Knowledge management in a research & development environment - The Integration of company culture and technology

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KNOWLEDGE MANAGEMENT
IN A RESEARCH & DEVELOPMENT ENVIRONMENT
– The Integration of Company Culture and Technology –
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Table of Contents

Abstract .................................................................................................................. 3
Background ........................................................................................................... 3
Assertion.................................................................................................................. 4
Methodology .......................................................................................................... 5

Part One – Company Structure, Company Culture, and Knowledge Management

Justification for Implementing Knowledge Management ........................................ 7
The Distinction Between Data & Knowledge .......................................................... 10
Understanding Organizational Structure and Culture ............................................. 11
Common Knowledge Management Inhibitors ......................................................... 19
Evaluating the Success of Knowledge Management Initiatives .............................. 21
Moving to a Knowledge-Based Culture ................................................................... 24

Part Two – Knowledge Management Tools

Tools for Sharing a Vision ...................................................................................... 30
Tacit Knowledge Management Tools (Collaboration Tools) ................................... 31
Expertise Location Tool .......................................................................................... 33
Explicit Knowledge Management Tools .................................................................. 34
Knowledge Management Cultural Support Tools .................................................. 36
Case Studies of Knowledge Management Implementations ................................... 37
Conclusion .............................................................................................................. 46
References ............................................................................................................. 49
Appendix ............................................................................................................... 56
Abstract

This thesis will show that understanding company structure and company culture are significantly more important than the actual technological tools an organization uses to implement successful knowledge management. An examination of company structure and cultural enablers will be followed by a review of some of the most widespread knowledge management tools to illustrate how knowledge management can be successfully put into practice.

Background

Knowledge management, at its most basic, is a program employed to retain, share, and build on knowledge to increase productivity and profitability for an organization. Successful programs are built on a solid, organization-specific strategy, which includes plans for implementation of technical tools or systems, along with necessary cultural and structural changes, staff training, policy adjustments, and more.

Knowledge and knowledge management are critical in today's rapidly changing business environment because they help a company create a competitive advantage. Early forms of knowledge management focused on cataloging, organizing, and making documents and other static forms of information available. This kind of management makes access to documents easier, but does not help to encourage collaborative knowledge processes. Having a vast number of old documents online is not necessarily of much benefit for creating new knowledge in a rapidly changing environment. The types of knowledge with the greatest potential to affect knowledge management include transient knowledge such as emails, since most are very
short-term and very real time. Emails can be scanned and processed, but then larger issues, such as privacy, must be addressed.

Intellectual capital is not just patents and copyrights, but the people who create knowledge and foster its growth. Who are these knowledge leaders and what tools do they effectively use to create and promote knowledge? Capturing the knowledge employees have before it disappears can be essential to a company’s survival.

To capture knowledge and nurture collaborative processes, we must first understand how people interact with and create knowledge. Getting people to see possible connections between seemingly dissimilar topics and processes can be one of the benefits of knowledge management. The first step is often simply learning how to share. Once people understand and are rewarded for sharing and the collaborative creation of knowledge, then the professionals in the information technology (IT) department can put tools in place to further its growth.

**Assertion**

The purpose of this paper is to show that successful knowledge management programs can only be accomplished when an organization properly addresses company cultural and structural issues. Based on the research I conducted for this thesis and the dozens of sources I reviewed, I estimate that knowledge management tools and the technology they are built upon usually represent less than one-third of a successful knowledge management program.

Once a knowledge management program has been implemented, how can its success be accurately determined? This thesis will illustrate success and failure of implementations based on the most widely accepted industry methods relevant to each phase of a knowledge management implementation. For example, in early phases, knowledge management implementations are
often measured through simple metrics such as how many questions were asked and answered using the system. In later phases of the implementation, success or failure can be measured by more specific metrics such as the percentage that cycle time was reduced from idea to product design phase, based on using the knowledge management system. One example of knowledge management failure includes companies who do not establish any motivation for employees to use the system. When little data is entered, meaningful information cannot be retrieved.

Methodology

There are two parts to my thesis. The first part will examine company structure, company culture, and enablers of knowledge management. I will explore the type of strategies needed to promote knowledge management. By reviewing current case studies and white papers of companies that have successfully implemented knowledge management and others that have failed, I will be able to validate my thesis assertion. The scope of my research will focus on knowledge management as it relates to research and development (R&D). The second part of my thesis will examine some of the current knowledge management tools and how they work with the cultural enablers identified. I will examine knowledge management issues in both national and international contexts. International aspects to knowledge management are becoming increasingly relevant as the traditional barriers of distance are removed and more companies utilize resources in multiple countries.
PART ONE

COMPANY STRUCTURE, COMPANY CULTURE,
AND KNOWLEDGE MANAGEMENT
Justification for Implementing Knowledge Management

Modern business is filled with uncertainty. In order to survive and maintain a competitive advantage, today’s companies must develop products faster and better than their competition. By enabling employees to work together more productively, knowledge management helps a company to innovate, create new products, and gain an edge in the marketplace.

The information that employees hold in their heads and develop together with their coworkers has become one of the most important assets that a company owns. Knowledge management helps a company discover, manage, and expand these intellectual assets.

When considering implementation of knowledge management, many companies first focus on the research and development area, because this is where intellectual assets are created and grow into new or enhanced products. In an economy where life cycles of products can be measured in months instead of years, rapid development is one way to increase market share and achieve success. The faster a company’s research and development community can create new products and technology, the more likely they are to increase the profitability of a business.

Stated simply, this is the primary return on investment (ROI) for knowledge management in research and development environments. It’s getting new products developed faster, into production more quickly, and into the marketplace before the competition, thus gaining the advantage and the increased revenue.

Another area of ROI for research and development (R&D) is that knowledge management can help a company do more with less and better utilize the workforce. As companies continue to struggle in today’s tight economic conditions, there is pressure on all areas of the company to contribute to the financial well being of the company. Controlled spending, reduced cycle time, and reductions in the labor force are used to control costs.
In an article titled “Mining for Gold in the Lab” in Chemical Week, author Rick Mullin explains some of the challenges being faced at internationally-known Dow Chemical: A decade of layoffs, budget cuts, and retirements … has created a need for new tools and strategies for cataloging and communicating information at the same time as new laboratory techniques such as computational chemistry and high-throughput screening add more speed to the process of product development and commercialization (Mullin, 2001, pg 2).

At Dow, knowledge management not only helped reduce costs by enabling a smaller workforce to accomplish department goals, but also helped the reduced employee base develop products more quickly.

Collaboration needs to take place within the company among researchers and developers, as well as between developers and the marketplace. By helping researchers leverage each other’s talents and experience, knowledge management in the R&D environment can help bring people together within and across disciplines. Sharing information and building knowledge together helps researchers reduce the amount of time it takes to develop ideas into viable products. In addition, taking knowledge management beyond the bounds of the company by connecting researchers directly with potential customers during the development cycle helps to insure new products are well received when produced.

