MGMT630 – Knowledge Management

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MANAGING INTANGIBLE RESOURCES AND KNOWLEDGE WORKERS

Knowing ignorance is strength
Ignoring knowledge is sickness
– L.TSU

The Growing Importance of Knowledge and Knowledge Workers

Tangible resources like rupees, land/buildings, motors/machinery and manual/physical labors are no doubt important to run a farm or a factory but all of these tangible resources can be bought or borrowed. On the other hand, brand image, reputation, information, talent, and knowledge are some of the intangible resources required for a modern organization to survive and thrive in the 21st century global markets and these intangible resources cannot be bought or borrowed.

The rise of information and knowledge based work has been foreseen for many years. Automation in factories and farms in developed economies for more than a century ago freed most of the workforce from having to perform physical labor. Over the last half-century, the advent of computers and the pervasive presence of information created a demand for workers who could produce the information in the first place, extract meaning from it, and take action on it.

Organizations with a high proportion of knowledge workers – let's call them knowledge intensive organizations – are the fastest-growing and most successful in the United States, Singapore Finland, Sweden and other leading economies, and have generated most of these economies' growth in the past couple of decades. The market value of many knowledge-intensive companies – which includes the market's perception of the value of knowledge and knowledge workers – dwarfs their book values, which includes only tangible assets. Even in so-called "industrial" companies, knowledge is increasingly used to differentiate physical goods and to fuel diversification into product-related service. As Prof. Quinn has pointed out, high proportions of workers in manufacturing firms (roughly 90 percent in semiconductors, for example) never touch the manufacturing process, but instead provide knowledge-based services such as marketing, distribution, or customer service.

It's already apparent that the firms with the highest degree and quality of knowledge work tend to be the fastest-growing and most profitable. Microsoft, for example, is one of the most profitable organizations in the history of the planet. Pharmaceutical firms not only produce sophisticated and life-saving drug treatments, they also tend to have high profit margins. Growth industries generally tend to be those with a high proportion of knowledge workers.

Following categories of work can be placed into the knowledge workers camp:

- Management
- Business and financial operations
- Soft/Hard ware and electronic engineer
- Architecture engineering
- Life, physical, and social scientists
- Legal personnel
- Health care practitioners
- Community and social services
- Education, training, and library staff
- Arts, design, entertainment, sports, media.
- System Manager/Analyst, Project Manager

The classification above yields about 36 million knowledge workers in the United States alone, or 28 percent of the labor force. While no classification scheme is perfect (for example, professional athletes are included in the knowledge worker group. Because the U.S government data lumps them in with arts, design, entertainment, and media workers), **it's clear that most people in these jobs think to earn for their living.**

Within organizations, knowledge workers tend to be closely aligned with the organization's growth prospects. Knowledge workers in management roles come up with new strategies. Knowledge workers in R&D and engineering create new products. Knowledge workers in marketing package products and services in ways that appeals to customers. Without knowledge workers there would be no new products and services, and no growth.

Knowledge Workers and the World Economy

Prof. Dr.Peter Drucker, who was the first person to describe knowledge workers to any substantial degree (in his 1959 book Landmarks of Tomorrow), said as far back as 1969 that:

"To make knowledge work productive will be the great management task of 21st century, just as to make manual work productive was the great management task of the 20th century.

Then in 1997 Drucker went even further out along the knowledge worker limb:

"The productivity of knowledge and knowledge workers will not be the only competitive factor in the world economy. It is, however, likely to become the decisive factor, at least for most industries in the developed/developing countries.

Why did Drucker – and why should we – believe that knowledge workers and their productivity were so important to the world economy? There are a variety of reasons. First, they are large and growing category of workers. If we can't figure out how to make more than a quarter of the labor force more productive, we're going to have problems with our economy overall. Second, they are comparatively expensive type of worker that organizations employ, so it's doubly shameful if they're not as productive as they could be. Third, they are key to the growth of many economies. Agricultural and manufacturing work has generally become commoditized, and is moving to the economies where they can be performed at the lowest cost. The only forms of agricultural or industrial work that survive in sophisticated economies are those in which a high degree of knowledge has been injected – for example, in biotechnology manufacturing, or in "precision farming," in which the fertilizer and pesticides administered to a given crop are carefully monitored using GPS devices in tractors. If agriculture and manufacturing are moving to countries with low labor costs (China is a particularly good example), the jobs that remain in the so-called knowledge-based economies are particularly critical to these countries' economic survival. It's not clear exactly what workers in the United States, Western Europe, and Japan are going to do for a living in the future, but it is clear that if these economies are to prosper, the jobs of many of the workers must be particularly knowledge –intensive.

Yet despite the importance of knowledge workers to the economic success of countries, companies, and other groups, they haven't received sufficient attention. We know little about how to improve knowledge workers' performance, which is very unfortunate, because no less an authority than Peter Drucker has said that improving knowledge worker performance is the most important economic issue of the age.

What is a Knowledge Worker?

Knowledge workers have high degrees of expertise, education, and/or experience, and the primary purpose of their jobs involves the innovation/creation, sharing/distribution, or application of knowledge.

Knowledge workers think for a living. They live by their wits-and heavy lifting on the job is intellectual, not physical. They solve problems, they understand and meet the needs of customers they make decisions, and they collaborate and communicate with other people in the course of doing their own work.

It's easy to point to examples of knowledge workers: physicians and physicists, scientists and scientific writers, airplane pilots and airplane designers, managers and marketers, and soft/hard ware engineers. We know them when we see them. They don't necessarily have to work in knowledge-intensive industries – managers of any company are knowledge workers, applying knowledge to make decisions in the best interests of their enterprises. Even the most industrial company has engineers, researchers, marketers, and planners. Knowledge workers work in small start-ups and large global corporations.

Whether someone is a knowledge worker or not is admittedly sometimes a matter of degree and interpretation. Many people use knowledge in their jobs and have some degree of education or expertise, but for knowledge workers the role of knowledge must be central to the job, and they must be educated or expert. Working with data or information alone isn't enough – it would be difficult to be a knowledge worker, for example, without having a college degree (college dropouts Bill Gates and Michael Dell notwithstanding).

It's clear that organizational success depends on the innovativeness and productivity of these knowledge workers within their organizations. However, along with adding value, knowledge workers also pose challenges to conventional management wisdom and organizing principles: they are mobile and concerned that their experiences should position them well for future opportunities; they are dispersed across the organizational structure and the globe, yet the interdependence and complexity of their work requires them to collaborate effectively with others in different functions, physical locations, time zones and even organizations; they must command a body of knowledge that needs to be constantly updated; and their work is inherently emergent – the important problems they solve and opportunities they capitalize on are novel and rarely, if ever, standard to the point that the work can be come routine. In short, knowledge workers are critical to the success of almost any organization, but they present unique challenges as well.

Knowledge Workers as a Class

Just how unique are the challenges knowledge workers present? Some might argue that knowledge workers and knowledge work should be managed in the same way that other work is.
Some one may argue that knowledge workers should be treated like any other workers in business processes, and that process improvement approaches apply just as well to knowledge workers as to anyone else.

If managers gave similar explicit instructions to their knowledge workers (Sharpen your pencil before you start that financial plan"), as they use to give to production or process workers, it's unlikely that their employees would stay with the company for long. If by some chance they tolerated being managed this way, it's unlikely that they'd give the job their full commitment and intellectual horsepower. This substantial difference in autonomy is only one of the key attributes of knowledge workers, but by itself it's enough to justify treating them as a separate class of workers deserving the separate approaches to performance improvement and management.

Commitment matters. In the industrial economy, one could do a job with one's body even when the brain and heart weren't committed to the job. But this isn't the case for knowledge work. It's unlikely that you'll get great performance out of a knowledge worker if he or she isn't mentally and emotionally committed to the job. The famous 3M company approach of giving researchers 15 percent of their time to work independently on something they think is important to the company Obviously knowledge workers are generally willing to do some things that others ask (or even tell) them to do, but a degree of voluntarism helps a lot.

Another factor affecting commitment is a perception of "fair process." As the strategy academics have pointed out, workers – and particularly knowledge workers-care not only about the fairness of outcomes, but also about the fairness of the process used to arrive at outcomes:

Fair process turns out to be a powerful management tool for companies struggling to make the transition from a production-based to a knowledge-based economy, in which value creation depends increasingly on ideas and innovation. Fair process profoundly influences attitudes and behaviors critical to high performance. It builds trust and unlocks ideas.

Knowledge workers value their knowledge, and don't share it easily. Knowledge is all that knowledge workers have – it's the tool of their trade, the means of their production. It's therefore natural that they would have difficulty relinquishing or sharing it in such a way that their own jobs might be threatened.

In the early days of knowledge management, when companies were beginning to talk about sharing knowledge within and across organizations, people used to say, "Sharing knowledge is an unnatural act." "Of course, unnatural acts are committed every day." Companies just needed to put the necessary incentives and assurances in place to ensure that people were willing to share their knowledge.

"As the (internet) world is flat" Almost every knowledge worker in western countries is wondering whether his or her job could be the next to move to India or China or Korea or Pakistan. It's enough to give anyone pause about contributing knowledge to some other worker or a knowledge repository. Again, this doesn't mean that we can't design organizations and processes in such a way that knowledge will flow across organizations. We just have to acknowledge workers will view their knowledge as a highly valuable asset, and that they will be reluctant to share it without rewards and/or guarantees of continued employment. Smart organizations will put smart approaches in place for the knowledge assets of their knowledge workers. A knowledge worker in Pakistan can provide services cheaper than one in North America so the work will flow to a place where it can be done cheaper (quality being same).

The global economy has decisively entered a new age. It is variously called the "Information Age," the "Third Wave," or the "Electronic Economy." Regardless of the terminology, these names and others refer to the transition that has taken place in the economies of the industrialized nations, followed closely by the developing nations. Although there are a few economies primarily involved in supporting traditional manufacturing industries, the future of development and growth is clearly centered on automated manufacturing and information-dependent services industries.

While knowledge, embedded in systems, brains, and technology, has always been the key to economic development, in recent years its importance has been steadily increasing. The OCED economies are more strongly dependent on the production, distribution, and use of knowledge than over before. Output and employment are expanding fastest in high-technology industries, such as computers, electronics, communications, healthcare and edutainment. During the past decade, the high-technology share of OECD manufacturing production and exports has more than doubled, to reach 20-25 percent.

Knowledge (Intangible) Capital

Accelerating the conversion of knowledge into financial gains using Information Age alchemy is the real challenge for contemporary organizations.

The key to generating economic growth and value in industrial-based economies was the accumulation of fixed, tangible assets, measured as capital investment. The knowledge economy is one where intangible assets or knowledge, in its various forms, combine with information technology and network infrastructure to drive growth and value creation. Knowledge assets include information and knowledge stored in patents, copyrights, corporate data warehouses, employees' brains, processes (e.g., work rules), and information systems. These tools and systems have been used to leverage employee knowledge in pursuit of improvements to core processes. Just as the means of production in the Industrial Age was industrial capital (plant, equipment, machinery), in today's economy the means of production is knowledge capital.

The information technology industry plays a central role in these activities. The tools to store, disseminate, and mange these vital corporate assets are provided by companies in this industry. Specifically, the network companies provide the platform for moving knowledge, information, and raw data to diverse locations where it is used to complete essential core processes, and to the end-users who pay for services and products within which knowledge assets are embedded.

Q: Visit a bank and identify knowledge workers. What is unique about knowledge workers? How do you distinguish them from regular employees?

A: Executives at front end in banks are known as Tellers who simply take deposits, enter them in the customer's account, and issue a receipt cannot be considered knowledge workers. On the other

hand, if a teller negotiates a deposit, where partial payments are made to pay the customer's lease/mortgage, place some of the money in a Current Deposit, and where she notices that the total value of his Current Deposits is at a point where the customer is advised to buy treasury bills or invest in funds that pay more dividends would be more of a knowledge worker. A job, where analysis and use of heuristics and technology are part of the day-to-day job is close to what is called knowledge work.

LESSON 2

DYNAMICS AND INTERCONNECTED NATURE OF 21ST CENTURY GLOBE

In a Nutshell

Welcome to the twenty-first century and the knowledge society. The business landscape is changing rapidly. The competitive environment is no longer linear or predictable. Survival and success depend entirely on the organization's ability to adjust to the dynamics of the business environment. Changes in information/communication technology (ICT) have generated gaps in access and control of information and knowledge. Even when these gaps are bridged, several fundamental challenges remain. How do we apply knowledge for value-added and competitive advantage? How do we convert information into knowledge? How do we use technology to convert challenges into opportunities? Knowledge management is the solution for realigning the firm's technical capabilities to create the knowledge that drives the firm forward.

There is obvious room for change in the way we work and communicate and in relationships and processes among people within and across organizations. To be empowered to face these challenges means not only accessing technology, but also developing the ability to manage knowledge. The key questions an organization must consider are "Does your company knows what you know?" Do you know what you know?" "How do you make best use of the knowledge you have?" It also means thinking "out-of-the-box," where "the box" is what represents all the tried-and-true procedures that have worked in the past. There is less room for "packaged solutions" to solve most of a firm's problems. Knowledge management means thinking outside the boundaries of current practices, products, services, and organizations. The new and unpredictable business environment puts a premium on innovation and creativity much more so than it has in the past.

We have progressed from the data processing age of the 1960s and 1970s to the information age of the 1980s and 1990s to the knowledge age of the 2000s. The latest transformation represents the most fundamental change since the introduction of the digital computer 4 decades ago. Knowledge and intellectual capital (viewed here as accrued knowledge) represent our corporate and national wealth. Knowledge workers are found in every organization, and they are the backbone of every successful business. Knowledge workers use technology to reason through problems and reach successful solutions. Computer–aided software gives them an edge over workers using conventional methods.

For a company to manage knowledge, it must first inventory its people, systems, and decisions. Professional knowledge workers within the company must be identified, and their functions must be defined. Knowledge technologies must be incorporated to reengineer the entire business process. Major decisions should be reviewed, and a knowledge system for making each decision should be developed. The company's information system should also be examined to determine how to benefit from emerging knowledge technologies. This self-assessment makes a company more cognizant of its strengths and weaknesses. It should also lead to changes that are more in tune with the competitive nature of the business environment.

Historical Overview

Knowledge has been the staple source of competitive advantage for many companies for hundreds of years. For example, the idea of passing knowledge to an apprentice from a master was used extensively during medieval times. Passing the "family recipe" that makes a certain product unique from one generation to another also attests to the notion of knowledge transfer and knowledge sharing. Although such transfer was extremely slow, it opened the door to modern methods of knowledge management that can exploit faster media of knowledge exchange, such as the Internet.

The recorded history of knowledge dates back to Plato and Aristotle, but its modern day understanding is credited to scholars like Daniel Bell (1973), Michael Polanyi (1958, 1974), Alvin Toffler (1980), and the Japanese guru, Ikujiro Nonaka (1995). Other writers like Sveiby (1997) and Stewart (2000) promoted the concept knowledge as the core asset for an organization.

In the early 1970s, researchers at MIT and Stanford were analyzing ways in which companies produced, used, and diffused knowledge. This was the first essential step in the evolution of knowledge management, as we know it today.

With the help of the Internet, KM became a feasible concept for many companies. It provided more opportunities for knowledge sharing and knowledge transfer than there had been in the past. In terms of methodology, KM was briefly presented in total quality management (TQM) philosophy. Professor Deming even asked every manager to develop his/her theory of knowledge at work and motivated the Japanese to work in teams to produce the quality product. Business process reengineering (BPR), downsizing, and outsourcing were also attempts to improve the performance of the firm, although they had limited success. They resolved the productivity factor, but drained knowledge from the organization.

These attempts were more like round one, where companies managed their knowledge assets in the same way they managed physical assets. Physical goods were stored in the warehouse, but for the intellectual equivalent, it was in the knowledge repository. When databases and "warehouses" were full (too many physical assets), they began thinking about supply chain management (SCM), trying to match the supply of goods with demand and reduce inventories to what was actually ordered for production. It was more like rewarding the efficiency-driven prediction of the future based on past trends-doing things right.

In contrast, in round two of KM, companies began to realize that to fit the supply of knowledge to the demand for it in products and service; they needed to toy with how knowledge worker did their jobs. To be effective, KM has to be "baked into" the job and be part of the fabric of the work to bring in knowledge when needed and export it anywhere in the organization when it is acquired (Davenport 1999). This is where we began to see a shift from "doing things right" to "doing the right thing" – working smarter, not harder.

Given the progress made in automating procedures in the 1970s and communications and networking (mostly through e-mail) in the 1980s the focus of technology in the 1990s was on cognitive computing to augment the knowledge work of humans. Of these, the Internet and intranets have had the most profound impact on spreading the know-how. From a knowledge perspective, the internet and accompanying technologies have demonstrated several characteristics in knowledge management:

- The internet is an incredible information source. Internet access is available worldwide. It means a company's knowledge workers can access information and share knowledge anywhere, anyplace, anytime, without delay.
- With the World Wide Web, every user can share and update information at will. This is especially attractive with the decreasing cost of communication.
- The internet uses a universal communication standard protocol. This protocol, TCP/IP, makes information access and exchange accessible from anywhere there is a computer and an internet service provider.
- The internet provides quicker interaction and communication with fellow knowledge workers. This interaction can be one-on-one as a group.

Setting the Context: An Interdependent World

Globalization, intense competition (often from unexpected quarters), demanding customers, regulatory changes, the relentless progress of technology -all are factors that recur high on the list of key challenges affecting businesses. How do they respond? Many management books, such as Thriving on Chaos by Tom Peters (1987), Competing for the Future by Gary Hamel and C. K. Prahalad (1994) and The World is Flat by Thomas Friedman (2007) offer prescriptions. A common thread in these is the need for organizations to be flexible, adaptive and to continually reinvent themselves. The harsh message is -- if they don't they won't survive.
The single most important factor that is driving most of these changes in the business environment, and within organizations, is that of information and communications technology (ICT). It is often said that information and communications technologies are business enabler, and should support business strategy. Progress in ICT and other technologies is so dramatic that it is fundamentally transforming our environment, the way we live, work and the business landscape and society itself. Organizations therefore need to understand and actively embrace new technologies as a core dimension of strategy.

Perhaps the biggest change during the last decade of information technology (IT) is not continual improvement in functionality and performance - incidentally a trend that has been happening continuously since the 1960s – but interconnectedness. Today, communications and computer networks are pervasive. Organizations, governments, individuals are becoming more closely interconnected in ways not hitherto possible or economic.

Networks, however, are relatively highly structured around a supply chain and well-defined business need. What is happening today is the growth of more dynamic networks, and a new layer of value on top of information- knowledge. We must also not forget the existence of many informal personal networks, often hailed as the main way that things move forward in business, scientific and other communities. We are creating not national utility grids but global knowledge networks or webs. These connect independent disparate knowledge that when combined and aggregated can lead to new knowledge and new opportunities.

Every few years there is anew strategic focus that promises hitherto unachievable improvement in business performance or a means of competitive advantage. Some initiatives are merely fads that disappear, while others become more established as mainstream business activities, perhaps after some reshaping. Total quality management (TQM) and business process re-engineering (BPR), for example, were two of the most significant management initiatives of recent years.

Now another is on the scene – knowledge management. But is this something fundamental to every business or is it merely another consultant's fad? The fundamentalists' argument is that knowledge is an important contributor to the performance, value and future prosperity of an organization. In order to maximize the benefits it must be properly managed and exploited. Too frequently, companies do not know what they know, thereby reinventing the wheel, or fail to apply best practice because that knowledge has not been shared.

The Networked Knowledge Economy

Many terms are used to describe the changing world in which we live and work --the post-industrial economy, information society, knowledge era, and 'networked knowledge economy' . Whatever term is used, this new environment has characteristics quite distinctive from the industrial era of the last two centuries.

Old certainties no longer exist

Throughout the 1990s we have witnessed change as never before. The demise of the former Soviet Union, the fragmentation of Yugoslavia and the rise then fall and then rise of the Asian economies were typical upheavals affecting stability and predictability in our environment. Coincident with closer integration within the European Union (EU), individual regions like Catalonia and Scotland gain more control over their own affairs. China is emerging as a new economic power and is a big factor itself.

Counter-currents, not just in Europe but elsewhere, are simultaneously strengthening the need for local autonomy alongside that for closer cross-border co-operation. Where will it all ends? What is the future of the nation state?

As individuals, we witness change at first hand. Life in the late twentieth century seems beset with complexity and uncertainty, resulting in a growing incidence of stress. The prospect of a secure job until pension-able age no longer exists. We live longer, but we face concerns about paying for nursing care in our old age as health services are stretched of resources.

For organizations, 'business as usual' is rarely a sustainable option. Even apparently powerful multinationals have had to bow to the influence of outside forces, such as Shell's reversal of plans for the proposed dumping of the redundant Brent Spar oil platform in the light of concerted action by environmentalists. Everywhere you look, the corporate landscape is changing.

The changing corporate landscape

In the new economy value is shifting to service-related and knowledge intensive industrial Health, education, finance, information systems, media and telecommunications have been growing strongly for over a decade. An analysis shows that during one year, US household spending on 'old economy' items

– food, cars, appliances and clothing -increased less than 1 percent, while that for a cluster of new economy items –telephone, entertainment, cable television, financial services and home computers – rose 12.5 per cent during the same period. How is it in Pakistan?

The demise of jobs

Another trend associated with dispersion of business activity and the growth of small businesses is that of self-employment. Most employees can no longer rely on organizations to provide them with a job for life. A significant trend is the rapid growth of self-employment by professionals, particularly those who have had previous large company experience. Many draw on this experience to create innovative opportunities, often global in nature. In turn, many large organizations contract with these individuals for specialist services.

Employment in the future should be viewed not in terms of full-time jobs, but in terms of work activities that are parceled out in the most cost-effective way to those with the necessary knowledge and skills. In the networked economy we have the opportunity to create electronic work markets, both within and beyond firms.

Globalization

Although brands such as Coca-Cola, Toyota and Philips are globally recognized, many industries and many companies are far from global. Even if its marketing is global, a company's manufacturing may be centralized. In retail, for every Toys 'R' Us that have expanded successfully overseas, otherwise successful retailers like Marks & Spencer have struggled hard in their overseas ambitions, or like Wal-Mart have remained largely in their home country.

Nevertheless, globalization is steadily increasing. Many large multinational companies design and manufacture at several locations around the world. They choose locations based on access to skills, markets and infrastructure. Many consumer and electronic products formerly manufactured in the USA and Europe are now manufactured in the Far East. Even there manufacturing has migrated from higher wage countries such as Taiwan and Malaysia to lower wage countries, such as China.

Global knowledge

In the industrial economy two reasons for going global were economies scale and the need to reduce physical transportation costs by manufacturing close to key markets. Now globalization is as much a response to regional specialization and expansion of long-distance relationships and markets. Through the Internet firms can reach distant markets at a price different from customers in their locality. Furthermore, higher value to weight ratios and networks like that of FedEx mean that global distribution is cost-effective.

A global enterprise takes advantage of unique skills and resources, wherever they are located. It may be the software expertise of India or artistic weaving skills of villagers in Pakistan, in Africa or in Bangladesh. This opportunity to harness knowledge on a scale hitherto unimaginable before the internet makes globalization attractive and exciting and is a phenomenon of 21st century.

LESSON 3

FORCES SHAPING THE FUTURE AND THE MEGA TRENDS OF KNOWLEDGE ECONOMY

Let us look at the networked knowledge economy through the perspective of major shifts or mega trends. This is followed by an overview of responses that are needed to adapt and thrive in the new economy.

The Mega Trends

The term mega trend was used by John Naisbitt to describe a fundamental underlying trend shaping the future. In his 1982 book Mega trends, he identified ten key shifts that were reshaping the world. Among these, were

- Industrial society → Information society
- National economy → World economy
- Hierarchies → Networking

Information and knowledge based industry
Information and knowledge are pervading all sectors of industry as well as creating new industries based around them. There are several distinctive characteristics of this new economy.

1. Every industry is becoming more knowledge intensive. Even in agriculture, knowledge adds value. By combining knowledge about the effect of a fertilizer, soil condition, the state of plant growth (using information from satellite photographs), and the forecast weather conditions, farmers can use 40 per cent less fertilizer on their crops, yet achieve the same results. A new generation of combine harvesters automatically measures the weight and moisture content of the corn and calculates yields per acre. Every industry has comparable examples.

2 Smart products. Another manifestation of knowledge intensity comes in so called 'smart products'. These use information or knowledge to provide better functionality or service that can command premium prices. There is a smart tire that senses the load it has to carry and adjusts its pressure accordingly. Think of smart phones and smart homes. I-pods provides best way of carrying your music around. Services can be enhanced through better customer knowledge. Marriott Hotels keeps track of individual references so that it can offer superior service to their customers when they check in.

3 Higher information to weight ratios. The value of electronics in cars now exceeds that of the value of the metal chassis, which itself, through better knowledge of structures, is significantly lighter than that of its predecessors. An indication of this trend at the macroeconomic level is the trend in weight. At the start of the twentieth century the ratio was roughly 1:1. Today the financial value is twenty times higher, while the physical weight of goods is about the same.

4 Value in intangibles. The market value of most companies is several times higher than the value of their physical assets as recorded in their balance sheets.

5 Trade in intangibles. The ultimate information to weight ratios is the weightless product or service. There is a growing range of these intangibles that are traded in their own right. Financial markets are almost wholly intangible. Futures options and complex derivatives are perhaps the ultimate intangible knowledge product, having been created through human ingenuity.

New knowledge industries

A consequence of these trends is the creation of industries that are almost wholly information and knowledge based. Y. Masuda describes a whole set of quaternary industries, as distinct from primary

(agricultural), secondary (manufacturing) and tertiary (services) industries (Table below). While we are now starting to recognize these as distinct and valuable industries, it must have taken some foresight to envisage these in 1980s, when Masuda's book was first published. He also described the 'information utility', in which he envisaged many of the features that we now see in the Internet and on-line communities.

Quaternary industries as defined by Masuda (1980)

Information industries	Printing and publishing
	News and advertising
	Information services – On-line analysis
	Information processing – software services
Knowledge industries	Legal, accountancy, consultancy, design
	Research and development
	Education and Training
Arts industries	Creators – authors, composers, artists, singers etc.
	Performers – orchestras, actors, singers
	Infrastructure – theatres, television, broadcasting, museums
Ethics industries	Corporate Social Responsibility
	Religion, Spiritual and Happiness
	Environment

New knowledge-intensive industries are being created all the time. The biotechnology industry is only fifteen years old but has more than 2000 companies and is expected to have annual revenues in excess of $500 billion by the year 2010. Other industries are emerging around the trading of information and knowledge using the Internet.

Networking -hard and soft

There are two defining characteristics that are fundamental in practice:

1. Networked organizations are less about organizational structure? and more about informal human networking: processes.
2 The technology of computer networking both underpins and enhances human networking.

Virtualization

A key effect of information and communications technologies such as the internet is an increase of virtualization in business activities and ways of working. Virtualization overcomes constraints of time and distance. The term 'virtual' is now appearing in many guises. Thus one view of a virtual corporation is: 'a temporary network of independent companies that co-ordinate activities to meet a common objective, such as anew product development or to meet a customer need.' This view relates to the dimension of time. However, another view relates to an organization not having a clear physical locus. Here a typical definition is: 'an organization distributed geographically and whose work is coordinated through electronic communications.'

Virtual ness can also operate at several levels, from individual to inter organizational. These variations give rise to many types of virtuality, ranging from workers communicating with colleagues globally via phone or email, or the creation of consortia to work on a specific project.

Making a virtue of virtuality

Some of the common types of virtuality are the following.

1. Virtual products and services. The cost of an electronic transaction is typically a tenth of that of the corresponding traditional transaction. Dell generates over $5 million of business a day the Internet. Bookseller Amazon.com sells exclusively this way. Electronic markets that match buyers and sellers are now emerging in everything from Dutch flowers to second-hand cars.

2 Virtual working or telework. Several million people in Europe and thousands in Pakistan now telework for some or part of their working week. They may work from home, from client premises, or indeed anywhere that has telephone access, which with cellular phones is now virtually everywhere! With the ubiquitous notebook computer, it has been said that 'my office is where I hang my modem'.

3 Virtual offices. A related type of virtualization is the virtual office, where the physical office is replaced by office services. IBM is one of many companies that have adopted 'hot-desking'. At several of its premises, employees do not have personal workspaces, but are allocated desks whenever they are in the office.

4 Virtual teams. To give flexibility and to avoid relocation, many companies simply create virtual teams, where employees work at locations more convenient to them. Other examples are where several teams working in conventional office settings at different locations co-operate virtually, such as engineering teams at Toyota, Ford or Boeing in locations across Europe and the USA.

5 Virtual organizations. These can range from a stable supply network that works as a single organization, to a loose federation of independent firms that come together temporarily for specific activities.

6 Virtual communities. Instead of a local community a virtual community is one of shared in terms, whatever the location. They are found on Internet newsgroups and discussion lists, or on an organization's intranet.

Whatever form virtualization takes, there are some common features that distinguish it from traditional forms:

- Information and communications technology allows operations to be dispersed.
- The barriers of time and space are reduced (or even disappear completely).
- Organizational structures are network-like, and more dynamic.
- The interface with customers and markets is different-
- Employees and associates (business partners, suppliers, customers etc.) adopt new patterns of work.
- The locus of knowledge is diffused. It is not necessarily in a specific place.

Technology – a fundamental driving force

Underpinning each mega trend is the fundamental driving force of technology. Technology amplifies human capabilities. In the industrial revolution, the core technology was steam power that gave humans a 15 times improvement in price-performance over manual methods. In the knowledge era it is ICT that is boosting our ability to process information. However, the pace of improvement in the information revolution is much faster.

The rate of improvement in microchips, the fundamental component of computers, has been fairly constant over several decades. In 1965 Intel's co-founder, Gordon Moore, projected that performance doubles and costs halve roughly ,every eighteen months, an observation now enshrined as Moore's Law. Such improvements are almost unparalleled in the world of science and technology. The Massachusetts Institute of Technology's (MIT) landmark study, Management in the 1990s indicated that over a ten-year period, IT showed a 25 times price-performance improvement, compared to 1.4 times for the six other most improve product groups. This rate of improvement equates to an industrial revolution every seven years!

The Revolution Continues

Moore's Law seems set to continue, at least through to the year 2010 , although there are likely to be changes in the specific technology used. Thus X-ray lithography should replace optical lithography, leading to the development of circuits only 0.01 microns (millionths of an inch) wide by 2010, compared to around .25 microns today, and processors that are 1000 times more powerful. Thereafter, provided new applications become economic and sustain demand, investments in a variety of new

technologies, such as holographic memory and molecular computers, should maintain the fundamental trend.

ICT Trends: Decade on Decade Improvements

	1988	1998	2008
Components: Processor speeds Transistors per chip Memory chips Basic disk capacity	 10MHz 275 000 64 Kbits 20 MB	 400 MHz 7.5 million 64 Mbits 1 GB	 10 000 MHz 250 million 16 Gbit 250 GB
Personal computer (typical)	PC-386 (8 MHz) 256 KB RAM 60 MB disk 14" CRT	Pentium 32 MB SDRAM 4 GB disk CD-ROM (32X) 17" CRT	10 GHz 4 GB memory 500 GB disk £100-£2000 20" flat panel Desk-top plus palm-held integrated PC and communicators
Software and applications	Basic Office Suite (word processing, spreadsheet). Profession specific	Adds database, email. Internet	Integrated voice and data messaging. Visual knowledge navigation
Users	Professionals, clerical staff have access in office	Most staff including unskilled. Professionals have several (office, home, mobile)	Everybody. Computers are consumer appliances (often for specific applications)
Typical functions	Calculations; procedures; transactions	Information retrieval; communications; décision support	Knowledge development; learning; symbiotic decision-making

LESSON 4

MANAGERIAL CONSIDERATIONS FOR INTERNET CUSTOMERS AND K- BASED MARKETING

In the industrial era, companies operated on assumptions rooted in tangible-assets-based explanations that basically tracked the physical transformations of atoms into finished goods in order to create wealth. Atoms represent the raw material used to create valued outputs. In this framework the Sultan of Brunei became one of the wealthiest individuals in the world by extracting petroleum atoms, or oil, that is eventually transformed into gasoline.

Companies competing under the old model tend to have highly standardized operational procedures for relatively simple products. Design and operational complexity, as well as customizability, is generally squeezed out of the production process. Examples of companies like these can be found in the commodity industries.

In the modern era based on knowledge, this approach can be suicidal because reverse-knowledge engineering enables competitors to produce the same processes/products easily. Personal computer manufacturing is a familiar example because components are based on defined common standards and companies readily produce commodity components. On the other hand, the PC software industry is a very different environment where Microsoft, Oracle, and SAP capture and reuse unique knowledge in the form of lines of code and in the methods to produce that code. As evidence of the shift in power from the Industrial to the Information Age, Bill Gates, CEO of Microsoft, is wealthier than the Sultan of Brunei.

Microsoft, for example, ultimately creates value by compiling bits into programs. The primary engine of wealth is not the compact disc or manual. Wealth is created by selling new and reused compute code. Both old and new paradigms provide assumptions that allow managers to manage corporate assets. Critically, the assumptions governing the management of knowledge assets differ radically from those governing the management of industrial-era tangible assets. Managers from both perspectives would see a group of employees and machinery, but the inputs, processes, and outputs are viewed in radically different ways.

Information Age manager see a set of knowledge assets distributed among people, machines, and processes coordinated to produce desired outputs. Basic decisions are based on assumptions about the knowledge required to operate a given process and how it can be embedded in information technology to make it easily reusable. These managers also recognize that some knowledge assets are better left in the brains of employees. Their intellectual capital creates the leverage and flexibility to rapidly deploy new knowledge and create an ever-changing array of products and services. In this way, the critical problem for management is how to best introduce, utilize, and deploy knowledge throughout the company's core processes.

In contrast, Industrial Age managers see a company's core processes as piece parts of a machine operating in predetermined ways to yield a more or less consistent set of tangible outputs. Ensuring that the parts are interchangeable is a common goal. Embedding knowledge within machines and employing tightly defined job descriptions are common approaches. Supervision aims to ensure that employees behave within the well-defined limits, and managers believe that obtaining enough measures of the process will optimize the process. This seeing the "trees through the forest" approach is based on the reductions it assumptions of the industrial-era paradigm. Focusing on tangible outputs rather than on the knowledge assets deployed to produce the outputs is common practice.

Although both managers focus on the same tangible assets, the Information Age manager's paradigm leads to explicit management of intangible assets. The Industrial assets he literally does not "see." The Information Age paradigm allows managers to "see" patterns, and the patterns that provide the most leverage in today's economy are based on knowledge.

Knowledge Management in Practice

Organizations around the world are adopting knowledge management practices at an accelerating pace. They have combined cultural and procedural changes with enabling technology to realize bottom-line improvements. A number of comprehensive surveys have indicated that organizations are engaged in wide-ranging efforts to implement and improve knowledge management practices.

Perceived Benefits from Knowledge Management

Improved decision making	89%
Improved responsiveness to customers	84%
Improved efficiency of people and operations	82%
Improved innovation	73%
Improved products/services	73%

Following are some of the organizations where managers took the challenge and implemented KM programs.

The World Bank

The World Bank is an organization owned by many of the governments of the world. It lends money to support economic development and provides advice. In 1996, the president made an announcement that forced the rum to make changes in how knowledge was managed. He announced that the organization was going to manage and share its knowledge with clients around the worldviathe1nternetandother methods. The goal of the initiative is to make World Bank knowledge available in a database to provide assistance for all personnel.

The conceptual model they are using treats knowledge management as a process of creating, organizing, and applying data. The organization as a whole has these seven goals.

1. Assembling a large knowledge base in a knowledge management system.
2. Creating a help desk that can help users find the things they need.
3. Establishing an expert's directory.
4. Developing data and statistics on changes in each country.
5. Articulating engagement information and links within the organization.
6. Providing dialog space for questions, answers, and conversations.
7. Facilitating access to users out side the organization.

At this point the World Bank is still trying to make this whole process a success and convince skeptics that an organization known for its static ways can change into an organization of the times.

Skandia

In the early 1980s, managers at Skandia found that traditional management and accounting theories did not accurately reflect value found within their company. Since Skandia is a knowledge-intensive service company, its inventory was only a fraction of its assets. Reports strove to define new methods of valuation and described ways to attach importance to a company's intangible assets.

Leif Edvisson, the director of the Swedish Coalition of Service Industries, was named director of the intellectual capital management function for the AFS business unit of Skandia in 1991. This was part of the effort to capture and define the value of intellectual capital as a complement to the balance sheet CEO Bjorn Wolrath and top executive Jan Carendi viewed intellectual capital (IC) reporting as a tool to aid internal decisions and descriptions of the company's knowledge assets to the shareholders.
Rapid growth occurred in the AFS division under Edvisson from 1991 to 1995, and he strove to create a system that could make the growth truly appreciated. During these years alliances grow from 50,000 to 65,000, and the employee count increased from 1,100 to 2,000 during the same period. In May 1995, the IC team released the first public IC annual report as a supplement to the financial report, and over 500 corporations have contacted Edvisson for assistance in developing their own IC reports. Skandia's

effort was not the first attempt to manage knowledge, but it was the most concentrated, and by doing so publicly they set the trend for other companies to .follow suit.

Knowledge Management Practices

Company	Country	Knowledge Management Objectives	Knowledge Management Practices and Initiatives
3M	USA	Build knowledge-sharing culture	Managers are required to link continuous learning to revenues.
Analog Devices	USA	Build knowledge-sharing culture	CEO Ray Stat initiated breakdown of functional barriers and competitive atmosphere ad created a collaborative knowledge-sharing culture from the top. Company encourages "community of inquirers" rather than "community of advocates."
Boeing 77	USA	Build knowledge-sharing culture	First "paperless" development of aircraft. Included customers in design teams. More than 200 teams with wide range of skills both designed and constructed subparts, rather than usual organization design team and construction team. Suppliers worldwide used same digital databases as Boeing.
Buckman Labs	USA	1. Build knowledge-sharing culture 2. Create careers based on knowledge management	A biotech firm that has reorganized itself to optimize knowledge sharing. Created knowledge Transfer Department to coordinate efforts. Employees' best at knowledge sharing gain both financial rewards and management positions.
Chaparral Steel	USA	Build knowledge-sharing culture	Mini steel mill that has introduced broad range of initiatives such as: flat hierarchy, broad education, blue-collar workers responsible for customer contacts and rewarded for personal initiatives. Chaparral uses 1.5 hrs labor per ton; industry standard of 1.5-3.0 hrs. per ton
Ford Motor	USA	Build knowledge-sharing culture	Company that has transformed itself by outsourcing and creating virtual networks of vendors using IT.
Oticon	Denmark	Build knowledge-sharing culture	Has created a "spaghetti organization." A chaotic tangle of interrelationships and interactions. Knowledge workers have no fixed job descriptions but work entirely on project basis.
Hewlett-Packard	USA	1. Build knowledge-sharing culture. 2. Create micro-environments for tacit knowledge transfer.	Implemented an overall culture of collaboration, which encourages knowledge sharing and risk taking on all levels. H-P even supports people who try out things that don't work.
Affaers-vaerlden	Sweden	Create micro-environments for tacit knowledge transfer.	Business journal uses "piggy-backing" and "team-writing" to speed up learning among new journalists. Interviews and larger articles are routinely assigned as team work, rather than one-man shows. This speeds up transfer of the seniors' tacit skills and networks to the juniors.

Honda	Japan	Create micro-environments for tacit knowledge transfer.	"Redundancy" routinely used; people are given information that goes beyond their immediate operational requirements. This facilitates sharing in responsibilities and creative solutions from unexpected sources and acts as a self-control mechanism.
PLS-Consult	Denmark	1. Measure knowledge-creating processes and intangible assets. 2. Create micro-environments for tacit knowledge transfer.	Categorizes customers according to value of knowledge contribution to the firm. Follows up in management information system. Appoints "mentors" with task to facilitate transfer of tacit skills between members in large projects. Actively seeks large projects, so that junior consultants can be added to the teams for learning.
Agro	USA	Offer customers additional knowledge	Data on farmers and soils are combined with weather forecasts and information on crops. Analyses are fed back to the farmer via sales reps to help farmer select best combinations of crops
Frito-Lay	USA	Offer customers additional knowledge.	Sales reps collect daily spot data about shelf space utilization for all brands. Data are computed, combined with market information, and refer to the sales reps, which use it to give the retailers information on best shelf utilization.
Benetton	Italy	Gain customer knowledge	Produces "mass-customized" apparel to fit latest trends in colors and designs. Daily sales data from their own boutiques are integrated with computer-aided design and computer-integrated manufacturing.
General Electric	USA	Gain customer knowledge.	Since 1982, the company has collected all customer complaints in a database that supports telephone operators in answering customer calls. GE has programmed 1.5 million potential problems and their solutions into its system.
National Bicycle	Japan	Gain customer knowledge	Produces "mass-customized" bikes to fit customers' exact height, weight, and color preferences in a day. Is achieved through computer-aided design and computer-integrated manufacturing integrated with customer database.
Netscape	USA	Gain customer knowledge	Very close links via Internet to opinion leaders among customers, who are encouraged to report problems to enable it to create new generations of software at a very fast pace.
Ritz Carlton	Worldwide	Gain customer knowledge	Staff required to fill out cards with information from every personal encounter with a guest. Data plus all quest requirements are stored and printed out to all staff when the guest arrives again, so that each guest receives personal treatment.
British	UK	Capture, store, and spread	Using knowledge management to draw

Petroleum		individuals' tacit knowledge.	together talents from all over the organization. BP emphasizes transfer of tacit knowledge rather than accumulation and transmission of raw data and has installed a communication network comprising videoconferencing, multimedia, and e-mail.
Chevron	USA	Capture, store, and spread individuals' tacit knowledge.	Created a "best practice" database that captures experience of drilling conditions and innovative solutions to problems on site in a database for sharing globally with other sites.
McKinsey and Bain & Co.	USA	Capture, store, and spread individuals' tacit knowledge.	These two management consulting firms have developed "knowledge databases" that contain experiences from every assignment including names of team members and client reactions. Each team must appoint a "historian" to document the work.
Dow Chemical	USA	Create new revenues from existing knowledge.	Puts all its 25,000+ patents into a database, which is used by all divisions to explore how existing patents can gain more revenues. The experience from this application is now being transferred into other intellectual assets.
Outoku-mppu	USA	Create new revenues from existing knowledge.	Knowledge on how to build smelting plants is used to construct whole plants including education of personnel and managers to customer all over the world. This business is now more profitable than its original business base.
Steel case	USA	Create new revenues from existing knowledge	Does basic research into innovation and learning, best learning environments, and new interfaces (3D and virtual tools). Steel case sells its knowledge in this area to other companies.
IBM	USA	Create careers based on knowledge management.	Employees are encouraged to switch between professional and managerial jobs in order to gain more holistic knowledge about the company.
Celemi	Sweden	Measure knowledge-creating processes and intangible assets.	Published first audit of its intangible assets in Annual Report 1995.
Telia	Sweden	Measure knowledge-creating processes and intangible assets	Sweden's Telecom company publishes since 1990 an annual Statement of Human Resources including a profit and loss account visualizing human resource costs and a balance sheet showing investments in human resources.

