Elena Revilla, Beatriz Rodriguez, Team vision in product development: How knowledge strategy matters, Technovation, Volume 31, Issues 2-3, February-March 2011, Pages 118-127.

The authors talk about the relationship between a product development success and the knowledge strategy of the organization. They test their hypothesis by studying 78 different product development programs from a wide variety of firms. Here they verify that the success of the product development is closely related to the strategic planning and alignment with the vision of the organization.

Elena, V. V. (2010). "Dimensions and Perspectives for Knowledge Management and Information." Journal of Knowledge Management, Economics and Information Technology 1(1): 23-30. (Cited 0 times).

This article discusses the importance of Knowledge Management (KM) as a resource to increase an organization's competitiveness. "Knowledge Management efforts typically focus on organizational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organization." The article models the major aspects of information and knowledge management in a concise manner and goes on to provide details on the main dimensions and major approaches of information and knowledge management, which include management, information sciences and information systems. The article distinguishes KM into the following aspects: data management, IT management and strategic use of IT and KM technologies.

Fahey, L., & Prusak, L. (1998). The eleven deadliest sins of knowledge management. *California Management Review*, *40*(3), 265-276. Retrieved April 20, 2011, from ABI/INFORM.

The 11 errors cited in this document are (quoted):

1. "Not Developing a Working Definition of Knowledge
2. Emphasizing Knowledge Stock to the Detriment of Knowledge Flow
3. Viewing Knowledge as Existing Predominantly Outside the Heads of Individuals
4. Not Understanding that a Fundamental Intermediate Purpose of Managing Knowledge is to Create Shared Context
5. Paying Little Heed to the Role and Importance of Tacit Knowledge
6. Disentangling Knowledge from its Uses
7. Downplaying Thinking and Reasoning
8. Focusing on the Past and the Present and Not the Future
9. Failing to Recognize the Importance of Experimentation
10. Substituting Technological Contact for Human Interface
11. Seeking to Develop Direct Measures of Knowledge

This last error is of most interest. The authors discuss a series of potential measurements that are proposed (number of reports, quality, number of database hits) but stresses the importance of knowledge stock and flows and that these metrics don't begin to address the actual flow of knowledge itself. They propose "proxies" to this knowledge flow via patents, new products, and customer retention.

Fairchild, A. M. (2002). Knowledge Management Metrics via a Balanced Scorecard Methodology. Proceedings of the 35th Annual Hawaii International Conference on System Sciences, 8, 243-250. Retrieved April 21, 2011, from IEEE Computer Society.

This paper reviews some examples of KM metrics that exists, provides a critique, and then proposes a balanced scorecard solution. One study quoted in this report found that only 20% of programs have metrics in place. "Although the focus on corporate culture and organizational change may extend the timeframe for a knowledge management program, only measurable benefits justify increased duration and cost in the eyes of senior management." (pg 244) "Given that there is no clear single activity that is knowledge management, it is more how and when knowledge management is integrated into organizational activities that can be measured." (pg. 244) The paper then continues with 2 approaches to a balanced scorecard creation. Both methods tie back to the original balanced scorecard proposed by Kaplan and Norton but modify the headings with the following approaches:

Original Balanced Scorecard	1st Approach Proposed	2nd Approach Proposed
Financial (ROI)	Intellectual Capital	Employees (measured similarly to Intellectual Capital)
Customer (satisfaction)	Social (done with surveys)	Customers (Customer Satisfaction)
Internal (response time, cost)	Structural	Processes (response time for information gathered using KM)
Learning and Growth (employee satisfaction)	Human	Technology (number of hits on KM project web sites)

Gourlay, S. (2003) "The SECI model of knowledge creation: some empirical shortcomings." 4th European Conference on Knowledge Management; 18-19 Sep 2003, Oxford, England.

The paper critiques several aspects of Nonaka's model of knowledge creation. He challenges the underlying empirical grounding of the model and rejects its paradigmatic status among authors and practitioners.