To understand how knowledge management can be beneficial in a research and development environment, consider a hypothetical example of several scientists working in different divisions of a large company. All are working on new digital imaging technologies, but employees A and B work in the printer group and employee C works in the camera group. The employees have different needs for their products, but all are working to reduce the appearance
of red-eye in images. Employee A sends a message to B explaining how adding specific code to the algorithm makes the red eye reduction work 10 times faster. The printer employees have solved a problem. Meanwhile, employee C in the camera group has the same problem, but he’s stuck. He can’t get at the knowledge in the emails and he doesn’t know there are documents on the servers that could help him. He doesn’t realize that there are people in another division who have the answer to his dilemma, because he doesn’t even know they’re working on it. As a result, employee C’s productivity suffers.

With a knowledge management system in place, the scenario changes and efficiency can be greatly improved. The three employees understand the benefits of knowledge management. They have “bought into” the concept and actively use the system. Management encourages them to use their time to share as well as invent. Periodically, the employees interact in person or via websites to exchange information as part of a community of practice in their area of expertise. This time, when employee C faces a problem, he utilizes the knowledge management system. Tools recognize the documents on the servers and email system, identify those related to the red-eye problem, and enable employee C to access them. He reviews the expertise locator to find additional researchers who might be working on similar projects. Employee C solves his problem quickly – soon after employee A reaches his conclusion.

Despite the potential return on investment to companies, however, a review of knowledge management literature suggests that it has not made a large impact on research and development to date. Many R&D environments have not been able to capitalize on the benefits of knowledge management due to poor implementations and a failure to understand the “people part” of the equation. Understanding the company culture, structure, and style is crucial to understanding the
people and getting them to share information. If researchers do not share, the system doesn’t work.

Beyond the R&D division, many areas of a company contribute to profitability. Knowledge management can have a role in other parts of a company as well. The legal department of a large company will more likely require document management due to the large volume of written artifacts produced. There is only limited need for collaboration in this space. Manufacturing can benefit from the documenting and sharing of best practices. Yet, the focus of manufacturing is seldom creating new knowledge. The ROI for knowledge management in manufacturing might be found in reducing cycle time through more efficient processes.

The Distinction Between Data & Knowledge

To conduct an examination of knowledge management, it is important to understand what we are attempting to manage. It can be generalized that data is the lowest common denominator in the knowledge management equation. Static and easily codified, data is easily manipulated and translated into the 1’s and 0’s that are the basic building blocks for computers and software.

Knowledge is gained through experience. In knowledge management, tacit knowledge is often referred to as a fluid kind of knowledge that is shared between people and not easily documented or sorted. Knowledge management experts Nakkiran Sunassee and David Sewry define tacit knowledge as, “the form of knowledge that is subconsciously understood and applied, difficult to articulate, developed from direct experience and actions and usually shared through highly interactive conversation, storytelling, and shared experience” (Sunassee & Sewry, 2002, pg. 236).
Tacit knowledge is perhaps the most important kind of knowledge for knowledge management, especially as it relates to research and development. Because tacit knowledge is fluid, it is current and often propels creativity into new ideas.

Explicit knowledge is one step up from raw data. It is the kind of knowledge that can be manipulated by information technology tools because it is relatively static and can be stored and sorted.

For example, when a researcher puts data into a spreadsheet and manipulates it, the content of that spreadsheet is explicit knowledge. When the researcher sends an email to a colleague in his department discussing his ideas based on the spreadsheet, the content in the email is tacit knowledge. Knowledge management systems capture both data and knowledge.

Some literature suggests that there is an area between data and knowledge that is neither tacit nor explicit. This area is information. Information is built on data. Thomas Davenport, knowledge management expert and author of several books, suggests that information is “data with relevance and purpose” (Stenmark, 2002, pg. 2). As is the case of data, information is also well suited to manipulation with information technology tools. Computers and software can sort and group information by similarities or dissimilarities. Still capable of being stored on computer systems, information does not necessarily have to be associated with or created by people.

**Understanding Organizational Structure and Culture as the Key to Successful Knowledge Management**

In many ways, knowledge management isn’t really about technology at all – it’s about sharing information. Knowledge management initiatives often fail because they only focus on what the information technology (IT) tools can do – the storing, cataloging, and managing of
documents or data — and forget about the importance of information sharing. Tools can sort through a large repository of documents to find common ideas, but the technology serves no purpose unless people use it. In order to get people to use a knowledge management system and to share, company leaders must understand how people work and think. In other words, management must understand the culture and structure of the workplace and how to effectively motivate their employees.

A company’s employees must be encouraged to put information where the knowledge management system can access it. For example, researchers might avoid creating notes on a server because they don’t want someone else to see their work and then take credit for it — they could be working on their own desktop or writing by hand on legal pads. To encourage behaviors conducive to knowledge management, a supportive environment and culture must be in place.

Managing knowledge requires that people work with other people, not just words and documents. As BP Amoco’s Knowledge Architect Chris Collison explains, “Communication theory suggests that in conversation, only seven percent of the message is in words, 38 percent in the voice, and 55 percent in the body language” (Collison, 1999, Pg. 5).

In general, the things that enable successful knowledge management revolve around how a company is structured, how people work together, how people use tools, how people communicate, and, in some cases, the physical environment or building layout. These can be referred to as “enablers.” For example, does the company have policies that reinforce teamwork and creativity or does the company have a top-down, focused management that tightly controls communication? In my experience studying sociology, I have found that culture is, at the most basic level, all about the way people come together and act on a daily basis. The organizational
culture within a company is about how things are done – the norms and values – what behaviors are rewarded and what behaviors are not.

While each business is unique, it is possible to focus on two different types of corporate organizational structures and the cultures typical to these companies. It can be generalized that there are hierarchical company structures, where the culture is control-oriented and management dictates who does what work and open or flat organizational structures, where there are fewer layers of management and a team approach is used to solve problems and complete work. The two types of company structures, which are described in detail below, illustrate the culture of the organization and directly affect the way knowledge is created and flows within a company (ProcessEdge, 2002, pg. 6).

Hierarchical Organizational Structure & Culture

For businesses with a hierarchical structure, the many layers of management result in a culture that rewards individual achievement. Employees strive to achieve and those who succeed are often recognized with advancement or other perks. The focus is on individual outcome, not on team work. This company structure, therefore, can be a disabler of knowledge sharing. An inventor may be unwilling to share his research because he wants to ensure he receives the credit for his ideas, as the reward structure is focused on the individual (ProcessEdge, 2002, pg. 6).

The hierarchical organization culture is a culture based on control. Management creates the strategic vision for the company and dictates how it will be realized. Several layers of management create a hierarchical structure to insure each component of the corporate business strategy is run according to plan. The hierarchical organizational structure has its roots in manufacturing and is often referred to as an industrial culture (Locke, 2002, pg. 9).
The impact of a hierarchical organization structure on knowledge management is quite pronounced. The same hierarchical structure that helps a company to realize operational efficiencies can be an inhibitor to information sharing and knowledge management. Individual workers in the hierarchical organizational structure are expected to carry out the work assigned them according to plan and not deviate from schedules or standard processes. People working in these companies are often put in an occupational paradigm referred to as a “silo” (Ambrecht et al., 2001, pg. 39). Silos usually have a narrow focus with limited growth opportunities and few expectations for employees to take creative initiative. The focus is limited to a narrow range of expectations.

The classic example is the creation of the assembly line by Ford Motor Company to mass produce cars. No longer were skilled craftsmen required to hand craft each part. When the skilled craftsmen were removed, the skilled knowledge was gone, too. Repetitive tasks became standard work that anyone could execute.