It is interesting to note the large number of Swedish companies involved in knowledge management. Swedish companies have been pioneers in this field and were the first to monitor and systemize intelligence activities in large European companies. Observations at Astra-Draco, Ericsson Radio, Gambro, Celsius Tech, Skandia, SAS, Telia, and Volvo identified four common features:

1. Balance between strategy and operational objectives.
2. A systematic supply-on-demand intelligence for corporate management.
3. A focus on information-sharing cultures, including systematic community meetings linking businesspeople, academics, and military officers.

4. Emphasis on knowledge-sharing acquisition processes.

Intellectual Capital	
Tracking a company's physical assets is straightforward enough, as long as you're counting computers, adding salaries, and estimating heating bills. But managing intellectual capital is a different ball game, and one in which few companies consistently hit home runs. Intellectual capital involves a company's employee expertise, unique organizational systems, and intellectual property. For example, if a company's book value is $10 per share and its stock is selling for $40 per share, the difference is often attributed to intellectual capital. "When you subtract book value from market value, the remaining is all the intellectual and knowledge and market capital. It includes all the patents they might have and all other intangibles," says Vish Krishna, associated professor of management at the McCombs School of Business at the University of the Texas at Austin. Once a company identifies its intellectual capital, the next step is to maintain it. One of the techniques that Dollar Bank uses to manage intellectual capital is to keep employees involved in decision making and planning, says	Abraham Nader, senior vice president and chief operating officer at the Pittsburgh-based bank. Ron Griffin, CIO at The Home Depot, Inc., says that Atlanta-based home improvement retailer has tried-and-true structures in place for measuring, maintaining, and growing intellectual capital. The company uses a nine-box grid system to measure each employee's performance and potential, and it offers developmental courses to bring employees up to speed on certain issues. The categories measured include leadership ability, how an employee fits into the Home Depot culture, financial acumen, and project management capabilities For its part, Home Depot posts a bulletin on its intranet with quick references on topics such as how to repair a leaky toilet or build a deck. That way, knowledge is available for employees to remain up to speed and to pass such information along to customers. "It's not just about selling product in our business; it's a lot of the knowledge, and we train on that extensively," Griffin says.
SOURCE: Excerpted from Taylor, Christie. "Intellectual Capital," Computerworld. March 12,2001, p.51.	

As a result of KM, systems have been developed to gather, organize, refine, and distribute knowledge throughout the business. In his study of Smart Business, Botkin (1999) suggests six top attributes of knowledge products and services:

- **Learn.** The more you use them, the smarter they get and the smarter you get, too.
- **Improve with use.** These products and services are enhanced rather than depleted when used, and they grow up instead of being used up.
- **Anticipate.** Knowing what you want, they recommend what you might want next.
- **Interactive.** There is two-way communication between you and them.
- **Remember.** They record and recall past actions to develop a profile.
- **Customize.** They offer unique configuration to your individual specifications in real time at no additional cost.

During the 1960s and 1970s, technology was focused on automating high-volume static processes such as claims processing, mortgage loan updating, airline reservation systems, and the like. The emergence of e-commerce in the late 1980s and 1990s showed how information technology could implemented a new way of doing business effectively. Ever-increasing processing power, high bandwidth data transmission, and networking made it possible to re-envision how business gets done. It has also changed the business environment and introduced new competitive imperatives. Among them are:

- **Reacting instantly to new business opportunities, which led to decentralized decision making (and competency) at the front lines, where the action is.** With that came the desire to build mutual trust between knowledge workers and management and to cooperate in handling time-sensitive tasks.

- **Building better sensitivity to "brain drain.**" It has been said that "expertise gravitates toward the highest bidder" (Applehans et al. 1999, 17). More and more companies realize the importance of managing and preserving expertise turnover. For the human resources

department, the key question is "How does the firm replace expertise when it retires, resigns, or simply leaves?

- **Ensuring successful partnering and core competencies with suppliers, vendors, customers, and other constituents.** Today's technology has enabled companies to reengineer the ways to do business. Getting partners up to your speed requires more than fast technology. Knowledge workers and others within the company should ensure that cooperation and coordination of work are practiced for the good of the firm.

Companies and managers that fail to embed a viable KM operation probably suffer from several oversights or pitfalls:

- **Failing to modify the compensation system to reward people working as a team.** The traditional method of compensating people based on the old-fashioned "information-hoarding" practice does not work in a knowledge-sharing environment. Merit increases and bonuses should be based on team contribution and team performance rather than quantity or volume.

- **Building a huge database that is supposed to cater to the entire company.** Generalized systems do not usually work well, because information and knowledge are not stratified to address specialized areas of expertise. Ideally, the human resources department should first determine who works best with who based on commonality of job type or job experience and then discover the knowledge that can be shared for each employee to be more successful.

- **Viewing KM as a technology or a human resource area.** This oversight relates to the earlier one – where human resources and information technology efforts are poorly coordinated – and defeats the purpose behind embedding KM into the fabric of the organization. The two departments should work jointly at introducing KM as part of the organizational processes.

- **Placing too much emphasis on technology.** Although intranets, knowledge-based tools, data warehouses, and other computer-based software are part of the way today's organization must adopt, technology is only the enabler of knowledge management. The knowledge it makes available must be organized and disseminated to human decision makers to be of any use.

- **Introducing KM into the organization via a simple project to minimize possible losses.** This is the wrong way to start KM. A company should start with a strategy and a champion, with a focus on a worthwhile, high profile project that can set the tone for the rest of the organization. It is a high risk approach, but one that is most likely to pay dividends in the long run.

- **Pursuing KM without being ready.** Spurred by the paradigm shift in our economy, many corporations pursue KM without evaluating whether they are organizationally ready 9stewart et al. 2000, 45). In other words, corporations that have been operating under classical management principles cannot be successful in adopting KM without major changes in culture, management attitudes, and communication skills.

- **Having poor leadership.** Like any high priority project, KM is best implemented with determined champions and top management commitment. For example, General Electric (GE) recognizes an organizational culture open to ideas from all levels of the company. By encouraging best-practice sharing, the company can grasp the knowledge within the employees and innovate the organization's processes. Jack Welch, former CEO, has established a knowledge management university and frequently teaches the classes himself. Only 10 percent of the 96 companies surveyed by the Conference Board sponsored by PricewaterhouseCoopers identified the CEO as a component of a KM initiative. By integrating the CEO of the company into the KM system, KM acquires a level of importance and respect that would otherwise be lacking. GE has incorporated all levels of the business and is well designed to share knowledge. The company is successfully able to use employee input and knowledge to produce a strategic advantage (Jones 199,3-18)

KM is slowly gaining acceptance across industries. Several factors triggered interest in KM:

- The pace of change has accelerated dramatically during the past decade. Companies are looking at innovative says of taking on the competition. Innovation is the one core competency needed by all organization (Drucker 1969).
- Globalization and geographic dispersion change the organization's scope. More and more organizations are trying to lean on years of experience to manage their global commitment in a timely and profitable fashion.
- Downsizing and reengineering resulted in staff attrition and knowledge drain. This prompted organizations to assess their knowledge core and make more effective use of it. Reengineering assumed a one-time fix to a situation. This created a vicious cycle, where solutions became new problems. It failed to recognized rapid changes in today's market.
- Networking and data communication made it easier and faster to share knowledge. Knowledge sharing is becoming the best way to distribute expertise across and around the firm via technology. Technology alone is insufficient.
- The increasing dominance of knowledge as a basis for improving efficiency and effectiveness triggered many companies to find the means for utilizing the knowledge they have gained from previous experience.

With these factors, it is easy to see how knowledge management works for the survival of the firm. Knowledge is the key. It is the core competence of any business. It is a function that can and should be embedded into every business process – new products and services, new channels of distribution, new marketing strategies, and new industry definitions. Technology is the backbone, and human components are necessary to utilize it.

LESSON 5

FRAMEWORK WITH NEW STRUCTURE, STRATEGIES AND LEVERS OF STRATEGY

Knowledge: The Strategic Imperative

Every few years a new management philosophy captures the attention of strategists and business leaders. In the 1990s, such movements have included those of total quality management (TQM) and, more recently, business process re-engineering. The last few years have seen knowledge take centre stage.

New Strategies, New Structures

Successful strategies will exploit the developments in IC technology. They will take advantage of the Internet and electronic commerce to create global markets for new products and services.

Value to customers will be enhanced through information and knowledge. Information products, such as database, and knowledge-based services, such as consultancy, will become important ways of generating revenues. Technology will be used to tailor services to individual customer needs and develop closer customer relationships.

In terms of structure, responsive organizations will be those that are more networked. Virtual teams and organizations will allow them to create value through unique combinations of skills that are flexibly combined as needed. The future organization is most likely to consist of networks of self-managed teams that reconfigure o adapt to opportunity and change. Teams, not functions or departments, will become the core productive units within organizations.

Strategies based on competitive advantage – conventional wisdom in the 1980s – may have done many organizations more harm than good. Sustainable wealth comes through creating and growing new markets, not competing in existing ones. Thus competing IT manufacturers increasingly co-operate on matters of standards, while care-makers collaborate on safety.

The innovation imperative

One of the main challenges for any organization is survival. The average life expectancy of most firms is low, around twenty years. One-third of all businesses in 1970 had disappeared thirteen years later. Today the environment is more turbulent and dynamic, so survival becomes even harder. Yet there are companies, like Shell (founded 1907), Siemens (1847), Du Pont (1802) and 3M (1902) that survive and thrive. How do they do this? They adapt and innovated.

Innovative 3M introduced 500 new products in 1996. A 1997 survey by Arthur D. Little of 700 companies in twenty-three countries showed that 84 per cent of companies believed that innovation was more crucial for their business success than it was in a similar survey carried out in 1991. They seek innovation for gaining new customers and creating new markets with innovative products, services and processes

Of all the responses to the challenges, the most important can be summarized in two words -fast innovation. Continuous improvement initiatives give incremental benefits. What is needed in the new economy is radical innovation. It is not uncommon to find organizations succeeding in creating improvements of not just a few per cent but a factor of ten. Remember when it took days or weeks to get prescription spectacles. Now you can get them in one or two hour~. It used to take BP 100 days with an expensive ship to drill anew deep-sea oil well. Now, by applying learning gained elsewhere this can be reduced to five days or less. Research at Rensselaer Polytechnic in New York State found that a key characteristic of organizations that make such breakthroughs is a free of ideas, in and out. In every case networking played a big role: 'the most successful researchers have wide-ranging networks of people'. They have discovered knowledge networking.

Seven levers of strategy

What can be done to secure a strategic advantage through knowledge? Analysis of many cases indicates seven commonly used levers:

1. Customer knowledge – developing deep knowledge through customer relationships, and using it to enhance customer success through improved products and services.
2. Knowledge in products and services – embedding knowledge in products and surrounding them with knowledge-intensive services.
3. Knowledge in people – developing human competencies and nurturing an innovative culture where learning is valued and knowledge is shared.
4. Knowledge in processes – embedding knowledge into business processes, and giving access to expertise at critical points.
5. Organizational memory – recording existing experience for future use, both in the form of explicit knowledge repositories and developing pointers to expertise.
6. Knowledge in relationships – improving knowledge flows across boundaries with suppliers, customers, employees, etc.
7. Knowledge assets – measuring intellectual capital and managing its development and exploitation.

The core levers are knowledge in people, processes and products. In most situations winning strategies are developed by concentrating on just two or three of the seven levers.

Customer knowledge

Virtually every survey ranks customer knowledge as an organization's, most important knowledge. In truth, most companies know a lot less about their customers and their markets than they claim. They place too much reliance on traditional market research. They carry out customer satisfaction surveys that tell them little of customers' real wishes and concerns. Customers can provide vital insights into the application of your products and services, but this requires forging close working relationships that surface this deep knowledge.

Developing good customer knowledge also needs effective environment scanning and market intelligence systems to gather and collate knowledge. Such systems should cover not just customers and markets but a whole range of external factors including technology, social, political, economic and regulatory developments.

Knowledge in products and services

Almost every product is knowledge intensive, even if we don't realize it. When we buy a prescription drug, we are not buying merely a tablet but also the knowledge it encapsulates, that of the therapeutic benefits and side effects gleaned from years of extensive clinical trials. We can use genetic knowledge to create genetically modified foods, such as disease resistant potatoes or square tomatoes that are easier to pack.

Companies hold vast amounts of knowledge that can be exploited as part of their product or service offering. Such knowledge includes applications knowledge, market knowledge, and how to solve problems encountered by users. Much of this is accumulated during the product development and testing process, but is then overlooked. Only a fraction is encapsulated into the final product, leaving under-utilized a rich source of knowledge that could create additional revenues .

This knowledge can be exploited in several ways. One way is through additional paid services, such as consultancy or training services. Another way is to make the product 'smart' or 'intelligent'. There is an intelligent oil drill, which 'knows' the shape of the reservoir it is drilling, and so extracts more oil.

Products and services can be customized by combining product and customer knowledge. One example is the personalized daily new bulletin that combines information from many disparate sources. Another is Campbell Soups' 'Intelligent Quisine', designed for people suffering hypertension or high cholesterol. It delivers weekly packages of nutritionally designed, portion-controlled meals based on personal information.

Knowledge in people

'People are our most valuable asset' runs the line in many company annual reports. Companies that truly believe it apply this knowledge lever through a competence or learning lens. One underlying model used in this approach is that of a repeating action-learning cycle:

- Plan: think, conceptualize, and devise a set of actions.
- Act: do, gain experience of' theory in practice'.
- Observe: record experiences, share knowledge with others.
- Reflect: consider what has been learnt and how it can be used to make improvements.

Learning programs typically mesh competence development activities at several levels -individual, team and organization. Individual competence and knowledge is developed through personal development plans that meet the needs of individuals as well as the organization. Team knowledge is enhanced through learning processes that encourage individuals to share their knowledge in teamwork. At the organizational level the focus shifts to overall competence measurement, corporate universities and human resource policies that reward learning and knowledge sharing. Motivating knowledge workers So that they work energetically and are committed to the success of the organization is another important aspect of a people-focused knowledge strategy.

In reality, many organizations fail to effectively use the knowledge in their people. They allow insufficient time for learning or reflection. They regard people as hired hands, rather than borrowed brains. They dictate to them what to do, giving them little discretion in how they do it. It is little wonder that their employees feel undervalued, and will indeed 'walk' at the first opportunity and take their knowledge with them.

In contrast, Shell is an organization long acknowledged as an excellent example of nurturing and developing its people. It has an initiative within its exploration business to 'harness this talent' and make 'better use of this intellectual capital' .Its focus is the development of an infrastructure for learning and leverage of knowledge. There are open learning centers and databases of learning resources on the company's intranet. However, the most significant developments have been the establishment of knowledge communities and developing skills for quality person-to-person dialogue and reflection. Learning is being built into daily work activities.

One company that combines both product and people levers is that of Teltech Resources.

Teltech -people are the product

Teltech Resources of Minneapolis manages a knowledge network of some 3000 human experts whose knowledge is harnessed to tackle difficult problems. This network includes academics, industry experts and recent if retirees who have specialist in-depth technical knowledge. Knowledge analysts provide a human interface between the client who has a problem, the expert network and over 1600 technical databases.

Teltech's business is based on a deep understanding of how its clients gather and use knowledge. It then develops close relationships with both suppliers and users of that knowledge. It also blends explicit and tacit knowledge. Explicit knowledge is structured according to a well-developed thesaurus of knowledge domain classifications. This also permits many synonyms, cross-referencing and multiple placements. Analysts 'act as guides in defining, clarifying and interpreting database-search results'.

In one case, a medical products developer had tried in vain to make a heart pump leak-proof in a saline solution. The answer came from an expert in submarine technology, whose equipment also operates in similar environments.

Knowledge in processes

Every business process contains embedded knowledge. Ad hoc activities, previously performed by people with specialist knowledge, become codified into routine processes. It is then more readily diffused through-out an organization. Even so, much tacit knowledge is frequently needed to perform

the process effectively and to deal with exceptions. Hence the explicit process knowledge is typically accompanied by training, procedure manuals and access to experts.

One way to enrich knowledge in processes is to embed backup resource material. Access to human expertise is available on IT systems through a 'click here for help' screen icon. This may either trigger an email or even a computer-generated phone call to a human expert. Other organizations use workflow software to blend computer held knowledge with human knowledge. The software applies rules to determine which transactions are straightforward, and are therefore handled automatically by computer, and which require human intervention.

Organizational memory

This strategic lever helps address the issue of 'knowing what you know'. It is also used to avoid repeating the mistakes of the past, and to draw lessons from similar situations or cases from elsewhere. Organizational memory exists in many places, most notably the brains of its people. But it also exists in records, filing cabinets, personal computer disk files and the physical surroundings. External sources should not be overlooked. After all, many outsiders follow an organization's actions, or have even been part of it at one time.

A common approach to managing organizational memory is to capture in explicit form the most important knowledge and enter it into knowledge databases. These databases may be in document management systems, in groupware such as Lotus Notes, or as web pages on an intranet. Often such databases will not contain the knowledge per se, but will provide pointers to it. Examples of knowledge databases include:

- Customer histories. These detail interactions with a given customer: products bought, sales visit reports, etc.
- Best practices. Chevron has best practices databases and a resource map organized according to the categories of the Baldridge quality award.
- Products and technologies. Details of the organization's various products and history.

Explicit knowledge bases, however, typically contain less than 10 per cent of an organization's memory. Therefore other approaches are used to make it easier to access the minds of experts. A common example is an on-line directory of expertise, often called Yellow Pages, because they are structured by skill and discipline, not by department. Novartis have also added Blue Pages that contain details of external experts with whom they collaborate. Knowledge-sharing events provide another way of sharing tacit knowledge. Thomas Miller & Co., a mutual insurance company, runs 'knowledge in a nutshell' events. Company experts give talks on their areas of expertise and describe their experiences. These live sessions are also recorded on video for further distribution and subsequent recall. The key to enhancing organizational memory is to make ongoing experience capture an integral part of everyday work. Techniques include decision diaries, learning histories and post-project reviews.

Knowledge in relationships

Many companies have an invaluable resource of knowledge developed through individual relationships -with customers, suppliers, business partners, professional and trade associations. When a salesperson leaves your company, it is not just their product or customer knowledge that is lost. It may be much of the customer relationship. This relationship involves shared knowledge and understanding -not just of needs and factual information, but of deeper knowledge such as behaviors, motivations, personal characteristics, ambitions and feelings. Such depth of knowledge is not easily replaced overnight.

Organizations can deepen their relationship knowledge by increasing their interaction with the outside world. This may take the form of regular meetings for knowledge exchange and sharing of databases. Toshiba collects comparative data on suppliers ranking 200 quantitative and qualitative factors. It has an active supplier's network where knowledge is shared and suppliers are integrated into future strategies. Extranets provide another way to develop wider linkages. By increasing the number of contacts with key stakeholders, at all levels and functions, you become less vulnerable to the loss of a single contact. Relationship knowledge can also be deepened by taking a whole range of inter-company interactions to deeper levels of intimacy, and by strengthening knowledge exchange. Relationship marketing, the new

vogue in consumer marketing, goes far beyond issuing customers loyalty cards. Customer relationship knowledge comes through exploring mutual interests, seeking new insights through extensive dialogue, and jointly creating new business opportunities. Activities that might previously have been considered confidential to the company are extended to involve stakeholders. These include product planning, marketing campaigns and human resource competency development. Social events also strengthen relationship knowledge. Corporate hospitality does have its benefits!

Knowledge as an asset

The final lever is that of knowledge as an asset. This builds on the notion, mentioned earlier, of measuring and managing intellectual capital. While many organizations have accountants and auditors track in detail every piece of physical plant and machinery, few devote even a fraction of this attention to intellectual capital. Yet this is much more valuable, since it includes knowledge and people.

The starting point of .any asset-based approach is that of understanding its different components. Intellectual assets are frequently categorized into the following groups.

1. Human capital – in the minds of individuals; knowledge, competencies, experience, know-how, etc.
2 Structural capital – 'that which is left after employees go home for the night': processes, information systems, databases, etc.
3. Customer capital – customer relationships, brands, trademarks, etc.

Dow Chemical provides a good example of this knowledge lever. In 1994 it had over 29000 patents in force around the world. However, maintaining the validity of a patent can be costly -up to $250000 over its lifetime. Dow's Intellectual Asset Management team developed a comprehensive framework for actively measuring and managing its patent portfolio. It found many patents not being effectively exploited, and others with no obvious ownership. It took measures to exploit patents, either through internal use, licensing or sale, while allowing others to lapse by not paying renewal fees. Within three years the team had generated $125 million in additional revenues, their original target for the year 2000.

LESSON 6

HISTORICAL SHIFTS IN WORLD ECONOMIES AND THE ROLE OF KNOWLEDGE AND INTELLIGENCE

Where is Wisdom?

We know that data and information does not convey wisdom and we also know that knowledge is also not wisdom. More we know, the more we know that we don't know. Education itself is a progressive discovery of our own ignorance.

As your knowledge increases, what happens to your ignorance? It obviously becomes larger, or at least your awareness of your ignorance becomes larger. When information and knowledge are impregnated with worthy purposes and principles, you have wisdom.

History of Management:

To understand current management dilemma, we might review the demands on management from the Agrarian age through Industrial Revolution and on into the Information/Knowledge age which has brought with it the quickening and flattening pace pf change.

The Agrarian age:

During the agrarian age people worked first as hunters and gatherers and then as farmers. Most people depend and lived on land and the rhythm and pace of life were defined by the seasons. They planted in spring, crops grew in summer and was` harvested in the autumn and then ploughed and the land remained fallow in the winter. Skills were passed down through families. Trade skills were learned under the apprentice/mastery system.

The Industrial age:

The agrarian way of life was changed for some if not for all forever when in 1763 James Watt invented the steam engine. The power of steam engine helped in the steal production and also increased our ability significantly to produce goods and thus brought the beginning of industrial revolution. The higher tensile strength of steal beams enabled the construction of large factories that housed the manufacturing machines that were driven by steam power.

The machines were designed to produce goods but needed people to operate them. So where did the labor come from? The labor came from the land and villages. People flocked from their farms to work in the factories which were in and around cities and so town and cities grew larger and larger. Generally these people coming from farms were farmers. The capitalists who owned the machines and factories required a new type of worker, the manager. The manager was needed to tell the poorly educated workers what to do.

In the agrarian age, the seasons defined the pace of life. Once you have the steam engine, you can run factory 24 hours a day, seven days a week. The pace of the game of life and business was changed forever. In early days, labor was exploited by capitalists and their trusted managers and hence union movement was born to fight injustice. Laborers who complained for harsh conditions, it was easy to get rid of them as there were plenty more where they came from the villages. Is it not the case going on still in many Textile /Leather factories of Pakistan.

The fundamental principle behind the industrial revolution was that managers needed to be intelligent and trained to direct workers activity. They understood what needed to be done in the factory. Managers directed and workers worked. Western education system developed to supply workers with basic primary and basic technical skills and provided managers with secondary enhanced trade and commerce and accounting skills. Central idea became that mangers know what to do. They tell the workers and workers do it.

The Information age:

We have moved from industrial revolution into information age. We no longer rely only on steam power and electricity. Much of our information is moving down glass fibers at light speed.

The pace of change is also quickening. Manufactured goods account for far less than they used to in world economies which are now more service driven. The endless range of choice has shifted the game of business to a customer focus, customer value, customer loyalty and the creativity to differentiate yourself from the competition. In every organization staff is spending more time with the customers . They like to know about their customers on a day to day basis and even hour to hour to hour basis. In the information age, it is not possible for managers alone to satisfy the customers and all the stakeholders of the organization.

Knowledge Perspective and Paradigm Shift:

It is not only the info and knowledge of select few managers which is required to sustain and grow in the 21st century global market. In fact to deal with customer market, you have to take care of the internal employee market. They are the one who know the business process, sales process, marketing process and operation process. If they are happy and competent, they will provide the better service and products to the external customers and bring higher profits. The experience, expertise of the staff must be continuously enhanced through learning and updation in their formal and informal knowledge.
In the twenty-first-century landscape, firms must compete in a complex and challenging context that is being transformed by many factors, from globalization, technological development, and increasingly rapid diffusion of new technology, to the development and use of knowledge. This new landscape requires firms to do things differently in order to survive and prosper. Specifically, they must look to new sources of competitive advantage and engage in new forms of competition. This, in turn, requires a clear understanding of the nature of competition and competitive dynamics.

One popular approach to understanding competitive dynamics is the resource-based view of the firm. According to this view, the explanation for why some firms ultimately succeed and others fail can be found in understanding their resources and capabilities. A firm's resources and capabilities influence both the strategic choices that managers make and the implementation of those chosen strategies.
To understand why certain competitive strategies are more effective than others, one must consider the distribution of resources in competing firms. Although a given firm may possess more or less of any particular resource, only those resources that are rare, valuable, and difficult to imitate provide a sustainable competitive advantage. When the strategies employed are successful in leveraging the firm's rare, valuable, and difficult-to-imitate resources that firm is likely to gain an advantage over its competitors in the marketplace and thus earn higher returns.
Competitive advantages that are sustained over time lead to higher performance. These arguments are somewhat clear when we consider tangible resources such as buildings, machinery, or access to capital. And in the more traditional competitive landscape, these tangible resources were the most important potential sources of competitive advantage. Thus, if a firm could modernize its plant, or develop a more efficient distribution process, or access cheaper credit, it could compete successfully and prosper. But firms employ both tangible and intangible resources in the development and implementation of strategies, and as the nature of work and competition changes, intangible resources are becoming more important. Examples of intangible resources are reputation, brand equity, and—for our purposes the most important of these human capital. In fact, in any competitive landscape it has been argued that intangible resources are more likely to produce a competitive advantage because they often are truly rare and can be more difficult for competitors to imitate. Among a firm's intangible resources, human capital may be the most important and critical for competitive advantage because it is the most difficult to imitate.
Generally speaking, human capital is more mobile than other intangible resources. Therefore, it may seem an unlikely source of sustained competitive advantage. Once an organization integrates human capital with other complementary resources and uses this integration to create organizational capabilities (that is, leverages them), losing one or a few individuals may not lead to a loss of competitive advantage. Instead, a competitor would have to gain access to all of the resources and the system in place to leverage those resources.

Human Capital as a Strategic Resource

Human capital is a general term that refers to all of the resources that individuals directly contribute to an organization: physical, knowledge, social, and reputation. However, we need to under-stand what it is about

human capital resources that helps individuals contribute to gaining and sustaining a competitive advantage.

During the industrial age, human capital was valued because of physical resources such as strength, endurance, and dexterity— these were the aspects of human capital that were most likely to lead to competitive advantage. But as new machinery and technology were introduced, these characteristics became less important. In the current economic landscape, human capital is more likely to be valued for intellect, social skills, and reputation.

In today's competitive environment, where there is even more uncertainty and dynamism, these knowledge-based resources are even more important than they were in the past.
The term knowledge-based resources refer to skills, abilities, and learning capacity. People can develop these through experience and formal training. Social resources (now sometimes referred to as social capital) include the personal relationships that bind together members of an organization as well as relationships that link organizational members to other external sources of human capital. Through social capital, individuals can gain access both to other human resources (the physical and intellectual capital, for example) and to other forms of capital (financial, for example).
We must emphasize again, however, that it is not enough to acquire individuals who have such attributes. It is also necessary to develop structures, systems, and strategies that allow the organization to exploit the resources and gain competitive advantage.

For example, a football team that acquires a strong passing quarter-back only gains a competitive advantage when it shifts its offensive strategy to focus on passing. Professional service firms leverage their human capital by forming project teams led by senior experienced professionals, often partners in the firm. The other members of the project teams usually are younger, less experienced associates. In this way, they leverage their most valuable human capital to complete projects for clients. Working together on the project also allows the associates to gain some of the tacit knowledge possessed by the more senior partners; they learn by doing
Of course, some scholars and practitioners have always under-stood the role of human capital in creating an organization's success. Carly Fiorina, CEO of Hewlett-Packard, emphasized the role of human capital in an address she made to MIT graduates: "The most magical and tangible and ultimately the most important ingredient in the transformed landscape of 21st century and in knowledge based economy is people. The greatest strategy, the greatest financial plan, the greatest turnaround, is only going to be temporary if it is not grounded in people"

Knowledge-Based Resources

Knowledge-based resources include all the intellectual abilities and knowledge possessed by employees, as well as their capacity to learn and acquire more knowledge. Thus, knowledge-based resources include what employees have mastered as well as their potential for adapting and acquiring new information. For several reasons, these resources are seen as being extremely important for sustaining competitive advantage in today's environment.

First, the nature of work has been changing over the past several decades, so that many jobs require people to think, plan, or make decisions, rather than to lift, assemble, or build. This kind of work requires both tacit and explicit knowledge.
But work continues to change, and in unpredictable ways. It is often difficult to state exactly what kinds of knowledge a person needs to succeed on the job, and it is almost impossible to predict what types of knowledge he or she will need in the future. Change and unpredictability in organizations mean that knowledge-based resources such as the ability to learn and personality traits such as adaptability are extremely important, and some organizations have begun rewarding employees financially when they demonstrate an ability to acquire and master new knowledge.

STRATEGIC CORPORATE ASSETS OF A 3RD MILLENNIUM ORGANIZATION, KNOWLEDGE CHARACTERISTICS

Characteristics of Knowledge

Knowledge defies normal economic rules. Harlan Cleveland, writing in his eminently readable book, The Knowledge Executive, describes six special characteristics of information or explicit knowledge. It is

1. Expandable. Unlike other resources that are managed because of their scarcity value, the more it is used the more is generated.
2 Compressible. It can be summarized for easier handling and can be packaged into small physical formats.
3. Substitutable. In many situations it can replace physical and other forms of resource. Thus telecommunications reduces the need for physical transport.
4. Transportable. It can move from place to place, quickly and easily, ready for collecting when the recipient chooses.
5. Diffusive. It tends to leak. As technology improves, it become ever more difficult to stop reproduction and transmission.
6 Shareable. If it is given to another person, the first person does not lose it.

Tacit knowledge is also expandable, diffusive and shareable, but is not as easily transmitted or diffused. It is intangible and difficult to identify and describe. It is context dependent. These characteristics present some interesting management challenges. Making knowledge explicit means that it can be more readily copied, diffused and shared. On the other hand this makes it 'leaky', and it could reach undesirable parties. The increasing rate of knowledge generation means that much existing knowledge has short 'half-life' and its value decays quite quickly. It needs constant refreshing and revalidating through use.

- Knowledge involves a human interaction with reality (or with information about reality, or information about other knowledge or information), where the human is the subject and acts as the active, creative element, and modifies the latter by way of reconstructing it. Knowledge involves attribution of *meaning and significance* by the knower as a person. In fact, every reconstruction is a reinterpretation as well.
- When I know something, it is relative to me. There can be no knowledge without me. It is always in relation to my existence and my knowing it. With my death dies my world, and with it my knowledge. In knowing something, I individualize, subjectify, and appropriate it and make it my own. What I know, in the process, becomes my own.
- Knowledge is essentially social in nature. We need universal categories for generation, expression, representation, storage, retrieval, and expropriation of knowledge. The categories are universal in the sense that (a) they are capable of holding the same meanings for all humans belonging to the same community and (b) the categories can be socialized in terms of being shared, reconstructed, and applied by other humans belonging to the concerned universe of discourse.
- In knowing something, I believe it to be true. Without this belief, it could just be some information, without that stamp of individualized identity marked on it. This belief is a part of a system of beliefs, values, and rationality, and hence constitutes a responsibility *and potential* commitment.
- Knowing takes place in relation to existing *knowledge*-it is placing things in context, in relation to existing constructions of reality, content, and concepts,
- Knowledge involves a *judgment,* a subsumption of the particular under the universal. It involves a certain amount of synthesis and integration of discreet information under a category, a construction, or an attribution of a causality or justifiability, relative to the knower's frame of reference.
- Knowledge has a moment of *categorical imperative* and can induce a cognitive dissonance between belief and practice, between the past and the present, between the preset and the future,

between what is and what ought to be, and so on, and therefore, can form a springboard for potential action. In other words, *knowledge by definition is driven into practice.*

- Knowledge is always a part of a *dynamic system.* Knowledge has the tendency to go for more of itself, to bypass itself, and t constantly develop itself. It is only limited by mental and environmental constraints.
- Knowledge is *gregarious* by nature and has a tendency to socialize itself. Socialization is the means by which individual knowledge gets reinforced, challenged, modified, improved, and validated.
- Knowledge processes are always a part of an, open system. It is like a game where the goalpost keeps shifting itself. *The meanings, the dictionaries, and even the rules of the language are always in flux* – as volatile as the turns in modern life. Knowledge creation, by definition, is a process of innovation.

What Can Happen To Knowledge

Knowledge Can Be Born

What apparently distinguishes Homo sapiens from the rest of the animal world is our ability to conceive, store, and manipulate ideas linguistically apart form the stimuli that gave rise to them. We can think about and name apples – make recipes for their use, use their visual image for decoration, even name computers after them -- without being under the influence of the smell, taste, feel, and appearance of actual apples. We can give birth to ideas as well as manipulate and change them.

Certainly every company desires such intellectual fertility on the part of its employees, particularly its leaders. But what are the circumstances that prove most conducive to the birth of new knowledge? Which individuals are most fertile in their ability to generate new knowledge? Why these individuals and not others? How can these individuals be discovered and nurtured? These are questions asked by organization and human enterprises of all kinds. Organizations carve knowledge spanners much as living organisms carve reproductive opportunities and capabilities. In both cases, the motive is the same: survival and maximization of life experience. The latter phrase, admittedly vague, may involve fulfillment through growth, and perceptual satisfaction (pleasures of the sense).

Knowledge spanners equip their organizations to confront change successfully, for example, rapidly changing global markets can threaten the viability of even the most established businesses. These companies rely upon new knowledge to maintain and extend their markets. The companies highly valued knowledge spanners come up with the biomedical formula, the algorithm for a faster chip, the alloy for a lighter auto-body, or the economic model for a better deployment of resources that allow their organizations to thrive when others are failing.

Increasingly, the spanning of knowledge involves a partnership between human cognition and machine – based intelligence. When a pharmaceutical company conducts a complex series of drug tests by means of computer analysis; when a physician makes a diagnosis based primarily on output from an expert system; when an aeronautics corporation designs an aircraft form computer – based flight test data, the question of where requisite knowledge resides for these tasks is not easily answered. On one hand, human project designers and data interpreters are certainly important knowledge sources. On the other hand, computers or other systems generate substantial and significant knowledge. Traditionally based on human inputs, this artificial knowledge is increasingly self – generated by artificial intelligence capabilities.

Any plan for knowledge management must make provision for both direct human knowledge an indirect human knowledge, as mediated by machines, which extend and enhance the powers of mind.

Knowledge Can Die

In terms of sheer quantity, the vast majority of things knows by human beings die with them. Few of us record even on – thousandth part of our knowledge accumulated form life experiences. Put in organizational terms, we are individually quite poor at "transition planning." Our stores of knowledge go with us to the grave almost entirely whole, leaving each new generation to reinvent much knowledge that could have been its birthright.

It could be argued, of course, that most important knowledge achieved during individual human lives gets preserved in the form of books, journal an magazine articles, patents, documentaries, oral histories, and other means. By this logic, the loss of sheer quantity of human knowledge through mortality is adequately compensated fro by preservation of quality of knowledge. In effect, we are the tip of the iceberg and therefore do not mourn the loss of the great unformed and unexamined mass of knowledge beneath the surface. For example, we cling to the works of Mozart (the tip of the iceberg) and are hardly aware of what it means to lose the capacity (i.e., the genius) to produce such works.

The death of knowledge for an organization occurs by means other than the mortality of its members. Firms that downsize without provision to preserve and extend necessary intellectual capital can find themselves brain dead after terminations and layoffs. After all, knowledge resides primarily within human heads; when "head count" is reduced, inevitably the sum of knowledge within the organizations reduced, sometimes critically so. This happens especially when a firm looks first to its highest paid, longest tenured employees as prime candidates for corporate bloodletting. Form a financial management perspective, terminating a few high paid employees may be less traumatic than firing many of the rank – and – file. But from a knowledge–management perspective, cutting off the experienced head from the working body may be foolish surgery indeed.

Knowledge can also die due to paradigm shifts. Aspects of knowledge that were important or sacred for one generation may cease to matter for another generation. Interpreting human character and health, for example, was inconceivable for Western medieval men and women apart form the theory of bodily "humors" (behavior – influencing fluids), such as phlegm, choler, and black bile. Their knowledge of these mysterious substances has become obsolete or anti – intellectual because the paradigms we use to understand mental and physical health have change.

When paradigm shifts occur, little intellectual effort is spent proving the past wrong. All knowledge resources quickly turn to the larger and apparently more promising task of proving the new vision right. In short, when the paradigm shifts, the knowledge of the past is not "killed" or proven to be wrong. Instead, it is allowed to die from inattention, in this sense, paradigm shifts are largely rhetorical acts arising form the ability of new paradigm thinkers to provide powerful explanations of anomalies in the old paradigm.

Knowledge management takes the death of knowledge seriously and accepts no paradigm shift on blind faith. Knowledge management takes the death of knowledge seriously and accepts no paradigm shift on blind faith. Knowledge managements seeks to understand causes for the failing health or death of knowledge. It memorializes and perpetuated what can and should be salvaged from the demise of a paradigm.

Knowledge Can Be Owned

In spite of high literacy rates in developed countries, most knowledge valuable for increasing wealth is privately held. Knowledge unrelated to or marginally related to wealth is freely available because it serves no one's specific interest in the marketplace. Such free knowledge is the stuff of general education – history, literature, music, art, philosophy, cultural appreciation, languages, and so forth. In other words, the works of Shakespeare are available to all of us not because Shakespeare willed it so – he charged per view, in fact, as co-owner of the globe Theatre – but because since Shakespeare's death no one has built an industry based on any kind of special or proprietary knowledge contained within his plays and poetry. The same cannot be said for the knowledge necessary to make paint, preserve food, make or repair computers, or remove air pollution. These and countless other technological and industrial functions are based on knowledge that is not made generally available. A company's competitive advantage," in fact, often lies precisely in its privately held knowledge.

Several implications fan out from the notion of privately owned knowledge. First, the identity of the owner must be clarified. Research ad development personnel at computer, drug, cosmetic, and other similar companies routinely sign explicit and binding agreements with their employer that all knowledge accumulated, discovered, or developed during and after their employment remains the sole possession of the employer.

No mater how careful the wording of ownership agreements, of course, truly advantageous knowledge often has a way of "getting out," usually with devastating results in the marketplace. Netscape's

"ownership" of Internet browsing technologies, for example was closely imitated –some have said stolen – by Microsoft, with substantial market losses to Netscape. Knowledge management devises ways to determine what knowledge should be privately held and how it can be protected from competitors and clients.

Modern organization find unique ways to pierce the shield of privately held knowledge. In the many industries, companies acquire proprietary knowledge (friendly or hostile acquisitions, hiring away key employees, and reverse engineering products are common tactics). Then that knowledge is openly imitated, with the often-cynical strategy that legal challenges will take years in the courts to resolve – years during which the war for market share and profitability will be won and the issue of knowledge ownership will become moot.

By and large, companies have been unsuccessful in attempting to protect knowledge that drives sustained competitive advantage. Even products and processes that are patented or trademarked under the laws of one country are stolen by companies not vulnerable to legal or political sanctions from that country. The blatant theft of U.S. television technology in the 1960s by Asian competitors is a classic example. So devastating was this loss of proprietary knowledge that, for all intents and purposes, the U.S. television manufacturing industry ceased to exist by 1980. Similar "borrowing" has occurred more recently in the chip making, disk drives, and telecommunication device industries. U.S. manufacturers have largely given up efforts to stop knowledge piracy through international courts or through the American political system. Instead, U.S. manufacturers have adopted a "first/best/least" philosophy of hitting the market place first and hard with new products, maintaining quality standards, and pricing products at levels that discourage start-up enterprises from copying them.

At best, however, this appears to be a desperation strategy that conceives and develops new markets only to give them over eventually to the idea pirates. The impetus falls upon American companies to continually innovate – and convince the marketplace to purchase "new" – while foreign competitors play a waiting game based on serving mass markets with inexpensive imitations.

Effective knowledge management assesses what knowledge must be protected for competitive advantage, how that knowledge will be protected, and to what degree legal and political entities can be trusted to enforce laws related to ownership of intellectual properties.

Knowledge is Immanent as Well as Extant

Not all knowledge worth managing in an organization is explicit and visible. Much organizational knowledge is held in creative reserve in the form of human resources and computer expert systems. This immanent and preformed knowledge has the potential for becoming extant and formed at any moment, just as the energy within a battery can be tapped when needed.

A brain surgeon's expertise and capacity for action is an example of immanent knowledge. After years of study and practice, few brain surgeons can list the items within their knowledge bases. Surgeons' core competencies lie in immanent knowledge – deep wells of insight, reflection, memory, and intuition that can be summoned when the need arises. The visible, extant "spark" of correct decisions and actions come to the fore in life-and-death circumstances. Similar knowledge banks are in the minds of virtually all personnel who exercise creative, thinking functions within organizations.

Immanent knowledge remains a challenging but crucially important aspect of knowledge management. Just as brain surgeons must create and maintain their immanent knowledge, organizations may use knowledge management to preserve such vital knowledge. This prospect forces us to confront several key questions. How does one nurture immanent knowledge without force-feeding it in a disruptive way?

Further, how does one monitor immanent knowledge to ensure that its store of resources is increasingly vital and relevant to the needs of the organization? Finally, how does an organization prevent unnecessary redundancy in immanent knowledge? Ho many people need specialized procedures that only a few will ever perform? Hasty answers are dangerous because the absence of such knowledge inhibits "spin-off" insights and may corrupt decision making in related areas. In short, a degree of redundancy in immanent knowledge resources probably is desirable if it encourages wholeness of vision and broad perspective in decision making.

Knowledge Can be Stored

It can safely be estimated that more knowledge has been externalized (that is, made observable and preservable) in the last 20 years than in the entire previous history of mankind. On paper, film, tape, and above all by electronic storage means we have "lent our minds out. For example, 12,000 new sites per week continue to appear on the Internet.

But now that we have so energetically externalized knowledge we face an unexpected and ironic problem: how to internalized knowledge again. Getting knowledge out of our heads and onto disks or paper was a feat of technology; getting facts back into our heads for practical and creative use is a task that involves much more than technology.