Handy, C. B. (1978). Gods of Management: How They Work, and why They Will Fail. Souvenir Press. (Cited 315 times)

In this classical work, Handy provides an easily readable metaphor of gods on top of Roger Harrisons typology of organizational cultures. It should not however be considered a mere popular adaptation as the author describes in depth different properties of different cultures as well as describing their conflicts.

Handzic, M. (2007). "Socio-Technical Knowledge Management: Studies and Initiatives" IGI Publishing.

The book provides a socio-technical framework for knowledge management within the context of the premise that any kind of knowledge management framework must be aligned with an organization's context and strategy for it to be successful. It provides a substantial amount of empirical evidence regarding the potential of sociotechnical knowledge management solutions to enhance and exploit knowledge.

Harrison, R. and H. Stokes (1992). Diagnosing Organizational Culture Instrument. Pfeiffer.

This book provides an excellent tool for assessing the organizational culture. In addition to providing some theoretical background, it also provides a through set of instructions from a questionnaire to suggestions about how to execute the survey to recommendations about interpreting the results.

Hatten, K. J. (2001). "Reaching for the knowledge edge: how the knowing corporation seeks, shares & uses knowledge for strategic advantage." AMACOM.

The book combines theory with practice and presents a pragmatic approach to knowledge management in corporations. The authors share a seven-step process aimed at allowing managers to optimize knowledge management in organizations and help keep them on the cutting edge of industry.

Huysman, M. and De Wit, D. (2002). "Knowledge Sharing in Practice." Kluwer Academic Publishers.

The book integrates best practices from three main schools of thought that it identifies within the knowledge management sector: one that believes that it is a Human Resource Management issue, one that believes that it is an Information Technology issue and one that views it within the context of 'Intellectual

Property'. It uses real-life examples of 10 companies' experiences with knowledge management and sharing throughout.

Garvin, David A. (2010). "Building a Learning Organization." Harvard Business Review: 78-91.

A learning organization creates, acquires and transfers knowledge. It also modifies its behavior, reflecting new knowledge and insights. In order to improve, changes in the way the work is done are necessary. Moreover, an incentive system favoring risk taking is necessary for successful programs. Finally, open and attentive listening is cultivated by learning organizations, and their managers have to be open to criticism.

Kemp, L. L., Nidiffer, K. E., Rose, L. C., Small, R., & Stankosky, M. (2001). Knowledge Management: Insights from the Trenches. IEEE Software, 18(6), 66-68. doi: 10.1109/52.965806 (Cited 22 times).

"Most respondents stressed the need to better leverage an increasingly vast and complex array of intellectual assets. Such assets represent today's new capital, marking a profound shift from more traditional types of capital." This paper is meant to "recap the lessons we have learned in pursuing our KM mandate and set forth what we believe are the keys to KM's future success."

Interesting lessons learned in the success of a knowledge management program summarized from the paper here:

- Clear Goals
- Strong Sponsorship
- Realistic Expectations
- Balance
- Iterative Approach
- A Systems Approach
- A flexible framework
- An evolutionary process
- Integrated measurement
- A capability model
- Technical maturity (of the KM tool)

Knox Haggie, John Kingston (2003), Choosing your knowledge management strategy, Journal of knowledge management practice, June 2003

This paper does a comparison of the key knowledge management strategies proposed and then they propose a simple classification tool to describe the drivers for a given management strategy by relying on published heuristics.

Koenig, M.E.D. (1996). Intellectual capital and knowledge management. IFLA Journal, 22(4), 299 –301.

Laudon, K. C., and Laudon, J. P. (2006): "Management Information Systems," Ninth Edition, Pearson Prentice Hall.

The book constitutes a review of the basics concepts of information systems, as well as their application to the management of organizations. In this sense, information systems include Enterprise Resource Planning, Customer Relationship Management, and Supply Chain Management. The text explains how information systems can be used to take decisions and support control processes.