The reduction in skills and breadth of knowledge is not unique to workers at the bottom of the hierarchical organizational structure. Managers too became specialized in their functions. This management specialization occurred as some companies grew and began to specialize operational functions.

In addition to a reduction in skills, the hierarchical structure creates an environment and a culture where individuals are not encouraged to rely on or even interact with one another. This isolation has a negative impact on learning and the sharing of knowledge. Knowledge management expert and author Thomas Davenport suggests that, “The socialization benefit is particularly important when the primary content of the work is informational…with no team structure to foster social interaction, the workers performing these job tasks become alienated”
(Davenport, 1993, pg. 98). The lack of a team orientation in the hierarchical organizational structure and the resulting alienation between workers can have a very negative impact on knowledge creation and sharing.

One final consideration for the hierarchical organizational structure is that not only does it negatively impact the sharing and creation of knowledge for workers and management, it also has the potential to isolate the customer. When corporate culture is primarily focused on process efficiencies enforced by strong top-down management strategies, the operational model can include very little consideration of customer input. Efficiency and profit are the main considerations for the hierarchical organizational model and often the customer is forgotten.

Open Organizational Structure & Culture

An “open” organizational structure has a distributed management style, where responsibility is shared across the company through a flat organizational structure and fewer management levels. In addition, the company focus tends to be on contributions from all employees and on the customer. The success of the company is measured by overall effectiveness, not individual achievements (ProcessEdge, 2002, pg. 6).

Companies that have an open organizational structure tend to encourage innovation and risk taking as an inherent part of their culture. In this type of structure, problems, challenges, and rewards are addressed from a team orientation. Although aggressiveness may be encouraged, there is a strong value placed on group dynamics. In this culture, when the team succeeds, all individuals on the team are rewarded. Open organizational structure is more flexible than the hierarchical organizational structure and the culture reflects that flexibility by being open to the distribution of decision-making and operational responsibility across the organization. Due to the
emphasis placed on sharing, an open organizational structure can be an enabler of knowledge management (Davenport, 1993).

Comparing Organizational Structure & Culture

Comparing the characteristics of the two major types of organizational structures in a simple table is a helpful way to highlight the differences. The following table, from the ProcessEdge website, details the characteristics of the open organizational structure (referred to as "Knowledge Culture") versus the hierarchical organizational structure (referred to as the "Industrial Culture").

<table>
<thead>
<tr>
<th><strong>Industrial Culture</strong></th>
<th><strong>Knowledge Culture</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited information distribution</td>
<td>Wide information distribution</td>
</tr>
<tr>
<td>Many management levels</td>
<td>Few management levels</td>
</tr>
<tr>
<td>Uneven responsibility</td>
<td>Shared responsibility</td>
</tr>
<tr>
<td>Rules based</td>
<td>Principles based</td>
</tr>
<tr>
<td>Structured</td>
<td>Unstructured</td>
</tr>
<tr>
<td>Risk adverse</td>
<td>Able to take some risks</td>
</tr>
<tr>
<td>Inward orientation (internal focus)</td>
<td>Outward orientation (external, customer focus)</td>
</tr>
<tr>
<td>Occasional training</td>
<td>Continuous learning</td>
</tr>
<tr>
<td>Financial (bottom-line focused)</td>
<td>Marketing (customer focused)</td>
</tr>
<tr>
<td>Political (hierarchical management)</td>
<td>Open (input encouraged from all levels)</td>
</tr>
</tbody>
</table>

(ProcessEdge, 2002, pg. 6)
Understanding the areas detailed in the previous table are important to understanding knowledge management for several reasons. The flattening of the management structure into fewer management levels requires shared responsibility and a distribution of information. Shared responsibility requires the involvement of more of the people throughout the organization. While the hierarchical organizational structure requires roles to be focused on a set of tasks and accomplished with a particular skill set, the open organizational structure requires a more diverse skill set. Distributing the responsibility in an organization requires people to see and understand the “larger picture” of how the organization works. Seeing the big picture is not only a responsibility, but an opportunity for people to share information with one another and build the collaborative networks that help knowledge flow.

Organizational management and in particular leadership styles, are important characteristics of organization culture. Data from Gartner, Inc., a leading provider of research and analysis on the global IT industry, suggests that, by 2005, eighty percent of information-intensive enterprises that have maintained or improved performance in the new economy will have adopted leadership styles that focus on facilitating creativity, sharing, and learning rather than on direction and control (Mahoney, 2001, pg. 1). The move to more creative leadership styles in such a large percent of the industry underscores the importance of an open organizational structure and its culture.

The distributed management style typical in the open organizational structure requires a certain level of trust in the individual and a respect for views that may be different. Work environments based on trust enable knowledge management by breaking down some of the barriers to sharing and improving the opportunities for collaboration.
An open organization structure can be an important enabler of knowledge management. Knowledge management implementations will progress more quickly and have a greater chance of success in an environment that values sharing. Aspects of an open culture can be found within a department's team environment or throughout the company as a whole. The more pervasive the open culture, the greater the positive impact on knowledge management.

*International Aspects of Company Culture*

Culture affects how we learn at home and at work and is also relevant when we consider knowledge management from a global perspective. Culture-specific shared values and beliefs are often different from country to country and are important issues to be considered by multinational companies implementing knowledge management. A lack of shared culture can lead to misunderstandings and can be problematic in teams working across cultural boundaries (Davenport, 1993).

Technology helps to break down the barriers that distance previously caused. High-speed network connections and other technologies make it possible and desirable for companies to have divisions located in many different countries. Knowledge management initiatives in multinational corporations must prepare for the possibility that a value in one country may not exist in another. For example, there may be low levels of participation because it is not "macho to type or for engineers to admit they did not know the answer to a technical problem" (Fulmer, 1999, pg. 9).
Common Knowledge Management Inhibitors

Some of the problems that appear in knowledge management implementations are technology related and others are social in nature. A few of the more common inhibitors will be reviewed in the following section, including: application focus, incompatible tools, job security, credit, physical layout, insufficient dedicated resources, and lack of creativity.

In general, focusing on technology or applications rather than people is going to impede a knowledge management implementation and possibly pre-dispose it to failure. Two common mistakes are building a technology and expecting people to be drawn to it for its own sake or creating a technology and imposing it on people. At United Technologies Corporation in Connecticut, the failed technology strategy was the latter. Jean Mayhew, Director of Knowledge Management at the United Technologies Research Center, explains why their IT applications were sometimes not successful, “Often when we create an application, we devise the app and then impose it on people and expect them to adapt” (Hildebrand, 2000, pg. 2). Failure will be evident by a lack of usage – either through inability to use or change to the new system, or through a lack of interest in the new system.

Failure is also likely when the tools or technology chosen for a knowledge management implementation don’t align with people’s job functions. In some instances, the misalignment of tools is subtle. At Sequent Inc., a developer of high-end multi-processor computer systems, a number of employees were reluctant to keep their content up-to-date on the system in part because they viewed the process as being extra work rather than a natural part of the job (Bumbo & Coleman, 2000).