The central intellectual work of the 21st century may lie not so much in accumulating externalized banks of knowledge as in developing time-efficient ways to process selected portions of that knowledge through a chip whose essential circuits have not and will not change: the chip between the ears. "Real-time" internalization of knowledge may be the most imposing challenge. A training videotape or movie, for example, cannot be internalized by the human mind using a "fast-forward" technique. The tape must be played in real time for human learning to take place. Traditional lectures and much educational software are similarly bound by real-time constraints. By contrast, still photos and, to a lesser degree, book or magazine pages can be accessed in "mind time," with the roving intellectual eye free to locate and select bits of content without also involving the entire surrounding context. CD, videodisk, and "computer search" technologies offer similar accessibility without the necessity to play through a cohesive context to ferret out a desired bit of content.

The most poignant example of this dilemma lies in the efforts of elementary schools to "get wired" to the Internet and thereby enhance the accessible knowledge and experience base of their students. But when well-intentioned teachers advise students to search for information on topics of interest, both teachers and students quickly confront the chaos of knowledge that currently characterizes the Internet. A second-grader searching for information on "goldfish" using the Info-seek search engine was dumfounded and discouraged to confront more than 100,000 "hits" for his search term – with the option, adding insult to injury, to seeing them 10 at a time. ("Click to see the next ten.") Where does one begin to make sense or use out of knowledge base that lacks familiar search paths, or heuristics, congenial to human learning and reflections?

Knowledge Can Be Categorized

In addition to the distinctions already suggested between immanent and extant knowledge, the various types of knowledge common within an organization can be enumerated.

Label knowledge is the vast catalog of names that we attach to the flora and fauna that make up the jungle of our particular organization. As a practical organizational necessity, names for things matter for day-to-day operations and efficiency. But label knowledge too often becomes an obsessive-compulsive totem for minds that equate organizational learning with mastery of jargon ad labels. In such an environment, newcomers to the organization are pilloried by old-timers until the ingénues are able to speak the specialized language of terms, tags, and titles correctly. Entire cultures within branches of the military, academic disciplines, and the professions are built up in large part of such sensitivity to label knowledge. God help the "grunt" who doesn't know the internal label language of the Army – or the sociologist, for that matter, who accidentally calls a spade a spade. It goes almost without saying that label knowledge makes up an exclusionary wall by which lawyers separate themselves, expensively, from the world of common sense and forth bright expression.

Process knowledge involves knowing how things work, even if one cannot name all components active within the process (i.e., label knowledge). Business environments value process knowledge on the micro-level – engineers who know how a heating system operates, for example – but often fail to recognize the importance of process knowledge at the macro-level. This has occurred, and still occurs, in spite of nearly a decade of Business Process Reengineering that explicitly focused management attention on gaining knowledge about processes. How can one describe the core processes at work in a large organization such as General Electric. Individually, each employee knows (or should know) the processes in which he or she is involved. But what can be said of larger process patterns – and who is in a position to observe and describe those processes?

Knowledge management should pay attention to both the micro- and macro-levels of process knowledge. If the macro-level process is the building of a pyramid, for example, that knowledge influences the specific work of stonecutters and laborers at the micro-level. But, beyond a vague notion of increasing shareholder value, too many organizations despair of attaining process knowledge at such a macro-level. In effect, they do not know whether they are building a pyramid or a coliseum, but their employees had better be quick about doing so.

Skill knowledge knows how to do something of value to the organization. This level of knowledge has long been managed devotedly by companies through job descriptions, training programs, performance evaluations, and other means. But once skill sets have been determined, companies tend to look upon them as unchanging constellations in the night sky – patterns that are "there" along with the furniture at the company. These skill sets become the basis of most hiring, and hence define the overall core competencies of the organization.

The coming era requires a much more fluid view of skill knowledge. Computer companies have already found that an employee's ability to learn quickly and well is an infinitely more valuable skill in a rapidly changing business environment than is a more vocationally oriented, specific skill. Knowledge management for the new century requires that skill knowledge be defined and developed so that new patterns (constellations of skill points) can come together quickly to meet emerging market needs.

People knowledge. This diffuse but virtually important category of knowledge comprises all the insights, intuitions, and relational information we use to work with other people. In the iceberg analogy previously cited, this kind of knowledge is truly subsurface but within organizations. Usually it is managed ineffectively or not at all preface but vast within organizations. Usually it is managed ineffectively or not at all precisely because of its lack of visibility. Few companies think about what knowledge their employees should have about one another's motives, communication styles, or professional goals. Interestingly, the same companies expect employees to congeal into efficient, cohesive work teams but devote little thought to the people knowledge that makes such tams possible.

Knowledge management brings people knowledge to visibility and to a position of prominence in a framework for understanding and using knowledge within the corporation.

LESSON 8

PERSPECTIVES OF KNOWLEDGE MANAGEMENT AND THE FORCES DRIVING KM

Why Knowledge Management?

A new word for the consumer in today's market, "prosumer," refers to the consumer who is no longer in the passive market where goods are offered at the exact face value. Prosumers are more educated consumers, and they demand more. They provide feedback to manufacturers regarding the design of products and services from a consumer perspective . This has initiated new and radical changes in the business world. Even with recent technology developments such as networking, e-mail, and the Web, business has yet to fully respond to the societal, cultural, and technical challenges. However, a positive response to knowledge sharing and knowledge management among growth-oriented firms is beginning to appear.

KM has already demonstrated a number of benefits and has offered justification for further implementation. The Internet facilitated its development and growth via fast and timely sharing of knowledge. By sharing knowledge, an organization creates exponential benefits from the knowledge as people learn from it. This makes business processes faster and more effective and empowers employees in a unique way. For example, Microsoft's Hotmail service advanced the wide use of e-mail that allowed users to exchange information through any Web browser. Today's Web-based interface is the norm for most Internet service providers.

Based on a number of published studies, KM has had a positive impact on business processes. The goal is to capture the tacit knowledge required by a business process and encourage knowledge workers to share and communicate knowledge with peers. With such knowledge, it is easier to determine which processes are more effective or less effective than others. The main constraint in KM, however, is initially capturing it. However, if an organization can succeed in capturing and dispersing knowledge, the benefits are endless. A company can leverage and more fully utilize intellectual assets. It can also position itself in responding quickly to customers, creating new markets, rapidly developing new products, and dominating emergent technologies.

Another benefit of KM is the intangible return on knowledge sharing rather than knowledge hoarding. Too often, employees in one part of a business start from "scratch" on a project because the knowledge needed is somewhere else but not known to them.

As a result of KM, systems have been developed to gather, organize, refine, and distribute knowledge throughout the business. In his study of Smart Business, Botkin (1999) suggests six top attributes of knowledge products and services:

- **Learn.** The more you use them, the smarter they get and the smarter you get, too.
- **Improve with use.** These products and services are enhanced rather than depleted when used, and they grow up instead of being used up.
- **Anticipate.** Knowing what you want, they recommend what you might want next.
- **Interactive.** There is two-way communication between you and them.
- **Remember.** They record and recall past actions to develop a profile.
- **Customize.** They offer unique configuration to your individual specifications in real time at no additional cost.

During the 1960s and 1970s, technology was focused on automating high-volume static processes such as claims processing, mortgage loan updating, airline reservation systems, and the like. The emergence of e-commerce in the late 1980s and 1990s showed how information technology could implemented a new way of doing business effectively. Ever-increasing processing power, high bandwidth data transmission, and networking made it possible to re-envision how business gets done. It has also changed the business environment and introduced new competitive imperatives. Among them are:

- **Reacting instantly to new business opportunities, which led to decentralized decision making (and competency) at the front lines, where the action is.** With that came the desire to build mutual trust between knowledge workers and management and to cooperate in handling time-sensitive tasks.

- **Building better sensitivity to "brain drain.**" It has been said that "expertise gravitates toward the highest bidder" .. More and more companies realize the importance of managing and preserving expertise turnover. For the human resources department, the key question is "How does the firm replace expertise when it retires, resigns, or simply leaves?

- **Ensuring successful partnering and core competencies with suppliers, vendors, customers, and other constituents.** Today's technology has enabled companies to reengineer the ways to do business. Getting partners up to your speed requires more than fast technology. Knowledge workers and others within the company should ensure that cooperation and coordination of work are practiced for the good of the firm.

Andersen consulting (now Accenture) provides another example of a well-developed knowledge-sharing system, called ANet. This electronic system connects employees and encourages the sharing of knowledge. ANet allows an employee to use the total knowledge of Accenture (formerly Arthur Andersen) to solve a customer problem anywhere in the world through electronic bulletin boards and to follow up with visual and data contacts. In theory, ANet expands the capabilities and knowledge available to any customer to that of the entire organization. It further enhances employee problem-solving capacity by providing access to compiled subject, customer-reference, and resource files available either directly through the system or from CD-ROMs available to all offices. Based on experience, Accenture reported that technological changes alone could not make ANet successfully used by employees. Major changes within the organization, such as changes in incentives and culture, were needed to create participation.

KM Justification

- Creates exponential benefits from the knowledge as people learn from it
- Has a positive impact on business processes
- Enables the organization to position itself for responding quickly to customers, creating new markets, developing new products, and dominating emergent technologies
- Builds mutual trust between knowledge workers and management and facilitates cooperation in handling time-sensitive tasks
- Builds better sensitivity to "brain drain"
- Ensures successful partnering and core competencies with suppliers, vendors, customers, and other constituents
- Shortens the learning curve, facilitates sharing of knowledge, and quickly enables less trained brokers to achieve higher performance levels
- Enhances employee problem-solving capacity by providing access to compiled subject, customer-reference, and resource files available either directly through the system or from CD-ROMs available to all offices.

Companies that fail to embed a viable KM operation probably suffer from several oversights or pitfalls:

- **Failing to modify the compensation system to reward people working as a team.** The traditional method of compensating people based on the old-fashioned "information-hoarding" practice does not work in a knowledge-sharing environment. Merit increases and bonuses should be based on team contribution and team performance rather than quantity or volume.

- **Building a huge database that is supposed to cater to the entire company.** Generalized systems do not usually work well, because information and knowledge are not stratified to address specialized areas of expertise. Ideally, the human resources department should first determine who works best with who based on commonality of job type or job experience and then discover the knowledge that can be shared for each employee to be more successful.

- **Viewing KM as a technology or a human resource area.** This oversight relates to the earlier one – where human resources and information technology efforts are poorly coordinated – and defeats the purpose behind embedding KM into the fabric of the organization. The two departments should work jointly at introducing KM as part of the organizational processes.

- **Placing too much emphasis on technology.** Although intranets, knowledge-based tools, data warehouses, and other computer-based software are part of the way today's organization must adopt, technology is only the enabler of knowledge management. The knowledge it makes available must be organized and disseminated to human decision makers to be of any use.

- **Introducing KM into the organization via a simple project to minimize possible losses.** This is the wrong way to start KM. A company should start with a strategy and a champion, with a focus on a worthwhile, high profile project that can set the tone for the rest of the organization. It is a high risk approach, but one that is most likely to pay dividends in the long run.

- **Pursuing KM without being ready.** Spurred by the paradigm shift in our economy, many corporations pursue KM without evaluating whether they are organizationally ready 9stewart et al. 2000, 45). In other words, corporations that have been operating under classical management principles cannot be successful in adopting KM without major changes in culture, management attitudes, and communication skills.

- **Having poor leadership.** Like any high priority project, KM is best implemented with determined champions and top management commitment. For example, General Electric (GE) recognizes an organizational culture open to ideas from all levels of the company. By encouraging best-practice sharing, the company can grasp the knowledge within the employees and innovate the organization's processes. Jack Welch, former CEO, has established a knowledge management university and frequently teaches the classes himself. GE has incorporated all levels of the business and is well designed to share knowledge. The company is successfully able to use employee input and knowledge to produce a strategic advantage.

The Forces Driving KM.

- **Increasing Domain Complexity.** The complexity of the underlying knowledge domains is increasing. As a direct consequence, the complexity of the knowledge that is required to complete a specific business process task has increased as well. Globalization has increased the domain complexity for many organizations, which need to provide products and services that meet the needs of customers across the globe.

- **Accelerating Market Volatility.** The pace of change, or volatility, within each market domain has increased rapidly in the past decade. The event of September 11 2001, crippled the travel industry almost overnight. In order to stimulate travel, companies in this industry were forced to reduce prices to levels way below their break-even prices. As a result, many companies in this sector were forced into bankruptcy.

- **Intensified Speed of Responsiveness**. The time required to take action based on subtle changes within and across domains is decreasing. The rapid advance in technology continually changes the decision-making landscape, making it imperative that decisions be made and implemented quickly, lest the window of opportunity closes. In order to be able to continue to support relevant IT education, universities need to adapt their curriculum to current industry trends. In the past, degree curriculums were more static with infrequent revisions. In today's environment three-year-old IT curriculums are old – in terms of Internet years!

- **Diminishing Individual Experience.** High employee turnover rates have resulted in individuals with decision-making authority having less tenure within their organizations than ever before. The recent dot-com explosion created many new opportunities for IT professionals that lured them away from their positions. As a result, many organizations had to

rehire new talent to fulfill their IT needs, and are now left with IT professionals who lack the business experience or understand the business culture at their organizations. This creates a huge barrier in terms of adequately supporting the needs of the organization.

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The Drivers

With these justifications to consider, several key KM drivers are worth noting. Each driver makes a compelling case for KM.

Technology Drivers The proliferation of technology, data communications, networking, and wireless transmission has revolutionized the way employees store, communicate, and exchange data at high speed. The World wide Web has changed KM from a fad to an e-business reality. With a personal computer , anyone can access people and information at any time and from anywhere. Today, the same technological infrastructure makes it possible to store, communicate, and exchange knowledge. This makes technology as core capability leveler, leaving knowledge as a competitive differentiator. It means that although technology can move information or knowledge from Chicago to Bombay to Lahore at lightening speed, it is people who turn knowledge into timely and creative decisions. Tomorrow's successful companies are ones that use information technology to leverage their employees' knowledge in ways that makes knowledge immediately available and useful. It also implies quality maximization and cost minimization over the long term.

Process Drivers One of the most critical sets of KM drivers is designed to improve work processes. Implied in this area is the elimination of duplicate mistakes by learning from the past and by transferring the best experiential knowledge from one location or project in the firm to another. Starting from scratch with each project makes no sense in terms of efficiency, productivity, and value-added contribution to the company's bottom line.

Another area where KM can improve process is the way companies react to market changes. "Just in time" is one approach to minimizing investment in inventory and more expeditiously meting the demands of the consumer. Responsiveness that exceeds the competition becomes the key contributor to differentiation. It requires knowledge of control processes. KM means allowing companies to apply unique knowledge that makes them more responsive to market changes by the hour.

Personnel-Specific Drivers This area of KM drivers focuses on the need to create cross-functional teams of knowledge workers to serve anywhere in the organization and minimize personnel turnover as a threat to collective knowledge. More and more of what was once viewed as impendent firms are now closely coupled. Products and services are jointly handled from diverse disciplinary areas (such as packaging, manufacturing, engineering, and technical skills), where creative cooperation is essential for innovation. Brainstorming, competitive response, and proactive positioning-all require collaboration and coordination of various tasks within and among corporations.

Another personnel-specific driver is minimizing knowledge walkouts. Highly marketable employees with unique knowledge can spell disaster for their employer. Competence drain that goes to the competition is probably the worst that can happen to a company struggling through the new knowledge economy.

Knowledge-Related Drivers Several KM drivers relate to the very concept of knowledge sharing and knowledge transfer within the firm. They include revisiting overlooked employee knowledge, making critical knowledge available at the time it is needed, and finding a mechanism to expedite available knowledge for immediate use. Companies often know what they know but have difficulty locating it. Take the case of a customer who wanted to return a product that was initially purchased from the same outfit in a different city to a local chain store. A code had to be entered into the computer to debit the initial store by the price of the product and then credit the local store by the same amount. There was only one employee in the local store who knew the code. She happened to be on

vacation. The customer service employee could not find critical existing knowledge in time. So, she had to contact the other store for instructions on how to handle the returned item. Counting wait time and learning the procedure took close to 1 hour, while the customer was waiting.

Financial Drivers As an asset, knowledge defies economic theory, where assets are subject to diminishing returns over the long run. Knowledge assets increase in value as more and more people use them. With this in mind, knowledge follows the law of increasing returns – the more knowledge is used, the more value it provides. KM provides a worthwhile opportunity to integrate knowledge in a way that enriches the quality of decision making throughout the organization.

In the final analysis, the goal of KM is to produce a positive return on investment in people, processes, and technology. It means measurable efficiencies in production.

What is Knowledge Management?

Knowledge management (KM) is a newly emerging, interdisciplinary business model that has knowledge within the framework of an organization as its focus. It is rooted in many disciplines, including business, economics, psychology, and information management. It is the ultimate competitive advantage for today's firm. Knowledge management involves people, technology, and processes in overlapping parts.

Researchers as well as practitioners have yet to agree on a definition. However, each definition of KM contains several integral parts:

- Using accessible knowledge from outside sources.
- Embedding and storing knowledge in business processes, products, and services.
- Representing knowledge in data bases and documents
- Promoting knowledge growth through the organization's culture and incentives
- Transferring and sharing knowledge throughout the organization
- Assessing the value of knowledge assets and impact on a regular basis.

In some ways, KM is about survival in a new business world – a world of competition that increases in complexity and uncertainly each day. It is a world that challenges the traditional ways of doing things. The focus is not only on finding the right answers, but also on asking the right questions. What worked yesterday may or may not work tomorrow. The focus is on "doing the right thing" rather than "doing things right" so that core competencies do not become core rigidities in the future.

KM is the process of capturing and making use of a firm's collective expertise anywhere in the business – on paper, in documents, in databases (called explicit knowledge), or in people's heads called tacit knowledge). It is implied that up to 95 percent f information is preserved as tacit knowledge. It is the fuel or raw material for innovation – the only competitive advantage that can sustain a company in an unpredictable business environment. It is not intended to favor expert systems of the early 1990s, when computers were programmed to emulate human experts' thought processes. The goal is to present a balanced view of how computer technology captures, distributes, and shares knowledge in the organization by linking human experts and documented knowledge in an integrated KM system.

The goal is for an organization to view all its processes as knowledge processes. This includes knowledge creation, dissemination, upgrade, and application toward organizational survival. Today's knowledge organization has a renewed responsibility to hire knowledgeable employees and specialists to manage knowledge as an intangible asset in the same way that one calls on an investor to manage a financial portfolio. A firm seeks to add value by identifying, applying, and integrating knowledge in unprecedented ways, much like an investor adds value by unique combinations of stocks and bonds. The process is part science, part art, and part luck.

Alternative definitions of Knowledge Management

- Knowledge management is the process of gathering a firm's collective expertise wherever it resides – in databases, on paper, or in people's heads – and distributing it to where it can help produce the biggest payoff (Hibbard 1997).

- KM is a newly emerging, interdisciplinary business modeling with all aspects of knowledge within the context of the firm, including knowledge creation, codification, sharing, and how these activities promote learning and innovation (encompassing technology tools and organizational routines in overlapping parts) Berkeley 2001).
- KM caters to the critical issues of organizational adaptation, survival, and competence in the face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combinations of data and information processing capacity of information technology, and the creative and innovative capacity of human beings (Malhotra 1999).
- Knowledge management is the art of creating value from an organization's intangible assets (Sveiby 2000).
- Knowledge management is the classification, dissemination, and categorization of information and people throughout an organization (Taft 2000).
- Knowledge management is the discipline of capturing knowledge-based competencies and then storing and diffusing that knowledge into business. It is also the systematic and organized attempt to use knowledge within an organization to improve performance (KPMG 2000).
- KM is really about recognizing that regardless of what business you are in, you are competing based on the knowledge of your employees (Johnson 2001).
- KM is a conscious strategy of getting the right knowledge to the right people at the right time; it is also helping people share and put information into action in ways that strive to improve organizational performance (O'Dell et al. 2000).
- Knowledge management is a framework, a management mind-set, that includes building on past experiences (libraries, data banks, smart people) and creating new vehicles for exchanging knowledge (knowledge-enabled intranet sites, communities of practice, networks (O'Dell et al. 2000).
- KM is accumulating knowledge assets and using them effectively to gain a competitive advantage (Brooking 1996).
- KM is a framework within which the organization views all its processes as knowledge processing, where all business processes involve creation, dissemination, renewal, and application of knowledge toward organizational sustenance and survival (Malhotra 2000).
- Knowledge management includes a combination of software products and business practices that help organizations capture, analyze, and distill information (Craig 2000).
- KM is not about technology; it is about mapping processes and exploiting the knowledge database. It is applying technology to people's minds (Deveau 2000).
- Knowledge management is the sharing of information throughout a company or even between business partners. It creates an environment in which the company leverages all its knowledge assets (Trepper 2000).
- KM can automate the classification of documents while using machine logic that comes as close as possible to human logic (Hersey 2000).
- Knowledge management is a discipline of identifying, capturing, retrieving, sharing, and evaluating an enterprise's information assets (Bair 2001).

The Knowledge Organization

A conceptual structure of the knowledge organization is as follows.. The middle layer addresses the KM life cycle – knowledge creation, knowledge collection or capture, knowledge organization, knowledge refinement, and knowledge dissemination.

The ideal knowledge organization is one where people exchange knowledge across the functional areas of the business by using technology and established processes. People exchange ideas and knowledge for policy formulation and strategy. Knowledge is also internalized and adopted within the culture of the organization. All knowledge workers (people) are in an environment where they can freely exchange and produce knowledge assets by using various technologies. This process influences the company as a whole in a positive way.

KM is Not About

- **Knowledge management is not reengineering.** Reengineering implies one-shot, drastic "electrical shock" change in organizational processes to improve efficiency. It is a mechanical shift from one stage of operation to a more efficient stage, and it usually involves radical changes of business processes and the people involved. In contrast, KM implies continuous change and addresses future threats and unique opportunities. There is continuous learning, unlearning, and relearning to ensure smooth change from top to bottom. The focus is on change that will generate gradual but solid gains in the competitive environment. Knowledge management is engrained in the day-to-day operations of the business and directed by people who are directly connected with the changing world of their company's business.

- **Knowledge management is not a discipline.** It is another way of improving quality, profitability, and growth.

- **Knowledge management is not a philosophic calling.** KM goes to the core of an organization's intangible asset (knowledge), revisits the knowledge, and taps into it.

- **Knowledge management is not intellectual capital, per se.** Intellectual capital (IC) represents the value of a company's trademarks, patents, or brand names. Intellectual capital is a company's collective brainpower, or a composite of experience, knowledge, information, and intellectual property – all the property of the organization. Although treated in the literature the same as knowledge, knowledge, per se, is the consequence of actions and interactions of people with information and knowledge exchange based on experience over time.

- **Knowledge management is not based on information.** Information can become knowledge after people use it in ways that create value. Knowledge has been viewed as information in action. As we shall explain in Chapter 2, information is context-sensitive; knowledge is consensus-oriented.

- **Knowledge management is not about data.** Data (facts without context) or information (interpretation or patterns of data) is not knowledge.

- **Knowledge value chain is not information value chain.** In contrast, knowledge value chains view humans as the key components assessing and reassessing information stored in a technological system. Best practices into organizational business processes are carried out after active human inquiry, and such processes are continuously updated in line with the changing external environment.

- **Knowledge management is not limited to gathering information from the company's domain experts or retiring employees and creating databases accessible by intranets.** KM is a collective concept of the organization's entire core knowledge.

- **Knowledge management is not digital networks.** KM is about improving business processes with people and technology in mind. Effective technology is the enabler of KM, and people must be in the equation from the start to use technology effectively.

- **Knowledge management is not about "knowledge capture," per se**. Knowledge cannot be captured in its entirety. Problems involving collaboration, cooperation, and organizational culture must be addressed before on can be sure or reliable knowledge capture.

Regardless of the business, a company competes based on the knowledge of its employees. A company also has a management mind-set that relies on past experience (such as smart people, documents, or databases) and creates a new way for exchanging knowledge by using intranets, the Internet, local area networks, and the like. Consider the case of a British supermarket chain that used a customer data-mining application to assess buying behavior. After running correlation analyses among several variables, it quickly discovered a clear association between the purchases of diapers and beer by male

customers on Friday afternoons. Armed with this knowledge, the store began to stack diapers and beer together.

Q: **Explain the difference with respect to the centrality of decision making between decision makers today and from pre-1990 and why this is leading to a greater emphasis on effective KM.**

In the past the knowledge for making high quality decisions lay primarily in the personal knowledge and experience of the decision maker (CEO). The recent increase in complexity and decreases in required response time and business experience of decision leaders requires that additional sources of knowledge (e.g., the WWW, other group members) be incorporated into the decision-making process to develop the highest quality, most informed decisions. These trends are some of the driving forces in the need for more effective KM.

LESSON 9

KNOWLEDGE HIERARCHY …. FROM DATA AND INFORMATION TO KNOWLEDGE AND WISDOM

KM Myths

KM is interwoven into all of an organization's processes. Although effective utilization of technology is essential, KM is not constrained by collecting knowledge from domain experts and building networked databases or databases supported by the company's intranet. Finally, KM is not defined in terms of the specific knowledge needs of every employee, the relevant knowledge needed, or the knowledge to be shared.

There are several myths as well:

Myth 1: Knowledge management is a fad. As mentioned earlier, there are many pessimists in industry who doubt the "good fit" potential of KM. Being at a crossroads, vendors push older software products under the KM label. BPR and artificial intelligence had their positive turn, although they suffered from raised expectations. Unlike earlier trends, however, true KM becomes embedded in the way people work in business. So, knowing what you know or what you need to know cannot be a fad.

Myth 2: Knowledge management and data warehousing are essentially the same. The term data warehousing implies a repository of data, not knowledge. Knowledge, per se, is how you take information and transform it into action. Data warehousing is critical for KM. it is where data, critical documents, e-mail, and other forms of information are available for eliciting knowledge at the time when it is needed. For example, Sears, Roebuck & Co. has a customer data warehouse with demographic information on over 100 million households to help the sales force improve marketing and sales quality. For example, a repairperson working on a customer's refrigerator notices through the KM system that such a customer is a likely prospect for a new freezer. Data mining serves a similar purpose, in that patterns within a mass of data allow management to better understand trends and directions in a product or consumer preference – a necessary dimension of KM.

Myth 3: Knowledge management is a new concept. As a concept, KM has been practiced by successful firms as far back as the early 1980s. Companies like Ford and General Motors Corporation have been exchanging design information and collaborating on design projects worldwide using technology all along. Today's version of KM goes under customer profiling, where a supermarket clerk scans a store-generated customer card to determine patterns of purchases and consumer preferences by data, by product, and by location. The idea is the same as it has been for the past 2 decades, except that in today's KM, technology has taken on a special role in the way knowledge is shared and disseminated.

Myth 4: Knowledge management is mere technology. This is a serious misconception. KM is really about people, relationships, and a new way of working together as an entity in an organizational setting. It is a unique way of thinking about work and about working. Imagine a knowledge community of employees with common interests sharing information on best practice that help everyone do a more efficient job. KM will work only if there is trust and confidence among coworkers. Over 80 percent of all technology-centered KM efforts have been known to fail because of a lack of attention to people .

Myth 5: Technology can store and distribute human intelligence. Data may be stored in a centralized database for employee access, but that does not ensure that employees will use the information. I a turbulent competitive environment, one cannot assume that companies can predict the right information for the right employee. So, it is hardly the case that technology distributes human intelligence. It is impossible to build a KM system that predicts who the right person is and at what time he or she needs specific information for decision making. Tacit knowledge exists within a person's brain; information or "knowledge" stored within the database can be viewed as a valuable exchange between people to make sense of a situation but should not be interpreted as human intelligence. In other words, knowledge repositories stored in computer do not allow for renewal of existing knowledge

and creation of new knowledge. KM should be considered as a system to be used with concentration on the human aspect aided by technology for decision making.

Myth 6: Knowledge management is another form of reengineering. Reengineering is efficiency-driven-a one-item attempt at introducing radical change in organizational processes to improve efficiency. The emphasis is on cost reduction and making better use of existing operations. Jump-starting such a business, however, often results in failure. KIM is an ongoing renewal of organizational processes to learn in advance about the company's future opportunities and contingencies. The concentration is on value added activities that demand innovation and creativity. This is ingrained in the day-to-day processes of the business. Technology plays a critical role in the way information becomes available at electronic speed.

Myth 7: Company employees have difficulty sharing knowledge. The answer is yes and no, depending on a number of factors: attitude of the knower, who the requester is, company culture, sensitivity of the knowledge requested, availability of attractive motivators, and trust level among company personnel. Under the traditional business model, employees with unique knowledge accumulated over years of experience tended to protect "turf" by not sharing such knowledge. In a KM environment, where knowledge sharing means great potential for everyone including the organization, knowledge workers need to be sold on how knowledge sharing will brig them mutual benefits. The terms sharing means "willing giving away a part" and "holding in common." It is a "give to get" attitude, and because "knowing" is personal, asking someone to share is to ask him or her to give something of themselves. Mature or secure people in a stable work environment tend to share knowledge more than others whose experience is to the contrary. Also, knowledge sharing can improve bonds between people, provided the act of sharing is reciprocal.

Myth 8: Knowledge management works only within an organization. On the surface, this may be true, but some of the most valuable knowledge comes from the outside – suppliers, brokers, government agencies, and customers. The problem with extending KM initiatives to outside sources is incompatible technology, security issues, and complexity of the design.

Myth 9: Technology is a better alternative than face-to-face. We have seen over the years that when it comes to real-life experience and use of human knowledge, technology does not hold all the answers. The emerging mind-set within today's forward-looking, creative organizations is that KM must entail cultural and organizational change as well as technology-based innovations. Data warehousing and data mining are all contributors to extracting and sharing knowledge, but the best knowledge resides in human minds. This make a face-to-face approach to knowledge acquisition and knowledge sharing a better alternative.

Myth 10: It is a "no brainier" to share what you know. In general, secure ad mature people are less reluctant to share what they know with others. Unfortunately, in traditional business, people with years of experience tended to hoard knowledge rather than share it, because it gave them leverage, control, and assurance of a job. Furthermore, "knowing" is personal. To ask people to share knowledge is tantamount to expecting them to give something of themselves. Sharing knowledge often depends on who the requester is, how sensitive is the knowledge requested, the attitude of the "knower," and the motivational forces at play. To share knowledge, the business has to undergo special employee training, instill trust within the business, and give employees and management a chance to cement relationships based on trust. A summary of the KM myths is shown in following list.

The Myths of Knowledge Management

1. Knowledge management is a fad.
2. Knowledge management and data warehousing are essentially the same.
3. Knowledge management is a new concept.
4. Knowledge management is mere technology.
5. Technology distributes human intelligence.
6. Knowledge management is another form of reengineering.
7. Company employees have difficulty sharing knowledge.
8. Knowledge management works only within an organization.
9. Technology is a better alternative than face-to-face.
10. It is "no brainier' to share what you know.

Understanding Knowledge

The most critical word in the KM area is knowledge. Unfortunately, there is a continuing myth that knowledge resides only in books, reports, or documents. This cannot be true any more than viewing musical notes on a page constitutes music. What we have here are representations of information and music, respectively. What do we mean when we talk about knowledge? Two key issues are distinguishing between knowledge and information and determining how they are interrelated. Knowledge is neither data nor information, although it is related to both. The terms are not interchangeable, and knowing what is needed often determines organizational success or failure.

The concept of knowledge is at the heart of an organization's productivity and growth. Intelligent behaviour implies the ability to understand and use language and to store and access relevant experience at will. Humans acquire expertise- that is, they learn via experience. Expertise incorporates the ability to reason and to make deductions; it also includes the concept of common sense. This makes human intelligence and the knowledge that humans amass over time the primary organizational asset. An organization's technology or telecommunications network is only a vehicle for knowledge transfer and knowledge exchange; it cannot replace human knowledge.

An essential criterion of knowledge and learning is memory. Learning by discovery is less understood than learning by experience or by example. A knowledge base is a critical component of knowledge management. Knowledge developers need to understand the theory and meaning of knowledge early in the knowledge capture phase and become familiar with the unique kinds of knowledge available in the corporation under study. It should be pointed out that an expert's knowledge is not limited to information or complex procedures. Knowledge embraces a wider sphere than information. Likewise, a knowledge base is not the same as a database. A database has a predetermined structure; a knowledge base is a set of facts and inference rules for determining new information and "smarter" knowledge for decision making. Knowledge as know-how may be either shallow or deep knowledge. It may also be procedural, declarative, semantic, or episodic knowledge. More recently, Knowledge has been classified as explicit or tacit knowledge.

Definitions

Before discussing knowledge and its many ramifications, knowledge needs to be defined in relation to intelligence, experience, and common sense.

Knowledge

We define knowledge as "understanding gained through experience or study." It is "know-how" or a familiarity with how to do something that enables a person to perform a specialized task. It may also be an accumulation of facts, procedural rules, or heuristics. These elements are defined as follows:

- A fact is a statement of some element of truth about a subject matter or a domain. For example, milk is white and the sun rises in the east and sets in the west are facts.
- A procedural rule is a rule that describes a sequence of relations relative to the main. For example, always check the traffic when entering a freeway; if the gas gauge indicates less than a quarter of tank of gas, look for a gasoline station.
- A heuristic is a rule of thumb based on years of experience. For example, if a person drives no more than 5 km above the speed limit, then that person is not likely to be stopped for speeding.

A beneficial aspect of knowledge is that it can compensate for some search time. A human expert who knows a set of solutions can get a job done without much searching for information. Conversely, a human novice in a video game searches a vast number of alternative moves at each juncture because he lacks experiential knowledge. Unfortunately, without the aid of knowledge that allows the novice to immediately eliminate inappropriate approaches, this methods encompasses too many approaches to evaluate.

Another aspect of knowledge is specificity; it cannot be transferred from one problem domain to another. Therefore, one must have the surgeon's know-how to repair a heart value, the auto transmission specialist's know-how to replace a reverse gear, and the painter's know-how to create an

accomplished portrait. These kinds of extensive knowledge are referred to as tacit knowledge and often take many years to acquire.

Finally, values, beliefs, and integrity are related to knowledge. This has a lot to do with what the knower perceives, accepts, and concludes from the environment. People generally organize a synthesize their knowledge by their values. Nonaka and Takeuchi suggest that "knowledge, unlike information, is about beliefs and commitment" (Nonaka and Takeuchi 1995). More recently, we began to attach integrity to the whole process of knowledge capture, knowledge sharing, and knowledge maintenance. Integrity means reliability, trustworthiness, privacy, and confidentiality. Integrity cuts across the discipline, regardless of company size or resources.

Intelligence

Intelligence refers to the capacity to acquire and apply knowledge. It is the ability to build or improve upon knowledge, to transform as much of one's knowledge a possible into knowledge that can be used to make good decisions. An intelligent person is one who has the ability to think and reason. This distinction separates the novice from the master in a game like chess. Knowledge conversion is directly responsible for much of the expert's efficiency in applying knowledge and for the difficulty of making it explicit.

Consider this example: Recent research into the true meaning of intelligence illustrates very well the difficulty of defining the term. This organization doing this research decided to get to the bottom of the question once and for all and, given its importance, assigned its most senior scientist to it. The esteemed scholar spent several months conducting this research. At the end of that period, the scientist gathered a number of colleagues together, held up in front them the artificially intelligent artifact chosen as the subject of the research, and said, "Ladies and gentlemen, this is a thermos bottle. It keeps hot stuff hot, and it keeps cold stuff cold. My question is, how does it know?"

Ability to understand and use language is another attribute of intelligence. Language understanding is not easy to acquire, especially for the existing technolo0gy. For example, consider the statement. The city of Fairmount is under 6 feet of water. Does this mean that the city is completely underwater, with the tallest building below the water level? Another example is the statement. The sub broke through the clouds. How literally should one interpret this statement? Of course, both the meaning of the words and the context of the statements determine how a reader should understand the messages. Prior knowledge and common sense also enter the picture.

Memory, or the ability to store and retrieve relevant experience at will, is part of intelligence. How the brain stores and retrieves information or knowledge is still unclear. Later, the text includes a discussion of knowledge organization and how it is exploited in the KM building life cycle.

Learning is knowledge or skill that is acquired by instruction or study. It is the inevitable consequence of intelligent problem-solving. Intelligent people learn quickly and make effective use of what they learn. Inasmuch as problem-solving and knowledge organization have been successfully demonstrated in the business enterprise, the same success has yet to be shown in technology or computer programs. People learn from experience; to date, computers have not.

Experience

Experience relates to what we have done and what has historically happened in a specific area of work. In Latin, the word experience means "to put to the test." People with deep knowledge in a given subject have been tested by experience. Experience also leads to expertise. Think of Sherlock Holmes investigating a murder. The goal is to find the murderer. Holmes's reasoning and deductions relay on all evidence collected; he works backward from the goal until the suspect is caught. Expertise is also intuition and the ability to access one's knowledge rapidly to achieve an efficient and successful outcome.

Experience is closely related to knowledge. Knowledge develops over time through successful experience, and experience leads to expertise. An expert is someone who knows what he or she does not know and is the first one to tell you so. Firms hire experts to benefit from their experience and proven knowledge in solving complex novices from experts. Exceptions do occur however. Bach, for

example, was expert musician at 5 years of age. In general, without experience, one would hardly be considered an expert. Experience in using knowledge allows people to refine their reasoning processes in a knowledge management environment.

Common Sense

Commons sense refers to the unreflective opinions of ordinary humans, which comes naturally to a child as young as 3 or 4 years old. For example, mot youngsters know that if they touch a hot stove, they will get burned. In contrast, a computer could be told all kinds of things about hot stoves and the effect of heat on the human skin, and it still would not perceive what would happen if it "touched" a hot stove: Machines lack common sense. Common sense is not easily learned or acquired.

Basic Knowledge-Related Definitions	
Artificial	Emulating or imitating something natural or real
Common sense	Innate ability to sense, judge, or perceive situations; grows stronger over time
Fact	A statement that relates a certain element of truth about a subject matter or a domain
Heuristic	A rule of thumb based on years of experience
Intelligence	The capacity to acquire and apply knowledge; ability to understand and use language; ability to store and retrieve relevant experience at will; learning from experience
Knowledge	Understanding gained through experience; familiarity with the way to do something to perform a task; an accumulation of facts, procedural rules, or heuristics
Procedural rule	A rule that describes a sequence of relations relative to the domain.

Lack of common sense makes technology "brittle"; that is, computers rarely go beyond the scope of their data warehouse or knowledge base. Many important projects assumed by humans in business today required common sense, which is only partially understood by today's computer.

Cognition and Knowledge Management

Cognitive psychology provides and essential background for understanding knowledge and expertise. This goal of cognitive psychology is to identify the cognitive structures and processes that relate to skilled performance within an area of operation. Cognitive science in general is the interdisciplinary study of human intelligence. Its two main components are experimental psychology, which studies the cognitive processes that constitute human intelligence, and artificial intelligence, which studies the cognition of computer-based intelligent systems.

With these relationships in mind, one can see cognitive psychology's contribution to KM. Understanding the limitations and biases provided by cognitive psychology helps in understanding expertise. Human limitations-such as memory capacity and the physical limits imposed by human sensory and motor systems-must be considered when attempting to understand how the human expert carries out a task.

The process of eliciting and representing expert knowledge typically involves a knowledge developer and one or more human experts. To capture human knowledge, the developer interviews the expert(s) and asks for information regarding a specific area of expertise that the expert is adept at solving. The expert maybe asked to "think aloud," to verbalize his or her thought processes, while solving the problem. People cannot always give complete, accurate reports of their mental processes. Experts may have greater difficulty in conveying some kinds of knowledge, such as procedural knowledge (explained later in the chapter). Psychologists have long been aware of problems related to verbal reports, and through research, they have developed methods for circumventing them.

Cognitive psychology research contributes to a better understanding of what constitutes knowledge, how knowledge is elicited, and how it should be represented in a corporate knowledge base for others to tap. Because knowledge developers should take knowledge elicitation (also called knowledge capture) seriously, they should have a strong educational and practical background in cognitive psychology and cognitive processes. Knowledge capture techniques are covered in Chapter 4.

Data, Information, and Knowledge

Data

Data are unorganized and unprocessed facts. They are static; they just sit there. For example, Ali is 6 feet tall. This is data; it does not necessarily lead one anywhere. However, the meaning one brings to the evaluation of this data could be important. Such an evaluation may indicate that Ali's height would make him an asset to the basketball team. This becomes information.

Data is a set of discrete facts about events – structured records of transactions. When a customer goes to the store and buys merchandise, the number of socks and the price he or she paid are all data. The data tells nothing about the motivation behind the purchase, the quality of the socks, or the reputation of the store. Quantitatively, stores evaluate patterns of purchases, number of customers purchasing specific items, and other items those customers purchased. Evaluation such as these can be used to derive information about customer behavior, the price-sensitivity of certain merchandise, and the like. This means that data is a prerequisite to information.

All organizations need data, and some companies depend more heavily on data than others. For example, insurance companies, banks, the internal revenue service, and the social security administration are heavy number crunchers. Millions of transactions are processed daily. The problem with too much data is that it offers no judgment ad no basis for action. This means that an organization must decide on the nature and volume of data needed to create information.

Information

The word information is derived from the word inform, which means "to give shape to" information means shaping the data to arrive at meaning in the eyes of the perceiver.

Information is an aggregation of data that makes decision making easier. It is also facts and figures based on reformatted or processed data. For example, a profit and loss statement provides information. It is an assembling of facts into a form that shows an organization's state of health over a specific time period. Here is another example of information:

> *Five farmers of northern Beirut, who had switched crops from watermelon to sugarcane with the high hope of a quick profit, could not bear the anguish of crop failures for two consecutive seasons. They committed suicide after having to sell the farm to pay the bank loan.*

Unlike data, information is understanding relations. It has meaning, purpose, and relevance. It has a shape, because it is organized for a purpose. The data may have been reorganized, statistically analyzed, or have had errors removed – all performed to add meaning to a message, a report, or a document. The medium is not the message, although it could affect the message. An analogy: Having a telephone does not ensure worthwhile conversation, although certain telephones make the message clear and more easily understood. Today, having more information technology is not a guarantee more easily understood. Today, having more information technology is not a guarantee for improving the state of information.

Information is accessible to employee's ad managers through the company's local area networks, intranet, e-mail, Internet, satellite infrastructure, snail mail, or hand delivery. Unlike data that emphasizes quantity and efficiency of processing, the focus of information is qualitative: Does the report tell me something I don't know? Is there new meaning in the semiannual report? The implication is that data becomes information when meaning or value is added to improve the quality of decision making.

Knowledge

Knowledge has always been an essential component of all human progress. Our ancestors must have employed an enormous amount of knowledge to form an axe-like object. From know-how to use seeds for planting to the invention of machinery, to travel to the moon – all required an accumulation of special knowledge to achieve the task. When it comes to basics, people use their intelligence and

creativity to come up with the value-added products and services that take on the competition. Knowledge capital is essentially a reflection of how well an organization leverages the knowledge of its workforce, the needs of its customers, and the knowledge of the suppliers to ensure value-added outcome. Knowledge capital is the way an organization derives wealth from its information resources on a regular basis.