Liebowitz, J. (1999). Knowledge management handbook. Boca Raton, FL: CRC Press.

"The knowledge management (KM) craze has commenced!" pg. iii in Preface

Liebowitz, J., & Wright, K. (1999). A look toward valuating human capital. In J. Liebowitz (Ed.), Knowledge management handbook (pp. 5-1 - 5-13). Boca Raton, FL: CRC Press.

Chapter 5 of the book, "A Look Toward Valuating Human Capital" by Jay Liebowitz and Kathie Wright, again began by surveying the area of KM for ideas of metrics. Many of the sources use global business indicators (i.e. "Sales of new products less than five years old as a percent of total sales"). Many were soft indicators in that although they provide a numeric output, their calculation is subjective (i.e. "Records replacement value, and estimate of the costs of replacing an employee with someone of equal value"). Some had equations to calculate the value of information. Many were truly measurable ideas of KM (i.e. "Number of college graduates", "Percentage of revenues invested in knowledge transfer system," "Patent-to-stock price ratio: the ratio of the number of patents divided by the price of a company's stock").

Liebowitz, J., & Suen, C. Y. (2000). Developing knowledge management metrics for measuring intellectual capital. Journal of Intellectual Capital, 1(1), 54-67. Retrieved April 20, 2011, from Emerald Library.

Similar to the source above from Liebowitz, this paper provides several pages of metrics being utilized by other companies / researchers. The authors noted three conclusions from these metrics surveyed: 1. They can be readily obtained and are quantifiable, 2. They lack creativity in determining the size and growth of the knowledge base and 3. They are subject to bad assumptions or point of reference. The authors then propose a list of possible new metrics that help to solve the above issues. They then apply them to a case at the University of Maryland-Baltimore in the Department of Information Systems. The applied some of the metrics suggested in the first part of the paper, but were left with the question "how can we interpret what they mean? Are there any baselines or benchmarks to measure against these numbers?" In the end, this was an open research question in the paper – conducting a baseline in order to make sense of the results obtained.

Louis, M. (1985). An investigator's guide to workplace culture. Newbury Park, CA: Sage.

This book provides a through understanding of the concept organizational culture as well as approaches to assessing them.

Mårtensson, M. (2000). A critical review of knowledge management as a management tool. Journal of Knowledge Management 4(3), 204–216. (Cited 207 times).

The paper by Mårtensson constitutes another attempt to provide a coherent view of knowledge management. It's most valuable part besides the bibliography is a short insight into the origins of knowledge management as a scientific research topic and as a practical management tool. The author comes to the conclusion that while knowledge management is useful, it should be treated with caution and one should be aware of its limitations.

Moore, C. R. (1999). Performance measures for knowledge management. In J. Liebowitz (Ed.), Knowledge management handbook (pp. 6-1 - 6-29). Boca Raton, FL: CRC Press.

Finally, chapter 6, "Performance Measures for Knowledge Management" by Carl R. Moore, continued discussions with mathematical equations after defining KM and the need for metrics where he divided the need into two categories: "project management … and quality control." The former is intended to "measure the size, effort, and duration … as well as measuring progress during development against budget". The quality control is meant to "measure the number of errors or defects".

Later in this chapter, the author brings up "The Rayleigh Curve" to illustrate the point that "when only two thirds of the duration is complete 90% of the effort has been expended." At this point, the chapter begins to use the metrics more as a project management tool in understanding the resources in "knowledge work" and uses software as an example as it is easier to measure the quantity of output (lines of code).