Another inhibitor of successful knowledge management is related less to technology and is more personal in origin. Concerns about job security often cause a lack of willingness to
contribute to a knowledge management system. Some people believe that once they put everything they know into a knowledge management system, that they will no longer be needed. Others may fear that anyone will be able to take knowledge from the system and use it to perform their jobs (ProcessEdge, 2002, pg. 11).

Ensuring that the individual gets credit for the work that he/she does is also a problem for knowledge management implementations. The concern among workers at some companies is that ideas may be attributed to a group rather than an individual. This challenge is particularly prevalent in businesses with a hierarchical structure. At international energy company BP Amoco, Chris Collison found that, “It’s vital to establish employee ownership; the boundaries must be defined and defended by the HR function” (Collison, 1999, pg. 2). Collison is not only suggesting that people need to get credit for their work to be encouraged to participate, but that it be formalized through human resources as an expectation for both the employee and the company.

The physical layout of a company can also impede the success of knowledge management. Offices with multiple locations pose special challenges. In addition, the layout of the space within each office can have an effect because office layout affects how people interact. Work areas with many closed offices and high partitions make casual interaction more difficult and inhibit spontaneous collaboration. Open offices with low partition walls and open conference spaces encourage spontaneous sharing and collaboration. Viant, an Internet solutions company based in the United States, is an example of one company that places high value on the role of open space in their knowledge management implementation (Bumbo & Coleman, 2000). The office buildings include meeting rooms with windows on several sides, cubicle spaces with low walls, and many wide open walkways and work spaces to encourage collaboration.
Companies without dedicated resources for knowledge management implementation are often destined to fail. At Hewlett-Packard, the international computer company, dedicated training staff, IT staff, managers, and senior corporate officers were all involved in the implementation of the knowledge management strategy and contributed to its success. According to knowledge management author F.M. Ambrecht, in his article titled “Knowledge Management in Research and Development” in Research Technology Management magazine, most companies have many people contributing to the knowledge management project on a part-time basis and at least one team member working on the initiative on a full-time basis (Ambrecht et al., 2001). Larger companies have a need for more full-time employees dedicated to the implementation due to their size and the need to communicate with more people about the initiative.

Lack of creativity is another inhibitor to successful knowledge management. Letting people use their creativity through collaboration provides incentive for participation in knowledge management efforts. In some knowledge management initiatives such as at BP Amoco, personal home pages are used as part of an expertise location tool. Individuals seeking an expert on a particular topic can search in the expertise location tool to track down a colleague with specific background or experience. Taking that tool a step further, Viant allows users to create their own home page and manage the page themselves (Bumbo & Coleman, 2000, pg. 3). Having a personal touch with home pages can help increase participation in knowledge management.

Evaluating the Success of Knowledge Management Initiatives

In the beginning of a knowledge management initiative, it is important to identify the goals for the implementation. Several case studies, including one about Buckman Laboratories, a leading manufacturer of specialty chemicals with offices in over 80 countries, suggests that
without a clear and well-communicated strategy, companies will struggle with knowledge management and may not succeed (Robin, 2001, pg. 4). External benchmarking of knowledge management implementations at other businesses is one way to help management understand the value of knowledge management. By gathering information about the success and ROI from knowledge management at other companies, the process is easier for management to understand.

The objective for a knowledge management initiative varies from company to company. Some organizations are focused on creating a specific financial return for their knowledge management investment, while others are more interested in incorporating knowledge management practices as part of the company culture and achieving value wherever they can.

Again, as the case study on knowledge management from Buckman Labs has shown, a holistic approach to knowledge management implementation blending culture and technology is most effective (Robin, 2001, pg. 4). Likewise, a holistic approach to measuring knowledge management is most appropriate to understanding the success of an implementation.

To help evaluate the success of an implementation, metrics can be used. Examples include counting the number of questions asked and answered in the system, tabulating the percentage of employees who have used the knowledge management system, and assessing the number of users who have created personal web pages in the expertise location tools.

Other measures focus on specific output of a knowledge management system such as reduced cycle time and increased revenues. At Ford Motor Company, the automobile manufacturer, best practices were evaluated based on their financial return, not on their value as potential problem solvers with suppliers and vendors (Swarup, 2002).

BP Amoco measured success by the number of people participating in tools in the knowledge management system. At Sequent, success was also measured by the ease and speed of
information retrieval and by reviewing the quality level of information being put into the knowledge management tools (Bumbo & Coleman, 2000).

Implementation measures can include specific information on financial returns if that is part of the knowledge management strategy. Many case studies have reported direct financial benefit associated with their knowledge management implementations. For example, an article titled “Measuring Knowledge Management” from the American Productivity and Quality Center, an internationally-known benchmarking authority, states that the international energy company ChevronTexaco saved $670 million from refining best practices (Vestal, 2002, pg. 3).

During a knowledge management implementation, it is important to monitor progress. If a shift in culture is desired, it is valuable to periodically assess employee responses. Hewlett-Packard started with a culture and structure relatively well-suited for knowledge management; their problem was sharing knowledge beyond autonomous groups. In other cases, the required culture change was more pronounced and required closer monitoring. For example, Buckman Labs started with a very strong central management model and moved to a flat organizational structure more conducive to knowledge management. The shift in culture at Buckman was more pronounced. In addition, Buckman Labs also faced challenges addressing culture differences across countries (Ellis & Rumizen, 2001).

Once implemented, a knowledge management system should be viewed as a continuous process that needs regular care and attention. At this stage, it is important to make sure that stored knowledge is kept up to date, ensure that there is a standard process for training all new people about the strategy and tools, and provide mentoring and coaching. It is also important to evolve and adapt measures as strategies change.
While all of the measures above apply to knowledge management in research and development, there are a few areas where special attention should be paid due to the unique requirements of R&D. Because of the importance of innovation, it is crucial to measure the use of collaboration tools once the knowledge management system has been established (Ambrecht et al., 2001). Other important areas to measure include participation in expertise location tools and hits on search and retrieval tools.

**Moving to a Knowledge-Based Culture**

*Strategy & Vision*

Clearly aligning a knowledge management strategy (overall plan) with the objectives of a business is essential to adding value and insuring positive returns. For example, in R&D there might be more emphasis on innovation and on creating new products and ideas. In contrast, in a law firm, knowledge management might center on document reuse. In manufacturing, best practices and gaining efficiencies may be the most important elements of the knowledge management strategies.

Yet in all environments, there are multiple factors to be considered when formalizing a knowledge management strategy. Ambrecht et al. illustrates a holistic approach to knowledge management with the image of a triangle. There are three areas that equally comprise knowledge management: culture, infrastructure, and technology. Culture appears as the focal or uppermost point of the triangle, Infrastructure (including physical layout and hierarchy) is the second point, and Technology is the third corner of the triangle (Ambrecht et al., 2001, pg. 38). When considering the impact of culture on knowledge management, there are four areas which must be addressed: understanding, support, incentives, and interaction.
Understanding is the first component of culture. Management must have a clear understanding of the knowledge management strategy to be implemented and must communicate it well so that the employees can share that understanding. The management vision must communicate the focus and value of the initiative. Once the strategy is communicated, there must be an understanding that the knowledge management objectives in the strategy are part of an employee’s expectations. Communicating and reinforcing the knowledge management strategy can occur a number of ways, but often includes a formal training program. Sometimes, the communication is supported through less formal broadcast-type memos and emails.