Knowledge is the most cherished remedy for complexity and uncertainty. It is a higher level of abstractions that resides in people's minds. It is broader, richer, and much harder to capture than data or information. People seek knowledge, because it helps them succeed in their work. (Relevant) information available in the right format, at the right time, and at the right place for decision making.

Knowledge has different meanings, depending on the discipline where it is used. In this text, knowledge is " human understanding of a specialized field of interest that has been acquired through study and experience." It is based on learning, thinking, and familiarity with the problem area in a department, a division, or in the company as a whole. The focus is on sustainable competitive advantage. Knowledge is not information, and information is not data. Davenport and Prusake (2000) define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information."

Knowledge is derived from information in the same way information is derived from data. It may be viewed as an understanding of information based on its perceived importance or relevance to a problem area. It can also be thought of as a person's range of information. Embracing a wider sphere than information, knowledge includes perception, skills, training, common sense, and experience. It is the sum total of our perceptive processes that helps us to draw meaningful conclusions. For example, an investor requires knowledge to evaluate two companies' profit and loss statements in order to determine which one is the healthier company.

Data	Information	Knowledge
Statement about reality (Acharya 2001) Unsorted bits of fact (Dixon 200) A representation of a fact, number word, image, picture, or sound Measurements (Applehans et al. 1999) A discrete, objective fact about events (Davenport and Prusak 2000)	Organized, systematized data (Acharya 2001) Data that has been sorted, analyzed, and displayed (Dixon 2000) Data that has been assigned a meaning (Liebowitz and Wilcox 1999) Data that is meaningful or useful to someone (Dickerson 1998) Potential for action; resides in the user (Malhotra 1998) A statement of fact about measurements (Applehans et al. 1999) Descriptive knowledge (Characterizing the state of some past, present, future, or hypothetical solution) Holsapple and Whinston 1996) Data that makes a difference (Davenport and Prusak 2000)	Human interaction with reality (Acharya 2001) Meaningful links people make in their minds between information and its application in action in a specific setting (Dixon 2000) The whole set of insights, experiences, and procedures that are considered correct and true and that, therefore, guide the thoughts, behavior, and communication of people (Liebowitz and Wilcox 1999) An ideational (i.e., conceptual rather than physical) construct generated via the agency of the human mind (Housel and Bell 1999) An organizational resource consisting of the sum of what is known (Holseapple 1996) A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information (Davenport ad Prusak 2000) Systematizing and structure information for a specific purpose (Johannessen et al. 1994) Information whose validity has been established through tests of proof (Libeskind 1996)

As can be seen, information is all around, but only a fraction of it is useful in problem solving. Knowledge has to be built and requires regular interaction with others in the know in the organization. It is social, time critical, interactive, evolving, and created for a purpose but drawing on experience from other times and domains. Cooperation and productivity are expected as people work to achieve, not to control. Teamwork is a prerequisite for people to talk, compare, and exchange thoughts, leading to a culture that makes it clear that "What is my job?" is les important than "What is the purpose of what I am doing?"

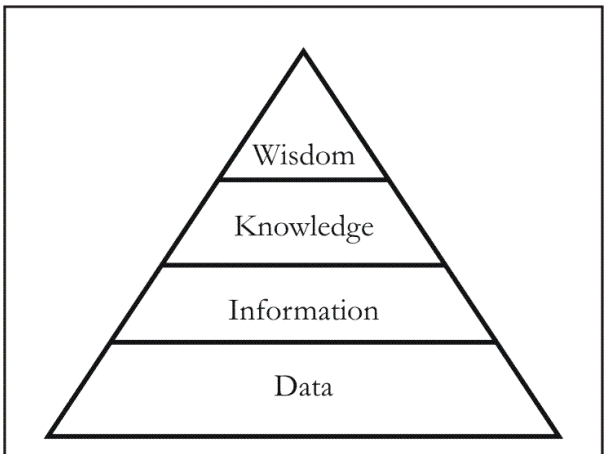
In summary,

- **Knowledge** can be defined as the ``*understanding obtained through the process of experience or appropriate study.''*

- Knowledge can also be an accumulation of facts, procedural rules, or heuristics.
    - A **fact** is generally a statement representing truth about a subject matter or domain.
    - A **procedural rule** is a rule that describes a sequence of actions.
    - A **heuristic** is a rule of thumb based on years of experience.
- **Intelligence** implies the capability to acquire and apply appropriate knowledge.
    - **Memory** indicates the ability to store and retrieve relevant experience according to will.
    - **Learning** represents the skill of acquiring knowledge using the method of instruction/study.
- **Experience** relates to the understanding that we develop through our past actions.
- Knowledge can develop over time through successful experience, and experience can lead to expertise.
- **Common sense** refers to the natural and mostly unreflective opinions of humans.

Data, Information and Knowledge

- **Data** represents unorganized and unprocessed facts.
    - Usually data is static in nature.
    - It can represent a set of discrete facts about events.
    - Data is a prerequisite to information.
    - An organization sometimes has to decide on the nature and volume of data that is required for creating the necessary information.
- **Information**
    - Information can be considered as an aggregation of data (processed data) which makes decision making easier.
    - Information has usually got some meaning and purpose.
- **Knowledge**
    - By knowledge we mean *human understanding of a subject matter that has been acquired through proper study and experience.*
    - Knowledge is usually based on learning, thinking, and proper understanding of the problem area.
    - Knowledge is not information and information is not data.
    - Knowledge is derived from information in the same way information is derived from data.
    - We can view it as an understanding of information based on its perceived importance or relevance to a problem area.
    - It can be considered as the integration of human perceptive processes that helps them to draw meaningful conclusions.



Data, Information, Knowledge and Wisdom

Kinds of Knowledge

- Deep Knowledge: Knowledge acquired through years of proper experience.
- Shallow Knowledge: Minimal understanding of the problem area.
- Knowledge as Know-How: Accumulated lessons of practical experience.

- Reasoning and Heuristics: Some of the ways in which humans reason are as follows:
    - Reasoning by analogy: This indicates relating one concept to another.
    - Formal Reasoning: This indicates reasoning by using *deductive* (exact) or *inductive* reasoning.
        - Deduction uses major and minor premises.
        - In case of deductive reasoning, new knowledge is generated by using previously specified knowledge.
        - Inductive reasoning implies reasoning from a set of facts to a general conclusion.
        - Inductive reasoning is the basis of scientific discovery.
        - A *case* is knowledge associated with an operational level.
- **Common Sense:** This implies a type of knowledge that almost every human being possess in varying forms/amounts.
- We can also classify knowledge on the basis of whether it is *procedural, declarative, semantic,* or *episodic*.
    - *Procedural knowledge* represents the understanding of how to carry out a specific procedure.
    - *Declarative knowledge* is routine knowledge about which the expert is conscious. It is shallow knowledge that can be readily recalled since it consists of simple and uncomplicated information. This type of knowledge often resides in short-term memory.
    - *Semantic knowledge* is highly organized, ``chunked'' knowledge that resides mainly in long-term memory. Semantic knowledge can include major concepts, vocabulary, facts, and relationships.
    - *Episodic knowledge* represents the knowledge based on episodes (experimental information). Each episode is usually ``chunked'' in long-term memory.
- Another way of classifying knowledge is to find whether it is *tacit* or *explicit*
    - *Tacit knowledge* usually gets embedded in human mind through experience.
    - *Explicit knowledge* is that which is codified and digitized in documents, books, reports, spreadsheets, memos etc.

LESSON 10

EXTRACTING GOLD FROM DATA; UNDERSTANDING CONVERSION OF DATA INTO KNOWLEDGE.

Q#1 How do the terms "data" and "knowledge" differ? Describe each term with the help of a similar example, elucidating the difference between the two.

To examine the differences between the terms data and knowledge, we need to understand the meaning of these terms.

Data comprises facts, observations, or perceptions that by themselves represent raw numbers or assertions, and may therefore be devoid of context, meaning, or intent.

Some examples of data could be:

a. The age and gender of each spectator in a cricket match during a game.
b. The price of each model of personal computer from every possible vendor at a particular point in time.

On the other hand, Knowledge has been distinguished from data in two different ways. A more simplistic view considers knowledge as being at the highest level in a hierarchy with information at the middle level and data at the lowest level. For example, an e-mail address is a piece of data, the fact that it belongs to a customer is information, and the fact that this customer needs to be e-mailed reminders every week to pay last month's dues is knowledge.

The second way would be to define knowledge in an area as justified beliefs about relationships among concepts relevant to that particular area.

If we consider the examples mentioned above:

a. While the age and gender of each spectator attending a game is only data, when used in conjunction with other information like the buying preferences of different consumers, stadium planners could forecast the kind of prducts that will be sold during a particular game.

b. Similarly, the price of each model of personal computer from every possible vendor, along with other information like the shipping cost for each vendor and the mail-in rebates available for each vendor and for each computer model, provides a potential buyer the knowledge as to how much he is likely to spend on each computer model he is considering.

To sum up, Knowledge differs from Data in the sense that it helps produce information from data or more valuable information from less valuable information which in turn results in the facilitation of an action.

Q# 2 "Information" contains "data" but not all "data" is "information." Justify this statement.

Data is devoid of context, meaning, or intent. Information is, in fact, a subset of data. Information only includes those data that possess context, relevance, and purpose. Information typically involves the manipulation of raw data to obtain a more meaningful indication of trends or patterns in the data.

Let us consider some examples:

a. The total number of television viewers who watched the Super Bowl is mere data. However, when the data says that the maximum numbers of viewers are found during the

third and fourth quarters of the game, this is information for companies who want to decide when to place a television commercial.

b. The price of a large bag of popcorn at a movie theatre is data. However when the theatre management wishes to stay competitive, it is imperative that he finds out the price of popcorn in all his competing theatres, and averages it out. This is also an example of raw data which becomes useful information.

Thus we see from the examples above that information is in fact derived from data by way of some manipulation performed on the data. All information is hence data, but not all data can be considered information.

Q# 3 Explain why the same set of data can be considered as useful information by some and useless data by others. Further, could this useful information be termed as "knowledge"? Why?

Data is devoid of context, meaning, or intent. Information is in fact, a subset of data. Information typically involves the manipulation of raw data to obtain a more meaningful indication of trends or patterns in the data. Information only includes those data that possess context, relevance, and purpose. So one could say that Information is processed Data.

However, irrespective of whether data is processed or not, whether certain facts are information or only data depends on the individual who is using those facts.

Useful information can be termed as knowledge, only if it enables action and decisions, or provides information with direction. Knowledge is intrinsically similar to information and data. It is the richest and deepest of the three, and is consequently also the most valuable.

Q# 4 Describe the ways in which "knowledge" differs from "data" and "information." Justify your answer with a relevant diagram.

Knowledge can be distinguished from data and information in two ways.

The basic view considers knowledge as being at the highest level in a hierarchy with information at the middle level and data at the lowest level. According to this view, knowledge refers to information that enables action and decisions, or information with direction. Hence, knowledge is intrinsically similar to information and data, although it is the richest and deepest of the three, and is consequently also the most valuable.

The more advanced view of knowledge is based on the fact that the basic view doesn't fully explain the characteristics of knowledge. The advanced view considers knowledge as intrinsically different from information. It defines knowledge in an area as justified beliefs about relationships among concepts relevant to that particular area.

To sum up, knowledge helps produce information from data or more valuable information from less valuable information, and this information facilitates action. Based on the new ly generated information, as well as the relationship with other concepts, knowledge enables the beholder to make decisions.

Q**# 5 Explain the importance of knowledge in creation and utilization of information.**

Knowledge helps produce information from data or more valuable information from less valuable information, resulting in the facilitation of an action or decision.

As discussed above, knowledge helps convert data into information. The use of information to make the decision requires knowledge as well. The decisions, as well as certain unrelated factors, lead to events, which cause generation of further data. The events, the use of information, and the information system might cause modifications in the knowledge itself.
Knowledge is vital in the ongoing cycle of creation of data, information, and decision making,

which in turn leads to events which generate further data and information. Knowledge is both the catalyst and the end product of this continuous cycle of events.

Q# 6 How does the subjective view of knowledge differ from the objective view? Explain how knowledge can be viewed as a state of mind, as a practice, as objects, as access to information and as capability.

Knowledge can be viewed subjectively or objectively.

The Subjective view of knowledge refers to it as an ongoing accomplishment, which continuously affects and is influenced by social practices. It cannot be placed at a single location, as it has no existence independent of social practices and human experiences.

The Subjective view represents knowledge as using two possible perspectives:

a) As a state of mind – this view considers knowledge as being a state of an individual's mind and organizational knowledge is viewed as the beliefs of the individuals within the organization.
b) As a practice -- this perspective, also knowledge is viewed as being held by a group and cannot be broken down into separate elements possessed by individuals. Moreover, this knowledge resides not in anyone's head but in practice. Knowledge is reflected in organizational activities rather than in the minds of the organization's individuals.

According to the Objective view, reality is independent of human perceptions and can be structured in terms of categories and concepts. In this way knowledge can be located in the form of an object or a capability that can be discovered or improved by human agents. The objective view considers knowledge from three possible perspectives.

When looked at objectively, knowledge is represented in three possible perspectives: as an object, as access to information, or as a capability:

a) Knowledge as Objects – views knowledge as an item that can be stored, transferred, manipulated, and can exist in a variety of locations.

b) Knowledge as Access to Information -- considers knowledge as something that enables access and utilization of information. This perspective extends the view of knowledge as objects, emphasizing the accessibility of the knowledge objects.

c) Knowledge as Capability -- this perspective differs from the last two perspectives on Knowledge as Objects in terms of the way in which knowledge can be applied to influence an action. This perspective places emphasis on knowledge as a strategic capability that can potentially be applied to seek a competitive advantage.

Q#7 What is the difference between knowledge characterized as "know what" and "know how"? In these situations, how would you classify the knowledge a computer programmer has?

One of the ways in which knowledge can be classified is into Declarative Knowledge and Procedural Knowledge.

a) Declarative Knowledge (Substantive Knowledge) – which focuses on beliefs about relationships among variables. Declarative knowledge can be stated in the form of propositions, expected correlations, or formulas relating concepts represented as variables. It is for this reason that Declarative knowledge is often characterized as "know what."

Example: The average fuel consumption of a particular car is declarative knowledge.

b) Procedural Knowledge - focuses on beliefs relating sequences of steps or actions to achieve a certain outcome. It is for this reason that procedural knowledge is often characterized as "know how."

Example: Following steps to fix a car to improve its petrol mileage, involves procedural knowledge.

The knowledge a computer programmer has can be termed as both declarative as well as procedural knowledge. The programmer needs to know the syntax of the language which is declarative knowledge. However he also needs to know the logic steps to take to develop his computer program, which is where his procedural knowledge is used.

Explicit knowledge is however used at a very basic level. This was probably used by the player to learn the rules of the game, but once the player is familiar with the rules, this knowledge is converted to tacit knowledge in his brain.

Q# 8 What is general knowledge? How does it differ from specific knowledge? Describe the types of specific knowledge with suitable examples.

One form of classifying knowledge is whether it is possessed widely or narrowly. This is usually in the form of General Knowledge or Specific Knowledge.

General Knowledge is possessed by a large number of people and is easily transferred from one person to another. For example, it is general knowledge that the earth revolves around the sun. This knowledge is easily passed on from high school teacher to students.

Specific Knowledge, on the other hand, is often referred to as Idiosyncratic Knowledge due to the fact that it is possessed by a very limited number of individuals, and is difficult to transfer among individuals. In the example above, while it is general knowledge that the earth revolves around the sun, it is specific knowledge of scientists who know the exact distance between the earth and the sun based on its orbit.

Further, specific knowledge can be of two types: technically-specific knowledge and contextually-specific knowledge.

a) Technically-specific knowledge is deep knowledge about a specific area and includes knowledge about the tools and techniques that may be used to address problems in that area. This kind of knowledge is often acquired as a part of some formal training and is then augmented through experience in the field. For example, the exact distance between the earth and the sun, as mentioned in the example above.

b) Contextually-specific knowledge refers to the knowledge of particular circumstances of time and place in which work is to be performed. Contextually-specific knowledge pertains to the organization and the organizational subunit within which tasks are performed. This type of knowledge cannot be acquired through formal training, but instead must be obtained from within the specific context. For example, an astro-physicist is able to calculate based on his experience and knowledge the exact duration and time an eclipse is likely to occur.

Q# 9 What is "expertise"? Distinguish among the three types of expertise.

Expertise is defined as knowledge of higher quality, which addresses the degree of knowledge. This term refers to very specific knowledge, and one who possesses expertise is able to perform a task much better that those who do not. A person can be an expert at a particular task irrespective of how sophisticated that area of expertise is.

To truly understand the meaning of an expert, and expertise, the skill levels of experts from different domains should not be compared to each other and the concept of expertise must be further classified for different types of domains. All experts require more or less the same cognitive skills. The difference however lies in the depth of their expertise when compared to others from their own domains. For example, a race car driver has more skill than the average car driver.

Q. # 10 Contrast the differences between knowledge in people and knowledge in artifacts. Describe the various repositories of knowledge within organizational entities.

Knowledge resides in several different locations or reservoirs. These can be classified into Knowledge in People, Knowledge in Artifacts, and Knowledge in Organizational Entities.

1. Knowledge in People -- A considerable component of knowledge is stored in people, often in individuals within organizations. Considerable knowledge also resides within groups due to the relationships among the members of the group. Groups also form beliefs about what works well and what does not, and this knowledge is over and above the knowledge residing in each individual member. Communities of practice, which develop as individuals interact frequently with each other to discuss topics of mutual interest, are a good example of this.

2. Knowledge in Artifacts -- Significant amount of knowledge is stored in organizational artifacts. It could be stored in practices, organizational routines, or sequential patterns of interaction. Knowledge in artifacts are often embedded in procedures, rules, and norms that is developed through experience over time and guide future behavior. Considerable knowledge is also often stored in technologies and systems. Knowledge repositories represent a third way of storing knowledge in artifacts. For example, a log of customer calls forms a good repository of information to develop a frequently asked questions section of an organization's Website.

3. Knowledge in Organizational Entities -- Knowledge in these entities can be considered at three levels:

a) Organizational units/Parts of the Organization -- represents a formal grouping of individuals, who come together not because of common interests but rather, because of organizational structuring. When individuals occupying certain roles in an organizational unit depart and are replaced by others, the incumbents inherit some, but not all, of the knowledge developed by their predecessors, via the systems, practices, and relationships within that unit.

b) An Entire Organization -- such as a business unit or a corporation, also stores certain knowledge, especially contextually specific knowledge. Its norms, values, practices, and culture within the organization, and across its organizational units, contain knowledge that is not stored within the mind of any one individual. The way in which the organization responds to environmental events is dependent on the knowledge stored in individuals and organizational units as well as in the overall organizational knowledge that has developed through positive and negative experiences over time.

c) Interorganizational relationships -- As organizations establish and consolidate relationships with customers and suppliers, they draw upon knowledge embedded in those relationships. Organizations often learn from their customers' experience with products about how these can be improved. They can also learn about new products that might be appealing to customers.

Q# 11 Determine the various types of knowledge you are used to. You should be able to state at least one of each type.

Knowledge has been classified and characterized in several different ways. In reading this chapter, we see examples of the various types of knowledge being used.

Declarative Knowledge – has been used in terms of the meanings of English words (such as "physical," "cognitive," etc., and the meanings of various punctuation marks, such as "," and ".".

Procedural Knowledge – was used in the actual reading of this book. When you reached the end of a page, you knew that you now needed to move on to the next page or turn to the next page, until you've reached the end of the book.

Tacit Knowledge – gained from reading the preface of this book, which tells you about the book and its contents, helps understand this chapter.

Explicit Knowledge – contained in the text of the chapter helps understand the tables and figures in the chapter.

General Knowledge – about topics such as restaurant, coins, and hurricanes , was used to understand the concepts explained in the chapter.

Specific Knowledge – was used to apply the concepts the student read about in the chapter to real -world situations she may have encountered at her work place.

LESSON 11

UNDERSTANDING DATA FOR ANALYSIS AND DECISION/POLICY MAKING

1. Consider five decisions you might have made today. (They could be simple such as, taking a turn while driving or even choosing a soft drink at a store.) In each case example below notice the data, information, or knowledge that were involved in the decision.

a) Action: Sending an e-mail message to a friend
Data: E-mail addresses of all individuals at the university at which your friend is a student
Information: E-mail address of the friend to be contacted
Knowledge: How to send an E-mail

b) Action: Watching your favorite television program
Data: Opening the TV guide
Information: Referring to the TV guide to find out when the program airs.
Knowledge: Turning on the TV and setting it to the correct channel

c) Action: Driving to work
Data: Details about the car functions like brakes, steering wheel, etc.
Information: Directions from home to work
Knowledge: How to drive and maneuver a car

d) Action: Answering a ringing telephone
Data: Hearing the phone ring
Information: Where the phone is located
Knowledge: How to pick up the receiver and answer the phone

e) Action: Setting a clock for Daylight Saving Time
Data: Dates with and without Daylight Saving Time
Information: The date and time when to make the time change
Knowledge: In which direction and by how much to adjust the clock

2. Now consider how those decisions would have been influenced by the lack of pre-existing data, information, or knowledge.

As we see from the discussion below, each of the above actions would be either hindered to some extent, or even completely impossible in some cases in the absence of pre-existing data, information, or knowledge.

Sending an e-mail to a friend would be impossible without information of the e-mail address of the friend to be contacted. Lack of data on the e-mail addresses of all students at the university would not be a problem if the information about the specific friend's e-mail address is available. Basic knowledge of how to open a program to send an e-mail is necessary.

Watching your favorite television program would be possible without having to use the TV guide or referring to the program schedule. However it would be a hindrance if one did not know what time the show airs.

Driving to work absolutely requires the knowledge of how to drive and the directions to work. It does not require detailed data about the car functions like brakes, steering wheel, etc.

In answering a ringing telephone, hearing the phone ringing is vital in the decision to answer the phone. Information about the location of the phone may not, however, be as important as one could determine this by moving towards the ringing sound.

Setting a clock for Daylight Saving Time requires the information on when and how to make the time change and knowledge about the direction and extent of clock adjustment.

3. You have recently invented a new product. Collect demographic data from a sample population, determine how you would use this data, and convert it into information and possibly knowledge for marketing the product.

This answer would focus on identifying the specific kinds of data (e.g., age, gender, education, income, etc.) and manipulating this data based on characteristics of the invented product (e.g., if the new product is one targeted at older men, the average education level and income of men in higher age groups would help identify the pricing and the target audience for advertising).

4. Interview a manager in a manufacturing organization, and one in a services-based organization. Determine the contrasting views of knowledge between the two due to the nature of their businesses.

Possible differences that might be surfaced through this analysis are:

a) The manager in the manufacturing organization might identify greater examples of procedural knowledge, whereas the manager in the servicing organization might identify greater examples of declarative knowledge.

b) The manager in the manufacturing organization might identify greater examples of tacit knowledge, whereas the manager in the servicing organization might identify greater examples of explicit knowledge.

Q 1 ***Describe the two ways presented in the text for distinguishing knowledge from information and data.***

The simpler view merely distinguishes between the value of the corresponding information, where data has little value, information has more value, and knowledge has the greatest value. In this view, knowledge is at the top of an information hierarchy with information value being the vertical axis.

The second view states that knowledge is what enables us to produce more valuable information from less valuable information, with the importance being on the transformation process. It is more about relationships between pieces of information.

Q 2 ***Give examples of data, information, and knowledge from the perspective of the fast food restaurant and restaurant manager.***

Data: the number of burgers ordered, number of burgers served (also true for all other menu items including shakes and fries), server and chef salaries, burgers in stock, sales price of an order, cost of a burger.

Information: daily sales numbers (rupees, quantity, or percent of daily sales) for each item, the daily reduction in inventory for each item, total number of customers for the day, percentage of customers ordering burgers/shakes/other, reorder quantities for restaurant food items, the average time spent by a server on each customer.

Knowledge: The trend of customer numbers indicating future customers and ordering patterns, the relationship between projected burger sales and bread inventory (or any other menu item and corresponding material, e.g., shakes and milk), the relationship between projected customers and average server time and desired server times to determine staffing needs.

Q 3 ***Briefly describe the various perspectives on knowledge.***

Knowledge may be examined either subjectively or objectively.

The subjective view ties knowledge to an individual's experience in social interactions with others and is classified as either a state of mind or as a practice.

The objective view claims that knowledge exists in *a priori* categories or concepts independent of any individual. This *a priori* knowledge may exist as an object, a capability, or simply as access to information

Q 4 ***List and briefly define the three types of objective knowledge.***

1. Knowledge as an object, where an object is something that can be stored, transferred, and manipulated.
2. Knowledge as access to information. Enable access and utilization of information.
3. Knowledge as capability. Emphasis on knowledge as a strategic capability, how knowledge may be applied to influence action.

Q 5 ***What are the three classifications of knowledge highlighted.?***

Procedural or declarative, indicating that knowledge may be classified as either data-oriented or task-oriented. Tacit or explicit, indicating knowledge that is held in the heads of individuals or groups or alternately encoded in some other storage medium. General or specific, indicating the breadth of ownership of the knowledge with general knowledge held by many and specific knowledge held by few.

Q 6 ***How can explicit knowledge be transferred to tacit knowledge?***

Explicit knowledge is knowledge that is articulated (and frequently encoded) and may be easily transferred to another individual or group. When an individual acquires knowledge from an explicit form (through reading/hearing/feeling/observing), then the knowledge must be remembered to become tacit and as such is transformed to conform to or modify the individual's existing belief system. An example would be when an employee looks into a manual to determine how to install a new piece of hardware in his/her computer. The manual is explicit procedural information. After performing a few installs, the employee will learn the specified procedures and possibly some improvements to the documented procedures, thus transforming the explicit knowledge into tacit knowledge.

Q 7 ***List and define the three types of expertise discussed in the text.***

Associational expertise comes from years of experience and recognizing patterns in data. An example would be a mechanic who can diagnose the potential problems in a car just from listening to the sounds made by the car.

Motor skill expertise is predominantly physical instead of cognitive and results from a very large number of practice sessions to develop a particular physical skill such as shooting a basketball.

Theoretical or deep expertise is knowledge of a particular topic far beyond the average individual. The ability to go beyond superficial understanding and create novel solutions to problems based on the theoretical foundations of the domain.

Test Your Understanding

1. ***Select one definition of KM and explain the reason(s) for your choice.***

Any definition is a candidate, because of one or more aspects of what KM has, is, or should be.

- Using accessible knowledge from outside sources
- Embedding and storing knowledge in business processes, products, and services
- Representing knowledge in databases and documents
- Promoting knowledge growth through the organization's culture and incentives
- Transferring and sharing knowledge throughout the organization

- Assessing the value of knowledge assets and impact on a regular basis

Students should be encouraged to come up with a creative support of their choice of a KM definition.

2. ***KM involves people, technology, and processes in overlapping parts. Explain the KM concept.***

The ideal organization is one where people exchange knowledge across functional areas of the business by using technology and established processes. The exchange may be for policy formulation and strategy, for training and development, or for problem solving in teams. None of the three areas can function independently of one another.

3. ***One unique indicator of KM in action is seeing people think ahead, not behind. Do you agree with this statement? Explain why you agree or disagree.***

Progress, advancement, and growth are future-oriented. They require people to think ahead.

4. ***In what way is KM not about:***

a. reengineering
b. a discipline
c. data
d. knowledge capture

a. KM is a mechanical shift from one stage of operation to a more efficient stage—not a one-shot drastic change in organizational processes to improve efficiency.
b. KM is another way to improve quality, profitability, and growth
c. Data is facts without context. KM is actionable information to create value.
d. Knowledge cannot be captured in its entirety, because of the implied human maturation over time that upgrades the quality and value of knowledge—especially tacit knowledge.

LESSON 12

KNOWLEDGE HIERARCHY… INDIVIDUAL VS ORGANIZATION

Human Thinking and Learning

Because knowledge is the focus of knowledge management, knowledge developers need to understand how humans think and learn. Scientists have long tried to under stand the human brain as part of their process of building computers that may someday duplicate the human expert's thought process in problem-solving. Imagine a child using blocks to build a tower. As soon as the tower is completed, the child takes a whack at the tower, destroying it. Next, the child builds a higher tower and then destroys it as well, and so on. Eventually, the child becomes hungry, and the pattern of BUILD and DESTROY begins to degenerate. The child gives the tower one final swipe, destroying it one the way to the kitchen. These spontaneous activities have proved to be difficult for computers, mainly because no one knows why people do them and, therefore, knows how to instruct the computer to do them.

According to Marvin Minsky (1991), the human mind is a "society of minds" that is hierarchically structured and interconnected so that the BUILD, DESTROY, and HUNGER agents of the child are minds that represent the self, promote intelligence, and provide the basis for acquiring knowledge. The study of artificial intelligence has introduced more structure into human thinking about thinking. So many activities of the computer resemble human cognitive processes that human and machine "thinking" are converging in many applications, despite the differences between the brain's architecture and the computer's. For example, both mind and machine accept data and information, manipulate symbols, store items in memory, and retrieve items on command.

Obviously, humans do not receive and process information in the same way that machines do. For instance, humans receive information via sensing-seeing, smelling, tasting, touching, and hearing. This system of receiving external stimuli promotes a kind of thinking and learning that is unique to humans. On a macro level, computers and human receive inputs from a variety of sources. Computers receive information from keyboards, speech, touch screens, and other external sensors. On a micro level, both the central processing unit of a computer and the human brain receive all information as electrical impulses. The difference is that computers must be programmed to do specific tasks. Performing one job does not transcend onto other jobs as it does with human.

Human Learning

Memory is an essential component of learning, because it accommodates learning. One interesting aspect of healthy human memory is that it never seems to run out of space. Also, as humans acquire more and more knowledge, they generally experience title interference with the recall ability or the quality of the information n memory. In other words, as people learn new facts, they integrate them in some way with what they think is relevant and organize the resulting mix to produce valuable decisions, solutions, or advice. Such learning ability is the basis of accumulating knowledge, experience, and expertise.

For humans, learning occurs in one of three ways: learning by experience, learning by example, and learning by discovery. The next section explores these types in an effort to see how they contribute to human knowledge.

Learning By Experience

The ability to learn by experience is a mark of intelligence. When an expert is selected whose knowledge someone wants to acquire, the expert is expected to have years of experience reworking problems and looking into different angles for solving difficult

Three types of Human Learning	
Learning by experience	Trial and error or reworking problems is used to acquire experience in problem-solving. An expert uses experience to explain how a problem is solved.
Learning by example	Specially constructed examples or scenarios are used to develop the concept(s) the student is expected to learn. In knowledge capture, the human expert uses a scenario to explain how a problem is solved.
Learning by discovery	This is an undirected approach, where humans explore a problem area with no advance knowledge of what their object is.

Problems. One way of testing potential experts is to observe their recall ability. Experts, who know a lot about a particular problem, have been found to remember facts in that problem area much more easily and more quickly than non-experts, who presumably have fewer facts to recall. This type of information would be important for the knowledge developer to keep in mind when understanding a human expert's range of knowledge.

Learning By Example

Like learning by experience, learning by example is a good contributor to accumulating knowledge over time. In learning by example, specially constructed examples are used instead of a broad range of experience. Much classroom instruction is composed of teaching by example – providing examples, cases, or scenarios that develop the concepts students are expected to learn. Because this method allows students to learn without requiring them to accumulate experience, it is more efficient than learning by experience.

Learning By Discovery

Learning by discovery is less understood than learning by example or by experience. It is an undirected approach in which humans explore a problem area without advanced knowledge of the objective. No one understands why human are so good at this. It is difficult to teach, and it will be years before we can benefit from this approach commercially.

In summary;

Thinking and Learning in Humans

- Research in the area of artificial intelligence has introduced more structure into human thinking about thinking.
- Humans do not necessarily receive and process information in exactly the same way as the machines do.
- Humans can receive information via seeing, smelling, touching, hearing (sensing) etc., which promotes a way of thinking and learning that is unique to humans.
- On macro level, humans and computers can receive inputs from a multitude of sources.
- Computers can receive inputs from keyboards, touch screens etc.
- On micro level, both human brain and CPU of a computer receive information as electrical impulses.
- The point to note here is that the computers must be programmed to do specific tasks. Performing one task does not necessarily transcend onto other tasks as it may do with humans.
- Human learning: Humans learn new facts, integrate them in some way which they think is relevant and organize the result to produce necessary solution, advice and decision. Human learning can occur in the following ways:
    - Learning through Experience.
    - Learning by Example.
    - Learning by Discovery.

Implications for knowledge management at Organization

Knowledge awareness benefits entire organizations. With today's emphases on sustainable competitive advantage, added value, and improved productivity, a firm's management needs to create, innovate, monitor, and protect its knowledge inventory. More specifically, a KM environment means a focus on

generating new knowledge; transferring existing knowledge; embedding knowledge in products, services, and processes; developing an environment for facilitating knowledge growth; and accessing valuable knowledge from inside and outside the firm. When this happens, it is beyond survival. In fact, it is beyond intranets and databases-the technology that supports KM.

Some sources claim that 20 percent of an organization's knowledgeable personnel can operate 80 percent of the organization's day-to-day business. The human resources manager can play an important role in identifying the knowledge core of the organization, recommending ways to preserve this critical core, and building a robust, long-range plan to ensure top-quality operation. Without such preparation, corporate talent could potentially erode through a brain drain that spells disaster for any business. At the same time, professionals with expertise are naturally drawn to organizations that recognize and reward expertise especially when that expertise directly contributes to the firm's productivity. Such matches explain the stability and growth of many successful "learning" companies.

Based on the discussion here, several ideas should be considered for how a company should perform in order to create and maintain sustainable competitive advantage. First, there should be more emphasis on tapping, sharing and preserving tacit knowledge and the total knowledge base of the company. A company's knowledge base includes explicit and tacit knowledge and exists internally in the business as well as within the firm's external connections. Second, companies should focus on innovation and the processes that convert innovation to new products and services. Knowledge sharing and an emphasis on the total knowledge base promote innovation.

What good is knowledge if it cannot be share? If knowledge is power, sharing it will multiply power across the business. Unfortunately, sharing knowledge is an unnatural thing. One person's knowledge is an added value to that person's career path. Knowledge management is designed to solve the problem of un-recycled knowledge. Systems have been developed to gather, organize, refine, and distribute knowledge throughout the business. Virtually all such systems should have six key attributes: learning capability, improving with use, knowing what you want, two-way communication between the system and you, recalling past actions to develo9p a profile, and unique configuration to your individual specification in real time.

In the final analysis, communication and connection make knowledge sharing an ongoing activity. Technology can only do so much to create a formal system. Success with KM exists when the culture is ready to communicate and connect. The end result is "community," built around knowledge and based on vision.

- Intelligent behaviour has several attributes:
  - The ability to understand and use language
  - The ability to store and retrieve relevant experience at will
  - Learning by example, from experience, or by discovery.

- Several key terms are worth noting:
  - Knowledge-Understanding gained through experience
  - Intelligence- the capacity to apply knowledge
  - Heuristics- rules of thumb bases on years of experience
  - Common sense – innate ability to sense, judge, or perceive situations that grows stronger over time.
  - Experience-changing facts into knowledge to refine a reasoning process

- A distinguishing feature of human learning is that as people learn new facts, they integrate them in some way and use the resulting mix to generate value-added decisions, solutions, or advice.
- Humans learn by experience, by example, and by discovery. Learning by discovery is less understood than learning by example and by experience. Learning continues to be a major concern in knowledge management.
- Knowledge developers, whose job is to capture expert's knowledge, need to be well prepared and to have a clear understanding of the distinctions among knowledge, information, and data. They must focus on knowledge as it relates to the problem area.
- The relative importance of data, information, and knowledge is a function of the importance of the problem, the decision approach, the nature of the problem, and the number of person

affected. Whereas data plays a relatively trivial role in problem-solving, knowledge occupies a major role. The decision approach is advisory and relates to a difficult problem affecting many people in the organization.

- Expert knowledge is clustered, or "Chunked," in long-range memory. Chunking promotes expert performance, but can also make it difficult for experts to be aware of their own knowledge in a way that allows them to describe it to others.
- Humans have common-sense knowledge, a collection of personal experiences and facts acquired over time. The fact that common-sense reasoning is so strong in experts makes it difficult for knowledge developers to capture their deep knowledge.
- Knowledge can be classified by procedural, declarative, semantic, or episodic means.
  - Procedural knowledge is knowledge that is used over and over again.
  - Declarative knowledge is knowledge that the expert is aware or conscious of. It is shallow knowledge.
  - Semantic knowledge is chunked knowledge that resides in the expert's long-range memory.
  - Episodic knowledge is knowledge based on experiential information. Each episode is chunked in long-range memory.
- Common sense is inferences made from knowledge about the world. Reasoning is the process of applying knowledge to arrive at solutions. It works through the interaction of rules and data.
- Deductive reasoning deals with exact facts and conclusions. The idea behind deductive reasoning is to generate new knowledge from previously specified knowledge. In contrast, inductive reasoning is reasoning from a set of facts to general principles. Induction usually produces results without explanation.
- Knowledge has also been classified as tacit and explicit knowledge. Tacit knowledge, or "know-how," is stored in people's minds and is not so easy to capture or share. By contrast, explicit knowledge is codified and digitized in the form of records, reports, or documents and is reusable for decision making.
- Case-based reasoning is reasoning by analogy. Human expert's reason about a problem by recalling similar cases encountered in the past.

Terms to Know

Case: Knowledge at an operational level; episodic description of a problem and its associated solution.

Case-based reasoning: A methodology that records and documents previous cases and then searches the relevant case(s) to determine their usefulness in solving a current problem; problem-solving a case by analogy withhold ones.

Chunking: Grouping ideas or details that are stored and recalled together as a unit.

Common sense: Possessing common knowledge about the world and making obvious inferences from this knowledge.

Compilation: The way a human translates instructions into meaning language or response.

Decision support systems (DSS): Computer-based information systems that combine models and data for solving complex problems with extensive user involvement.

Declarative knowledge: Surface information that experts verbalize easily.

Deductive reasoning: Also called exact reasoning; takes know principles (exact facts) and applies them to instances to infer an exact conclusion.

Deep knowledge: Knowledge based on the fundamental structure, function, and behavior of objects.

Episodic knowledge: Knowledge based on experiential information chunked as an entity and retrieved from long-term memory on recall.

Experience: The factor that changes unrelated facts into expert knowledge.

Expert: A person whose knowledge and skills are based on years of specialized experience.

Expertise: The skill and knowledge possessed by some humans that result in performance that is far above the norm.

Explicit knowledge: Knowledge codified in documents, books, or other repositories.

Fact: A statement of a certain element of truth about a subject matter or a problem area.

Heuristic: A rule of thumb based on years of experience.

Inductive reasoning: Reasoning from a given set of facts or specific examples to general principles or rules.

Inferencing: Deriving a conclusion based on statements that only imply that conclusion.

Intelligence: The capacity to acquire and apply knowledge through the ability to think and reason.

Knowledge: Understanding, awareness, or familiarity acquired through education or experience.

Learning: Knowledge or skill acquired by instruction or study.

Learning by discovery: Acquiring new ideas by exploring a problem area with no advance knowledge of what is being sought.

Learning by example: Acquiring new ideas based on specially constructed examples or scenarios.

Learning by experience: Acquiring new ideas based on hundreds of previously stored concepts.

Logic: The scientific study of the process of reasoning and the set of rules and procedures used in the reasoning process.

Memory: The ability to store and retrieve relevant experience at will.

Premise: Provides the evidence from which the conclusion must necessarily follow; evaluates the trust of falsehood with some degree of certainty.

Procedural rule: A rule that describes a sequence of relations relative to the problem area.

Reasoning: The process of applying knowledge to arrive at solutions based on the interactions between rules and data.

Scenario: The formal description of how a problem situation operates.

Semantic knowledge: highly organized, "Chunked" knowledge that resides in the expert's long-term memory and represents concepts, facts, and relationships among facts.

Shallow knowledge: Readily recalled knowledge that resides in short-term memory.

Short-term memory: Readily recalled knowledge that resides in short-term memory.

Short term memory: The part of the human brain that retains information for a short period of time.

Tacit knowledge: Knowledge used to create explicit knowledge; the mind-set of individuals that includes intuitions, values, and beliefs that stem from experience.

Test Your Understanding

1. ***If intelligence is the capacity to acquire and apply knowledge, what is knowledge?***
   Knowledge is one's capacity to acquire and apply knowledge. Knowledge is familiarizing, understanding, or awareness acquired through experience. An intelligent person has the ability to think and reason.

2. Briefly explain the key attributes of intelligent behavior

The key attributes of intelligent behavior are:

a. Ability to understand and use language. Such language understanding is not so easy for the computer. Prior knowledge and common sense also enter the picture.
b. Memory or storing and retrieving relevant experience at will. How this is all done is unclear.
c. Learning is knowledge or skill acquired by instruction or study. We have yet to see some success in "machine learning." People learn from experience—not computers

2. Distinguish between:

a. fact and rule
b. knowledge and common sense
c. experience and heuristics
d. learning by example and learning by discovery

a. A fact is a statement that relates a certain element of truth about a subject matter or domain. A rule describes a sequence of relations relative to the domain or subject matter.
b. Knowledge is a person's range of information, embracing a wider sphere than information. Knowledge includes common sense, perception, and experience. Common sense is unreflective opinions of ordinary people. It comes to them naturally. Lack of it makes knowledge based systems brittle.
c. Experience is closely related to knowledge. We use experience to change facts into knowledge, which separates novices from experts. Experience is the factor that changes unrelated facts into expert knowledge. Heuristics is a rule of thumb based on experience. So, heuristics takes experience as the bases for rules of thumb.
d. Learning by example incorporates specially constructed examples rather than a broad range of experience. Much classroom learning is learning by exception. In contrast, learning by discovery is an undirected approach where humans or machines explore a domain with no advance knowledge of what their object is. It is difficult to teach and will be years before we can benefit from this approach.

3. Define episodic knowledge and semantic knowledge. Give an example of each.

Episodic knowledge is knowledge based on experiential information chunked as an entity and retrieved from long-term memory on recall. It is synonymous with deep knowledge. For example, a professor with years of consulting experience tends to teach by scenarios or by examples. Such a person doesn't have to think long about citing an episode to illustrate a point.

Semantic knowledge is highly organized, "chunked" knowledge that resides in the expert's long-term memory and represents concepts, facts, and relationships among facts. For example, a professor teaching networking would explain openly and clearly the network concepts, types of cables and their functions, how PCs are connected to a server, etc. These are all facts, relationships, and realities based on experience.

4. Illustrate by example the possible relationship between (a) knowledge and information and (b) knowledge and data.

a. Knowledge is understanding of information based on its perceived importance or relevance to a problem domain. It is a person's range of information. It includes perception, skills, training, common sense, and experience. It is the sum total of our perceptive processes that helps us draw meaningful conclusions. In contrast, information is an aggregation of data that makes decision making easier. It is reformatted or processed data. A step higher in abstraction than information is knowledge.
b. Compared to knowledge, data are unprocessed facts. However, the meaning one brings to the evaluation of data becomes information which, in turn, could add to one's knowledge

5. Why is knowledge compiled? Discuss its relationship to long-range memory

Knowledge is compiled in the expert's long-range memory as chunks. Knowledge compilation or chunking, enables experts to optimize their memory capacity and process information quickly. Chunking promotes expert performance. The more chunking a person does, the more efficient is his or her recall. So, as a person becomes an expert, more and more of the knowledge and experience is compressed in one's long-range memory. It is tantamount to storing files on the hard disk when not in use.