McDermott, R. (1999). Why information technology inspired but cannot deliver knowledge management. California management review 41(4), 103. (Cited 764 times)

McDermott starts his article by quoting Albert Einstein: "Knowledge is experience. Everything else is just information" and goes on to explain the importance of cultural transformation in knowledge management efforts. His main thesis is that technology just enforces existing behaviors and communication patterns: if these did not do a good job at knowledge management before, they will not do a good job now: doing a wrong thing more thoroughly does not make it right. He argues that knowledge sharing is an act of thinking and can thus be undertaken only by a human. The author uses the metaphor of "knowledge junkyards" to illustrate how technology can help collect vast bodies of useless information. In addition McDermott brings an interesting definition of knowledge by stating among others its property of being "a residue of thinking" and "be- longing to communities". By this he establishes a link with systems thinking (thinking is a human act and therefore a person is an integral part of the process) and refers to social relationships between people that are a manifestation of culture. However, McDermott falls short while building a bridge to organizational cultures. He clearly states eight guidelines to leverage knowledge five of which are either possible only in certain types of cultures or indicate the need for active management of culture and its change but does not go further than that. All in all, it's an excellent article about the nature of knowledge, its management and the implications of it. It even manages to establish a link to popular culture by quoting Wallace Stevens saying: "Thought is an

infection, some thoughts are an epidemic". This train of thought is thoroughly explored in a cyberpunk classic "Snow Crash" (Stephenson, N. (2000). Snow Crash. Spectra.).

McInerney, C. (2002). "Knowledge management and the dynamic nature of knowledge." Journal of the American Society for Information Science and Technology 53(12): 1009-1018. (Cited 138 times).

This article examines knowledge management and the means by which an organization uses its collection of knowledge to complete the organization's mission. The article looks at knowledge as "dynamic process" that changes over time and must be constantly updated within an organization. The article examines tacit and explicit knowledge and models the relationship with a detailed explanation on how the two relate. This is a good article that goes into detail on the complexity of knowledge management as a dynamic process.

Nonaka, I. (1991). "The Knowledge-Creating Company." Harvard Business Review November-December: 96-104.

Knowledge is a source of lasting competitive advantage. Successful companies consistently create knowledge, disseminate it through the organization and embody this knowledge in products and products. The business of the knowledge-creating company is continuous innovation. For knowledge creation to be possible, knowledge has to first be converted from explicit to tacit if it is not already tacit. It is only from internalized knowledge that new knowledge can be created.

Nonaka, I. (1994). "A Dynamic Theory of Organizational Knowledge Creation" ***Organization Science,*** **Vol. 5, No. 1 (Feb., 1994), pp. 14-37 Published by: INFORMS Stable URL: http://www.jstor.org/stable/2635068.**

The author defines a knowledge creation process for an organization. The initial section delve into the definition of knowledge itself and then into the different forms of knowledge, tacit and explicit. The author highlights the challenges posed in capturing the explicit knowledge. He then defines a knowledge creation process and different modes of creation of knowledge. He then delves into the management models that are prevalent today and does a comparison to explain their relevance in knowledge creation and sharing.

Nonaka, I. and G. von Krogh (2009). "Perspective--Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory." Organization Science 20(3): 635-652. (Cited 7 times).

This article aims to "systematically and comparatively analyze the debate on organizational knowledge creation theory." The article distinguishes between "tacit" and "explicit" knowledge and clarifies knowledge conversion in Knowledge Management. Organizational knowledge creation theory is defined in three parts. First, "knowledge is justified true belief." Second, "knowledge is the actuality of skillful action," and third, "knowledge is explicit and tacit along a continuum." The inclusion of tacit knowledge into the knowledge creation theory prevented the mainstream theory's tendency to discuss knowledge and information as synonymous concepts.

Nonaka, I., and Takeuchi, H. (1995): "The Knowledge-Creating Company," Oxford University Press.

This book summarizes the mechanisms by which an organization can accomplish the task of creating knowledge, which makes it capable of prospering and surviving in a hostile environment. The creation of knowledge is defined as a spiral process oscillating between explicit to tacit and tacit to explicit conversion mechanisms. Thus, the book explains the success of Japanese companies in the 1970s and 1980s.

Nonaka, I., K. Umemoto, D. Senoo. 1996. "From information processing to knowledge creation: A paradigm shift in business management." Tech. Soc. 18(2) 203–218.