Beyond creating and establishing the vision for a knowledge management implementation, management can steer a company towards a knowledge culture by firmly establishing and communicating company values, priorities, and performance measures. A good example of a supportive R&D vision statement can be found at ChevronTexaco. In Chevron’s knowledge management implementation, they realized the need for a clear and supportive vision and strategy, thus it is exhibited in their corporate values statement: “We will create an organization that learns faster and better than competitors through benchmarking... through sharing and implementing best practices... by learning from experience... and through continuous individual learning and personal growth” (Derr, 1999, pg. 1). This statement from Chevron is holistic, focusing on moving faster and gaining efficiencies through sharing, supported by continuous learning and growth.

Company values and culture are interwoven with the history of the company as well. In order to be successful, a company must first recognize the existing culture and then decide how it
must adjust to align with the knowledge management strategy. At Buckman Labs, the company was founded with a strong hierarchical management model. CEO and Chairman Bob Buckman identified this as the first area that needed to change (Fulmer, 1999, pg. 2). There must also be an acknowledgement that changing company culture can take a long time. Authors and knowledge management experts Nakkiran Sunassee and David Sewry suggest that, “the objective of the change is not to change the organizational culture drastically, but to modify the behavior of the people in a way that suits the demands of knowledge management in the context of the organization” (Sunassee & Sewry, 2002, pg. 240). When a senior level officer communicates the knowledge management strategy, it helps to set the expectations. Implementing the strategy in phases helps to pace the initiative. It can occur through pilot groups or be targeted to specific areas of the company closely aligned to the knowledge management strategy.

Supportive Environment

To ensure success, the environment must be supportive in many ways, starting with top management as mentioned above. In addition, it must be communicated that spending time on knowledge management activities is not only acceptable, but encouraged through performance commitments and reward systems.

An example of a supportive environment is one that is comprised of a positive management team that values the individual. Christopher Locke, author of the book Internet Apocalypso, summarizes the essence of the supportive environment issue, “business environments based on command-and-control are usually characterized by intimidation, coercion, and threats of reprisal. In contrast, genuine conversation flourishes only in an atmosphere of free and open exchange” (Locke, 2002, pg. 11). Part of what Locke is referring to is an issue of trust. Management must
trust employees and “let go” to some degree of the hierarchical organizational model focused on limited individual responsibility.

Training is one of the more important parts of providing a supportive environment. Instruction programs help communicate strategy and objectives and at the same time, give people the tools they need to share knowledge. Strong and proactive training programs show employees that the company sees the value of the investment.

**Incentives and Rewards**

Rewards for new behaviors are important in the beginning of a knowledge management implementation and become less important over time as the company culture adapts to a knowledge-centric culture. Management must reward people for following the new behavior. Without incentive, it is difficult to create the critical mass required to start a knowledge management initiative and move it forward. Bob Buckman of Buckman Labs stated that the efforts of people who successfully participated in their knowledge management implementation would be obvious and those individuals would be promoted; on the contrary, those who did not participate would not progress in the company (Fulmer, 1999).

An important cultural aspect to incentives for knowledge management is credit for group and team contributions versus individual contributions. Recent Gartner data on knowledge management implementations concludes that, “In knowledge workplaces, which are often composed of virtual teams, conflict between personal, team, and knowledge objectives can be particularly damaging” (Mahoney, 2001, pg. 4). People are concerned about getting credit for their individual contributions because their contributions might not be recognized if attributed to a team accomplishment. It is therefore, very important that recognition be clearly aligned with
the knowledge management strategy so both individual and team contributions can be appropriately commended.

Interaction

Interaction is the final aspect of the Ambrecht et al. research and development knowledge management model. In order to create and share knowledge, it is essential to have some person-to-person contact. One way to help move to a knowledge-based culture is to emphasize skill enhancement and move away from occupation silos.

As explained earlier when discussing the hierarchical organization model, operational silos tend to keep people isolated and inhibit collaboration. Viant worked to overcome the silo issue in their knowledge management model by insuring that each phase of the implementation was handled by teams populated with members from all the disciplines. At CNA Insurance, a national insurance provider, they recognized during their knowledge management implementation that employees needed to expand their general knowledge of the company instead of enhancing their expertise in a narrow product niche (Santosus, 2002).

A natural way to start a knowledge management implementation is by beginning with people who have enthusiasm for the initiative and who are willing to encourage and reward others for their participation. Interaction will be enhanced and occur more naturally in a group predisposed to knowledge management.
PART TWO

KNOWLEDGE MANAGEMENT TOOLS
Technology and tools play an important role in knowledge management, although they are not the most important element of an initiative. This section will focus on some of the tools that can be used to enable successful knowledge management implementations and how they work with the cultural enablers identified and defined earlier in the thesis. The focus will not be on specific products, but rather general areas of technology and practice.

Following is a review of: tools for sharing the vision; tacit knowledge management tools (also referred to as collaboration or “people” tools), including communities of practice and networks of practice; expertise location tools; explicit knowledge management tools such as document management, content management, intranet search, and knowledge capture tools; and supportive culture tools. All of these tools are examples of technology with the exception of tacit management (or collaboration tools) and supportive culture tools.

**Tools for Sharing a Vision**

Knowledge management needs to start with a strategy that outlines objectives. The responsibility for sharing a corporation’s “vision” with the entire organization rests with the company’s leadership and knowledge management team. There are a wide variety of tools for sharing information throughout a company, from electronic mail to bulletin boards. Effective leaders often utilize a combination of the following to share information and obtain feedback on the vision: one-on-one telephone calls, intranets, corporate websites, email, streaming video, audio conferences, online communities, and face-to-face meetings (Morello, 2002).
Tacit Knowledge Management Tools (Collaboration Tools)

The word “tool” as used here does not refer to technology, but instead to specific groups of people – communities of practice and networks of practice, which are defined below. As explained earlier, knowledge management is about people and how they interact. Getting people to share, create, and reuse knowledge in an organization is highly dependent on the kind of organizational structure present and how willing the organization is to change to an open, knowledge based culture.

Collaboration is a key area for R&D departments in particular, because it involves getting people to work together. Sharing information and creating new knowledge through collaboration can take place in person, in real time or not, with any size group and with various combinations of technology (such as interactive websites). Collaboration, however, is about involving the human touch in work, whether through virtual teams or in person.

Communities of Practice

Communities of practice (CoP) are people with common interests and a common frame of reference working together to share knowledge. Dr. Etienne Wenger, author of the book titled *Cultivating Communities of Practice*, underscores the importance of communities of practice in regard to company culture and knowledge management when he explains that, “CoPs are united by common values, vocabulary, and purpose, it is at the community level where needed cultural change can be targeted. Hence the CoP is an effective implementation vehicle for the knowledge management system” (Odom & Starns, 2003, pg. 1). The CoP can be used to help share a corporate vision and strategy through both synchronous and asynchronous communication.
For communities of practice working in a synchronous or real time environment, some portion of the CoP will meet in person while others in the group will participate in a virtual framework through voice, video, and other online meeting tools. Real-time sharing of documents allow communities to form without regard to physical boundaries or offices in multiple locations.

The second major dimension of communities of practice is asynchronous in nature where people interact through virtual environments that allow for offline interaction rather than in real-time. This kind of community relies more on interaction between people and data or information. The most common tools used in the asynchronous mode are electronic team rooms and document repositories where messages and data can be collected for later review by the members of the community (Hayward, 2001).