Knowledge Exercises

1. People do not think in the same way as machines, because they are biological." Do you agree? Explain

a. Humanlike behavior implies thinking. Since computers can only display such behavior, they are not thinking things
b. Humans are alive and reason with reality. Computers have neither attribute; therefore, they cannot think as such
c. Humans have consciousness. They look at options and are conscious of subtle constraints or the immediate environment before they choose to move one way or the other. Computers don't have such freedom, because they are not conscious of the possibilities. Therefore, they don't think.
d. Humans rely on commonsense knowledge or intuitively follow a path that lead to a solution or a decision. Computers do not have such intelligence. Therefore, they cannot think. For example:
A baseball player is ready to bat. As he waits, he looks at the pitcher's face, reviews his peers at the bases, and the layout of the other players in the field. Something tells him that the pitcher is going to pitch a ball that will force him to walk. Or he senses that the next pitch will be for real; so, he'd better bat. This assessment is done in a matter of seconds. Computers are nowhere close to this level of intelligent decision making. Therefore, they cannot think.

You're driving on a busy highway. There is a car in front of you traveling at the same speed. You look ahead and see a slow truck going up a hill. Something tells you that the car in front of you is going to pass the truck soon. You look at the icy conditions in the left lane and the last accident you had two weeks ago. Something tells you to pass after the front car does. Computers cannot be that intuitive. Therefore, they cannot think.

You enroll in professor Dr. A. Rashid Kausar's knowledge management course. You have already scanned the notes the night before. You listen to her review of the syllabus and course requirements. He has a reputation for being a good teacher, but tough when it comes to the final grade. Something about the tone of his voice and the way he's setting up the course tells you that you'd better enroll in a different elective. Computers are not that intuitive. Therefore, they cannot think.

2. What type of knowledge is used in each of these activities:

a. tying a shoelace
b. debugging a computer program
c. baking a pie
d. replacing a car's flat tire
e. negotiating peace with a hostile country
f. driving in congested traffic

Explain each classification

a. Typing a shoelace is automatic after a person performs the task a number of times. It is procedural knowledge, in that it involves an understanding of how to do a task or a procedure. It is essentially motor in nature
b. Debugging a computer program is pretty much semantic knowledge, depending on the programming language and the level of complexity of the program. Generally, in

programming, debugging knowledge is hierarchically organized knowledge of relationships among facts. It could also be episodic knowledge, in that looking at segments of the program, the programmer uses past experience with similar program segments to determine the likely solution to a bug or logical error. In this case, it is experiential information that is chunked by episodes

c. Baking a pie is procedural knowledge, if all there is to do is to measure the ingredients, and follow a procedure based on a recipe. If a pie is devised from memory and is baked using past experience with similar pies and constraints such as thickness, ingredients (number, consistency, texture, etc.), and the size of the pie, then it is episodic knowledge

d. Replacing a car's flat tire is procedural knowledge. It is knowledge of how to do a task that is essentially motor in nature. The same knowledge is used over and over again.

e. Negotiating peace with a hostile country is definitely episodic knowledge. Think of former Secretary of State Henry Kissinger's experience and knowledge in his shuttle diplomacy to negotiate the end of war in Vietnam and peace in the Middle East between Israel and Egypt.

f. Driving in congested traffic is declarative, semantic, or episodic knowledge, depending on the years of experience of the driver. A young, inexperienced driver driving during the rush hour in a large city would probably stick to one lane and stay in it all the way home. It is safe and prudent. The knowledge used is declarative, in that it is easily verbalized and is the building block toward semantic knowledge, which uses experience to hierarchically organize knowledge of facts, procedures, and relationships among facts for improved efficiency of navigating through congested traffic in the future. In contrast, a seasoned driver maneuvers around automobiles across different lanes, sizing up the traffic, the car(s) ahead, and behaving accordingly. This is referred to as episodic knowledge.

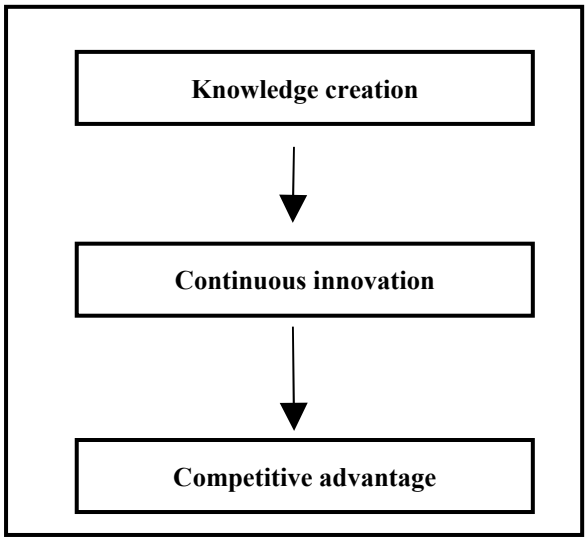
LESSON 13

DIMENSIONS OF HUMAN KNOWLEDGE, TREE OF KNOWLEDGE

Core Vs Innovative Knowledge

How do Japanese companies bring about continuous innovation? One way is to look outside and into the future, anticipating changes in the market, technology, competition, or product. Thus far the living in a world of uncertainty worked in favor of Japanese companies, since they were constantly forced to make their existing advantages obsolete. In fact, this trait – the willingness to abandon what has long been successful – is found in all successful companies, not only those in Japan. To these companies, change is an everyday event and a positive force. Contrast this mindset, which became preoccupied with defending their advantages and treated change with the fear that there was much to lose. They became insular, seeking predictability and stability.

Times of uncertainty often force companies to seek knowledge held by those outside the organization. Japanese companies have continually turned to their suppliers, customers, distributors, government agencies, and even competitors for any new insights or clues they may have to offer. Just as the proverbial "drowning man will catch at a straw." These companies accumulate knowledge from the outside almost in desperation during times of uncertainty. What is unique about the way Japanese companies bring about continuous innovation is the linkage between the outside is shared widely within the organization, stored as part of the company's knowledge base, and utilized by those engaged in developing new technologies and products. A conversion of some sort takes place; it is this conversion process – from outside to inside and back outside again in the form of new products, services, or systems – that is the key to understanding why Japanese companies have become successful. It is precisely this dual internal and external activity that fuels continuous innovation within Japanese companies. Continuous innovation, in turn, leads to competitive advantage, as shown below.



Japanese companies, however, have a very different understanding of knowledge. They recognize that the knowledge expressed in words and numbers represents only the tip of the iceberg. They view knowledge as being primarily "tacit" – something not easily visible and expressible. Tacit knowledge is highly personal and hard to formalize, making it difficult to communicate or to share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideals, values, or emotions he or she embraces.

To be more precise, tacit knowledge can be segmented into two dimensions. The first is the technical dimension, which encompasses the kind of informal and hard-to-down skills or crafts captured in the term "know-how." A master craftsman, for example, develops a wealth of expertise "at his fingertips"

after years of experience. But he is often unable to articulate the scientific or technical principles behind what he knows.

At the same time, tacit knowledge contains an important cognitive dimension. It consists of schemata, mental models, beliefs, and perceptions so ingrained that we take them for granted. The cognitive dimension of tacit knowledge reflects our image of reality (what is) and our vision for the future (what ought to be). Though they cannot be articulated very easily, these implicit models shape the way we perceive the world around us.

The distinction between explicit knowledge and tacit knowledge is the key to understanding the differences between the Western approach to knowledge and the Japanese approach to knowledge. Explicit knowledge can easily be "processed" by a computer, transmitted electronically, or stored I databases. But the subjective and intuitive nature of tacit knowledge makes it difficult to process or transmit the acquired knowledge in any systematic or logical manner. For tacit knowledge to be communicated and shared within the organization, it has to be converted into words or numbers that anyone can understand. It is precisely during the time this conversion takes place – from tacit to explicit, and, as we shall see, back again into tacit – that organizational knowledge is created.

Although Western managers have been more accustomed to dealing with explicit knowledge, the recognition of tacit knowledge and its importance has a number of crucially relevant implications. First, it gives rise to a whole different view of the organization – not as machine for processing information but as a living organism. Within this context, sharing an understanding of what the company stands for, where it is going, what kind of a world it wants to live in, and how to make that world a reality becomes much more crucial than processing objective information. Highly subjective insights, intuitions, and hunches are an integral part of knowledge. Knowledge also embraces ideals, values, and emotion as well as images and symbols. These soft and qualitative elements are crucial to an understanding of the Japanese view of knowledge.

The Japanese have come to realize that tacit knowledge cannot be easily communicated to others. Everyone in Japan would agree that Shigeo Nagashima, nicknamed "Mr. Baseball" in Japan, is one of the greatest baseball players of all time. Having had the opportunity of meeting him in person, we asked him why he was so successful in rising to the occasion and hitting so many game-winning runs in tight moments. He used a lot of figurative language and body movement, but couldn't explain exactly what he meant. His words were not very logical or systematic. In the end, Nagashima simply said, "You have to feel it."

In fact, the most powerful learning comes from direct experience. A child learns to eat, walk, and talk through trial and error; she or he learns with the body, not only with the mind.

Similarly, managers in Japan emphasize the importance of learning from direct experience as well as through trial and error. Like a child learning to eat, walk, and talk, they learn with their minds and bodies. This tradition of emphasizing the oneness of body and mind has been a unique feature of Japanese thinking since the establishment of Zen Buddhism. It stands in sharp contrast to the thinking behind the "learning organization," in phrase that has become a conceptual catch all of the new business organization. Peter Senge (1990), the apostle of the learning organization, utilizes "systems thinking" to shift the mind from seeing the parts to seeing the whole. Systems thinking, according to Senge, is a conceptual framework, a body of knowledge and tools that has been developed over the past 50 years in the West to help people see the full pattern more clearly. The focus of the learning organization is clearly on learning with the mind, not with the body. Senge goes a step further and says that trial-and-error learning is a delusion, since the most critical decisions made in an organization have system wide consequences stretching over years and decades, a time frame that makes learning from direct experience impossibility.

The second implication of tacit knowledge follows naturally from the first. Once the importance of tacit knowledge is realized, then on begins to think about innovation in a whole new way. It is not just about putting to ether diverse bits of data and information. It is a highly individual process of personal and organizational self-renewal. The personal commitment of the employees and their identity with the company and its mission become indispensable. In this respect, the creation of new knowledge is as much about ideals as it is about ideas. And that fact fuels innovation. The essence of innovation is to recreate the world according to a particular ideal or vision. To create new knowledge means quite

literally to re-create the company and everyone in it in an ongoing process of personal and organizational self renewal. It is not the responsibility of the selected few-a specialist in research and development, strategic planning, or marketing – but that of everyone in the organization.

Creating new knowledge is also not simply a matter of learning from others or acquiring knowledge from the outside. Knowledge has to be built on its own, frequently requiring intensive and laborious interaction among members of the organization. New-product development team members at Canon, for example, hold "camp sessions" at a local hotel over a weekend to brainstorm through a critical problem or issue. In this respect, the Japanese approach is at variance with the "best" and "benchmarking" practices carried out at companies like GE, AT&T, and Xerox that are bent on learning from others.

Two Dimensions of Knowledge Creation

Although much has been written about the importance of knowledge in management, little attention has been paid to how knowledge is created and how the knowledge-creation process is managed. In this section we will develop a framework in which traditional and nontraditional views of knowledge are integrated into the theory of organizational knowledge creation. Our basic framework of human knowledge contains two dimensions-epistemological and ontological

Let us start with the ontological dimension. In a strict sense, knowledge is created only by individuals. An organization cannot create knowledge without individuals. The organization supports creative individuals or provides contexts for them to create knowledge. Organizational knowledge creation, therefore, should be understood as a process that "organizationally" amplifies the knowledge created by individuals and crystallizes it as apart of the knowledge network of the organization. This process takes place within an expanding "community of interaction," which crosses intra- and inter-organizational levels and boundaries.

As for the epistemological dimension, we draw on Michael Polanyi's (1966) distinction between tacit knowledge and explicit knowledge. Tacit knowledge is personal, context-specific, and therefore hard to formalize and communicate. Explicit or "codified" knowledge, on the other hand, refers to knowledge that is transmittable in formal, systematic language Polanyi's argument on the importance of tacit knowledge in human cognition may correspond to the central argument of Gestalt psychology , which has asserted that perception is determined in terms of the way it is integrated into the overall pattern or Gestalt. However, while Gestalt psychology stresses that all images are intrinsically integrated, Polanyi contends that human beings acquire knowledge by actively creating and organizing their own experiences. Thus, knowledge that can be expressed in words and numbers represents only the tip of the iceberg of the entire body of knowledge. As Polanyi (1966) puts it, "We can know more than we can tell" .

In traditional epistemology, knowledge derives from the separation of the subject and the object of perception; human beings as the subject of perception acquire knowledge by analyzing external objects. In contrast, Polanyi contends that human beings create knowledge by involving themselves with objects, that is, through self-involvement and commitment, or what Polanyi called "indwelling." To know something is to create its image or pattern by tacitly integrating particulars. In order to understand the pattern as a meaningful whole, it is necessary to integrate one's body with the particulars. Thus indwelling breaks the traditional dichotomies between mind and body, reason 'and emotion, subject and object, and knower and known. Therefore, scientific objectivity is not a sole source of knowledge. Much of our knowledge is the fruit of our own purposeful endeavors in dealing with the world.

While Polanyi argues the contents of tacit knowledge further in a philosophical context, it is also possible to expand his idea in a more practical direction. Tacit knowledge includes cognitive and technical elements. The cognitive elements center on what Johnson-Laird (1983) calls "mental models," in which human beings create working models of the world by making and manipulating analogies in their minds. Mental models, such as schemata, paradigms, perspectives, beliefs, and, viewpoints, help individuals to perceive and define their world. On the other hand, the technical element of tacit knowledge includes concrete know-how, crafts, and skills. It is important to note here that the cognitive elements of tacit knowledge refer to an individual's images of reality and visions for the future, that is, "what is" and "what ought to be." As will be discussed later, the articulation of tacit mental models, in a kind of "mobilization" process, is a key factor in creating new knowledge.

Knowledge of experience tends to be tacit, physical, and subjective, while knowledge of rationality tends to be explicit, metaphysical, and objective. Tacit knowledge is created "here and now" in a specific, practical context and entails what Bateson (1973) referred to as "analog" quality. Sharing tacit knowledge between individuals through communication is an analog process that requires a kind of "simultaneous processing" of the complexities of issues shared by the individuals. On the other hand, explicit knowledge is about past events or objects "there and then" and is oriented toward a context-free theory. It is sequentially created by what Bateson calls "digital" activity.

Knowledge Conversion/Creation: Interaction Between Tacit and Explicit Knowledge

Westerners tend to emphasize explicit knowledge, the Japanese tend to stress tacit knowledge. In our view, however, tacit knowledge and explicit knowledge are not totally separate but mutually complementary entities. They interact with and interchange into each other in the creative activities of human beings. Our dynamic SECI model of knowledge creation is anchored to a critical assumption that human knowledge is created and expanded through social, interaction between tacit knowledge and explicit knowledge. We call this interaction "knowledge conversion." It should be noted that this conversion is a "social" process between individuals and not confined within an individual. According to the rationalist view, human cognition is a deductive process of individuals, but an individual is never isolated from social interaction when he or she perceives things. Thus, through this "social conversion" process, tacit and explicit knowledge expand in terms of both quality and quantity (Nonaka, 1990b).

LESSON 14

DIMENSIONS OF AND MULTIPLE VIEWS OF KM IN ORGANIZATIONS

Knowledge has become the preeminent economic resource-more important .than raw material; more important, often, than money, Considered as an economic output, Information and knowledge are more important than automobiles, oil, steel, or any of the products of the industrial Age.,

In today's Information Age economy, knowledge is increasingly regarded as the preeminent contributor to value creation across industrial and service landscapes. The collection of information has always been of interest and value .to companies. However, it is the emergence of tools that enable companies to manage and leverage their information and knowledge in meaningful ways that has engendered revolutionary change in the way knowledge is regarded. Unfortunately, the ability to manage and leverage knowledge has led to a proliferation of knowledge management approaches, measurement tools, initiatives, definitions, and procedures. This proliferation has created confusion and inhibits companies from reaching their desired destination.

Knowledge Management Overview

Companies in a wide variety of industries have launched knowledge management initiatives. According to leading practitioner in the field the potential impact of knowledge management on the national and global economy is immense. International Data Corporation {IDC) believes that the market impact of knowledge management will be analogous to that of the Internet. The firm makes the following primary points:

- Knowledge management will be a catalyst for many il1formationtechnology (IT) product and service markets.
- Knowledge management will allow companies to establish exclusive market niches.
- Knowledge management will be an integral enhancement for many existing offerings.

There is agreement on some of the principal difficulties associated with designing and implementing knowledge management practices:

- Culture change can be painful and exceptionally slow.
- Investment in necessary tools can be tenuous, incremental.
- Knowledge management is a high-level solution sell.
- A wall of confusion about knowledge measurement inhibits growth.

This last point is perhaps the most daunting. Most practitioners of knowledge management assessments have focused on qualitative issues; few have employed reliable measure merit tools or applied rigorous quantitative analysis to the clients' processes.

Regardless of the difficulties, companies are beginning to realize the extraordinary benefits that can be gained from the implementation of knowledge management pro- grams. For example, automakers Chrysler, Ford, and General Motors all have aggressive knowledge management initiatives under way. Petroleum and chemical companies Amoco, Dow, and Monsanto are implementing knowledge management practices. Companies as diverse as health care company Columbia/HCA Healthcare Corp. and clothing maker Fruit of the Loom, Ltd., have embraced the movement.

Knowledge management offers opportunities for companies to:

- Capture and analyze corporate information and apply it strategically in the form of data warehousing and data mining, decision support systems, and executive information systems.

- Create processes for worldwide access to information, enabling employees to make faster, more informed, and better decisions through intranets, groupware, and group decision support systems.
- Leverage the accumulated knowledge of past experiences across the company. .Develop and complete projects with improved speed, agility, and safety.

Knowledge Management And Value Creation

Companies making the investment in knowledge management can realize huge bottom line benefits. Those neglecting to do so can suffer tremendous costs in terms of lost revenues, customers, and markets. Consider the significant tangible benefits realized by the following companies:

- Chevron realized a $170 million annual savings by pooling and sharing knowledge that had been scattered and localized in various offices around the world. One team saved $.150 million by sharing ways to reduce the use of electric power and fuel. Another team saved $20mi.11ionbycomparingdata on gas compressors.
- Dow Chemical increased its annual.1icensing revenues by $100 million by strategically managing its patents arid licenses.

Knowledge Management Initiatives

External structure initiatives	Internal structure initiatives	Competency initiatives
Gain knowledge from customers	Build knowledge-sharing culture.	Create careers based on knowledge management
Offer customers additional knowledge	Create new revenues from existing knowledge Capture individuals' tacit knowledge, store it, spread it, and reuse it. Measure knowledge-creating processes and intangible assets.	Create microenvironments for tacit knowledge transfer.
Companies: Benetton, General Electric, National Bicycle, Netscape, Ritz Carlton, Agro Corp., Frito-lay, Dow Chemical, Skandia, Steelcase	Companies; 3M, Analog Devices, Boeing, Buckman Labs, Chaparral Steel, Ford Motor Co., Hewlett-Packard, Chevron, British Petroleum, Telia, Celemi, Skandia	Companies: Buckman Labs, IBM, Pfizer, Hewlett-Packard, Honda, Xerox, National Technological University, Matsushita

It is clear that knowledge management is emerging as the critical strategic activity. Unfortunately, it is also clear that a consolidated approach to interpreting, implementing, and applying knowledge management principles has yet to emerge. Knowledge management should be seen as a remedy for earlier attempts at "reengineering" rather than its latest version. Knowledge management's focus on identifying and maximizing knowledge value creation stands in sharp contrast to the "slash-and- burn" techniques associated with many reengineering strategies. Indeed, many of the reengineering efforts of companies have led to downsizing efforts that have actually cut huge swaths out of the knowledge base of these companies. Many are now struggling to repair the damage that resulted.

The State Of Knowledge Management

Research into knowledge management reveals interesting anecdotal evidence and varied literature on current methodologies, techniques, tools, and case studies.

- Numerous and conflicting definitions of knowledge management
- Wide diversity of implementation strategies with many companies in disparate industries engaged in knowledge management initiatives.
- No comprehensive understanding of the best techniques for designing and launching knowledge management initiatives.

- Very few detailed case studies of corporate experiences With knowledge management and know ledge gaps.
- Restricted access toinforn1ation on how companies have resolved specific problems; this is primarily available at industry conferences on knowledge management.
- Ad hoc and non-comprehensive discussion of the techniques for measuring the value of knowledge management
- Unclear links between knowledge asset utilization and financial results. General confusion about the difference between information retrieval and knowledge management.

Why is Knowledge Management Important?

Knowledge management is crucial because it points the way to comprehensive and clearly understandable management initiatives and procedures. When companies fail to utilize tangible assets, they suffer the economic consequences, and this failure is clearly observable to markets and competitors alike. Although knowledge assets are harder to quantify, they are just as critical for the long-term survival and growth of the company.

We believe that success in today's competitive marketplace depends on the quality of knowledge and knowledge processes those organizations apply to key business activities. For example, maximizing the efficiency of the supply chain depends on applying knowledge of diverse areas such as raw materials sources, planning, manufacturing, and distribution. Likewise, product development requires knowledge of consumer requirements, recent scientific developments and new technologies, and marketing.

Deployment of the knowledge assets to create competitive advantage becomes even more crucial as:

- The marketplace becomes increasingly competitive and the rate of innovation continues to rise; knowledge must evolve and be assimilated at an ever faster rate.
- Corporations (re)organizes business units to create customer value, and staff and management functions are redirected. As a result, there is a strong push to replace inforn1alstaffpolicies with formalized methods to align processes with customers.
- Competitive pressures reduce the size of the workforce that holds corporate knowledge. These pressures include increased employee mobility and early retirement, and they all lead to a loss of corporate knowledge.
- Employees have less and less unstructured time in which to acquire knowledge.
- Technologies increase complexity by allowing small operating companies to link with suppliers into transnational sourcing operations.

Restructuring often results in changes in strategic direction and in the loss of knowledge in specific functional areas. Subsequent reversals may create demand for the lost knowledge, but the essential employees with that knowledge maybe long gone. Effective knowledge management initiatives can help eliminate the need for drastic restructurings as they help companies evolve with the changing economic environment. They can also help capture knowledge assets that would otherwise be lost due to necessary restructurings, retirement, and departing employees. This in turn can result in increased revenues, increased customer satisfaction and loyalty, enhanced competitive standing, and the ability to respond easily to changing market conditions. In this sense, knowledge management is as critical for companies in the Information Age as the assembly line and production management were in the Industrial Age.

Practical Principles for Managing Knowledge

Theorists and practitioners alike are struggling to find a common set of principles to apply in successfully managing knowledge. Principles have been categorized according to how to create, collaborate, disseminate, reuse, embed, store, monitor, and measure knowledge to meet a variety of organizational goals. The principles have been derived from practice, theory, and various combinations of the two.

The following list is by no means exhaustive or generally agreed upon. However, the principles provide basic guidance for those attempting to develop new ways of managing knowledge assets. Customer

knowledge, deploying knowledge in information technology, and monitoring and measuring knowledge assets are the places where knowledge management principles can be practically applied.

Customer Knowledge

The first set of principles aims to lower transaction costs, increase the volume of transactions, and improve customer satisfac1ion. These outcomes are accomplished by embedding customer knowledge and fail-safeing the transaction process.
1. Identify the knowledge that customers really value and make sure it is deployed in products, services, and self-service opportunities.

Following this principle would lead the manager to ask how much knowledge a customer employs in completing a transaction with the company. For example, an "e-tailer" such as eToys has created a transaction process where the customer visits their web site and uses the company Web interface obtain a desired toy, seek suggestions, find out what others have purchased, or to review the company's toy inventory.

By visiting the company website, the customer becomes apart of the transaction process by activating the knowledge embedded ill company sales, order, provisioning, and production software.

The customer-activated knowledge costs the company next to nothing, as1ongas the site is well designed. Costs are incurred only if the site interface is so bad that customers make errors requiring human intervention in the form of call center support, rework with suppliers, system failures, or bad debt collection. A site with a robust technology plat form also allows a very large number of customers to complete transactions at the same time. The benefits of having customers activate transaction process knowledge, cost savings, and .virtually unlimited transaction capacity are possible only when the customer interlace prevents them from making errors and is so appealing to the customer that customers will return time and time again.

To prevent customer induced errors, company interfaces must facilitate customers' self-service without generating errors. One method is to use the notion of "e-Poke- Yoke." The concept of mistake-proofing or Poke- Yoke originated in Japanese manufacturing practice, and Dick Chase adapted the principles and practices for the service sector. "Mistake-proofing is a powerful and comprehensive method for eliminating mistakes and defects, ensuring quality products and services;"

Many e-tailer company interfaces are neither knowledge intensive nor customer enticing. They force the customer to use the same amount of knowledge required for a standard transaction with a brick-and-mortar retailer. However, superior interfaces that embed customer knowledge within the transaction process on a personalized basis can 1ead to faster and more satisfying transactions. Give the sad-state of sales and customer support at many traditional retailers, the e-tailers have an opportunity to provide superior service.

Applying the customer-knowledge-embedding principle requires interfaces that make maximum use of customer knowledge in completing the transaction process. Several points to consider in designing a superior customer interface include:

- The time an average customer is willing to spend activating transaction knowledge.
- The amount of knowledge a customer will employ before losing interest.
- How much value is added each time they execute knowledge.

The goal here is to find the optimal upper and lower limits within these constraints and develop an interface that:

- Reduces the time a customer needs to complete the transaction process.
- Reuses a customer's knowledge by embedding it in the transaction process.
- Ensures that valued .is added for the customer each time they execute knowledge in the transaction process.

Successful embedding of customer knowledge in more personalized interfaces will reduce the time required to complete the transaction process. The ongoing acquisition and embedding of customer knowledge will also create a "learning" interface1hatwill continually be personalized for each customer.

A further step ill providing customer value occurs when customers can compare their transaction behavior to that of others. These opportunities for social comparison meet customers' needs for reviewing their decisions, gaining support for their decisions, seeking advice, and maintaining inclusion in their perceived social groups.

The social comparison is facilitated by the use of collaborative filters, which com- pare user input with that of other users. For example, movie ratings and CD purchases can be tabulated to generate composite scores and recommend purchases of popular items: such decision-support capabilities built into company interfaces increases their perceived value for customers.

Personalized knowledge may be obtained from customers during their introductions to the interface by:

- Providing some type of financial incentives, such as lower prices or discounts.
- Using Web-based client-server technologies to track browser behavior.

The benefits of incorporating customer knowledge via the company interface are many:

- Customer perception of more control over the transaction process.
- Closer bonding with customers.
- Lower company transaction costs.
- Greater volume of transactions per time period.

Appealing interfaces empower customers to do as much self-service as possible. The key to success is building interfaces, electronic and human, that deploy as much knowledge as customers need and want, to make the transaction process satisfying.

2. Make sure the customer product description and company description are as close as possible.

Customers expect that products and services will match their descriptions. Know based descriptions can be used to ensure that they are delivered as specified. The knowledge required to produce the product or service can be used to ensure that customer providers have the same product description.

This is especially true for business-to-business transactions: Outsourcing decisions are common, and decisions are predicated on the belief that the outsourced service livered as specified.

Similarly, customers use lists of ingredients, fat content, and calories per serving, certifications, and so forth as guides for believing that they are getting a food product as specified. Brand names often serve as a surrogate for products and services that he customer's expectations and the knowledge required to make them.

Over time, customers have become more discerning and look for more than brand names. For example, products and services that are assumed to be of high quality customer expectations for performance over time. Given that it takes more edge to build a high-quality than a low-quality product or service, there should be a difference in the description of each. Companies can use this principle to guide their advertising, requirements for outsourcers, and production processes to ensure the knowledge required to produce a high-quality product/service has actually been applied.

Getting technology to do the work of humans has been the Holy Grail of the Information Age. Deciding what human work to move to information technology has been debated since the introduction of computers in the early 1950s. We believe the essence of the problem is deciding what human knowledge to deploy in information technology (IT). In general the more complex the knowledge is, the harder it is to deploy in IT.

Moving knowledge assets to IT offers a host of advantages if two basic principles are followed.

1. Move simple, procedural knowledge that is employed frequently to IT.

The focus of early automation efforts followed this principle as companies developed file-processing systems to do much of the tedious work in accounting, billing, and basic manufacturing. Since this knowledge is employed frequently and follows very specific, well-defined rules, moving it to IT allowed companies to dramatically lower the cost peruse of the know ledge.

IT systems have advanced over time, making it easier to embed procedural knowledge that is activated frequently. The latest attempt to follow this principle can be found in enterprise resource planning (ERP) software from companies such as SAP, People- Soft, Baan, JD Edwards, and Oracle. These systems have succeeded largely where they have stuck to this principle. They have fallen down where they have attempted1o tackle more complex knowledge or knowledge that is used infrequently. For example, attempts to use an ERP system at Hewlett-Packard Labs failed largely because the system attempted to embed engineering knowledge.8 Several studies on Nova Corporation and CBPO found that attempts to automate simple knowledge that was used infrequently resulted in costs that far exceeded those of leaving the knowledge inhuman operators' heads and hands.

2. Capture and embed knowledge in IT that is volatile and might be lost when employees leave the company.

When employees leave a company, they often take with them knowledge that is critical to continued smooth operations. It may not be possible to always capture complex are at the mercy of their technical employees whose heads contain the kind of complex knowledge necessary to build and grow a technical platform that will allow the company to rapidly expand.

In one case, .the business development executive of an Internet start-up company described his strategy for dealing with this issue as "a knowledge redundancy strategy: .two key1echnical employees for every key technical job." His company hired two employees for every area where critical technical knowledge was required, Given venture capitalists' demands for nearly immediate and continued growth, technical failure was not allowable. This is a rational approach because such complex knowledge is not ill ready supply in the employment marketplace and is nearly impossible to embed in IT. However, the management realized that its long-term sustainability depends on capturing and embedding critical technical knowledge in less volatile forms such as IT and is currently moving to do so.

The field of artificial intelligence supports this general principle and has spawned expert systems and neural networks. Many of the earliest commercial attempts to embed complex knowledge in IT systems were based on what would be lost when "experts" in well-defined areas retired or left the company. Neural networks use an inductive approach, learning from the patterns that evolve from the behaviors of quasi- animate objects such as electronic ant colonies.

Groupware systems have attempted to capture critical complex knowledge assets so that they can be indexed and reused by others in a company.. Many of the large consulting firms such as Arthur Andersen and Ernst & Young use groupware systems like Lotus Notes for just this purpose. Ernst &Young has a system named Ernie that allows clients to "ask Ernie" when they confront problems involving relatively complex consulting knowledge, be used for a variety of specific tasks. A variety of such agents embed knowledge used to meet specific goals and are reviewed in Chapter

As information technology advances allow for greater embedding o(complex human knowledge, they will provide a way to capture and reuse critical employee knowledge. However, until someone discovers the algorithm for creativity, it is unlikely that all employee knowledge will be amenable to embedding in IT.

Monitoring and Measuring Knowledge

The basic goal for monitoring knowledge is to determine; how well it is producing value in corporate processes. This requires following the use of knowledge throughout an Organization's core processes and its interactions with the marketplace. As an organization interacts with its customers and competitors, it can learn what works and doesn't work. It learns from its customers what products and services are valued because customers are willing to pay for them. It also learns that its competitors are not far behind. This learning must be transformed into actionable activities within core processes to develop and produce evermore appealing products and services. The rate at which this knowledge can

be transformed into corporate core process knowledge will determine how quickly value is created through the offering of new products and services.

1. Accelerate the learning-knowledge-value cycle through monitoring of the transformation process.

Self-organizing approach, which differs from Industrial Age command-and-control approaches Interfaces can be used to elicit direct comment from customers about company products and services. Running tallies of sales and customer comments can be mined to interpret responses from the marketplace. These activities usually support evolutionary developments. Research and development efforts to create "truly new" products and services require more complex analysis and synthesis of market responses to company offerings.

Transforming these learnings into core process knowledge must also be monitored. Fortunately, there is software available to monitor an enterprise and how well it transforms learnings into core process performance (see, for example, Enterprise Strategist and the monitoring-learning tool suite from Intelligent Systems Technology, Inc.). These software suites allow management to determine how much value new knowledge produces when embedded in core processes.

This knowledge monitoring principle requires corporate management to go beyond the traditional view of "build it and they will come." Management must accelerate the pace at which they embed critical marketplace learnings within their core processes. And, they must go a step further and determine what value the introduction of this new knowledge produces. If embedding does not produce good return on the new knowledge, then management has done a poor job of synthesizing learnings from .the marketplace or the marketplace has changed, making the new embedded knowledge less valuable."

Conducting acknowledge-gap assessment aids management in determining the gaps in know ledge necessary for current operations. The assessment can identify know ledge assets that will be required to produce future value. Combining the concepts of sense, monitor and respond with a knowledge-gap assessment will help management identify the most promising knowledge for embedding in core processes.

2. Identify existing and future knowledge gaps.

Monitoring the learning-knowledge-value cycle will reveal gaps "in current performance. Planning for future products and services will reveal gaps in knowledge required to produce these future products and services.

Corporations must draw on the "knowledge market place" to fill its current and future gaps. The first step is to identify these gaps in the corporate knowledge portfolio, and the knowledge-gap assessment is a powerful method for identifying the gaps.

- Begin with a definition or mapping of core processes interns of the knowledge required to conduct normal operations.
- Make a list of the knowledge potential not currently in use within the core processes.
- Make a list of the knowledge no longer necessary to successfully generate the outputs.
- List the kinds of knowledge the company will need in the future to meet its long-and short-term goals.
- Compare the current knowledge assets deployed in the processes and identify the gaps between this and the untapped knowledge potential currently available and future knowledge required to meet new market demands.

This simple gap analysis motivates managers to recognize the untapped intellectual capital residing in their employees as well as the contributions of existing information technology. The results provide a framework for developing the requirements for upgrades or rep1acements.

Enhancing, maintaining, and acquiring knowledge assets to fill knowledge gaps is one of management's most significant duties. The basic steps to follow in filling and maintaining knowledge assets are:

- List the methods to maintain the current level of knowledge assets deployed. .
- List the methods to remove the know ledge that is no longer needed.
- List the methods to narrow or remove the gaps in knowledge needed and knowledge assets currently available.
- List current strategies for knowledge maintenance and acquisition through hiring, training, outsourcing, information systems, and work rules.

Filling knowledge gaps and maintaining current valuable knowledge assets can involve the company's information systems, human resources, and strategy areas, as well as the specific core process owners affected. As with any portfolio decision, there are multiple interdependent outcomes. For example, embedding critical knowledge in IT in an upstream process may produce bottlenecks in downstream processes that have not been upgraded. These interdependencies can be examined with work-flow software before making final decisions requiring significant investment.

3. Identify the best practices for embedding knowledge in IT, people, and processes.

Best practices ill knowledge management have been benchmarked by the American Productivity and Quality Center and at Arthur Andersen and are available in various forms from both organizations.

4. Measure the value-added by knowledge to create an internal marketplace.

This principle can be followed best by creating a simple accounting system to monitor knowledge utilization. The knowledge accounting system should allow managers to establish a price and cost per unit of knowledge. The price and cost must be tied directly to companies' normal financial performance measures such as ROI, cash flow, and earnings per share. This principle provides management with feedback about how well they are managing the learning knowledge-value cycle. Providing price and cost per unit of knowledge will lead to new performance ratios such as

- Knowledge in use compared to knowledge in inventory.
- Total knowledge compared to amount reused.
- Knowledge in people compared to knowledge in IT.

Such measurement systems, when adopted by the accounting community, will lead to better protections for investors in companies with large market capitalization based on intangible assets contained in intellectual capital.

Questions For Review

1. Why is knowledge management expected to have such a significant impact on business? Do you agree or disagree with the book on this issue? Why?
2. What is missing from the knowledge management initiatives to make them successful in the Internet marketplace?
3. What are some of the general guidelines for developing a knowledge management strategy?
4. What is driving the need for such a strategy?
5. How should the relationship between customer and transaction knowledge guide the development of a knowledge management strategy?
6. What are some general principles for moving knowledge into information technology?
7. How can you justify moving the knowledge to information technology?
8. What are the benefits of monitoring and measuring knowledge usage?

STUDY: The Distance Learning Case

Taken together, public and private colleges and universities in the United States comprise a $200 billion industry where knowledge is for sale. Throughout the 20th century, these institutions had difficulty achieving economies of scale. The number of students served by an individual faculty member across school averaged 20-to-1 per class taught, a ratio enforced by size limitations of classrooms, faculty resistance to grading larger numbers of tests and papers, and the desire for smaller classes and individuation of learning on the part of students and parents.

To achieve competitive advantage, institutions pursued various strategies, including hiring famous faculty as an inducement for student enrollment, pouring resources into high-interest fields (e.g., computer science) and canceling low-interest programs (e.g., Latin), scheduling classes at times and places conducive to student life, farming-alumni resources more assiduously, and maximizing college name recognition and reputation through nationally ranked sports teams.

Due to the pervasive tenure system, most colleges and universities do not have the option of "right-sizing" by firing expensive senior faculty to hire inexpensive junior faculty, even though this alternative would yield extraordinary savings in institutional G per student educated. It has occurred 10 such schools that the only practical way to significantly increase the per student load of each faculty" member (and thereby increase system productivity) was to broad cast the image, voice, and learning materials of the instructor to a broader audience.

Enter distance learning. With the combined technologies of the Internet, e-mail, and video teleconferencing, educational institutions are able to enroll exponentially more students at home or at remote sites without increasing the number of faculty members employed or their salaries. Additional grading responsibilities involved in distance learning can be delegated to graduate teaching assistants working at not much above minimum wage. Famous and popular faculty members can be given large electronic audiences, thereby maximizing their influence on behalf of the institution. Less successful teachers could be confined to traditional face-to-face instruction, thereby minimizing their impact on the reputation and welfare of the institution.

This case asks you to extrapolate the implications of distance learning for the design and workings of colleges and universities of the *future.* As knowledge is managed in hew ways, dramatic changes may be in store for these institutions. In your speculations, consider the following;

- Physical requirements of the new "campus."
- Instructor qualifications, including preparation for distance learning.
- Viability of traditional "courses," "majors," and "degrees."
- Interactive versus "canned" instruction. (Would you prefer to learn from Professor X interactively or from Einstein via videotape?)
- The loss of un-measurable when the traditional face-to-face classroom is superseded electronically.
- Compensation and career paths for faculty. (Will research be of less importance as a faculty member more and more plays1he role of anchor person or mouthpiece in distance learning?)
- Links with or mergers with corporations. (Will/should corporate universities swallow up public and private institutions?)
- Is distance learning more appropriate for some subjects than others? For some types of students?

Attempt to draw together your speculations into a design for future knowledge management useful for present institutions of higher learning.

LESSON 15

HOW KM IMPACTS ORGANIZATIONS?

1. Briefly enumerate the ways in which KM can impact an organization.

Knowledge management can impact organizations in various ways and at several levels by way of people, processes, products and overall organizational performance. At all of these levels, Knowledge management affects organizations in two ways:

1. Knowledge management can help create knowledge, which can then contribute to improved performance of organizations along these four levels.
2. Knowledge management can directly cause improvements along these four levels.

Let us now briefly consider each of the levels discussed above:

Impact on People: KM can facilitate learning throughout the organization, which allows the organization to be constantly growing and changing in response to the market and the technology, and causes the employees to become more flexible, and enhances their job satisfaction.

Impact on Processes: Knowledge management also enables improvements in organizational processes such as marketing, manufacturing, accounting, engineering, public relations, etc. These impacts can be seen along three major dimensions: effectiveness, efficiency, and degree of innovation of the processes.

Impact on Products: Knowledge management also impacts the organization's products. These impacts can be seen in two respects: value-added products and knowledge-based products.

Impact on Organizational Performance: In addition to potentially impacting people, products, and processes, KM may also affect the overall performance of the organization, either directly or indirectly.

2. State the importance of KM with specific reference to its impact on employee adaptability and job satisfaction.

Knowledge management plays an important role in employee adaptability and job satisfaction. Let us see how:

On Employee Adaptability: Knowledge management process at an organization encourages its employees to continually learn from each other, and they are likely to possess the information and knowledge needed to adapt whenever organizational circumstances so require. When employees are aware of ongoing and potential future changes, they are less likely to be caught by surprise. Awareness of new ideas and involvement in free flowing discussions not only prepare them to respond to changes, but also make them more likely to accept change. Thus, KM tends to facilitate greater adaptability among employees.

On Job Satisfaction: Two benefits of KM that accrue directly to individual employees are (a) they are able to learn better than employees in firms that are lacking in KM, and (b) they are better prepared for change. These impacts cause the employees to feel better because of the knowledge acquisition and skill enhancement, and also enhance their market value relative to other organizations' employees. Knowledge management also provides employees with solutions to problems they face in case those same problems have been encountered earlier, and effectively addressed. This helps to keep employees motivated, for a successful employee would be highly motivated, while an employee facing problems in performing his job is likely to be demotivated. In conclusion, as a result of their increased knowledge, improved market value, and greater on-the-job performance, KM facilitates employees' job satisfaction.

3. Explain why poor KM reduces the effectiveness of organizational processes.

Effectiveness is performing the most suitable processes and making the best possible decisions. Poor KM can result in mistakes by the organization because they risk repeating past mistakes or not foreseeing otherwise obvious problems. Organizations lacking in KM find it difficult to maintain process effectiveness when faced with turnover of experienced and new employees. In contrast, a good knowledge management system can enable organizations to become more effective by helping them to select and perform the most appropriate processes. Effective KM enables the organization's members to collect information needed to monitor external events. This results in fewer surprises for the leaders of the organization, and consequently reduces the need to modify plans and settle for less effective approaches. Further, knowledge management enables organizations to quickly adapt their processes according to the current circumstances, thereby maintaining process effectiveness in changing times.

4. What three dimensions are relevant for examining the impact of KM on business processes?

Knowledge management is an important factor to the effectiveness of organizational processes such as marketing, manufacturing, accounting, engineering, public relations, etc.

The impact of KM can be seen along three major dimensions: effectiveness, efficiency, and degree of innovation of the processes. Effectiveness is performing the most suitable processes and making the best possible decisions. Efficiency is performing the processes quickly and in a low-cost fashion. Innovation is performing the processes in a creative and novel fashion that improves effectiveness and efficiency.