Abstract: "This paper examines how information technology (IT) can help implement the concept of "the knowledge-creating company," which we propose as the management paradigm for the emerging "knowledge society." We present our theory of organizational knowledge creation, along with actual examples of IT that are being used now or can be used in the near future by business organizations. Also, several differences between the Japanese- vs. Western-style organizational knowledge creation and their implications in relation to IT are discussed."

Nonaka, I., R. Toyama, N. Konno. 2000a. "SECI, Ba and leadership: A unified model of dynamic knowledge creation. Long Range Planning," 33(1) 5–34.

This paper analyzes how companies can manage knowledge in a dynamic way ensuring the organization captures that knowledge in an effective and efficient manner. Their ability to do so will directly impact their competitive advantage in the marketplace, which Nonaka elaborates in detail over the course of the paper. The paper give a thorough background on the SECI model, the concept of "Ba" and the overall "knowledge creating process."

Nonaka, I., R. Toyama, A. Nagata. 2000b. "A firm as a knowledge- creating entity: A new perspective on the theory of the firm." Indust. Corporate Change 9(1) 1–20.

This is another paper by Nonaka that continues to push the theory that a firm's ability to capture knowledge and create new knowledge will directly impact their competitive advantage. This paper differs with regards to other papers written by Nonaka in the sense that it directly correlates this knowledge creation to a firm's ability to innovate new products, processes and services.

O'Dell, C., & Grayson, C. J. (1998). If only we knew what we know: Identification and transfer of internal best practices. California Management Review, 40(3), 154-174. Retrieved April 20, 2011, from ABI/INFORM.

This is a great introductory paper into KM. It starts by talking about the GM / Toyota JV at the NUMMI plant we read the case on earlier this semester. It alludes to the great failure in knowledge transfer within GM and that a new division, Saturn, had to be created in order to get the knowledge out. The article cites three reasons for this: ignorance by the source and recipient as to the existence of knowledge in the organization, absorptive capacity discusses the lack of resources to utilize the knowledge, and lack of a relationship between the source and recipient. A study quoted in the paper by Szulanski said that best practice found 27 months for knowledge to get across an organization!! The paper then reviews several success stories illuminating the potential gains (i.e. "At Dow Chemical, early efforts to manage intellectual capital brought an immediate kick-back in the form of $40 million in savings.") This paper also discusses 5 "instigators" that generate interest in KM: A compelling call to action, Demonstrated success, Decentralization and downsizing, Benchmarking evidence, and Recognition of the potential gain.

This paper presents two types of measurement relative to KM: measuring performance in order to identify a best practice within an organization, and measuring impact of best practice transfer.

The paper proposes 4 possible measurements of KM:

- Frequency of use of the system and user satisfaction
- Business success as a result of sharing knowledge
- Improved cycle time (reduce 27 months quoted above)
- Increase number of networks within an organization (think about Tom Allen's charts from class)

Finally, the paper presents 7 keys to effective KM:

- "Use benchmarking to create a sense of urgency or find a compelling reason to change.
- Focus initial efforts on critical business issues that have high payoff and are aligned with organizational values and strategy.
- Make sure that every plane you allow to take off has a runway available for landing.
- Don't let measurement get in the way.
- Change the reward system to encourage sharing and transfer.
- Use technology as a catalyst to support networks and the internal search for best practices, but don't rely on it as a solution.
- Leaders will need to consistently and constantly spread the message of sharing and leveraging knowledge for the greater good."

Orero, A., Chaparro, J., Merino, J. and Álvarez, C. (1996): "The Manage of Organizational Change by Information Systems". Third IFSAM World Conference.

Information technology is integrated in the strategic plans of the organization. This integration should drive to a change in the structure of the organization. Information systems and information technology thus support the organizational change. The relationship between information technology and organization is analyzed. A methodology is then described to manage the organizational change using information technology as a support.

Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. Journal of Knowledge Management, Emerald Group Publishing

This paper goes over the fundamental concepts in knowledge management and then critically discusses barriers that exist at the individual, organizational and technological levels that impede companies' abilities to implement successful knowledge management and knowledge sharing processes.

Roos, G., & Roos, J. (1997). Measuring your company's intellectual performance. Long Range Planning, 30(3), 413-426. doi: 10.1016/S0024-6301(97)90260-0

This paper first discusses the important of intellectual capital and begins to set-up a framework. They then conducted an exercise by interviewing executives from 5 Northern-European companies. Graphics within the paper present the frameworks set-up by these companies. Of particular note were the several pages of conclusions. First, they discussed three requirements for developing an Intellectual Capital System: mature business to be looking beyond only financial performance, clear definitions of business directions, and clear commitment supported by top management. Another conclusion included three ways to derive indicators: 1. Indicators of the vision / direction of the business, 2. Indicators grounded in the intellectual capital categories developed and 3. Indicators grounded in inter-capital flows.

Rubenstein-Montano, B., Liebowitz, J., Buchwalter, J., McCaw, D., Newman, B. and Rebeck, K. (2001). "A systems thinking framework for knowledge management. Decision Support Systems, 31(1), 5-16. Retrieved April 12, 2011, from Elsevier. (189 times).

This paper presents an interesting couple of pages (pg 4 and 5 of the article) that summarizes many papers on knowledge management and the framework for KM proposed by each of the sources. They then divide these into one of the following types of frameworks: prescriptive, descriptive, or a hybrid. Their analysis of the various frameworks presented suggested that:

> "The frameworks are not consistent with systems thinking:
>
> 1. the frameworks are prescriptive in nature and thus center on knowledge management tasks; and
> 2. the frameworks do not address the notion of double-loop learning.
>
> There is a lack of cohesiveness across frameworks:
>
> 3. there is no single definition of what constitutes a knowledge management framework; and
> 4. there are many concepts that are common to multiple frameworks, but the ordering or structure of the frameworks varies."

It further states that "for knowledge management to be consistent with systems thinking, it must consider the entire knowledge management process: purpose of the organization (strategic objectives), knowledge, technology, learning, and people / culture. These parts can then be further divided into different types of knowledge, knowledge flows, knowledge tasks, learning, and technology and sub-groups of people / cultures within the organization."

Schwartz, H. and S. M. Davis (1981). Matching corporate culture and business strategy. Organizational Dynamics 10(1), 30–48 (Cited 460 times)

The classical paper provides yet another definition of organizational cultures but does it through defining its relationships with organizational climate that is frequently and mistakenly considered to be synonymous with culture. Its main value is the comprehensive framework it provides for linking organizational culture and business strategy and assessing cultural risk.

Scott Morton, M. S. (1991). The Corporation of the 1990s. Oxford University Press.

This book presents the idea that information technologies can be used to provide organizations with the potential to survive and prosper in a hostile environment. Organizational change is a must in a turbulent environment. But the rapid change of information technologies makes possible for organizations to get adapted to this change. An interaction model is proposed that related information technologies to structure, processes, and individuals and roles.

Sinclair, N. (1998), "Preface" in Williams, K. (Ed.), *The Land and The Sea,* Gomer Press, Llandysul.

Snowden, D. (2002). "Complex Acts of Knowing: Paradox and Descriptive Self-Awareness." Journal of Knowledge Management 6(2): 12.

Stewart, T.A. (1998). Intellectual capital: The new wealth of organizations. New York: Bantam.

Stewart, T.A. (2001). The wealth of knowledge: Intellectual Capital and the twenty-first century organization. New York: Currency.

Szulanski, G. (1996). Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm. Strategic Management Journal, JSTOR.

This paper uses "stickiness" as a metaphor to discuss the difficulties that some organizations have in getting best practices and other forms of tacit knowledge replicated internally. The author analyzes discusses a model of stickiness, leverage data consisting of 271 observations of 122 best-practice transfers in eight companies. The author then suggests reasons beyond motivation as the main barriers to knowledge transfer within organizations.