Networks of Practice

Networks of practice are an extension of the community of practice, connecting individual communities into a larger framework. Larger in nature, a network of practice may not be as tightly bound together as the smaller community of practice. Networks of practice are important within a large company or within a company with multiple locations.

Recently, networks of practice have grown to include work between companies. Creating CoPs between companies is a kind of business-to-business sharing that expands the opportunities for people within a company to benefit from the knowledge of their peers throughout the industry.

In addition, knowledge management strategies are beginning to address customer access to suppliers' knowledge bases for joint product development, general collaboration, and market
research. “The companies that are doing R&D knowledge management really well are the ones that are making a connection between markets and technology” (Mullin, 2001, pg. 2).

The specific tools used within a network of practice are very similar to those found in a community of practice. Expanding the community beyond the traditional boundaries of the company does require a little more technology, largely due to security considerations. One example is that instead of using a company intranet to share and post information, the Internet would be used to share between companies. Enabling sharing through the Internet requires much more stringent security due to its wide-open nature.

**Expertise Location Tool**

Expertise location has particular relevance for knowledge management in R&D. These tools enable people to locate other people who have the expertise that they need. This occurs through searches of customized databases and explicit knowledge profiles of in-house experts, as well as online workplace communities.

The Intranet is one tool used by both BP Amoco and Hewlett-Packard in their expertise location. People were encouraged to use their own creativity in creating and maintaining their own web pages. At BP Amoco and Hewlett Packard, the personalized web pages served as the starting point for expertise location, acting as a kind of yellow pages accessed through the company Intranet.

Expertise location tools have the common feature of listing people throughout the company in relation to their particular field of interest or specialization. Expertise location tools also are used to help people share things they are interested in learning about. Communicating fields of interest can also help when building communities of practice.
Explicit Knowledge Management Tools

The knowledge management tools reviewed so far have centered on tacit knowledge – the knowledge between minds that is hard to document and capture, the knowledge that people create through interaction. Explicit knowledge, however, can be easily captured, stored, and cataloged using tools as discussed below.

Document Management

Document Management Systems are focused on cataloging and storing documents. The types of documents range from word processing documents to presentations to answers to frequently asked questions. Managing explicit documentation makes it easier to retrieve and reuse knowledge, which can help make sharing flow more smoothly.

Content Management

Taking document management one step further is the purpose of content management. Content management helps people easily draw information from vast numbers of documents. In KMWorld magazine, author Tom McKinley writes that content management is, “specifically designed to manage as many input sources as possible… content management systems were designed to satisfy that demanding market of global collaboration. Content management creates an environment of dynamic, updated documents, customizable on demand to match the specific need of each user” (McKinley, 1998, pg. 1).
Intranet Search

Intranet search is a tool that searches across a company intranet seeking specific content. This is a relatively mature tool that has started to meet some of the needs of knowledge management for the next generation. Intranet searching tools will grow to cover a wide range of information sources from documents to databases complementing and overlapping with enterprise portals and other collaboration software.

Intranets and the next generation of Intranet search tools work well with the cultural enablers of knowledge management because they serve as an interface to many different aspects of knowledge management. This blending helps Intranets become the foundation of communication strategies – providing raw and processed data and bringing people together.

Knowledge-Capture Tools

Tools for capturing knowledge are aimed at capturing the transient information often found in emails and other documents that are very current, but short-lived. While vendors advertise these types of applications as tacit knowledge management tools, they are really just another set of tools that help make connections between people and information. Some transient knowledge, such as a conversation around the water cooler, cannot be captured by technology.

Knowledge-capture products are capable of scanning a wide variety of applications and then using software to draw connections. At IBM Lotus, the international computer company, writer Mario Morejon explains on the CRN news website that their knowledge capture product “builds user profiles based on the documents that a user views and writes. The product also tracks personal information such as affinities, expertise, education, and job function. All of that data gets incorporated into a user profile that the system maintains and provides as search
criteria” (Morejon, 2003, pg. 1). Different from document management tools, portals and search engines, knowledge capture tools and the intelligence built into them help knowledge workers sort through relevant information quickly without investing a lot of time reviewing search returns and databases. One weakness of knowledge capture tools is that since the profile is built on assumptions of the user’s current actions, it may not be helpful if he/she begins to branch out into other areas outside of the current user profile.

**Knowledge Management Cultural Support Tools**

Creating a supportive culture that helps employees to continuously learn and grow has been identified as an important ingredient in most of the case studies reviewed for this paper. Training and continuous learning help to relay the knowledge strategy set forth by a company, share company values, and reinforce company culture.

Mentoring and coaching are effective tools for creating a supportive culture. For many people, one of the easiest ways to learn a new behavior is by having someone else who is proficient show the way. BP Amoco uses a system of “desk side” coaching, which is a direct approach to mentoring where individuals work one-on-one at a colleagues’ desk to share information. (Collison, 1999, pg. 4). A more visual example of a coaching tool is story telling. Buckman Labs uses storytelling to help mentor people by example as Bob Buckman explains “Basically, in a vision story, you paint a picture of the future. The hook is that you tell a story set in a common situation in your organization” (Ellis & Rumizen, 2001, pg. 3).

Rewards and recognition are other tools that help promote a supportive culture. Rewards can be financial, public recognition, recognition in a peer setting, or a combination thereof. A rewards program can be part of a formal human resources function or it can be a less formal
function within a community of practice. Regardless of the method used – being rewarded and recognized for effort encourages people to participate.

Case Studies of Knowledge Management Implementations

This thesis has established a general understanding of the key components of knowledge management from industry literature. The following section will examine several implementations of knowledge management in companies with large and small R&D environments, tying the generalized industry data already presented to specific examples. The case studies that follow illustrate both successful and unsuccessful implementations of knowledge management.

Knowledge Management at Buckman Laboratories International Inc.

Buckman Laboratories is a multinational chemical company with 19 offices in over 80 countries and headquarters in Memphis, Tennessee (Fulmer, 1999, pg. 2). The chemicals that they develop have a short product life, and are developed in response to customer needs. Therefore, R&D is an extensive part of the business. The implementation of knowledge management at Buckman Labs strongly supports the assertion that understanding and aligning company culture is critical.

At the beginning of the Buckman Labs knowledge management implementation, the company had a classic hierarchical organizational structure with a controlled decision making process. As Bob Buckman said, “I knew I didn’t want to do it Dad’s way. Every single business decision had to be approved by my father” (Fulmer, 1999, pg. 2). This tightly controlled company culture was one of the first aspects of the organization Bob Buckman wanted to
change. It was also critical to successful knowledge management implementation, which Buckman Labs may not have understood at the beginning, but which in actuality, laid the foundation for their success.

The multinational composition of the organization was one of the primary issues that forced Buckman Labs to understand culture at the beginning of the implementation. Buckman explained that, “The combination of decentralization and an expanding ‘multicultural, multilingual organization’ led to the recognition that there was a need for a statement of organizational values…it evolved out of a need to have a common understanding about how we should relate to each other and to outsiders” (Fulmer, 1999, pg. 3). The statement of organizational values not only addressed multicultural issues, but became part of the company culture in what Buckman refers to as the “company’s code of ethics.”