5. State reasons how KM helps improve process effectiveness, efficiency, and innovation.

Process Effectiveness: Poor KM can result in mistakes by the organization because they risk repeating past mistakes or not foreseeing otherwise obvious problems. Organizations lacking in KM find it difficult to maintain process effectiveness when faced with turnover of experienced and new employees. In contrast, a good knowledge management system can enable organizations to become more effective by helping them to select and perform the most appropriate processes. Effective KM enables the organization's members to collect information needed to monitor external events. This results in fewer surprises for the leaders of the organization, and consequently reduces the need to modify plans and settle for less effective approaches. Further, knowledge management enables organizations to quickly adapt their processes according to the current circumstances, thereby maintaining process effectiveness in changing times.

Process Efficiency: KM can also enable organizations to be more productive and efficient. The ability to effectively create and manage network-level knowledge sharing processes,results in productivity advantages enjoyed by the organization.

Process Innovation: Organizations increasingly rely on knowledge shared across individuals to produce innovative solutions to problems as well as to develop more innovative organizational processes. Knowledge management has been found to enable riskier brainstorming and thereby enhance process innovation.

6. Describe how KM can contribute to an organization's products.

Knowledge management can impact the organization's products in two respects: value-added products and knowledge-based products.

Impact on Value-Added Products: With the aid of KM processes, organizations can offer new products or improved products that provide a significant additional value as compared to earlier products. Further, value-added products also benefit from KM due to the effect the latter has on organizational process innovation.

Impact on Knowledge-Based Products: Knowledge-based products, such as in consulting or software development industries, can also benefit from knowledge management. Using KM,

consulting firms can quickly access and combine the best available knowledge and bid on proposals that would otherwise be too costly or too time consuming to put together. In such industries, KM is necessary for mere survival. However, knowledge-based products can also sometimes play an important role in traditional manufacturing firms. For example, in order to design an automated machine to spin yarn, the organization will have to observe an expert hand-spinner to learn how the process takes place in order to give the machine proper functionality.

7. How can we assess the direct impact of KM on organizational performance?

Knowledge management affects the overall performance of the organization. Knowledge management can impact overall organizational performance either directly or indirectly:

Direct impact on organizational performance occurs when knowledge is used to create innovative products that generate revenue and profit, or when the KM strategy is aligned with business strategy. Such a direct impact concerns revenues and/or costs, and can be explicitly linked to the organization's vision or strategy. Consequently, measuring direct impact is relatively straightforward. It can be observed in terms of improvements in return on investment.

Unlike indirect impacts on organizational performance, direct impacts can be associated with transactions and, therefore, are easily measured.

8. Describe the ways in which the indirect impacts of KM in an organization may be observed.

Indirect Impact on Organizational Performance - comes about through activities that are not directly linked to the organization's vision, strategy, revenues, or costs. Such effects occur--through the use of KM to demonstrate intellectual leadership within the industry, which, in turn, might enhance customer loyalty. Alternatively, it could occur through the use of knowledge to gain an advantageous negotiating position with respect to competitors or partner organizations. Indirect impact cannot be associated with transactions and, therefore, cannot be easily measured.

Further, a company's output is said to exhibit economy of scale if the average cost of production per unit decreases with increase in output. A company's output is said to exhibit economy of scope when the total cost of that same company producing two or more different products is less than the sum of the costs that would be incurred if each product was produced separately by a different company. Knowledge management can contribute to economies of scale and scope by improving the organization's ability to create and leverage knowledge related to products, customers, and managerial resources across businesses. Product designs, components, manufacturing processes, and expertise can be shared across businesses, thereby reducing development and manufacturing costs, accelerating new product development, and supporting quick response to new market opportunities. Economies of scope also result from the deployment of general marketing skills and sales forces across businesses.

Another indirect impact of KM is to provide a sustainable competitive advantage. Knowledge can enable the organization to develop and exploit other tangible and intangible resources better than the competitors can. Knowledge, especially context-specific tacit knowledge, tends to be unique and therefore difficult to imitate, and it cannot easily be purchased in a ready-to-use form. To obtain similar knowledge, the company's competitors have to engage in similar experiences, but this takes time. Therefore, competitors are limited in the extent to which they can accelerate their learning through greater investment.

9. Knowledge management is an invaluable tool to the oil and gas industry. Justify this statement with suitable examples.

Oil exploration often involves extrapolating from sketchy data and comparing exploration sites to known ones. This allows geoscientists to decide if enough reserves exist on a site to make developing it worthwhile.

For example, one site contained layers of oil-bearing sand that were less than an inch thick. To decide if thin sand beds could extend over a large enough area for the oil in them to be efficiently

pumped out, a Shell exploration team asked one of Shell's communities of practice, including geoscientists from several disciplines, for help. By comparing this site to others, the community helped in the team's analysis of where to drill more accurately, resulting in fewer expensive exploratory wells.

By investing in knowledge management and consulting the community of practice, the Shell team estimated that the discussions of such comparisons enabled them to drill and test three fewer wells a year, saving US$20M in drilling and an additional US$20M in testing costs for each well, i.e., an annual saving of US$120M. It is, however, possible that they might have reached the same conclusions on where to drill, but the leader estimated that the community could claim 25 percent of the savings and was 80 percent sure of this estimate. So the community may be argued to have saved 25 percent of 80 percent of US$120M, i.e., US$24M annually. Since it costs between US$300K and US$400K annually to run the community, this represented an annual return of 40 times the investment. This was not the only benefit, but it was sufficient to address the senior executives' need to know whether the community was worth the investment.

10. Describe the impact of internalization, externalization, socialization, and communities of practice on employee learning.

Knowledge management can help enhance the employees' learning and exposure to the latest knowledge in their fields. This can be accomplished in a variety of ways, including externalization and internalization, socialization, and communities of practice. Let us now look at each in detail.

Internalization – is the conversion of explicit knowledge into tacit knowledge. It works in conjunction with externalization to help individuals learn. If an employee in an accounting firm reads a book on well-established accounting practices, he can use this externalized knowledge to acquire tacit knowledge and improve his daily work.

Externalization – is the process of converting tacit knowledge into explicit forms. It works in conjunction with internalization to help individuals learn. Externalization could be demonstrated by means of a report made at the end of a project, indicating the procedures followed and the lessons learnt.

Socialization – also helps individuals acquire knowledge by means of joint activities, such as meetings, informal conversations, etc. By participating in these meetings or activities, individuals obtain both explicit and implicit knowledge.

Communities of Practice – are an extension of socialization. They are an organic and self-organized group of individuals who are dispersed geographically or organizationally but communicate regularly to discuss issues of mutual interest. They result in increased learning among all the participants.

Application Exercises

1. Identify the possible ways in which KM (or the lack thereof) in your organization (it could be your academic institution or your workplace) affects your learning and job satisfaction.

If we consider an academic institution, we can see the extent to which knowledge management affects the functioning of the institution as well as its faculty and students.

Knowledge management can impact organizations and organizational performance at several levels: people, processes, products, and the overall organizational performance. It is important to note that KM processes can impact organizations at these four levels in two main ways. First, KM can help create knowledge, which can then contribute to improved performance of organizations along these four dimensions. Second, KM can directly cause improvements along these four dimensions. We next apply this in the context to an educational institution:

People – The faculty and staff at the institution can facilitate their learning (from each other as well as from external sources) due to knowledge management techniques. This learning allows the institution to grow constantly and change in response to the market and the technology, which is

vital to its success. It also causes its employees to be more flexible, and enhances their job satisfaction.

Processes -- Knowledge management can improve the above interrelated aspects of organizational processes through several means, including better knowledge being imparted to individuals at the institution (through exchange and socialization), and the provision of workable solutions (through directions and routines) for students to solve the problems faced in their tasks.

Products – In the case of an academic institution, the impact of KM on its products are seen in two respects, value-added education, and knowledge-based education. The first refers to an improved system of education that provides a significant additional value as compared to the earlier system, prior to the implementation of KM. In the case of the latter, knowledge based education involves studying the expert (in this case the professor) and then learning from his teachings and techniques.

Organizational Performance -- KM also affects the overall performance of the institution, either directly or indirectly. An example of a direct impact is when a professor learns of a new effective teaching method, which he then shares with his colleagues so as to better educate all the students of the institution. An example of an indirect effect is the use of KM in the organization to demonstrate intellectual leadership within the industry, which, in turn, might enhance customer loyalty and raise the institution's ranking in the industry.

2. BP-Amoco (http://www.bpamoco.com) introduced *Connect* as their KM system. Over 12,000 staffs use *Connect* for sharing and disseminating their knowledge and expertise. Find information on *Connect* at BP-Amoco and compare the KM of BP-Amoco and that of Shell, which was discussed in the previous chapter of this book.

The BP-Amoco *Connect* system is a searchable intranet repository, which serves as internal Yellow Pages for finding BP experts. Employees present themselves on their personal Web page, displaying their professional skills, relevant experiences, interests, and other personal background. The site contains items like name, job title, team business unit, structures taxonomy of 'areas of expertise, languages spoken, internal and external contacts, favorite web links, uploaded photographs, resume, audio clip, network memberships, and contact information. Employees also have a free text area and the listed categories of expertise are ever evolving.

Connect was started up with a pilot of 500 upstream technology staff. During its initial phase, the design was kept open enough to easily encompass the entire organizations. After this pilot, focus groups were held to enhance the interface. The number of users grew rapidly to 10,000 employees in the first year. An awareness campaign was set up, mounted by a group of heavy users. Already in the first year (1998) about 10,000 staff used *Connect* as their key to the vast knowledge repository of BP-Amoco. After four years the number of users is 32,000 (May 2002), one- third of the whole company.

The basic philosophy behind this method is that the best medium for knowledge is the human brain and the best networking protocol is conversation. Therefore the emphasis should lie on creating the connection and building the relationship. On content and structure of the repository, a balance needs to be found between anarchy and structure.

Some general lessons on knowledge management at BP-Amoco are:

1. The difficult thing of KM is that you can't manage knowledge. The ideal outcome is that employees manage knowledge themselves as part of their daily business without thinking of it as an extra task.

2. Knowledge management is more about connecting to those who know the recipe than capturing an encyclopaedia of knowledge.

3. If departments are set to compete with one another, free knowledge exchange will not take place.

4. A common response to knowledge management initiatives is: "We don't have the time right

now on top of everything else we have to do." Then the response should be: "What if we told you someone else has already done the very task you are about to do. We just need to find out who and what they learned."

5. Essential to KM is a good communicator, a central person and also a person in each team who has bought in to the process. Best is someone who talks a lot. He or she has to get out there, find information, and feed it back again.

3. Dow Chemical (http://www.dow.com) introduced Intellectual Asset Management Model (IAM) for managing its intellectual assets. It involves six phases: strategy; competitive assessment; classification; valuation; investment; and portfolio of its managing intellectual assets. Compared to Ford's best practice replication process system, what are the similarity and difference of IAM in terms of impact on employee, business process, and organizational performance?

The Dow Chemical Intellectual Asset Management Model involves six phases: strategy; competitive assessment; classification; valuation; investment; and portfolio. Considering that the company already had patents that were underutilized, the group initially started with the portfolio phase. It required them to identify each patent, determine whether it was still active, and find a business that would take financial responsibility for it.

Next came the classification phase. Each business classified its patents in three categories — stating whether the business is "using," "will use," or " will not use" the patent. The businesses further stated other designations such as whether the patents were to be licensed or abandoned.

In the strategy phase, the group focused on integrating the patent portfolio with business objectives in order to maximize its value. It also identified gaps in the portfolio that needed to be addressed. This phase is connected to the valuation and competitive assessment phases.

In the valuation phase, value was placed on the asset for licensing, opportunity prioritization, or tax purposes. Dow has also developed a comprehensive intellectual property/asset valuation tool known as the "Tech Factor Method." The Tech Factor, which relies on several industry-accepted methodologies, facilitates a quick and inexpensive financial valuation of intangible assets within a particular business unit. It enables Dow to value the monetary contribution of each property or asset as a percentage of the business enterprise's total net present value.

In the competitive assessment phase, the knowledge, capabilities and intellectual assets of competitors are determined. The company accomplishes this using what it calls a "patent tree" — a map of opportunities that incorporates the patents of both Dow and its competitors. The 15-year-old tool evaluates such factors as dominance, breadth of coverage, and opportunity openings.

Finally, the group entered the investment phase: Judging whether to put more money in R&D, enter a joint venture, or license a technology from outside in order to meet business objectives — basing the decision on a prior assessment of the company's knowledge gaps. If the company successfully obtains a needed technology or secures an appropriate patent, the intellectual asset is incorporated into the portfolio and the process repeats itself.

In contrast, Ford's best practice replication process is a tool to collect, share, and track the value of replicating better ways of doing business across the enterprise. Started in 1995, the process has identified over $1.3 billion in projected value at Ford across twenty-five collaborative communities of practice.

This proprietary technology is a worldwide KM process, driven by the Ford Motor Company operation groups, and focused on three major principles of Knowledge Management: collecting knowledge, in this case gathering; valuable proven practices; communicating knowledge about the practices to communities of practice/networks; and leveraging knowledge by actively managing the process.

The best practice replication system at Ford Motor Company's vehicle operations division was reported to have saved the company $34 million in one year.

Each week, the 37 plants receive through the intranet between five and eight best practices that apply only to the division. Each plant manager appoints production engineers as 'focal points' responsible for best practice, who retrieve information passed to them and enter their own plant's best practice into the system.

4. **You are a CEO who considers implementing KM system to your company. You have to decide one option out of two: 1) our KM system can be accessed by customers; 2) our KM system cannot be accessed by customers. Describe your decision and provide the reason in terms of organizational performance.**

As a CEO considering implementation of a KM system for the company, based on the nature of the company and its business, I would more than likely choose to have the KM system accessible to customers. Often customers can point out information, which employees would not have normally considered. A good example of this is the Microsoft *Knowledge Base*. If the knowledge base was not available to the public, the technical support teams at Microsoft would more than likely be inundated with calls for answers that could easily be looked up on a Website. However the nature of the specific business orgaization would have to be considered as well.

LESSON 16

THREE SCHOOLS OF THOUGHT AND APPROACHES TO KM. ECONOMIC SCHOOL AND KVA

Approaches to KM:

Introduction

There is a growing recognition in the business community about the importance of knowledge as a critical resource for organizations. Traditionally, this resource has not been treated with the degree of systematic, deliberate, or explicit effort devoted to managing human, material, and financial resources. But in the coming years, the firm that leaves knowledge to its own devices may be putting itself in sever jeopardy. More and more practitioners and researchers believe that knowledge resources matter more than the conventionally tended resources (material, labor, capital) and must be managed explicitly, not left to fend for itself.

Knowledge management can be defined as a method to simplify and improve the process of sharing, distributing, creating, capturing and understanding knowledge in a company. Knowledge management is description, organization, sharing and development of knowledge in a firm. Knowledge management is managing knowledge-intensive activities in a company. Knowledge management refers to identifying and leveraging the collective knowledge in a company to help the company compete. Knowledge management is a method for achieving corporate goals, by collecting, creating and synthesizing and sharing information, insights, reflections, thoughts and experience. Knowledge management is a discipline focused on systematic and innovative methods, practices, and tools for managing the generation, acquisition, exchange, protection, distribution, and utilization of knowledge, intellectual capital and intangible assets.

The purpose of knowledge management is to help companies create, share and use knowledge more effectively. Effective knowledge management causes fewer errors, less work, more independence in time and space for knowledge workers, fewer questions, and better decisions, less reinventing of wheels, improved customer relations, improved service and improved profitability. Knowledge management is purported to increase both innovation and responsiveness. The recent interest in organizational knowledge has prompted the issue of managing knowledge to the organization's benefit.

Earl (2001) developed taxonomy for knowledge management that he labeled schools of knowledge management. Each school was proposed as an ideal type. No claims were made that any new school outperforms others. Each represents a particular orientation r perspective. The schools are not mutually exclusive.

Earl's (2001) taxonomy is applied to classify a number of approaches to knowledge management. This classification of approaches is based on an overall match to each ideal type in terms of school of knowledge management. Three relevant schools are labeled the economic school, the organizational school and the strategic school. The economic school has a focus of income, in which the aim is to exploit knowledge assets. The organizational school has a focus of networks, in which the aim is knowledge pooling. The strategic school has a focus of competitive advantage, in which the aim is to identify, exploit and explore knowledge capabilities.

The Economic School

According to Earl (2001), the economics school is explicitly concerned with both protecting and exploiting a firm's knowledge or intellectual assets to produce revenue streams (or rent). It is concerned with managing knowledge as an asset, in which knowledge or intellectual assets include patents, trademarks, copyrights and know-how. Intellectual property could be another means of describing the object being managed. This school is more concerned with exploitation of knowledge and less concerned with exploration. One critical success factor in this school appears to be the development of a specialist team or function to aggressively manage knowledge property through intellectual capital

accounting, intellectual capital management and creation of effective and efficient knowledge marketplace. Otherwise it is too easily forgotten.

Intellectual Capital Accounting

According to Roslender and Fincham (2001). Intellectual capital is currently the focus of significant discussion and enquiry across the management disciplines and beyond. This reflects the recognition that intellectual capital provides a crucial source of value for the contemporary business enterprise. It is a source that requires careful management if it is to fulfill its maximum potential.

In the case of those businesses whose shares are publicly quoted, the success with which organizations manage their intellectual capital is increasingly mirrored in their market values, values that are often many times the book values of enterprises. Bridging the gap between these two values provides one motivation for seeking to account for intellectual capital.

Another motivation for seeking to account for intellectual capital is the need to manage intellectual capital successfully. Given the importance of managing intellectual capital successfully, accounting is being challenged to develop new approaches to performance measurement that capture the quality of management evident in the context of intellectual capital.

Stewart (1997) has suggested several tools for measuring intellectual capital. Value is defined by the buyer, not the seller. A company, therefore, is worth what the stock market says: price per share x total number of shares outstanding = market value; what the company as a whole is worth. One measure of intellectual capital is the difference between its market value and its book equity. The assumptions is that everything left in the market value after accounting for the fixed assets must be intangible assets. If Microsoft is worth 100 billion dollars, and its book value is 10 billion dollars, then its intellectual capital is 90 billion dollars.

Three components of intellectual capital can be identified. Human capital is the first component, consisting of the know-how, capabilities, skills and expertise of human members of an organization. Relational capital is the second component, consisting of any connection that people outside the organization have with it, together with customer loyalty, market share, the level of backorders, and so forth. Structural capital embraces the remaining component of intellectual capital, including both systems and networks, and cultures and values, together with elements of intellectual property such as patents, copyrights, trademarks, and so forth.

To begin intellectual capital accounting necessitates an acceptance that it is possible to include within the same financial statement objective measures of value, as in the case of tangible assets for which there are historical expenditures. Intangible assets such as goodwill are already problematic in accounting. For example, in the UK, only purchased goodwill can be reported in the accounts of the business that acquires it.

If goodwill continues to prove problematic for financial accounting and reporting, intellectual capital as the new goodwill serves to multiply the difficulties involved. Intellectual capital assumes many more forms than does goodwill, and while both concepts are ultimately open-ended, several years of thinking about intellectual capital have confirmed its greater breadth and depth. One consequence of this, according to Roslender and Fincham (2001), is that we might now think in terms of degrees of intangibility, so that while brands, patents and know-how still count as intangible assets, customer data, distribution channels and employee qualification profiles are more intangible. Off the scale are such assets as employee commitment, organizational culture and corporate values, yet it is just such assets that ensure that some businesses exhibit impressive market-to-book value rations.

The market-to-book value ratio is sometimes used to indicate the value of intellectual capital in an organization. Three decades ago, the market-to-book value ratio was close to one in most businesses. Today, this ratio has grown to four on average. Microsoft is an extreme example. The book value of the company was 11 billion dollars in 1997, while the market value was 200 billion. This give a market-to-book value ration of 20. Afuah and Tucci (2003) argue that this ratio is caused by intellectual capital.

A number of approaches to valuing knowledge assets exist. Reliable approaches require a common language to discuss the underlying value of an organization's knowledge assets. The knowledge-value-

added methodology seems to conform to this reinforcement as one of the more robust approaches. The knowledge-value-added (KVA) methodology as described by Housel and Bell (2001) addresses a need long recognized by executives and managers by showing how to leverage and measure the knowledge resident I employees, information technology, and core processes. KVA analysis produces a return-on-knowledge (ROK) ratio to estimate the value added by given knowledge assets, regardless of where they are located.

The essence of KVA is that knowledge utilized incorporate core processes is translated into numerical form. This translation allows allocation of revenue in proportion to the value added by the knowledge as well as the cost to use that knowledge.

Balance Including Intellectual Capital in a Business Organization (this example developed by Egil Sandvik using Invisible Balance Sheet in Sveiby's toolkit: www.sveiby.com)

Balance Sheet					
Tangible assets	25,000,000				
Human capital	20,000,000		Material values	15,000,000	
Relational capital	25,000,000		Immaterial values		75,000,000
Structural capital	30,000,000		Debt		10,000,000
Assets	100,000,000		Liabilities		100,000,000

Tracking the conversion of knowledge into value while measuring its bottom-line impacts enables managers to increase the productivity of these critical assets. Housel and Bell (2001) present the following example.

The example begins with an average person who needs to learn how to produce all the outputs of a given company. In a very real sense, then, her adding processes including selling, marketing, producing, accounting for, financing, servicing, and maintaining. It is these core processes that add value while converting inputs into outputs that generate the company's revenue.

Knowledge Value Added (KVA):

KVA provides a methodology for allocating revenue and cost to a company's core processes based on the amount of change each produces. Significantly, the knowledge required to make these changes is a convenient way to describe the conversion process.

We define knowledge in a particular way here: It is the know-how required to produce process outputs. This kind of knowledge is proportionate to the time it takes to learn it. Learning time has been found to be a quick and convenient way to measure the amount of knowledge contained in any given process. This understanding can be put to test with the example. In a widget company, there is one person, the owner, who makes and sells widgets. This person knows all there is to know in order to make and sell widgets for $1. The owner's sales production knowledge can be used as a surrogate for the dollar of revenue generated by the owner's application of the core process knowledge. And we can determine how long it would take the widget company owner to transfer all the necessary sales and production knowledge to a new owner. Further, we can use these learning times to allocate to dollar of revenue between the sales and production processes.

In Housel and Bell's (2001) example, it is assumed that it takes 100 hours for the new owner to learn the processes, with 70 hours spent learning how to make the widget and 30 hours learning how to sell it. This would indicate that 70 percent of the knowledge and value added was contained in the production process and 30 percent in the sales process. It would follow that #0.70 of the revenue would be allocated to production knowledge and $0.30 to sales knowledge.

All that would be left to do in this example would be to determine how much it costs to use the sales and production knowledge, and then we would have a ratio of knowledge value added to knowledge utilization cost. In other words, we can measure return on knowledge (ROK). For the sake of argument, it is assumed that the total cost to sell and produce a widget was $0.50 : $0.25 for sales and $0.25 for production. The basic approach here is to find out how much it costs to use the sales and production knowledge. In this case the cost is directly tied to how long the new owner spends performing each

process. As it turns out, in this case, the new owner spends the same amount of time to do both and, therefore, the cost to use the knowledge of each process is the same.

Based on our estimates for distribution of revenue and cost, we would generate an estimate of ROK. We would conclude that the production process is a more productive use of the knowledge asset (ROK = 0.70/0.25 = 280%) than the sales process (ROK = 0.30/0.25 = 120%).

LESSON 17

ECONOMIC SCHOOL: MANAGEMENT AND KNOWLEDGE METRICS

Management and Knowledge Metrics: Transforming Knowledge into Value

To remain competitive, an organization's core processes must produce a bottom-line profitability that will attract investors, maintain the organization's market capitalization, and enhance corporate value production while ensuring that customers get the value they want in the products and services they receive.

Managers must constantly analyze and design processes that meet these requirements. In organizations whose growth and viability increasingly depend on rigorous, deployment of knowledge assets, management needs measures that quantify the performance of core process knowledge assets and tie them directly to the bottom line. Currently, management design options are based on heuristics, "rules-of-thumb" that provide semi-empirical support for their creative strategies. However, these heuristics cannot produce modifiable insights as to whether actual or proposed changes to core processes have had or will have the desired impact on the firm's bottom line.

The use of creative knowledge represents a special case for knowledge measurement. Creative knowledge is by definition not modifiable. Trying to manage and measure this type of knowledge is problematic. For example, the- value of the creative knowledge used in the research and development area of a company can only be determined after the outputs of this knowledge have been translated into core processes that produce final products. Knowledge metrics become useful for managers of creative knowledge because, using knowledge metrics, they can track the speed with which this kind of knowledge results in changes in core processes and the amount of new or changed "modifiable" knowledge in core processes. In this manner, knowledge metrics also will reveal the embedding of such creative know ledge in the company's other core processes. This provides a means to identify, quantify, and help manage the transformation of knowledge into value.

Additional Valuation Methodologies Vis-À-Vis Knowledge Metrics

It is critical for the successful and widespread use of knowledge metrics that they be interoperable with traditional accounting and finance valuation approaches whenever possible. Just as the theory of relativity drove physics into the next millennium, so knowledge metrics will be the driver of accounting and finance .valuation methodologies.

Cost, Income, Market, And Real Options Approaches

The cost, income, and market approaches are the three fundamental approaches used by the business valuation profession to value specified ownership interests in privately held companies. The real options approach was developed to value stock options but also can be applied to the problem of valuing intangible assets. A review of these approaches will prove useful ill framing a discussion of the general principles and practices of valuing assets, including intangibles such as knowledge.

The cost approach is based on the concept that a company is worth the market value of all its assets minus the market value of all its .liabilities. For this reason, not only each balance sheet asset/liability bur also each off -balance-sheet asset/liability (tangible and intangible) is identified, valued, and included on .the balance sheet. Bringing the historical cost of each and every asset and liability to its current market value is time-consuming and difficult and may involve the use of additional experts to value specific categories of assets (i.e., real estate of machinery and equipment).

Variations of the cost approach are generally used to value holding and investment companies and asset-intensive companies such as those in natural resources and utilities. Asset-based methods are also reliable in early-stage companies where book values can be used as a reasonable proxy for fair market value, A particular form of the cost approach, the excess earnings approach, is regularly used to value professional practices and service companies.

The income approach is based on the concept that a company is worth the present value of its future earning power. Future economic income is projected *out* from the valuation date using historical trends' and management's, professional judgment as to the future growth of the company. If the recent history of the company's cash flows is stable and its future growth is incremental and sustainable, a single projection will be made into perpetuity. If the recent history of the company's cash flows has peaks and valleys and/or its future will involve high or uneven rates of growth, projections will be made for each year of five years (one business cycle), and then a single projection will be made from the fifth year our into perpetuity. Either way, the projected cash flows will be converted back to present value using a total rate of return on investment that is comparable to the rate of return available in the market on investments *of* similar risk and other characteristics. The resulting estimate of value is adjusted for whether a controlling or minority ownership interest is being valued and for the marketability or lack of marketability of that ownership interest. The income approach is generally used to value operating companies and/or specific projects that are being proposed by management within an operating company.

The market approach is based on the concept that the value of a privately held company can be reasonably estimated by examining, adjust in, and using the market multiples (such as the price/earnings ratios) of "guideline" publicly held companies that bear enough similarity to the "subject" privately held company to make their multiples relevant.

First, the fundamental financial variables both the subject company and its guide-line companies are adjusted to make them more comparable to each other and enable the valuation professional to better assess their relative strengths and weaknesses. Financial ratios for the subject and guideline companies are calculated and compared. One or several guideline company market multiples are selected and adjusted to reflect the relative growth prospects and risks (strengths and weaknesses) of the subject company. Finally, these adjusted multiples are weighted by degree of importance and applied to the fundamental financial variable of the subject company. The resulting estimate of value is adjusted for whether a controlling or minority ownership interest is being valued and for the marketability of lack oft marketability of that ownership interest. Variations of the market approach are used in conjunction with the cost and/or income approaches for valuing all kinds of companies.

The real options approach has grown out of options theory. The value of an option increases as the variability in the value of the underlying asset (cash flow per unit) increases. There are six key parameters that affective value of a real option: the market value of the asset, the exercise price of the option, the time remaining until the option matures, the volatility of the underlying asset, the risk-free rate of the asset, and the amount of dividends paid by the underlying risky asset. This measure not only values a project's immediate return but allows inclusion of the potential value generated in multiple investment outcomes. The real options approach is a basic capital budgeting technique that focuses on measuring the value of an individual project, in conditions of uncertainly, before the project begins.

The real options approach is not used to value specified ownership interests in privately held companies but to value internal and external investment opportunities for an individual company, public or private. As such, it is a strategic business valuation tool. It is widely used by the Internet venture capital community for determining the potential future value of companies with no economic history. It also has been applied to the valuation of patents and licenses.

LESSON 18

MEASURES OF INTELLECTUAL CAPITAL

Measuring Return on Knowledge

We have provided a broad brush-stroke review of some of the most promising approaches to valuing knowledge assets as well as the more traditional approaches to valuing company assets. As we noted in the last chapter, reliable approaches require a common language to discuss the underlying value of an organization's knowledge assets. The knowledge-value-added methodology conforms to this reinforcement and is one of the most robust approaches. Really understanding how the methodology works requires a fairly complete review. Going into more detail here will provide an opportunity to work through some of the more practical issues involved in actually trying to measure knowledge at a granular level. Ultimately, it will be at the granular level that new knowledge measures will provide new raw data for Information Age financial and accounting professionals. Investors, managers, and even customers can rely on such professionals for basic analysis and insight upon which to base their decisions.

Knowledge-Value-Added Methodology

The knowledge-value-added (KVA) methodology addresses a need long recognized by executives and managers by showing how to leverage and measure the knowledge resident in employees, information technology, and core processes. KVA analysis produces a return-on-knowledge (ROK) ratio to estimate the value added by given knowledge assets regardless of where they are located.

The essence of KVA is that knowledge utilized in corporate core processes is translated into numerical form. This translation allows allocation of revenue in proportion to the value added by the knowledge as well as the cost to use that knowledge. Tracking the conversion of knowledge into value while measuring its bottom-line impacts enables managers to increase the productivity of these critical assets. KVA, though based on sophisticated concepts from thermodynamics, is relatively straightforward to apply.

KVA Example

Let's begin with an "average" person who needs to learn how to produce all the outputs of a given company. In a very real sense, then, her knowledge of the company would be the embodiment of the company's value-adding processes including selling, marketing, producing, accounting for, financing, servicing, and maintaining. It is these core processes that add value while converting inputs into outputs that generate the company's revenue.

KVA provides a methodology for allocating revenue and cost to a company's core processes based n the amount of change each produces. Significantly, the knowledge required to make these changes is a convenient way to describe the conversion process.

We define knowledge in a particularly way here: It is the know-how required to produce process outputs. This kind of knowledge is proportionate to the time it takes to learn it. We have found learning time to be a quick and convenient way to measure the amount of knowledge contained in any given process. We can put this understanding to the test with a simple example. In the widget company, there is one person, the owner, who makes and sells widgets. This person knows all there is one person, the owner, who makes and sells widgets. This person knows all there is to know in order to make and sell widgets for $1. The owner's sales-production knowledge can be used as a surrogate for the dollar of revenue generated by his application of the core process knowledge. And we can determine how long it would take the widget company owner to transfer all the necessary sales and production knowledge to a new owner. Further, we can use these learning times to allocate the dollar of revenue between the sales and production processes.

For simplicity's make, let's assume that it takes 100 hours for the new owner to learn the processes, with 70 hours spent learning how to make the widget and 30 hours learning how to sell it. This would indicate that 70 percent of the knowledge and value added was contained in the production process and 30 percent of the knowledge and value added was contained in the production process and 30 percent in the sales process. It would follow that $0.70 of the revenue would be allocated to production knowledge and $0.30 to sales knowledge.

All that would be left to do in this example would be to determine how much it costs to use the sales and production knowledge and then we would have a ration of knowledge value added to knowledge utilization cost. In other words, we can measure return on knowledge (ROK). For the sake of argument, let's assume that the total cost to sell and produce a widget was $0.50: $0.25 for sales and $0.25 for production. The basic approach here is to find out how much it costs to use the sales and production knowledge. In this case, the cost is directly tied to how long the new owner spends performing each process. As it turns out, in this case, the new owner spends the same amount of time to do both and, therefore, the cost to use the knowledge of each process is the same.

Based on our estimates for the distribution of revenue and cost, we would generate an estimate of the ROK. We would conclude that the production process is a more productive use of the knowledge asset (TOK = 0.70/.25 = 280 percent) than the sales process (ROK = 0.3/0.25 = 120 percent).

The KVA methodology can be applied at any level in a company. We can conduct rough-cut estimates of the relative return on knowledge of a company's core processes and information technology using the same general approach. Let's say that we want to conduct a quick-and-dirty KVA of the SBC Corporation. We could gather together executives representing the core processes, including sales-order provisioning, a marketing, network provisioning, maintenance, and so forth. Each would estimate how long it takes the average person to learn how to produce the outputs of the core areas. For reasons explained below, we'll add one boundary condition: We only have a total of 100 months for average person to learn everything necessary to generate the annual revenue at SBC. It is normal in such cases to lump support and administrative processes together in one large category or to ignore such processes, depending on the goals of the KVA and for the sake of convenience.

We would not ask the executives to make estimates of the value of their core processes, since discussion could degenerate into a no-win dogfight. Rather, they would be asked to achieve consensus estimates of approximately what portion of the total allotted 100 months our average person should use to learn each core process These estimates would be weighted by the number of employees in each core process to estimate how frequently the knowledge in a given process is employed in a typical year.

To make a back-of-the-envelope estimate of the knowledge embedded in the information technology of core processes, we could ask for the percentage of the process that is automated. Then the percentage of knowledge for each process, including its supporting information technology, can be calculated by dividing process knowledge by the total amount of knowledge. Revenue is then allocated proportionately.

If we wanted to understand the contribution of information technology, the revenue for each process could be further partitioned into the amount attributable to information technology. The annual budget for each area can be used to estimate the cost to use the given core process knowledge. In most high-tech firms, his is usually the cost for employee salaries and information technology costs. The final step would be to divide the allocated revenue by the cost per core process to determine the relative ROKs.

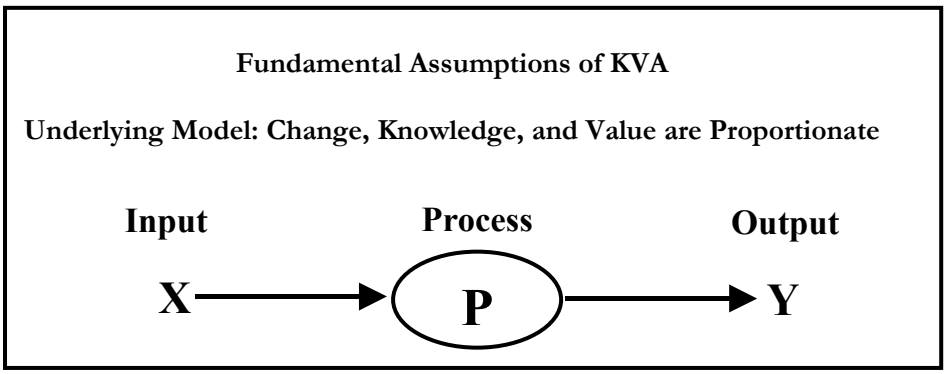
The revenue attributable specifically to the knowledge embedded in information technology and the cost to use it would provide the ROK for IT within and among processes. This can be quite revealing in that "all IT is not created equal." Some highly automated processes provide much lower ROKs than others in which there is a lower percentage of automation, but IT provides much more "bang for the buck."

Given a common point of reference, learning-time cheating is infrequent because the executives know their estimates can be verified by other knowledge measure such as actual training times and number of process instructions for each process. More importantly, the common reference point for estimation provides a meaningful framework for discussion. And, once the ROKs are calculated, the executives can move forward to prioritize efforts to improve overall company performance.

KVA Theory

KVA is firmly rooted in the Information Age. It allows managers and investors to analyze the performance of corporate knowledge assets in core processes in terms of the returns they generate. This is true whether knowledge is embedded in information technology or employees' heads. This is accomplished by postulating a common unit of knowledge that can be observed in core process and counted in terms of its price and cost. The results of a KVA analysis are ratios that compare the price and cost for these common units of knowledge. Economics components for these ratios are derived from the cash flow from ongoing operations and can be derived contemporaneously with the generation of the case flow.

The fundamental assumptions can be summarized as below



P(X) = Y

Fundamental assumptions:

1. If X=Y, no value has been added.
2. "value" x "change"
3. "change" can be measured by the amount of knowledge required to make the change.

So "value" x "change" x "amount of knowledge required to make the change"

The principle of replication states that given that we have the knowledge necessary to produce the change, then we have the amount of change introduced by the knowledge. Be definition, if we have not captured the knowledge required to make the changes necessary, we will not be able to produce the output as determined by the process. These tests to determine if the amount of knowledge required to produce an output has been accurately estimated.

For the purposes of simplification, the knowledge audit of KVA methodology can be delineated in seven steps for those who need a more concrete guide. Table 7.1 summarizes three different ways to generate estimates of the value of the knowledge embedded in the core processes of a firm. The Exodus case study that follows will provided detailed examples of how KVA might be applied to helping manage the knowledge in an Internet infrastructure company.

The KVA approach is currently being embedded in the "Process Edge" TM2 process modeling tool suite from Intelligent Systems Technology Incorporated. This software will allow analysts to gather and represent KVA data within a process work-flow model as well as monitor the ongoing return on knowledge (ROK) and return on process (ROP).

Three Approaches to KVA

Steps	Learning time	Process description	Binary query method
1.	Identify core process and its sub processes		
2.	Establish common units to measure learning time.	Describe the products in terms of the instructions required to reproduce them and select unit of process description.	Create a set a binary yes/no questions such that all possible outputs are represented as a sequence of yes/no answers.
3.	Calculate learning time to execute each sub process	Calculate number of process instructions pertaining to each sub process.	Calculate length of sequence of yes/no answers for each sub process.
4.	Designate sampling time period long enough o capture a representative sample of the core process's final product/service output.		
5.	Multiply the learning time for each sub process by the number of times the sub process executes during sample period.	Multiply the number of process instructions used to describe each sub process by the number of times the sub process executes during sample period.	Multiply the length of the yes/no string for each sub process by the number of times this sub process executes during sample period.
6.	Allocate revenue to sub processes in proportion to the quantities generated by step 5 and calculate costs for each sub process		

The knowledge within a process can be represented as learning time, process instructions, or bits. In fact, any approach that satisfies the basic KVA assumptions will work. Based on the fundamental assumption of KVA, the correlation between any two or more estimates should be at a high level to ensure an accurate estimate. This simple matched correlation measures the reliability of an estimate.

LESSON 19

KNOWLEDGE MARKET MODEL AND KVA CASE STUDY

Knowledge Market Framework

Within the economic school, knowledge transfers occur in knowledge markets. This is a transactional perspective, in which knowledge exchanges occur in a marketplace. In defining any market, one must be clear as to whom the buyers and sellers are, and what pricing system exists to determine what the consumer pays for a product or service. Knowledge markets exist within every organization. These markets include not only knowledge that has been codified or synthesized (realized) into a company's processes, structure, technology or strategy, but also include all dynamic exchanges of knowledge between buyers and suppliers.

According to Grover and Davenport (2001), organization can be viewed to have two categories of buyers of knowledge, local buyers and global buyers. The local buyers are people who are searching for knowledge assets to address an issue that they need to resolve. The require more than information. Expertise, experience, insight, and judgment are needed to bring to bear on the issue. They could pay for knowledge in hard currency via for example a consultant from outside the firm, or buy the knowledge from internal suppliers. The global knowledge buyer is the firm, which has a vested interest in realizing knowledge assets into valuable products and services. The global knowledge buyer, represented by organizational stakeholders whose benefits are tied to organizational level outcomes, has a strong interest in transferring local knowledge to global knowledge. Doing so reduces dependency on knowledge sellers – in case they choose to leave the firm. Knowledge sellers are people who have knowledge (usually tacit) to sell. The quality of this knowledge might be high or low depending on the credibility of the source.

Davenport and Prusak's (1998) approach to knowledge management is concerned with knowledge markets. A knowledge market can be defined as a system in which participants exchange a scarce unit for present or future value. Buyers, sellers and brokers are the role on knowledge markets. Knowledge buyers or seekers are usually people trying to resolve an issue whose complexity and uncertainty require knowledge. They seek knowledge because it has distinct value to them. Knowledge sellers are usually people in an organization with an internal market reputation for having substantial knowledge about a process of organization.

KVA: Case Study of Exodus Communications Inc.

The following is an example of how KVA can be applied to a company in the Internet infrastructure marketplace. The same general approach can be extended to any company. The KVA methodology is generic and robust enough to be applicable to companies and core processes in any industry.

Exodus Communications Inc. Financial Summary

Price	52-week Range	Shares outstanding (MM)	EPS 99A	EPS 2000E	P/E	Market capitalization
#34	$15-$89	412.4	$(0.36)	$(0.6)		NM

NM = not meaningful.
Exodus is leading provider of web hosting services. The company offers a suite of services including data center, Internet access, and managed services.

1. Exodus is a typical Internet infrastructure company that cannot be meaningfully evaluated by the traditional financial ratios and multiples method; for example, the P/E ratio is not derivable because the company has no positive net income.
2. The price-to-book value of Exodus is 44.59 while the industry average for this ration is only 16.69 and the S&P 500 is 9.66. the price-to-tangible value of Exodus is 67.99 while the

industry average is only 20.51 and the S&P 500 is 12.77. This means that Exodus stock is being valued more richly relative to the value of its assets than is the case for the S&P 500. It's a good example to illustrate that most of the value of the company is derived from the underlying knowledge assets embedded in the company structure and culture, which is not reflected o the traditional accounting statement.

Company Description

Founded in 1994, Exodus Communications ™ has been a pioneer in the Internet data center market. The company offers system and network management solutions, along with technology professional services for customers' websites. Exodus delivers its services from geographically distributed Internet data centers that are connected through a high-performance dedicated and redundant backbone network. The company's tailored solutions are designed to integrate with existing enterprise systems architectures and to enable customers to outsource the monitoring, administration, and optimization of their equipment, applications and overall Internet operations, Exodus is publicly trade on the Nasdaq National market under the ticker symbol EXDS.

As of December 31, 1999, the company had over 2,200 customers under contract and managed over 27,000 customer servers worldwide. The company's customers represent a variety of industries, ranging from Internet leaders to major enterprise customers. Yahoo!, USA TODAY.com, weather.com, pricleine.com, British Airways, and Nordstrom are just a few of the companies selecting Exodus as their complex Web hosting provider.

Exodus currently operates Internet data centers located in nine metropolitan areas in the United States: Atlanta, Austin, Boston, Chicago, Los Angeles, New York, Seattle, Silicon Valley, and Washington, D.C. In addition, the company opened its first Internet data center outside of the United States I the London metropolitan area in June 1999 and the second in Tokyo, Japan, in December 1999.