Trice, H. M. and J. M. Beyer (1993). The Cultures of Work Organizations. Upper Saddle River: Prentice Hall. (cited 1361 times)

For a person seeking to undestand the concept of organizational culture, this is the most definitive source of information. Without committing to any particular approach, Trice and Beyer give a systematic overview of different approaches, theories and research. The book includes a thorough bibliography covering effectively the entire body of significant scientific research on organizational cultures.

Von Bertalanffy, L. (1968). General System Theory. George Braziller, New York.

The book explains the General System Theory, which is applicable to the original field of the author – biology – as well as to any other field of knowledge, including engineering, economics or sociotechnical systems. The book presents the concept of open systems and feedback as a means for them to get adapted to an external environment. This book is important because it establishes the bases of systems thinking.

Von Krogh, G., Ichijo, K., and Nonaka, I. (2000). Enabling Knowledge Creation. Oxford University Press.

The book is a sequel of "The knowledge Creating Company", by Nonaka and Takeuchi (1995). It explores how to create the conditions in an organization so that the creativeness of the individuals is left in freedom to allow the organization to generate knowledge. Five enablers are presented that enable the before mentioned processes: Instill a Knowledge Vision, Manage Conversations, Mobilize Knowledge Activists, Create the Right Context, and Globalize Local Knowledge.

Womack, K. K. (2001). Knowledge Management: The business proposition for government organizations. In R. C. Barquin, A. Bennet, & S. G. Remez (Eds.), *Knowledge management: the catalyst for electronic government* (pp. 361-392). Vienna, VA: Management Concepts. (Cited 10 times)

Womack first suggests two measures of knowledge management: end-user participation and business value. "If enough momentum is gained in driving usage and participation up, we then have a foundation for measuring impacts on bottom line business performance." (pg 371).

He further breaks down business value measures into four categories: Improved Operational Excellence, Increased Product Leadership, Increased Customer Intimacy, and Improved Employee Capability.

Womack discusses the common pitfalls in using metrics as he had said earlier: "We are what we measure" (pg 372). The pitfalls include:

- "Using too many metrics
- Using delayed and risky reward ties
- Choosing metrics that are hard to control
- Choosing metrics that are hard to focus on
- Choosing metrics that measure the hard results and neglect the 'soft stuff'
- Choosing metrics that are too rear-view oriented
- Measuring the wrong things." (pg 374)

Zack, M.H (1999), Developing a Knowledge Strategy, California Management Review Vol 41.NO.3 Spring 1999.

The paper starts with the review of various knowledge management practices prevalent in 1999 and then starts to talk about the relvance of such management tools only if the knowledge strategy is appropriately alligned to meet the challeges of the changing times.The article then aligns the knowledge strategy as the key piece of the business strategy for any organisation. The author proposes ways of categorising types of knowledge and then based on the knowledge readiness defines if the organisation is aggressive or conservative.

Zhang, D., & Zhao, J. L. (2006). Knowledge Management in Organizations. Journal of Database Management, 17(1), i-viii. Retrieved April 12, 2011, from ABI/INFORM Global. (Cited 17 times).

This paper starts with a bar chart showing how many articles found in a database, INSPEC, addressed the topic of KM starting from 1980 through 2005. Numbers increased from 6 articles between 1980-1985 (first one in 1983) to almost 1200 articles from 2001-2005. The next chart in the paper shows the same database and the number of knowledge management articles by the topic they cover from the following list (listed in decreasing order of popularity of coverage):

- Tools / Systems ~1200 articles
- Modeling
- Organizations
- Algorithms
- Applications
- Management
- Adoption 15 articles

This paper is an introduction to 6 additional papers in the journal that address KM and are divided in half based on 2 sub-topics: Research Issues and Opinions, and Architectural and Technical Foundations.