The Buckman Labs knowledge management model stresses the importance of the individual and the key issues of trust and responsibility. Distributing the knowledge and decision making process to the individuals moved Buckman Labs away from the narrow knowledge focus associated with the previous hierarchical model and led them toward an understanding of knowledge across the whole company. Buckman Labs also acknowledged that knowledge management is about people, their interactions, and tacit knowledge. Management also recognized the need to shift from an expense-based philosophy to one focused on investment.

Continuous learning and investment in individual knowledge workers was achieved at Buckman Labs through a global distance-learning center. The training center started by focusing on training users on the K’Netix knowledge management system used at Buckman Labs, but this was not the only focus (Fulmer, 1999, pg. 8). Over time, the learning center became a key part of sharing the culture and communicating ongoing strategic initiatives at Buckman Labs.
The implementation of knowledge management at Buckman Labs was not without difficulties. One of the significant lessons learned from their implementation was that all areas of the company must buy into the process. In this case, the top managers were aligned with the project because it was initiated by Bob Buckman himself. The individual contributors were aligned because they were the focus of the implementation. The gap existed in the middle management area where people were not sure of the expectations. Buckman Laboratories’ Knowledge Strategist Melissie Rumizen explains in an interview with Knowledge Management magazine, “Like anyone else that’s involved in the change, you have to explain to them, “this is what’s going to be new. This is what’s expected of you. Here are the consequences” (Robin, 2001, pg. 4).

One problem area surfaced regarding the blending of cultures and due to the multinational nature of the company. Different cultures have different attitudes about sharing knowledge and collaborating. This becomes evident when multinational companies create workgroups or communities of practice across cultural boundaries. To address some of the cultural issues, multiple forums were set up in the knowledge management system which provided the ability for Europeans to work in their own language.

_Buckman Labs – Measures of Success_

When measuring the success of knowledge management at Buckman Labs, VP of Buckman Learning Center Sheldon Ellis and Melissie Rumizen explain that there has been a, “50 percent rise in sales from new products” and that “Sales per associate have increased 51 percent, while operating profit per associate has gone up 93 percent” (Ellis & Rumizen, 2002, pg.1). However, these percentages were not the goal of the knowledge management initiative at
Buckman Labs. The objective was to increase efficiency and improve the way the company was operating.

Buckman Labs started with an understanding of what they wanted to change and then developed a strategy for change. The strategy addressed company culture through a clearly stated code of ethics. Buckman Labs changed its organizational structure from hierarchical to an open model, distributing information across the organization and trusting individuals with the responsibility to take the knowledge and move the business forward. A learning center was created to not only teach the mechanics of the technology, but to promote and grow the company culture, which Buckman realized, was critical to success.

Knowledge Management at BP Amoco

BP Amoco is a well-known name in the petroleum industry, and is a company that has been recognized as a leader in knowledge management. BP Amoco rated second only to Microsoft in a 1999 survey of Most Admired Knowledge Enterprises (SAIC, 2000, pg.1). One of the keys to BP Amoco’s success is their focus on tacit knowledge and their reliance on people, not tools.

Unlike Buckman Labs, BP Amoco started their knowledge management implementation with a distributed, yet relatively flat organizational structure consisting of 87 business units world wide (Hackett, 2000, pg. 2). The distributed organization structure presented some technical challenges, which necessitated the combination of technology and people to allow for collaboration. In addition, the distributed organizational structure required a level of autonomy that presented some cultural challenges.

Knowledge management at BP Amoco was all about people, tacit knowledge, and getting people together to share what they know. Technology was a tool, but not the focus. Chris
Collison of BP Amoco summarizes the focus of the knowledge management program, “Its primary aim is to generate 10 minute telephone calls and email help requests... the underlying knowledge management philosophy here is the premise that the best medium for knowledge is the human brain, and the best networking protocol is conversation” (Collison, 2000, pg. 1).

Due to the distributed nature of the business units of the company, there was an opportunity for technology to help remove the distance barrier. This was accomplished through the creation of virtual teams enabled by email, knowledge sharing software and desktop videoconferencing. These technologies became part of a virtual tool kit for collaboration at BP Amoco.

BP Amoco realized early in their implementation that communicating the knowledge management strategy and training their staff in the use of their tools was of primary importance. The method chosen to share the company knowledge management strategy and train users is what makes BP Amoco unique and particularly successful. Training at BP Amoco focused on people working with people – personal interaction. As Hackett explains, “A critical success factor was the adoption of coaching, rather than traditional team training approach” (Hackett, 2000, pg. 1).

A core component of the technology used to bring people together and start the person-to-person interaction, was a kind of electronic yellow pages called “Connect” hosted on the company’s Intranet. Connect, an internally-developed application, provides a place for each employee to list their expertise and other information they want to share such as relevant experiences and interests. Connect was implemented in way that provided clear guidelines to follow, yet allowed individual creativity. The personal touch BP Amoco provided in their implementation made it enjoyable for employees to use. As a result, participation increased. (Collison, 1999, pg. 3).
**BP Amoco – Measures of Success**

Like Buckman Labs, BP Amoco has come to accept knowledge management as a fundamental part of the way they do business. There is not a strong focus on measuring the success of knowledge management itself but rather on the results for the company as a whole. There are several key indicators of success. In terms of collaboration, “One thousand staff at BP Amoco, together with over 30 of its key partners, share extensive desktop collaboration, videoconferencing, and information sharing tools as part of a major program to support the creation of virtual teams” (Hackett, 2000, pg. 6). Usage levels of the Connect tool, while voluntary, are also high with over 12,000 workers participating out of 100,000. Finally, in terms of financial measures, BP Amoco was able to realize a $260 million savings in 1998, which they attribute to knowledge management. (Stewart, 1999, pg. 1).

Knowledge management at BP Amoco has realized significant savings for the company by bringing people together to share knowledge. The focus on interacting to share and create knowledge, supported by technology has made BP Amoco successful and is an excellent example of a company culture enabling knowledge management.

**Knowledge Management at Ford**

Knowledge management efforts at Ford Motor Company have been a combination of successes and failures that help to illustrate the need for a holistic approach to knowledge management. Ford’s experience underscores the importance of interweaving the knowledge management strategy and corporate culture. Ford is recognized as an industry leader in knowledge-sharing practices as is evidenced by the licensing of their knowledge management
process to Shell Oil, Kraft Foods, and Nabisco. (Swarup, 2002, pg. 15). However, I reviewed their experiences not to analyze their success, but to see the areas where they have failed, discover why they failed, and determine what can be learned from their errors.

Ford has evolved from a fairly centralized industrial model to a multinational company with multiple suppliers and vendors throughout the world. This diverse and distributed company now has relatively autonomous business units similar to those found at BP Amoco.

When they began, the focus of the knowledge management strategy at Ford was the capturing and sharing of best practices. The Best Practices Replication Process has captured and shared over 2,800 best practices over a 4.5 year period (Swarup, 2002, pg. 11). The strategy started with communities of practice based on the work groups in areas such as production, engineering, assembly, planning, and logistics. The knowledge management strategy at Ford has grown to include an estimated 150,000 daily users (Fletcher, 2001, pg. 1). Sanjay Swarup outlines the following three principles of the knowledge management initiative at Ford, “Capture only proven, high value practices, Quantify [the] value-add to the business, Manage the process (Swarup, 2002, pg. 9). All of the principles listed above emphasize how the knowledge management strategy at Ford is focused on value.