Exodus offers three types of services:

1. Internet server hosting.
2. Network solutions.
3. System management and monitoring services.

Current Issues

Exodus Communications currently has three areas of concern:

1. **Decreasing profit margin:** Bandwidth of the Network solutions and the co-location of Internet Service Hosting are rapidly becoming commodities with smaller and smaller margins as a result of increased competition and the maturation of the industry.
2. **Expansion opportunity:** Exodus's core customers are mostly "blue chip" Fortune 500 companies due to the limited amount of time and sales staff resources. There are opportunities for small customers that require simple and standardized solutions. The current process of service selection and network architecture and design (NAD) is very labor intensive and takes up lots of resources, which makes further expansion difficult.
3. **Emerging competition:** The emerging competition in the industry will lower the average revenue per user of Exodus's customers.

The goal of the exercise is to identify the area for focus on increasing revenue from existing knowledge assets, rather than just cutting cost. The following is an example of how KVA could be applied to Exodus on both the aggregate and the operation levels to measure the value of knowledge created in its core and sub processes.

Aggregate-Level KVA

A rough-cut estimate KVA on Exodus Communications Inc. is targeted at the aggregate level of analysis. On one hand, the top executives can benchmark the company's us of knowledge assets against other industries. On the other hand, management can look at the level of performance in the company's core processes before deciding how to improve performance.

Assumptions and Methodology The KVA team would interview process subject matter experts (SMEs), make observations, and talk wit process employees and managers to obtain average learning-time estimates and the number of roughly equivalent process instructions required to complete each sub process. Some of the numbers for the aggregated-level analysis, such as number of employees and expenses, were annualized figures derived from the 19991 financial statements.

1. Determine the core areas – We would gather together the various executives of the core processes in Exodus. Then they would be asked to categorize the company's functions at the aggregate level: Management, Sales and General Administration (S&GA), and Operation. These three functions would be the aggregate of all core processes in the company.
    a. Management includes finance and strategic management.
    b. S&GA includes all supporting functions such as human resources, public relations, and marketing.
    c. Operations includes sales support and design, service selection and network architecture design (NAD), procurement, integration, troubleshooting, and final testing.
2. Gather the data on the amount of knowledge embedded in each core area using the learning time approach.
    a. Ranking. Executives from the company would be asked to rank the three abovementioned areas in terms of hardest to easiest to learn or most to least complex to learn. This ranking method creates a framework to guide the executives to make a first-cut analysis of the underlying amount of knowledge created in each area. It also offers a knowledge estimate that, a priori, is assumed to correlate with the 100-month learning time estimate. The level of the correlation is an indication of the accuracy of the estimate.
    b. Learning time estimation. Executives would then be asked to estimate how long it would take the average person to learn how to produce the outputs of each core area using the 100-month approach. There is a total of only 100 months for an average person to learn everything in the above areas necessary to generate the annual revenue at Exodus. The executives have to estimate the time an average person would use, of the total allotted 100 months, to learn each core process.
3. Weight the amount of knowledge executed in the process.
    a. Determine the number of employees within each core area.
    b. Ask for the percentage of the process that is automated. To truly understand the knowledge embedded in the process, we have to talk to the process subject matter experts to tell us precisely what we need to know to produce the information technology's output within the sub process under review.
    c. Calculate the percentage of knowledge contained in each process, including its supporting technology. The amount of knowledge in each process is equal to relative learning time multiplied by the number of employees + automation. Then revenue can be allocated proportionately based on this percentage.
    d. Determine the annual budget for each core process or area used in the analysis to generate the cost estimates.
    e. Calculate the ROK ratio to estimate the value added by given knowledge assets in each process.

Table 7.2 represents our annualized high-level aggregate view of Exodus's 1999 performance. Each entry of the table is described in the following paragraphs.

In column 1 we identify the core areas of Exodus Communications. The three high level core areas are categorized as S&GA, Operations, and Management.

Inc column 2 we rank the areas in terms of the most difficult to the easiest to learn, 1 being the easiest and 3 the hardest. In the table below, S&GA is the easiest area to learn and Operations is the hardest.

In column 3 we assume that it takes 100 months for an average person to learn the three areas based on an average person. For example, S&GA is the easiest area to learn and takes an average person 20 months out of 100 months to learn all processes in the S&GA area. This approach can keep the executives within the conceptual framework of quantifying the amount of knowledge contained in each

function. This figure should correlate with the ranking in column 2. If the two figures don't correlate highly, we will ask the executives to reconsider and re-estimate. The theory predicts that figures in column 2 and column 3 should be 100 percent correlated. However, given the fact that no estimate will ever be perfect, there will always be some measurement error. We have found that the level of correlation should reach a minimum of 85 percent to be acceptable by most executives for the rough-cut, aggregated estimation and 95 percent for the more detailed core process analyses.

Table 7.2 High-Level Aggregate KVA Analysis

Col.1	Col.2	Col.3	Col.4	Col.5	Col.6	Col.7	Col.8	Col.9	Col.10	Col.11
Core areas	Rank in terms of difficult to learn (1=easiest, 3=hardest)	Relative learning time (total= 100 months)	Number of employees	Percent-age of automation	Amount of knowledge embedded in automation	Total amount of knowledge	Percentage of knowledge allocation	Annual revenue allocation (in millions of U.S. dollars)	Annual expense (in millions of U.S. dollars)	ROK
S&GA	1	20	855	80%	13,680	30,780	34.18%	$82.7	$118.8[a]	70#
Operations	3	45	600	60	16,200	43,200	47.98	116.1	197.2[b]	59
Management	2	35	255	80	7,140	16,065	17.84	43.2	51.0[c]	85

In column 4 the number of employees is a rough-cut way to "weighing" knowledge in the core areas for the annualized period. The actual number of executions of knowledge may vary and this issue should be addressed when discussing the reasonableness of the employee-weighting method with executives familiar with the core areas. In Exodus, there are a total of 255 people in the Management area, which represents the number of times the knowledge embedded in the management function area is executed. If we don't have the exact figures of total employees in each area, percentage of employees distributed in each area can be used.

In column 5 the percentage of automation is the estimated amount of knowledge contained in the information technology systems that support these core functions. The percentage is based on an estimation of how long it would take the average person to learn how to perform the instructions manually that are currently performed by the IT. If we remove the automation, it is the amount of knowledge used to produce the same output as is produced with the automation.

Remember, we need the amount of knowledge embedded in the IT but not the time and cost it takes to execute the knowledge to obtain the output. The time used to produce the same output is an estimate of the cost of using the knowledge embedded in the automation.

In column 6 we calculate the amount of knowledge embedded in automation, which is the learning time (column 3) multiplied by the number of employees 9column 4) multiplied by the percentage of automation (column 5).

S&GA 20 x 855 + 80% = 13,680
Operations 45 x 600 + 60% = 16,200
Management 35 x 255 + 80% = 7,140

In column 7 we calculate the total amount of knowledge, which is the learning time (column 3) multiplied by the number of employees (column 4) plus the automation (column 6).

S&GA 20 x 855 + 13,680 = 30,780
Operations 45 x 600 + 16,200 = 43,200
Management 35 x 255 + 7,140 = 16,065

In column 8 we calculate the amount of knowledge allocated to each functional area:
S&GA (30,780/90,045) x 100% = 34.18%
Operations (43,200/90,045) x 100% = 47.98%
Management (16,065/90,045) x 100% = 17.84%

The amount of knowledge is the total value surrogate of the annual revenue ($242 million). In column 9 annual revenue is allocated based on the percentage of the amount of knowledge embedded in each stage in terms of total knowledge.

S&GA $242 x 34.18% = $82.7 million

Operations $242 x 47.98% = $116.1 million
Management $242 x 17.84% = $43.2 million

Column 10 captures the cost used to generate the outputs of the process.

S&GA $118.8 million includes the general administrative costs and marketing expenses
Operations $197.2 million
Management $51 million

In column 11 we calculate return on knowledge (ROK), which is the allocated revenue (column 9) divided by the cost to use this knowledge (column 10).

S&GA $ 82.7/$118.8 = 70%
Operations $116.1/$197.2 = 59%
Management $43.2/$ 51 = 85%

ROK is the ratio of revenue allocated to each core area compared to its corresponding expenses. By comparing the expenses and revenues associated with the knowledge asset, an internal hurdle rate can be computed to compare efficiency in performance of the core areas. In the above example, Exodus's ROK in the three core function areas are less than one because it has not generated positive net income.

Management Implication

Among the three core function areas, the performance of Operations (59 percent) is relatively low as compared to S&GA (70 percent) and Management (85 percent). To take constructive actions to make the company profitable, the KVA analysis can identify the area(s) where the company can be more effective in exploiting its knowledge resources to generate outputs more effectively and efficiently.

To investigate which area in Operations needs improvement, we must go into the core processes to analyze the distribution and contribution of knowledge. Currently, the sales provisioning process is one of the core processes in Exodus' Operations. It presents a major opportunity for further business expansion with the explosive growth in demand for data storage. However, it is also the area where customer turnaround is the slowest due to lack of automation. The costs of expansion in terms of the sales provisioning process are accelerating. Five out of the six sub processes of sales provisioning fall within the Operations area. The lower ROK in the Operations area has confirmed management's guess and intuition that the sales provisioning process is one of the areas needing improvement.

To reassure investors that management is tackling the biggest problem area, the sales provisioning area was selected for further KVA analysis. The sales provision process includes six sub processes: sales support and design, service selection and NAD, procurement, integration, troubleshooting, and final testing. All of these sub processes fall into the Operations area, except the sales support functions.

KVA: Sales Provisioning Process

Assumptions and Methodology

1. Data center: Exodus has a total of 22 Internet data centers worldwide. The operations cost and process structure are based on the E1 Segundo center located in Los Angeles. We assume that all centers are staffed and operated more or less the same way.
2. Learning time and process instruction approach: In addition to learning time, the process instruction approach is another way to measure the amount of knowledge required to produce process outputs. The amount of knowledge required is proportionate to the number of process instructions pertaining to each process.

The learning time as well as the process instructions, will serve as an estimate for the amount of knowledge contained in each sub process and should be defined in terms of rightly equal complexity. For example, instructing a person to paint the door green may be less complex than instructing a person to make the customer happy. Generating two independent estimates of knowledge is use full in that it allows an estimate of the accuracy and the reliability of knowledge estimates by making a matched correlation test among the two. The higher the correlation, the better the estimates.

Seven Steps of KVA on Sales Provisioning Process Step one is to identify the core and sub processes. The Exodus core sales provisioning process involved six processes: sales support and design, service selection and NAD, procurement, integration, troubleshooting, and final testing. (See Table 7.3, column 1)

In step two we establish a common definition of learning time for the six processes under review. We would ask the subject matter experts (SMEs) to describe the process instructions for producing the outputs of the six sub processes. We also would ask the SMEs to estimate how long it would take to teach an "average" person to learn to produce the outputs. The learning time estimate indicated that a total of approximately 2,000 weeks were required to learn the whole sequence of how to execute each sub process.

In step three we calculate the total time to learn how to execute each sub process.

1. Learning time approach: we calculate the total time to learn how to execute each sub process. Given that there were a total of 2,000 weeks to learn how to execute the six processes, the distribution of learning time was as follows: sales required 240 weeks, service selection and NAD required 400 weeks, procurement required 60 weeks, integration required 500 weeks, troubleshooting required 500 weeks, and final testing required 300 weeks (Table 7.3, column 2).
2. Process instruction approach: We need to identify a common language to describe the sub processes in terms of the process instructions required to produce the outputs. For example, the sale support and design function required 240 learning weeks or 280 process instructions to produce the output.
3.

Table 7.3 KVA on the Sales Provisioning Process

Col.1	Col.2	Col.3	Col.4	Col.5	Col.6	Col.7	Col.8	Col.9	Col.10
Sub-process	Learning time (weeks)	Number of employees	Amount of knowledge embedded in IT (35%)	Total amount of knowledge	Percentage of knowledge allocation	Annual revenue allocation (in million)	(in million)Process costs	ROK	ROK on industry average
Sales	240	8	672	2,592	15%	$13.7	$12.2	112%	100%
Service selection and NAD	400	8	1,120	4,320	25	22.8	24.3	94	150
Procurement	60	5	105	405	2.5	2.3	3.0	77	150
Integration	500	5	875	3,375	20	18.3	20.3	90	80
Trouble-shooting	500	6	1,050	4,050	23.5	21.4	19.0	1.13	1
Final testing	300	6	630	2,430	14	12.8	6.4	200	125
Total	2,000	38		17,172	100%	$91.3	$85.2	107%	

The process instruction estimates for the six sub processes correlated above 89 percent with the corresponding learning time estimates (Table 7.4). Given the high level of correlation, there would be a fair degree of confidence that both learning times and process task estimates were a reasonably accurate measure of the same underlying amounts of knowledge embedded in eac sub process. Because of the high correlation we decided to use only the learning times for the ROK estimates.

In step four we designate a sampling time period long enough to capture a representative sample of the compound processes' final product/service output. In this case, the annualized period was used, so number of employees was the weighting factor.

In step five we multiply the learning time for each sub process by the number of times the sub process executes during the sample period. In this case, we multiplied the number of employees (Table 7.3, column 3) by the learning time (Column 2). Then we added the amount of automation (column 4) to derive the total amount of knowledge used in the sub process (column 5). The total percentage of knowledge is proportionately allocated to each sub process in column 6 and the total amount of revenue for each sub process is also allocated in column 7.

In step six (see Table 7.5) we calculate the cost to execute each sub process based on the assumption that the total of 22 worldwide data centers shares the same cost structure as a typical one in E1 Segundo. This assumption can be checked for accuracy in further discussions with the appropriate SMEs and executives. The annual cost for each sub process is represented in column 8. In this case, the primary determinant of cost was the number o employees working in each

Table 7.4 Learning Time And Process Instructions Approach Correlation

Sub process	Learning time (weeks)	Process instructions
Sales	240	280
Service selection and NAD	400	400
Procurement	60	200
Integration	500	560
Troubleshooting	500	400
Final testing	300	280
Total	2,000	2,120
Correlation	Learning time	Process instructions
Learning time	1	1
Process Instructions	0.8903	1

And this was used to allocate cost with other general expenses (real estate, equipment, power, etc.) equally divided among the sub processes.

In step seven we compute the ROKs for each sub process using revenue allocated for each sub process (Table 7.3, column 7) as the numerator and cost for each sub process (column 8) for the denominator. The resulting returns on knowledge are represented in column 9, with hypothetical average benchmark comparisons from other companies in the industry represented in column 10.

The following is a partial list of the beneficial ways that KVA analyses have been used in a wide variety of companies. Creative managers and executives will find new ways adapted to their particular needs.

- Tool to control operations: Management needs current and dynamic feedback to steer the company to profitability. Traditional financial tools provide a set of figures with no indication to management what kinds of returns each core area or process is providing. The results of a KVA analysis are ratios that compare the price and the cost for these common units of knowledge across core areas and processes. The economic data for these ratios are derived from cash flow from ongoing operations and can be derived contemporaneously with the generation of cash flow. KVA therefore provides contemporaneous feedback to the company's performance about how well the company is self-organizing and adapting to the dynamic market environment to enhance value for both shareholders and customers. It is a tool to direct allocation of knowledge assets and capital resources.
- New set of raw data: KVA uses a new set of raw data that can be validated and reliably used to measure the performance of corporate knowledge assets. The calculation of ROP and ROK will help avoid subjective manipulation. However, it should be remembered that all calculations are subject to manipulation, but when both value and cost are matched for given core areas and processes, manipulation becomes more difficult.

Table 7.2 High-Level Aggregate KVA Analysis

Column.1	Column.2	Column.3	Column.4	Column.5	Column.6
Cost for executing the knowledge	Execution time (months)	Monthly Rate	Process cost	Process cost of each data center on an annual basis	Process cost of the whole company (total of 22 data centers) (in million)
Sales	3	$15,400	$46,200	$ 554,400	$12.2
Service selection	12	7,680	92,160	1,105,920	24.3
and NAD	3	3,840	11,520	138,240	3.0
Procurement	20	3,840	76,800	921,600	20.3
Integration	15	4,800	72,000	864,000	19.0
Troubleshooting	5	4,800	24,000	288,000	6.4
Final testing					
Total				$3,872,160	$85.2

- Increase in employee's understanding of the value of the production process: KVA is easy to understand. It helps employees, even persons not familiar with finance and accounting, to understand the value they are contributing to the core processes and the company bottom line. Such a concept helps to convert the company's strategy into tangible objective for employees such as setting a return-based hurdle rate for their performance.
- Enhancement of employees' productivity: KVA helps to create a framework throughout the company that encourages managers and employees t think and behave like owners. I addition, it provides a framework for the Information Age managers to more explicitly understand how to mange knowledge assets.
- Efficient resource allocation: At the operational level, this approach helps to increase the shareholder's value through increased efficiency in allocation of knowledge assets and capital resources. In many companies, all effort is diverted to cut cost while ignoring revenue; value at all levels has been ignored because, in the past, there has been no explicit way to allocate revenue to core process activities.
- Tool to measure manager's performance: KVA makes to managers responsible for the operations over which they have control. Value is created by knowledge that is affected by their decisions rather than by external market factors that they feel they cannot control, for example, the market price of the company's share or product.
- Benchmark of the company with industry or competitors: KVA offers a value based method for comparing companies' knowledge asset performance within an industry.
- A starting point to improve financial and business policy: When companies examine themselves as a set of knowledge assets and knowledge outputs, companies can identify and invest in the processes, technologies, and people that provide the greatest return.

LESSON 20

SVEIBY'S INTELLIGENT ASSET MONITOR

Intellectual Capital Management

One of the key authors in the area of intellectual capital is Sveiby (2001), who has developed a knowledge-based theory of the firm to guide in strategy formulation. He distinguished between three families of intangible assets. The external structure family consists of relationships with customers and suppliers and the reputation (image) of the firm. Some of these relationships can be converted into legal property such as trademarks and brand names. The value of such assets is primarily influenced by how well the company solves its customers' problems, and there is always and element of uncertainty here.

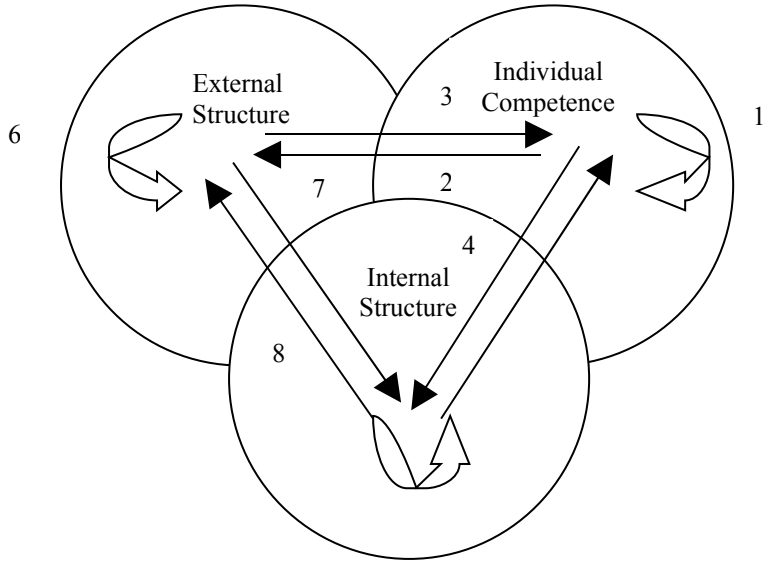
The internal structure family consists of patents, concepts, models, and computer and administrative systems. These are created by the employees and are thus generally owned by the organization. The structure is partly independent of individuals and some of it remains even if a large number of the employees leave. The individual competence family consists of the competence of the professional staff, the experts, the research and development people, the factory workers, sales ad marketing – in short, all those that have a direct contact with customers and whose work is within the business idea.

Competence is a term introduced here. Competence can be defined as the sum of knowledge, skills and abilities at the individual level. With this definition, we say that knowledge is part of competence, and competence is part of intellectual capital.

These three families of intangible resources have slightly different definitions when compared to the capital elements. The external structure seems similar to relational capital, the internal structure seems similar to structural capital, while the individual competence seems similar to human capital.

To appreciate why a knowledge-based theory of the firm can be useful for strategy formulation, Sveiby (2001) considers some of the features that differentiate knowledge transfers from tangible goods transfers. In contrast to tangible goods, which tend to depreciate in value when they are used, knowledge grows when used and depreciates when not used. Competence in a language or a sport requires huge investments in training to build up; managerial competence takes a long time on-the-job to learn. If one stops speaking the language it gradually dissipates.

Knowledge Transfer Within and Between Families of Intangible Assets (Sveiby, 2001)



Given three families of intangible assets, it is possible to identify nine knowledge transfers. These knowledge transfers can occur within a family and between families, as illustrated in Figure 2.

Each of the nine knowledge transfers in Figure 2 can be explained as follows (Sveiby, 2001):

1. Knowledge transfers between individuals concern how to best enable the communication between employees within the organization. The strategic question is: How can we improve the transfer of competence between people in the organization? Activities for intellectual capital management focus on trust building, enabling team activities, induction programs, job rotation and master/apprentice scheme.
2. Knowledge transfers from individuals to external structure concern how the organization's employees transfer their knowledge to the outer world. The strategic question is: How can the organization's employees improve the competence of customers, suppliers and other stakeholders? Activities for intellectual capital a management focus on enabling the employees to help customers learn about the products, getting rid of red tape, enabling job rotation with customers, holding product seminars and providing customer education.
3. Knowledge transfers from external structure to individuals occur when employees learn from customers, suppliers and community feedback through ideas, new experiences and new technical knowledge. The strategic question is: How can the organization's customers, suppliers and other stakeholders improve the competence of the employees? Activities for intellectual capital management focus on creating and maintaining good personal relationships between the organization's own people and the people outside the organization.
4. Knowledge transfers from competence to internal structure concern the transformation of human capital into more permanent structural capital through documented work routines, intranets and data repositories. The strategic question is: How can we improve the conversion from individually held competence to systems, tools and templates? Activities for intellectual capital management focus on tools, templates, process and systems so they can be shard more easily and efficiently.
5. Knowledge transfers from internal structure to individual competence is the counterpart of the above. Once competence is captured in a system it needs to be made available to other individuals in such a way that they improve their capacity to act. The strategic question is: How we improve individuals' competence by using systems, tools and templates? Activities for intellectual capital management focus on improving human computer interface of systems, action-based learning processes, simulations and interactive e-learning environments.
6. Knowledge transfers within the external structure concern what customers and others tell each other about the service of an organization. The strategic question is: How can we enable the conversations among the customers, suppliers and other stakeholders so they improve their competence? Activities for intellectual capital management focus on partnering and alliances, improving the image of the organization and the brand equity of its products and service, improving the quality of the offering, and conducting product seminars and alumni programs.
7. Knowledge transfers from external to internal structure concern what knowledge the organization can gain from the external world and how the learning can be converted into action. The strategic question is: How can competence from the customers, suppliers and other stakeholders improve the organization's systems, tools, processes and products? Activities for intellectual capital management focus on empowering call centers to interpret customer complaints, creating alliances to generate ideas for new products and research and development alliances.
8. Knowledge transfers from internal to external structure is the counterpart of the above. The strategic question is: How can the organization's systems, tools and processes and products improve the competence of the customers, suppliers and other stakeholders? Activities for intellectual capital management focus on making the organization's systems, tools and processes effective in servicing the customer, extranets, product tracking, help desks and e-business.
9. Knowledge transfers within the internal structure in which the internal structure is the backbone of the organization. The strategic question is: How can the organization's systems, tools, processes and products be effectively integrated? Activities for intellectual capital management focus on streamlining databases, building integrated information technology systems and improving the office layout.

LESSON 21

STRATEGIC PERSPECTIVE OF KNOWLEDGE AND STRATEGIC SCHOOL APPROACH IN KM

Strategic View of knowledge

Business strategy has traditionally focused on produces and services to gain competitive advantage. Recent work in the area of strategic management and economic theory has begun to focus on the internal side of the equation – the firm's resources and capabilities. This new perspective is referred to as the resource-based theory of the firm. According to the resource-based theory of the firm, performance differences across firms can be attributed to the variance in the firms' resources and capabilities. Resources that are valuable, unique, and difficult to imitate can provide the basis for firms' competitive advantages. In turn, these competitive advantages produce positive returns. The essence of the resource-based theory of the firm lies in its emphasis on the internal resources available to the firm, rather than on the external opportunities and threats dictated by industry conditions. Firms are considered to be highly heterogeneous, and the bundles of resources available to each firm are different. This is both because firms have different initial resource endowments and because managerial decisions affect resource accumulation and the direction of firm growth as well as resource utilization.

The resource-based theory is a useful perspective in strategic management. The resource-based theory of the firm holds that, in order to generate sustainable competitive advantage, a resource must provide economic value and must be presently scarce, difficult to imitate, non-substitutable, and not readily obtainable in factor markets. This theory rests on two key points: first, that resource are the determinants of firm performance, and second, that resources must be rare, valuable, difficult to imitate and non-substitutable by other rare resources. When the latter occurs, a competitive advantage has been created. Research on the competitive implications of such firm resources as knowledge, learning, culture, teamwork, and human capital was given a significant boost by resource-based theory – a theory that indicated it was these kinds of resources that were most likely to be source of sustainable competitive advantage for firms. Firms' resource endowments, particularly intangible resources, are difficult to change except over the long term. For example, although human resources may be mobile to some extent, capabilities may not be valuable for all firms or even for their competitors. Some capabilities are based on firm-specific knowledge, and others are valuable when integrated with additional individual capabilities and specific firm resources. Therefore, intangible resources are more likely than tangible resources to produce a competitive advantage. In particular, intangible firm-specific resources such as knowledge allow firms to add value to incoming factors of production.

Knowledge As A Strategic Resource

The knowledge-based view of the firm argues that the products and services produced by tangible resources depend on how they are combined and applied, which is a function of the firm's know-how. This knowledge is embedded in and carried through individual employees as well as entities such as organization culture and identity, routines, policies, systems, and documents. The knowledge-based view of the firm posits that these knowledge assets may produce long-term sustainable competitive advantage for the organization because knowledge-based resources are socially complex to understand and difficult to imitate by another organization.

Companies having superior knowledge, however, are able to coordinate and combine their traditional resources and capabilities in new and distinctive ways, providing more value for their customers than can their competitors. That is, by having superior intellectual resources, an organization can understand how to exploit and develop their traditional resources better than competitors, even if some or all of those traditional resources are not unique. Therefore, knowledge can be considered the most important strategic resource, and the ability to acquire, integrate, store, share and apply it the most important capability for building and sustaining competitive advantage. The broadest value proposition, then, for engaging in knowledge management is that it can enhance the organization's fundamental ability to compete. Long-term sustainable competitive advantage comes from the firm's ability to effectively apply the existing knowledge to create new knowledge and to take action that forms the basis for achieving

competitive advantage from knowledge-based assets. The knowledge existing at any given time per se is not sufficient to form such a basis for long term sustainable competitive advantage.

Knowledge-based competitive advantage is also sustainable because the more a firm already knows, the more it can learn. Learning opportunities for an organization that already has a knowledge advantage may be more valuable than for competitors having similar learning opportunities but starting off knowledge less. Sustainability may also come from an organization already knowing something that uniquely complements newly acquired knowledge, which provides an opportunity for knowledge synergy not available to its competitors. New knowledge is integrated with existing knowledge to develop unique insights and crate even more valuable knowledge. Organizations should therefore seek areas of learning and experimentation that can potentially and value to their existing knowledge via synergistic combination.

Sustainability of knowledge advantage, then, comes from knowing more about some things than competitors, combined with the time constraints faced by competitors in acquiring similar knowledge, regardless of how much they invest to catch up. This represents what economists call increasing returns. Unlike traditional physical goods that are consumed as they are used (providing decreasing returns over time), knowledge provides increasing returns as it is used. The more it is used, the more valuable it becomes creating a self reinforcing cycle. If an organization can identify areas where its knowledge leads the competition, and if that unique knowledge can be applied profitably in the marketplace, it can represent a powerful and sustainable competitive advantage.

Organizations should strive to us their learning experiences to build on or complement knowledge positions that provide a current or future competitive advantage. Systematically mapping, categorizing, and benchmarking organizational knowledge not only can help make knowledge more accessible throughout an organization, but by using a knowledge map to prioritize and focus its learning experiences, an organization can create greater leverage for its learning efforts. It can combine its learning experiences into a critical learning mass around particular strategic areas of knowledge. While a knowledge advantage may be sustainable, building a defensible competitive knowledge position internally is a long-term effort, requiring foresight and planning as well as luck. Long lead-time explains the attraction of strategic alliances and other forms of external ventures as potentially quicker means for gaining access to knowledge. It also explains why the strategic threat from technological discontinuity tends to come from firms outside of or peripheral to an industry. New entrants often enjoy a knowledge base different than that of incumbents, one that can be applied to the products and services of the industry under attack. This has been especially evident in industries in which analog products are giving way to digital equivalents.

Knowledge has a strategic role if unique firm knowledge can successfully be applied to value-creating tasks and if it can be used to capitalize on existing business opportunities. Since competitors in developing their own survival strategies, are likely to benchmark themselves against the industry leader to level out performance, knowledge must be difficult to imitate.

Looking strategically, let us make distinctions once again between data, information, knowledge and wisdom:

- Data are letters and numbers without meaning. Data are independent, isolated measurements, characters, numerical characters and symbols.
- Information is data that are included in a context that makes sense. For example, 40 degrees can have different meanings depending on the context. There can be a medical geographical or technical context. If a person has 40 degrees Celsius in fever, that is quite serious. If a city is located 40 degrees north, we know that it is far south of Norway. If an angle is 40 degrees, we know what it looks like. Information is data that make sense, because is can be understood correctly. People turn data into information by organizing it into some unit of analysis, for example, dollars, dates, or customers. Information is data endowed with relevance and purpose.
- Knowledge is information combined with experience, context, interpretation and reflection. Knowledge is a renewable resource that can be used over and over, and that accumulates in an organization through use and combination with employees' experience. Humans have knowledge; knowledge cannot exist outside the heads of individuals in the company. Information becomes knowledge when it enters the human brain. This knowledge transforms

into information again when it is articulated and communicated to others. Information is an explicit representation of knowledge; it is in itself not knowledge. Knowledge can be truths and lies, perspectives and concepts, judgments and expectations. Knowledge is used to receive information by combining, prioritizing and decision making; and by planning, implementing and controlling.

- Wisdom is knowledge combined with learning insights and judgmental abilities. Wisdom is more difficult to explain than knowledge, since the levels of context become even more personal, and thus the higher-level nature of wisdom renders it more obscure than knowledge. While knowledge is mainly sufficiently generalized solutions, wisdom is best thought of as sufficiently generalized approaches and values that can be applied in numerous and varied situations. Wisdom cannot be created like data and information, and cannot be shared with others like knowledge. Because the context is so personal, it becomes almost exclusive to our own minds and incompatible with the minds of others without extensive transaction. This transaction requires not only a base of knowledge and opportunities for experiences that help create wisdom, but also the processes of introspection, retrospection, interpretation and contemplation. We can value wisdom in others, but we can only create it ourselves.

In our resource-based perspective of knowledge, data are raw numbers and facts, information is processed data, and knowledge is information combined with human thoughts. Knowledge is the result of cognitive processing triggered by the inflow of new stimuli. Information is converted to knowledge once it is processed in the mind of individuals, and the knowledge becomes information once it is articulated and presented to others. A significant implication of this view of knowledge is that for individuals to arrive at the same understanding of information, they must share the same knowledge framework.

The Knowledge-Strategy Link

The traditional SWOT framework, updated to reflect today's knowledge- intensive environment, provides a basis for describing a knowledge strategy. In essence, firms need to perform a knowledge-based SWOT analysis, mapping their knowledge resources and capabilities against their strategic opportunities and threats to better understand their points of advantage and weakness. They can use this map to strategically guide their knowledge management efforts, bolstering their knowledge advantages and reducing their knowledge weak-nesses. Knowledge strategy, then, can be thought of as balancing knowledge-based resources and capabilities with the knowledge required for providing products or services in ways superior to those of competitors. Identifying which knowledge-based resources and capabilities are valuable, unique, and inimitable as well as how those resources and capabilities support the firm's product and market positions are essential elements of a knowledge strategy (Zack, 1.999).

To explicate the link between strategy and knowledge, an organization must articulate its Strategic intent, identify the knowledge required to execute its intended strategy, and compare that to its actual knowledge, thus revealing its strategic knowledge gaps (Zack, 1999).

Every firm competes in a particular way-operating within some industry and adopting competitive position within that industry .Competitive strategy may result from an explicit grand decision -the traditional perspective on strategy -or from an accumulation of smaller incremental decisions. It may even be revealed in hindsight, by looking back on actual behaviors and events over time.. Regardless of the strategy formation process, organizations have a de facto strategy that must first be articulated (Zack, 1999).

Every strategic position is linked to some set of intellectual resources and capabilities. That is, given what the firm believes it must do to compete, there are some things it must know and know how to do. The strategic choices that companies make -regarding technologies, products, services, markets, and processes -have a profound influence on the knowledge, skills, and core competencies required to compete and excel in an industry (Zack, 1999).

On the other hand, what a firm does know and knows how to do limits the ways it can actually compete. The firm, given what it knows, must identify the best product and market opportunities for exploiting that knowledge. The firm 's existing knowledge creates an opportunity and a constraint on

selecting viable competitive positions, while the firm ' s selected competitive position creates a knowledge requirement. Success requires dynamically aligning knowledge-based requirements and capabilities (Zack, 1999).

Assessing an organization's knowledge position requires cataloging its existing intellectual resources by creating what is commonly called a knowledge map. Knowledge can be characterized in many ways. Popular taxonomies distinguish between tacit and explicit knowledge, general and situated context specific knowledge, and individual and collective knowledge. Knowledge can also be categorized by type, including declarative (knowledge about), procedural (know-how), and causal (know-why), conditional (know when), and relational (know-with). While these distinctions are useful for mapping and managing I knowledge at the process level once a knowledge strategy has been formulated, our purpose requires knowledge taxonomy oriented towards strategy and which reflects the competitive uniqueness of each organization (Zack, 1999).

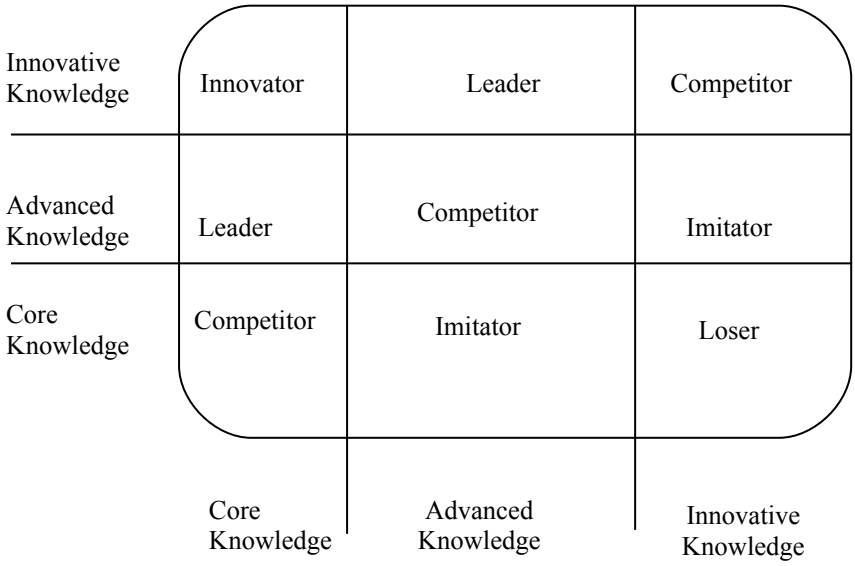
Categorizing or describing what a business firm knows and must know about its industry or competitive position is not easy. Although firms within particular industries, firms maintaining similar competitive positions, or those employing similar technologies and other resources often share some common knowledge, there are no simple answers regarding what a firm must know to be competitive if there were, the there would be no sustainable advantage (Zack, 1999).

A typical company develops an approach to describing and classifying its strategic or competitive knowledge that is in some ways unique. In fact, each firm's general awareness of and orientation to the link between knowledge and strategy tends to be somewhat unique and may, itself, represent an advantage. Regardless of how knowledge is categorized based on content, every firm's strategic knowledge can be categorized by its ability to support a competitive position. Specifically, knowledge can be classified according to whether it is core, advanced, or innovative (Zack, 1999). Knowledge is not static and what is innovative knowledge today will ultimately become the core knowledge of tomorrow. Thus defending and growing a competitive position requires continual learning and knowledge acquisition. The ability of an organization to learn, accumulate knowledge from its experiences, and reapply that knowledge is itself a skill or competence that-beyond the core competencies directly related to delivering its product or service -may provide strategic advantage (Zack, 1999).

Although knowledge is dynamic, the strategic knowledge framework in Figure below offers the ability to take a snapshot of where the firm is today vis-a-vis its desired strategic knowledge profile (to assess its external knowledge gaps). Additionally, it can be used to plot the historical path and future trajectory of the firm's knowledge. The framework may be applied by area of competency or, taking a more traditional strategic perspective, by strategic business unit, division, product line, function, or market position. Regardless of the particular way ea.ch firm categorizes its knowledge, each category can be further broken down into elements that are core, competitive, or innovative to produce a strategic knowledge map (Zack, 1999).

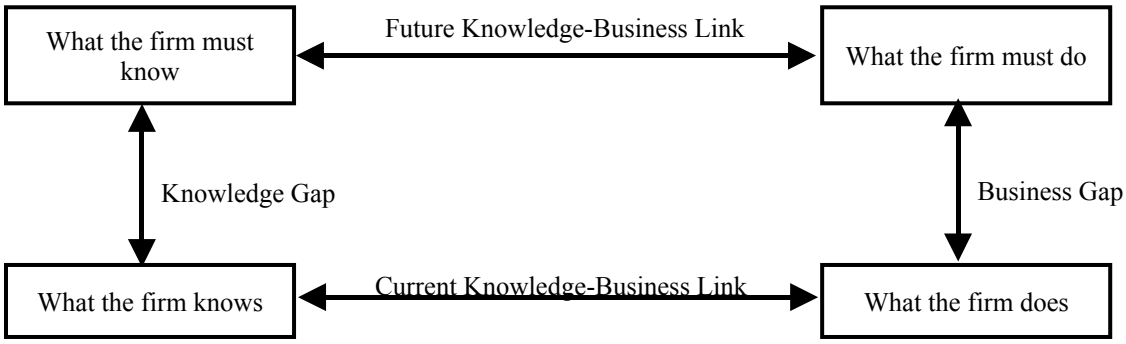
Having mapped the firm’s competitive knowledge position, an organization can perform a gap analysis. The gap between what a firm must do to compete and what it actually is doing represents a strategic gap. Addressing this gap is the stuff of traditional strategic management. As suggested by the SWOT frame-work, strengths and weaknesses represent what the firm can do; opportunities and threats dictate what it must do. Strategy, then, represents how the firm balances its competitive cans and musts to develop and protect its strategic niche (Zack, 1999).

Strategic Knowledge Framework



At the same time, underlying a firm's strategic gap is a potential knowledge gap. That is, given a gap between what a firm must do to compete and what it can do, there may also be a gap between what the firm must know to execute its strategy and what it does know. Based on a strategic knowledge and capabilities map, an organization can identify the extent to which its various categories of existing knowledge are in alignment with its strategic requirements. The result is a set of potential knowledge gaps. In some cases, an organization might even know more than needed to support its competitive position. Nevertheless, a knowledge strategy must address any possible misalignments. The greater the number, variety, or size of the current and future knowledge gaps, and the more volatile the knowledge base because of a dynamic or uncertain competitive environment, the more aggressive the knowledge strategy required. A firm not capable of executing its intended or required strategy must either align its strategy with its capabilities or acquire the capabilities to execute its strategy (Zack, 1999).

Knowledge Gap Derived From and Aligned with Strategic Business Gap



Having performed a strategic evaluation of its knowledge-based resources and capabilities, an organization can determine which knowledge should be developed or acquired. To give knowledge management a strategic focus, the firm's knowledge management initiatives should be directed toward closing this strategic knowledge gap. The important issue is that the knowledge gap is directly derived from and aligned with the strategic gap, as illustrated above. This simultaneous alignment of strategy and knowledge management efforts are divorced from strategic planning and execution. However, having an appropriate knowledge strategy in place is essential for assuring that knowledge management efforts are being driven by and are supporting the firm's competitive strategy (Zack, 1999).

The Strategic School Perspective

The strategic school sees knowledge management as a dimension of competitive strategy. Indeed, it may be seen as the essence of a firm's strategy. Approaches to knowledge management are dependent on management perspective.

LESSON 22

STRATEGIC SCHOOL: STOCK, FLOW, AND GROWTH STRATEGY IN KM

The Strategic School

The strategic school sees knowledge management as a dimension of competitive strategy. Indeed, it may be seen as the essence of a firm's strategy. Approaches to knowledge management are dependent on management perspective. Distinctions can be made between the information-based perspective, the technology-based perspective and the culture-based perspective:

- *Information-based perspective* is concerned with access to information. I have a problem, and I am looking for someone in the organization who has knowledge that can solve my problem.
- *Technology-based perspective* is concerned with applications of information technology. We have all this hardware and software in the firm: how can we use this technology to systematize, store and distribute information to knowledge workers?
- *Culture-based perspective* is concerned with knowledge sharing. We are an organization because division of labor makes us more efficient and because we can draw on each other's expertise.

All three perspectives belong in a knowledge management project to be successful. However, the main focus may vary depending on corporate situation. If reinventing the wheel all the time is the big problem, then the information-based perspective should dominate project focus. If the technology in the firm is unable to provide even basic services to knowledge users, then the technology-based perspective should dominate project focus. If knowledge workers are isolated and reluctant to share knowledge, then the culture-based perspective should dominate project focus.

Codification and Personalization Strategy

Some companies automate knowledge management, while other rely on their people to share knowledge through more traditional means. In some companies, the strategy centers on the computer. Knowledge is carefully codified and stored in databases, where it can be accessed and used easily by anyone in the company. These companies have developed elaborate ways to codify, store and reuse knowledge. Knowledge is codified using a people-to-documents approach: it is extracted from the person who developed it, made independent of that person, and reused for various purposes. Knowledge objects are developed by pulling key pieces of knowledge such as interview guides, work schedules, benchmark data, and market segmentation analysis out of documents and storing them in the electronic repository for people to use. This approach allows many people to search for and retrieve codified knowledge without having to contact the person who originally developed it. That opens up the possibility of achieving scale in knowledge reuse and thus of growing the business. Hansen et al. (1999) call this the codification strategy for managing knowledge.