Ford – Measures of Success

The following measures of success at Ford support the conclusion that their knowledge management implementation has been highly successful and returns good value to the company. Statistics include: “2,800+ active high value practices have resulted in: $1.5+ Billion of identified value, $1 Billion of actual value added to the company… 53 Communities of Practice launched with 2,115 Focal Points” (Swarup, 2002, pg. 15). All of these measures are fairly
impressive indicators of a successful knowledge management implementation. How then, could knowledge management at Ford be considered a failure?

One example of the failure of knowledge management at Ford can be found in the recent problems with Ford trucks and faulty Firestone tires. The key to Ford’s failure is the strong management focus on cost savings and the inability of Ford’s knowledge sharing communities to bridge the sharing gap to its suppliers. Although Ford shares knowledge well within the company, it has difficulty sharing across communities to its suppliers – in this case, Firestone Tires. In his *Fortune* magazine article titled “Knowledge Worth 1.25 Billion,” writer Thomas A, Stewart, explains that, “Neither Ford’s nor Firestone’s social network is rich enough to support the kind of extramural communication that might have uncovered the problem” (Stewart, 2000, pg. 3). Ford focuses too heavily on sharing within the community and not across communities to suppliers, which might have exposed the tire problem before widespread distribution to the consumer occurred.

The second aspect of knowledge management failure at Ford is directly related to their knowledge management strategy. They focused on creating value, not necessarily finding potential problems with their products. The Best Practices Replication Process focused on “Tasks” assigned by upper management to middle managers and on using their knowledge base for finding cost reduction efficiencies. The focus was too narrow. Management controlled the process tightly and did not provide much incentive for looking beyond the defined focus.

A narrow strategy and the difficulties of sharing across company cultures both contributed to Ford’s inability to uncover a potential problem through knowledge management. For its many successes, however, Ford’s knowledge management is a model for others. The issues with Firestone tires do, nevertheless, support the suggestion that knowledge management is a
continually evolving process that must be constantly adjusted to meet the needs of the company and their clients.

Knowledge Management at Hewlett-Packard

Hewlett-Packard (HP) is a large, successful, geographically diverse computer company with a decentralized organizational structure comprised of many business units that work fairly autonomously. The company culture at Hewlett-Packard is an open one and very conducive to knowledge sharing as Anjali Prayag explains, HP is: “Famous for its overall culture of collaboration, which encourages knowledge sharing and risk taking on all levels. HP even supports people who try out things that do not work” (Prayag, 2002, pg. 1). The open culture at Hewlett-Packard has promoted knowledge sharing so well, that there are at least six knowledge management systems throughout different areas of the company. Some of the systems overlap functionality and some compliment each other. Unfortunately, since different parts of the company started knowledge management efforts in a decentralized manner, they ultimately became barriers to sharing knowledge across the company.

Hewlett-Packard – Measures of Success

In the R&D area of Hewlett-Packard, knowledge management was recognized as important to growing the business and a separate knowledge management effort was created. The efforts in R&D focused on the need to identify and connect people with unique skills and expertise in their fields. The expertise location service did create a directory of experts, however the company is still struggling with “the issue of how to motivate scientists to include their biographies, and with the controversial connotations of the term ‘expert’.” (Crompton, 2000, pg.
6). While researchers were willing to list their skills in the expertise locator, they struggled with the idea of being recognized as experts.

The need to consolidate some of the knowledge management systems brought together several training systems throughout the company. However, getting the systems together did not necessarily mean it was successful. Due to the lack of a centralized knowledge strategy, it was difficult to get people to contribute to the new system. The lack of success is attributed to the fact that there were no rewards in place for participating.

One final knowledge management issue at Hewlett-Packard, and perhaps the single most important one, is the lack of a comprehensive knowledge management strategy. There is not an acceptance at the highest level of the corporation that knowledge management requires full time staffing (Davenport, 1998, pg. 9) at a corporate level. Without a strategy tying together the open knowledge sharing culture, knowledge management will continue to grow but in a decentralized fashion. This is evidenced by the number of separate knowledge management systems and initiatives at HP. There are currently more than seventy Learning Communities worldwide (APQC, 2000, pg 21).

**Conclusion**

Through a careful examination of literature from knowledge management experts and specific case studies of implementations, this thesis has shown that successful knowledge management programs can only be accomplished when an organization addresses both company structural and cultural issues, as well as the implementation of appropriate electronic and "people" tools. Another important element for success is having a well-designed knowledge management strategy. A successful strategy outlines how an organization’s culture (values,
business objectives, and structure) is conducive to knowledge management and identifies any cultural changes that are needed. A comprehensive knowledge management strategy will also specify the technical systems and tools to be instituted, as well as how “people” tools, such as communities of practice, will be put into place.

The American Productivity and Quality Center (APQC), an internationally recognized benchmarking authority in the fields of knowledge management and process improvement, has generated measures and metrics on knowledge management implementations worldwide (http://www.apqc.org). Currently, APQC is helping more than 200 companies with knowledge management issues. An APQC article detailing the financial benefits realized after successful knowledge management implementations explains that a people-based approach was used in all nine of the examples of knowledge management they reviewed. Communities of practice, which indicate a people-centered approach, were also used in all nine cases and in some instances were used exclusively (Vestal, 2002, pg. 2).

Benchmarking of knowledge management by industry experts over time has also demonstrated support for the assertion that successful knowledge management cannot be implemented without addressing the issues of company culture and communication. In 1996, knowledge management industry benchmarking materials illustrated a heavy use of technology, with the top four areas promoted being email, the Internet, video conferencing, and databases (Elliot, 1996, pg 7). The benchmarking literature in 2003 illustrates a dramatic shift towards a people-oriented knowledge management focus, with communities of practice making up 60% of the key knowledge management elements (APQC, 2003, pg. 1).

The importance of knowledge management in the research and development arena is distinct because professionals in these areas typically work on ideas and innovation more than
any other individuals in the company. The key to success is getting people together and
generating, capturing, and growing ideas through interaction and collaboration. External
collaboration with customers, suppliers, and peers is also becoming increasingly important.
Providing people with the open collaboration environment they need, yet protecting each
company’s intellectual assets is a challenge.

The personal reluctance of individuals to work together is another obstacle that often must
be overcome. It is crucial to recognize people for their contributions as part of a team as well as
individually. The knowledge management strategy must be broad enough to encourage sharing
beyond traditional company boundaries. In the example cited from BP Amoco, their success was
due primarily to a carefully developed knowledge management strategy which considered both
tools and culture. As shown in the case study of Ford discussed in this thesis, a narrow
knowledge management strategy, which focused primarily on business value, may have hindered
knowledge sharing with Ford’s supplier Firestone.

Knowledge management succeeds best in a holistic environment. Support for a knowledge
management initiative must be present from the top all the way down through an entire
organization. The knowledge management strategy developed by a company must align with its
business objectives and, more importantly, its organizational structure must be supportive.

Knowledge management efforts take time to plan, time to employ, and time to evaluate.
The implementation of knowledge management is a journey, not a one-time event.
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