In other companies, knowledge is closely tied to the person who developed it and is shared mainly through direct person-to-person contacts. The chief purpose of computers at such companies is to help people communicate knowledge, not to store it. These companies focus on dialogue between individuals, not knowledge objects in a database. Knowledge that has not been codified is transferred in barnstorming sessions and one-on-one conversations. Knowledge workers collectively arrive at deeper insights by going back and forth on problems they need to solve. These companies invest heavily in building networks of people. Knowledge is shared not only face-to-face, but also over the telephone, by email, and via video conferences. Networks can be fostered in many ways: by transferring people between offices, by supporting a culture in which knowledge workers are expected to return phone calls from colleagues promptly, by creating directories of experts, and by using knowledge managers within the firm to assist project teams. These firms may also have developed electronic document systems, but the purpose of the systems is not to provide knowledge objects. Instead, knowledge workers scan documents to get up to speed in a particular area and to find out who has done work on a topic. They then approach those directly. Hansen et al. (1999) call this the personalization strategy for managing knowledge.

Codification and personalization strategy can be contrasted with each other using criteria such as competitive strategy, economic model, knowledge management strategy, information technology and human resources. The competitive strategy by codification is to provide high quality, reliable, and fast information-systems implementation by reusing codified knowledge. The competitive strategy by personalization is to provide creative, analytically rigorous advice on high-level strategic problems by channeling individual expertise. The economic model for codification strategy can be labeled reuse economics, while the economic model for personalization can be labeled expert economics. Reuse economics implies investing once in a knowledge asset, and then reusing it many times. Expert economics implies charging high fees for highly customized solutions to unique problems.

Knowledge management strategy will either be people-to-documents for codification or person-to-person for personalization. People-to-documents implies developing an electronic document system that codifies, stores, disseminates, and allows reuse of knowledge. Person-to-person implies developing networks for linking people so that tacit knowledge can be shared. By codification, the company invests heavily in IT, where the goal is to connect people with reusable codified knowledge. By personalization, the company invests moderately in IT, where the goal is to facilitate conversations and exchange of tacit knowledge. By codification, the human resource approach will be concerned with training people in groups and through computer-based distance learning. By personalization, the human resource approach will be concerned with training people through one-on-one mentoring.

How do companies choose the right strategy for managing knowledge? Competitive strategy must drive knowledge management strategy. Executives must be able to articulate why customers buy a company's products or services rather than those of its competitors. What value do customers expect from company? How does knowledge that resides in the company add value for customers? Assuming the competitive strategy is clear, managers will want to consider three further questions that can help them choose a primary knowledge management strategy. The three questions developed by Hansen et al. (1999) are concerned with standardized versus customized products, mature or innovative products, and explicit versus tacit knowledge.

The first question is: Do you offer standardized or customized products? Companies that offer standardized products will fit the codification strategy, while companies that offer customized products will fit the personalization strategy. The second question is: Do you have mature or innovative products? Companies that offer mature products will fit the codification strategy, while companies that offer innovative products will fit the personalization strategy.

The final question is: Do your people rely on explicit or tacit knowledge to solve problems? Explicit knowledge is knowledge that can be codified, such as simple software code and market data. When a company's employees rely on explicit knowledge to do their work, the people-to-documents approach makes the most sense. Tacit knowledge, by contrast, is difficult to articulate in writing and is acquired through personal experience. It includes scientific expertise, operational know-how, and insights about an industry, business judgment, and technological expertise. When people use tacit knowledge most often to solve problems, the person-to-person approach works best.

Hansen et al. (1999) stress that people need incentives to participate in the knowledge sharing process. The two knowledge management strategies call for different incentive systems. In the codification model, managers need to develop a system that encourages people to write down what they know and to get those documents into the electronic repository. And real incentives – not small enticements – are required to get people to take those steps. The level and quality of employees' contributions to the document database should be part of their annual performance review. Incentives to stimulate knowledge sharing should be very different at companies that are following the personalization approach. Managers need to reward people for sharing knowledge directly with other people.

Stock, flow and Growth Strategy

Approaches to knowledge management are dependent on knowledge focus in the organization. Distinctions can be made between expert-driven business, experience-driven business and efficiency-driven business:

- Expert-driven business solves large, complex, risky, new and unusual problems for customers. Competitive advantage is achieved through continuous improvisation and innovation.

Knowledge workers apply general high-level knowledge to understand, solve and learn. Learning from problem solving is important to be able to solve the next new and unknown problem for customers. An expert-driven business is characterized by both new problems and new methods for solution.

- Experience-driven business solves large and complicated problems for customers. The problems are new, but they can be solved with existing methods in a specific context every time. Competitive advantage is achieved through effective adaptation of existing problem solving methodologies and techniques. Continuous improvement in effectiveness is important to be able to solve the next problem for customers. An experience-based business is characterized by new problems and existing methods for solution.
- Efficiency-driven business solves known problems. The quality of the solution is found in fast and inexpensive application to meet customer needs. Competitive advantage is achieved in the ability to make small adjustments in existing goods and services at a low price. An efficiency-driven business is characterized by known problems and known methods for solution.

Few knowledge-intensive firms are only active in one of these businesses. Most firms are active in several of these businesses. For example, medical doctors in a hospital are mainly in the experience-driven business of solving new problems with known methods. Sometimes, they are in the expert-driven business of solving new problems with new methods. Similarly, lawyers in a law firm are often in the expert-driven business, but most of the time in the experience-driven business. In some engineering firms, engineers are often in the efficiency-driven business, but most of the time in the experience-based business.

Knowledge focus will be different in expert-driven, experience-driven and efficiency-driven businesses. In the expert-driven business, learning is important, while previous knowledge becomes obsolete. In the efficiency-based business, all knowledge concerning both problems and solutions is important in an accumulation of knowledge to improve efficiency. These differences lead us to make distinctions between the following three knowledge management strategies of stock strategy, flow strategy and growth strategy:

- Stock strategy is focused on collecting and storing all knowledge in information bases in the organization. Information is stored in databases and made available to knowledge workers in the organization and in knowledge networks. Knowledge workers use databases to keep updated on relevant problems, relevant methods, news and opinions. Information on problems and methods accumulate over time in databases. This strategy can also be called person-to-knowledge strategy.
- Flow strategy is focused on collecting and storing knowledge in information bases in the organization as long as the information is used in knowledge work processes. If certain kinds of knowledge work disappear, then information for those work processes becomes obsolete and can be deleted from databases. This is a yellow-pages strategy in which information on knowledge areas covered by individuals in the firm is registered. The link to knowledge sources in the form of individuals is made specific in the databases, so that the person source can be identified. When a knowledge worker starts on a new project, the person will search company databases to find colleagues who already have experience in solving these kinds of problems. This strategy can also be called person-to-per strategy.
- Growth strategy is focused on developing new knowledge. New knowledge is developed in innovative work processes taking place when knowledge workers have to solve new problems with new methods for customers. Often, several persons are involved in the innovation, and together they have gone through a learning process. When a knowledge worker starts on a new project, the person will use the intra-organizational and inter-organizational network to find information on work processes and learning environments that colleagues have used successfully in previous innovation processes.

There is a strong link between these three knowledge management strategies and the three alternatives of expert-driven, experience-driven and efficiency-drive business. In Figure below, characteristics of the three strategies are presented. Typically, efficiency-driven businesses will apply the stock strategy, while experience-driven businesses will apply the flow strategy, and expert-driven business will apply the growth strategy.

Characteristics of Knowledge Management Strategies

Characteristics	Stock strategy	Flow strategy	Growth strategy
Knowledge focus	Efficiency-driven business	Experience-driven business	Expert-driven business
Important persons	Chief knowledge officer Chief information officer Database engineers	Chief knowledge officer Experienced knowledge workers	Management experts
Knowledge base	Databases and information systems	Information networks	Networks of experts, work processes and learning environments
Important elements	Access to databases and information systems	Access to knowledge space	Access to networks of experts and learning environments
Management task	Collecting information and making it available	Connecting persons to experienced knowledge workers	Providing access to networks
Learning	Efficiency training applying existing knowledge	Experience accumulation applying existing knowledge	Growth training developing new knowledge

LESSON 23

THE ORGANIZATIONAL SCHOOL OF THOUGHT IN KM

The Organizational School

According to Earl (2001), the organizational school describes the use of organizational structures, or networks, to share or pool knowledge. Often described as knowledge communities, the archetypal arrangement is a group of people with a common interest, or problem, or experience. These communities are designed and maintained for a business purpose, and they can be intra- or inter organizational.

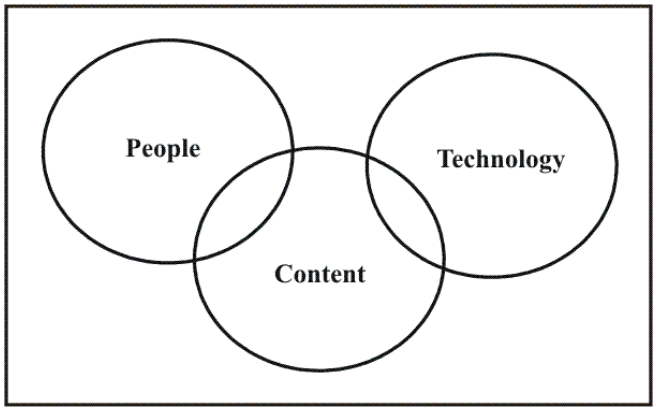
In the following, a number of approaches to knowledge management belonging to the organizational school are presented. The first approach is managing common knowledge; the second approach is the socialization externalization combination internalization (SECI) process.

Managing Common Knowledge

Dixon (2000) defines common knowledge as the knowledge that employees learn from doing the organization's tasks. Common knowledge is managed through knowledge transfer mechanisms. Knowledge transfer in an organization can be defined as the process by which one unit (e.g., a group, department or division0is affected by experiences. Another definition suggests that knowledge transfer at the individual levels is how knowledge acquired in one situation applies

Knowledge Architecture for communication in organizations

- Knowledge architecture can be regarded as a prerequisite to knowledge sharing.
- The infrastructure can be viewed as a combination of people, content, and technology.
- These components are inseparable and interdependent.



The People Core

- By *people*, here we mean knowledge workers, managers, customers, and suppliers.
- As the first step in knowledge architecture, our goal is to evaluate the existing information/ documents which are used by people, the applications needed by them, the people they usually contact for solutions, the associates they collaborate with, the official emails they send/receive, and the database(s) they usually access.
- All the above stated resources help to create an employee *profile*, which can later be used as the basis for designing a knowledge management system.
- The idea behind assessing the people core is to do a proper job in case of assigning job content to the right person and to make sure that the flow of information that once was obstructed by departments now flows to right people at right time.
- In order to expedite knowledge sharing, a knowledge network has to be designed in such a way as to assign people authority and responsibility for specific kinds of knowledge content, which means:

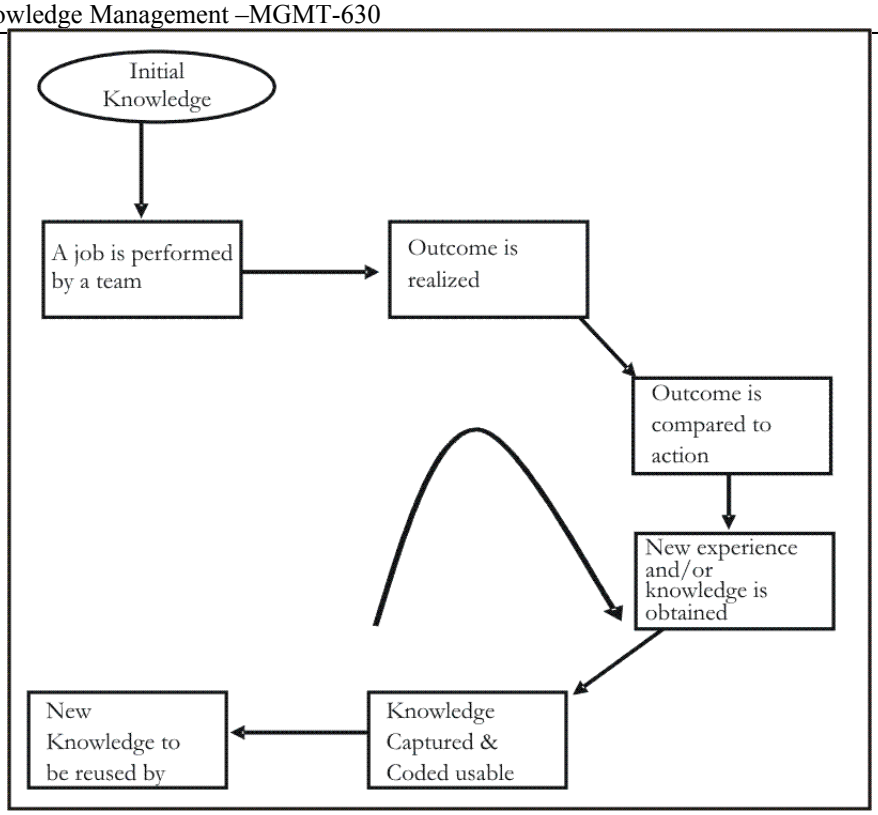
- Identifying knowledge centers:
  - After determining the knowledge that people need, the next step is to find out where the required knowledge resides, and the way to capture it successfully.
  - Here, the term *knowledge center* means areas in the organization where knowledge is available for capturing.
  - These centers supports to identify expert(s) or expert teams in each center who can collaborate in the necessary knowledge capture process.
- Activating knowledge content satellites
  - This step breaks down each knowledge center into some more manageable levels, satellites, or areas.
- Assigning experts for each knowledge center:
  - After the final framework has been decided, one manager should be assigned for each knowledge satellite that will ensure integrity of information content, access, and update.
  - Ownership is a crucial factor in case of knowledge capture, knowledge transfer, and knowledge implementation.
  - In a typical organization, departments usually tend to be territorial.
  - Often, fight can occur over the budget or over the control of sensitive processes (this includes the kind of knowledge a department owns).
  - These reasons justify the process of assigning department ownership to knowledge content and knowledge process.
  - adjacent/interdependent departments should be cooperative and ready to share knowledge.

The Technical Core

- The objective of the technical core is to enhance communication as well as ensure effective knowledge sharing.
- Technology provides a lot of opportunities for managing tacit knowledge in the area of communication.
- Communication networks create links between necessary databases.
- Here the term *technical core* is meant to refer to the totality of the required hardware, software, and the specialized human resources.
- Expected attributes of technology under the technical core: Accuracy, speed, reliability, security, and integrity.
- Since an organization can be thought of as a knowledge network, the goal of knowledge economy is to push employees towards greater efficiency/ productivity by making best possible use of the knowledge they posses.
- A knowledge core usually becomes a network of technologies designed to work on top of the organization's existing network.

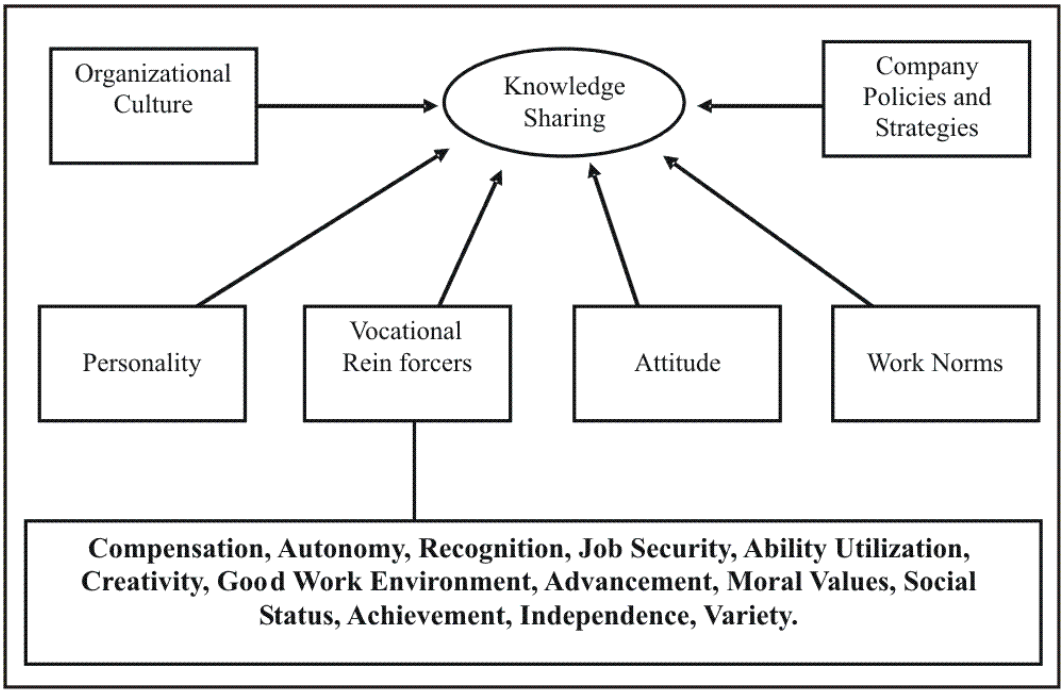
Knowledge Creation in Organizations

- Knowledge update can mean creating new knowledge based on ongoing experience in a specific domain and then using the new knowledge in combination with the existing knowledge to come up with updated knowledge for knowledge sharing.
- Knowledge in organizations can be created through teamwork
- A team can commit to perform a job over a specific period of time.
- A job can be regarded as a series of specific tasks carried out in a specific order.
- When the job is completed, then the team compares the experience it had initially (while starting the job) to the outcome (successful/disappointing).
- This comparison translates experience into knowledge.
- While performing the same job in future, the team can take corrective steps and/or modify the actions based on the new knowledge they have acquired.
- Over time, experience usually leads to expertise where one team (or individual) can be known for handling a complex problem very well.
- This knowledge can be transferred to others in a reusable format.



There exists factors that encourage (or retard) knowledge transfer.

- Personality is one factor in case of knowledge sharing.
- For example, extrovert people usually posses self-confidence, feel secure, and tend to share experiences more readily than the introvert, self-centered, and security-conscious people.
- People with positive attitudes, who usually trust others and who work in environments conductive to knowledge sharing tends to be better in sharing knowledge.
- Vocational rein forcers are the key to knowledge sharing.
- People whose vocational needs are sufficiently met by job rein forcers are usually found to be more likely to favour knowledge sharing than the people who are deprived of one or more rein forcers.



Impediments to knowledge Sharing in Organizations

LESSON 24

IMPORTANCE OF TACIT AND EXPLICIT KNOWLEDGE

Knowledge Creation And Knowledge Architecture

Test Your Understanding

1. *What is knowledge creation?*

Is using the new knowledge acquired from ongoing experiences in a particular problem area, in combination with the initial knowledge, to come up with extended knowledge that should improve the quality and effectiveness of performing the same job the next time around.

2. A job is more than a task. Do you agree? Give an example.

True. It is a series of specific tasks carried out in a specific order, format, or sequence.
Example: The job of procurement coordination requires several tasks such as
(Planning short-term purchases, creating profiles for suppliers, selecting the best supplier, tracking orders progress, ...etc).

3. How is knowledge created and transferred via teams?

- Essentially, a team commits to performing a job with an initial knowledge
- The team performs the job
- Realizes outcome
- Compares outcome to action "before and after"
- New experience/ knowledge is gained
- Knowledge captured and represented in a form usable by others
- This new knowledge is reusable by same team on next job

4. Explain the main impediments in knowledge sharing.

- Personality
- Attitude
- Vocational rein forcers
- Work norms

5. Explain the main steps in knowledge transfer.

- A team gets together with initial knowledge. It performs a specific job
- The job outcome is realized and is compared to action
- A new experience or knowledge is gained
- The new experience is captured and codified in a form usable by others
- The new knowledge is reusable by the same team on the next job.

6. In your own words, define tacit knowledge capture. What makes it unique?

Knowledge capture is the process of extracting the knowledge of how an expert arrives at a solution for a particular problem. This includes the actual steps and reasoning involved in arriving at the solution as well as the subjective logic that an expert uses in addressing the problem.

Knowledge capture is unique, in that the procedure does not follow an algorithmic flow or a particular syntax to solve a problem.

7. Are there any particular steps involved in knowledge capture? Explain briefly.

Knowledge capture involves three steps:

Using an appropriate tool to elicit the information from the expert. Extensive interview with the expert usually accomplishes this step.

Interpreting the verbal information and inferring the expert's underlying knowledge and reasoning process. In this step, the knowledge developer decides where the information gathered fits into the development process of the knowledge-based system. Throughout the interviewing process, the knowledge developer gathers information on the expert's rationale for arriving at a decision. It is important that the knowledge developer thoroughly questions the expert on all angles of the problem domain.

Taking the results from step two and using it to build the rules that represent the expert's thought process or solutions. This step may require several checks to ensure the resulting system meets the needs of the user and has captured "the expert" as closely as possible. Flowcharts, flow diagrams, decision trees, decision tables, and other graphic representation can be used to depict the rules for the expert's solution.

8. How would one identify expertise?

The collection of the several indicators of expertise would help the knowledge developer identify who would be an appropriate expert for a problem domain. These include:

a. Genuine respect from peers with regard to the expert's decisions as good decisions
b. People consult the expert when a problem arises
c. Admitting to not knowing everything about a problem which demonstrates his or her
d. confidence and provides a realistic view of limitations, avoiding irrelevant information and focusing on the facts.
e. Working with a clear focus
f. Being able to explain the information to different audience levels.
g. Depth of detail and exceptional quality in explanations
h. Demonstrating no arrogance regarding personal credentials
i. Years of experience
j. Strong ties with people in power

9. Working with experts requires certain skills and experience. What suggestions or advice would you give to an inexperienced knowledge developer concerning:
a. working with or approaching an expert
b. preparing for the first session

A and b are interrelated in the overall effort and interactions with the expert(s). Any knowledge developer, no matter how well experienced, must educate himself or herself in the expert's area and be fully prepared for the knowledge acquisition phase. Perceptions are extremely important in knowledge capture. If the

10. Working with multiple experts has definite benefits and limitations. Cite an example in which the use of multiple experts is a must. Explain your choice.

An example in which the user of multiple experts is a must could be for development of a knowledge-based system to predict the next direction of a given stock on the New York Stock Exchange. The reasons you would need multiple experts are the complexity of the problem domain, listening to a variety of views on stock exchange theory and behavior before attempting an approach or a solution. With this example, there is no single individual who is an expert in all aspects of the company stocks or the stock exchange or even the economy.

LESSON 25

SECI PROCESS AND BA FOR K. CREATION

Nonaka's Model of Knowledge Creation & Transformation

In 1995, Nonaka coined the terms *tacit knowledge* and *explicit knowledge* as the two main types of human knowledge. The key to knowledge creation lies in the way it is mobilized and converted through technology.

- **Tacit to tacit communication** (Socialization): Takes place between people in meetings or in team discussions.
- **Tacit to explicit communication** (Externalization): Articulation among people trough dialog (e.g., brainstorming).
- **Explicit to explicit communication** (Communication): This transformation phase can be best supported by technology. Explicit knowledge can be easily captured and then distributed/transmitted to worldwide audience.

Explicit to tacit communication (Internalization): This implies taking explicit knowledge (e.g., a report) and deducing new ideas or taking constructive action. One significant goal of knowledge management is to create technology to help the users to derive tacit knowledge from explicit knowledge.

Socialization-Externalization-Combination-Internalization Process

Organizations create and define problems, develop and apply knowledge to solve the problems, and then further develop new knowledge through the action of problem solving. In many organizations, developing new knowledge is even more important than keeping track of existing knowledge. The organization is not merely an information processing machine, but an entity that creates knowledge through action and interaction. It interacts with its environment, and reshapes the environment and even itself through the process of knowledge creation.

Hence, Nonaka et al. (2000) argue that the most important aspect of understanding a firm's capability concerning knowledge is the dynamic capability to continuously create new knowledge out of existing firm-specific capabilities, rather than the stock of knowledge that a firm possesses at any one point in time. With this view of an organization as an entity that creates knowledge continuously, we need to reexamine our theories of the firm, in terms of how it is organized and managed, how it interacts with its environment, and how its members interact with each other. This is the topic in a later chapter on resource-based strategy.

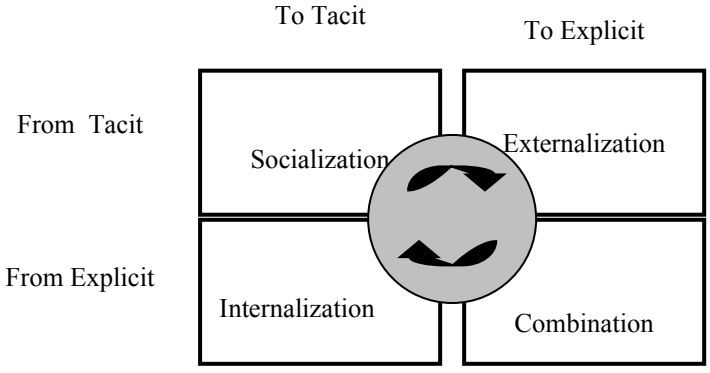
Knowledge creation is a continuous, self-transcending process through which one transcends the boundary of the old self into a new self by acquiring new context, a new view of the world, and new knowledge One also transcends the boundary between self and other, as knowledge is created through the interactions among individuals or between individuals and their environment.

To understand how organizations create knowledge dynamically, Nonaka et al. (2000) proposed a model of knowledge creation, consisting of three elements: (1) the SECI process, the process of knowledge creation through conversion between tacit and explicit knowledge, in which SECI captures socialization, externalization, combination, and internalization (2) ba, the shared context for knowledge creation and the place to create knowledge, and (3) knowledge assets, the resources required to enable knowledge creation, such as inputs, outputs, and moderator of the knowledge creating process.

The three elements of knowledge creation have to interact with each other to form the knowledge spiral that creates knowledge. An organization creates knowledge through interactions between explicit and tacit knowledge. This interaction is a called knowledge conversion. Through the conversion process, tacit and explicit knowledge expand in both quality and quantity. There are four steps in knowledge conversion: from tacit to tacit, from tacit to explicit, from explicit to explicit, and from explicit to tacit. These four steps are called socialization, externalization, combination and internalization, and they cover the SECI process.

- Socialization is the conversion of tacit knowledge to tacit knowledge. New tacit knowledge is converted through shared experiences. New tacit knowledge is acquired through shared experience, such as spending time together or living in the same environment. Socialization takes place when new skills are acquired by spending time with others who have those skills. Socialization does also occur outside the typical workplace, when mental models and opinions are shard among persons who are present. Socialization is the sharing of tacit knowledge between individuals, usually through joint activities rather than written or verbal instructions. For example, by transferring ideas and images, apprenticeships allow newcomers to see the way other think. Knowledge is produced in a group setting not only through mere acquisition of the individuals' knowledge, but also through the sharing of common understanding. Social processes play an important role in the transition of knowledge across individuals or groups.
- Externalization is the conversion of tacit knowledge to explicit knowledge. Tacit knowledge is articulated into explicit knowledge. Explicit knowledge can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications manuals and the like. This kind of knowledge can be readily transmitted between individuals both formally and systematically. The successful conversion of tacit knowledge into explicit knowledge depends on the common knowledge space as well as use of means such as metaphors, analogy and mental models. Externalization involves the expression of tacit knowledge and its conversion into comprehensible forms that are easier to understand. Conventional learning methodologies require the externalization of the professor's knowledge as the initial step in the students' learning process. Externalization involves techniques that help to express ideas or images as words, concepts, visuals, or figurative language (e.g., metaphors, analogies, and narratives), and deductive/inductive reasoning or creative inference.
- Combination is the conversion of explicit knowledge to explicit knowledge. Explicit knowledge is converted into more complex and systematic sets of explicit knowledge. Explicit knowledge is collected from inside and outside the organization and then combined, edited and processed to from new explicit knowledge. The new knowledge is then disseminated among the members of the organization. When the financial controller collects information from all parts of the organization and puts it together to show the financial health of the organization, that report is new knowledge in the sense that it synthesizes explicit knowledge from a many different sources in one context. Combination involves the conversion of explicit knowledge into more complex sets of explicit knowledge. Focusing on communication, diffusion, integration, and systemization of knowledge, combination contributes to knowledge at the group level as well as tat the organizational level. Innovative organizations seek to develop new concepts that are created, justified, and modeled at the organizational, and sometimes inter organizational, level. Complex organizational processes require the cooperation of various groups within the organization, and combination supports these processes by aggregating technologies and knowledge.

SECI Process of Knowledge Creation



- Internalization is the conversion of explicit knowledge to tacit knowledge. Individuals convert explicit knowledge into tacit knowledge. By reading documents or manuals about their jobs and the organization, new employees can internalize this explicit knowledge in such documents to start doing their jobs. When internalization has occurred, the new knowledge becomes part of existing mental models and know-how. This tacit knowledge accumulated at the individual level

can stimulate a new spiral of knowledge creation when it is shared with others through socialization. Internalization requires the individual to identify the knowledge relevant to oneself within the organization's explicit knowledge. In internalization processes, the explicit acquiring the knowledge can re-experience what others go through. Alternatively, individuals could acquire tacit knowledge in virtual situations, either vicariously be reading or listening to others' stories, or experientially through simulations or experiments. Learning by doing, on-the-job training, learning by observation, and face-to-face meetings are some of the internalization processes by which individuals acquire knowledge

Knowledge creation is a continuous process of dynamic interactions between tacit and explicit knowledge. Such interactions are shaped by shifts between different modes of knowledge conversion, not just through one mode of interaction. Knowledge created through each of the four modes of knowledge conversion interacts in the spiral of knowledge creation. Nonaka et al. (2000) emphasize that it is important to note that the movement through the four modes of knowledge conversion forms a spiral, not a circle.

The first element of the Nonaka et al. (20000 model for knowledge creation is the SECI process. The second element is ba, which is the name given the location or context where knowledge creation takes place. Knowledge needs a context to be created. The context is defined in terms of who participates and how they participate. Knowledge needs a physical context to be created; there is no creation without a place. Ba, which can be translated to place, offers such a context. Ba does not necessarily mea a physical place. The Japanese word ba means a place at a specific time. Ba is the real cultural, social and historic context which is of importance to each knowledge worker, and which enables each knowledge worker to understand and appreciate information. Ba is the place where information is understood so that it becomes knowledge.

The key concept in understanding ba is interaction. Knowledge creation is a dynamic human process that transcends existing boundaries. Knowledge is created through the interactions among individuals or between individuals and their environments, rather than by an individual operating alone. Ba is the context shared by those who interact with each other, and through such interactions, those who participate in ba and the context itself evolve through self-transcendence to create knowledge. Participants of ba cannot be mere onlookers. Instead, they are committed to ba through action and interaction.

Ba lets participants share time and space, and yet it transcends time and space. In knowledge creation, especially in socialization and externalization, it is important for participants to share time and space. A close physical interaction is important in sharing the context and forming a common language among participants. Also, since knowledge is intangible, unbounded and dynamic and cannot be stocked, ba works as the platform of knowledge creation by collecting the applied knowledge of the area into a certain time and spaces and integrating it. However, as ba can be a mental or virtual place as well as a physical place, it does not have to be bound to a certain space and time.

The third and final element of the knowledge creation model is knowledge assets. Assets are firm-specific resources that are used to create value for the firm. Knowledge assets are resources required to support the knowledge creating process. Important knowledge assets are trust, roles and routines. Trust is required to stimulate knowledge workers to share knowledge and to enter into a social knowledge creation process. Roles have to be defined so that knowledge workers are familiar with how the knowledge creation process is to take place. Routines are important to know, so that different knowledge workers in different roles handle time and place and frequencies for knowledge creation equally. Knowledge assets must be built and used internally in order to be valuable to the firm, as they cannot be acquired externally.

To understand how knowledge assets are created, acquired and exploited, Nonaka et al. (2000) proposed to categorize knowledge assets into four types: experiential knowledge assets, conceptual knowledge assets, systemic knowledge assets and routine knowledge assets. Experiential knowledge assets consist of the shared tacit knowledge that is built through shared hands-on experience amongst the members of the organization, and between the members of the organization and its customers, suppliers and affiliated firms. Skills and know-how that area acquired and accumulated by individuals through experiences at work are examples of experiential knowledge assets.

Conceptual knowledge assets consist of explicit knowledge articulated through mages, symbols and language. They are the assets based on the concepts held by customers and members of the organization. Systemic knowledge assets consist of systematized and packaged explicit knowledge, such as explicitly stated technologies, product specifications, manuals, and documented and packaged information about customers and suppliers. Routine knowledge assets consist of the tacit knowledge that is routinized and embedded in the actions and practices of the organization. Know-how, organizational culture and organizational routines for carrying out the day-to-day business of the organization are examples of routine knowledge assets.

These four types of knowledge assets form the basis of the knowledge creating process. To manage knowledge creation and exploitation effectively, a company has to map its stocks of knowledge assets. However, cataloguing the existing knowledge is not enough. As stated above, knowledge assets are dynamic, and new knowledge assets can be created from existing knowledge assets.

The three elements of the knowledge creation model – SECI, ba and assets – represent requirements which all have to be taken care of by management to achieve successful knowledge creation. The SECI process takes care of the interaction between tacit and explicit knowledge, while ba is the place for this interaction, and knowledge assets are the resources for this interaction. When moving through the SECI process in a spiral, the organization develops new knowledge. This spiral is dependent on ba and is stimulated by conditions of growth based on available knowledge assets.

Management is important in all three elements. Executive management is responsible for articulating corporate knowledge ambitions. Middle management is responsible for creating and sustaining ba. Both executive and middle management are responsible for the availability of knowledge assets. The knowledge-creating process cannot be managed in the traditional sense of management, which centers on controlling the flow of information. Managers ca, however, lead the organization to actively and dynamically create knowledge by providing certain conditions.

Researchers and practitioners argue that most of the knowledge applied by individuals in organization is tacit knowledge. Traditionally, organizations have been concerned with management of explicit knowledge, which is of less importance to the business at any point in time. However, tacit and explicit knowledge are dependent on each other to be complete sources of knowledge. When we apply the SECI process, we see that there is an interaction between explicit and tacit knowledge, which creates new knowledge. In the externalization stage, tacit knowledge is concerted into explicit knowledge. The successful conversion of tacit knowledge into explicit knowledge depends on the common knowledge space as well as use of means such as metaphors, analogy and mental models. Such means help individuals express knowledge in words and numbers and share it in the form of data, scientific formulae, specification, manuals and the like This kind of knowledge can be readily transmitted between individuals both formally and systematically.

Nonaka et al. (2000) argue that fostering love, care, trust and commitment amongst organizational members is important, as it forms the foundation of knowledge creation. For knowledge (especially tacit knowledge) to be shared and for the self-transcending process of knowledge creation to occur, there should be strong love, caring and trust among organization members. As information creates power, an individual might be motivated to monopolize it, hiding it even from his or her colleagues. However, as knowledge needs to be shared to be created and exploited, it is important for leaders to create an atmosphere in which organization members feel safe sharing their knowledge. It is also important for leaders to cultivate commitment amongst organization members to motivate the sharing and creation of knowledge, preferably based on a corporate knowledge vision.

Nonaka et al. (2000) defined knowledge assets as firm-specific resources that are indispensable to create value for the firm; knowledge assets are inputs, outputs and moderating factors of the knowledge-creating process. For example, trust amongst organizational members is produced as an output of the knowledge-creating process, and at the same time trust moderates how ba functions as a platform for the knowledge-creating process. This definition of knowledge assets focuses on resources for knowledge creation.

LESSON 26

KNOWLEDGE SPIRAL AND SUSTAINED ORGANIZATIONAL ADVANTAGES THROUGH SECI PROCESS

Knowledge Conversion: Interaction between Tacit and Explicit Knowledge

The history of Western epistemology can be seen as a continuous controversy about which type of knowledge is more truthful. While Westerners tend to emphasize explicit knowledge, the Japanese tend to stress tacit knowledge. In our view, however, tacit knowledge and explicit knowledge are not totally separate but mutually complementary entities. They interact with and interchange into each other in the creative activities of human beings. Our dynamic model of knowledge creation is anchored to a critical assumption that human knowledge is created and expanded through social, interaction between tacit knowledge and explicit knowledge. We call this interaction "knowledge conversion." It should be noted that this conversion is a "social" process between individuals and not confined within an individual. According to the rationalist view, human cognition is a deductive process of individuals, but an individual is never isolated from social interaction when he or she perceives things. Thus, through this "social conversion" process, tacit and explicit knowledge expand in terms of both quality and quantity (Nonaka, 1990b).

The idea of "knowledge conversion" may be partially consonant with the ACT model developed in cognitive psychology .This model hypothesizes that for cognitive skills to develop, all declarative knowledge, which corresponds to explicit knowledge in our theory, has to be transformed into procedural knowledge, which corresponds to tacit knowledge, used in such activities as riding a bicycle or playing the piano. The ACT model has one limitation. It views the transformation as a special case, because this model's research interest is focused on the acquisition and transfer of procedural (tacit) knowledge, not declarative (explicit) knowledge. In other words, proponents of this model consider knowledge transformation as mainly unidirectional from declarative (explicit) to procedural (tacit), whereas we argue that the transformation is interactive and spiral.

Four Modes of Knowledge Conversion

The assumption that knowledge is created through the interaction between tacit and explicit knowledge allows us to postulate four different modes of knowledge conversion. They are as follows: (1) from tacit knowledge to tacit knowledge, which we call socialization; (2) from tacit knowledge to explicit knowledge, or externalization; (3) from explicit knowledge to explicit knowledge, or combination; and (4) from explicit knowledge to tacit knowledge, or internalization. Three of the four types of knowledge conversion-socialization, combination, and internalization-have been discussed from various perspectives in organizational theory. For example, socialization is connected with the theories of group processes and organizational culture; combination has its roots in information processing; and internalization is closely related to organizational learning. However, externalization has been somewhat neglected. Each of these four modes of knowledge conversion will be discussed in detail below, along with actual examples.

Socialization: From Tacit to Tacit

Socialization is a process of sharing experiences and thereby creating tacit knowledge such as shared mental models and technical skills. An individual can acquire tacit knowledge directly from others without using language. Apprentices work with their masters and learn craftsmanship not through language but through observation, imitation, and practice. In the business setting, on-the-job training uses basically the same principle. The key to acquiring tacit knowledge is experience. Without some form of shared experience, it is extremely difficult for one person to project her- or himself into another individual's thinking process. The mere transfer of information will often make little sense, if it is abstracted from associated emotions and specific contexts in which shared experiences are embedded. The following three examples illustrate how socialization is employed by Japanese companies within the product development context.

The first example of socialization comes from Ronda, which set up "brainstorming camps" (tama dashi kai)-informal meetings for detailed discussions to solve difficult problems in development projects. The meetings are held outside the workplace, often at a resort inn where participants discuss difficult problems while drinking sake, sharing meals, and taking a bath together in a hot spring. The meetings are not limited to project team members but are open to any employees who are interested in the development project under way. In these discussions, the qualifications or status of the discussants are never questioned, but there is one taboo: criticism without constructive suggestions. Discussions are held with the understanding that "making criticism is ten times easier than coming up with a constructive alternative." This kind of brainstorming camp is not unique to Ronda but has been used by many other Japanese firms. It is also not unique to developing new products and services but is also used to develop managerial systems or corporate strategies. Such a camp is not only a forum for creative dialogue but also a medium for sharing experience and enhancing mutual trust among participants. It is particularly effective in sharing tacit knowledge and creating anew perspective. It reorients the mental models of all individuals in the same direction, but not in a forceful way. Instead, brainstorming camps represent a mechanism through which individuals search for harmony by engaging themselves in bodily as well as mental experiences.

The second example, which shows how a tacit technical skill was socialized, comes from the Matsushita Electric Industrial Company. A major problem at the Osaka-based company in developing an automatic home bread-making machine in the late 1980s centered on how to mechanize the dough-kneading process, which is essentially tacit knowledge possessed by master bakers. Dough kneaded by a master baker and by a machine were x-rayed and compared, but no meaningful insights were obtained. Ikuko Tanaka, head of software development, knew that the area's best bread came from the Osaka International Hotel. To capture the tacit knowledge of kneading skill, she and several engineers volunteered to apprentice themselves to the hotel's head baker. Making the same delicious bread as the head baker's was, not easy. No one could explain why. One day, however, she noticed that the baker was not only stretching but also "twisting" the dough, which turned out to be the secret for making tasty bread. Thus she socialized the head baker's tacit knowledge through observation, imitation, and practice.

Socialization also occurs between product developers and customers. Interactions with customers before product development and after market introduction are, in fact, a never-ending process of sharing tacit knowledge and creating ideas for improvement. The way NEC developed its first personal computer is a case in point. The new-product development process began when a group from the Semiconductor and IC Sales Division conceived of an idea to sell Japan's first microcomputer kit, the TK-80, to promote the sales of semiconductor devices. Selling the TK-80 to the public at large was a radical departure from NEC's history of responding to routine orders from Nippon Telegraph and Telephone (NTT). Unexpectedly, a wide variety of customers, ranging from high school students to professional computer enthusiasts, came to NEC's BIT-INN, a display service center in the Akihabara district of Tokyo, which is famous for its high concentration of electronic goods retailers. Sharing experiences and continuing dialogues with these customers at the BIT-INN resulted in the development of NEC's best-selling personal computer, the PC-8000, a few years later.

Externalization: From Tacit to Explicit

Externalization is a process of articulating tacit knowledge into explicit concepts. It is a quintessential knowledge-creation process in that tacit knowledge becomes explicit, taking the shapes of metaphors, analogies, concepts, hypotheses, or models. When we attempt to conceptualize an image, we express its essence mostly in language-writing is an act of converting tacit knowledge into articulable knowledge . Yet expressions are often inadequate, inconsistent, and insufficient. Such discrepancies and gaps between images and expressions, however, help promote "reflection" and interaction between individuals.

The externalization mode of knowledge conversion is typically seen in the process of concept creation and is triggered by dialogue or collective reflection.13 A frequently used method to create a concept is to combine deduction and induction. Mazda, for example, combined these two reasoning methods when it developed the new RX-7 concept, which is described as "an authentic sports car that provides an exciting and comfortable drive." The concept was deduced from the car maker's corporate slogan: "create new values and present joyful driving pleasures" as well as the positioning of the new car as "a strategic car for the U.S. market and an image of innovation." At the same time, the new concept was

induced from "concept" trips," which were driving experiences by development team members in the United States as well as from "concept clinics," which gathered opinions from customers and car experts. When we cannot find an adequate expression for an image through analytical methods of deduction or induction, we have to use a non analytical method. Externalization is, therefore, often driven by metaphor and/or analogy. Using an attractive metaphor and/or analogy is highly effective in fostering direct commitment to the creative process. Recall the Ronda City example. In developing the car, Riroo
Watanabe and his team used a metaphor of "Automobile Evolution." His team viewed the automobile as an organism and sought its ultimate form. In essence, Watanabe was asking, "What will the automobile eventually evolve into?"

> I insisted on allocating the minimum space for mechanics and the maximum space for passengers. This seemed to be the ideal car, into which the automobile should evolve. ...The first step toward this goal was to challenge the "reasoning of Detroit," which had sacrificed comfort for appearance. Our choice was a short but tall car...spherical, therefore lighter, less expensive, more comfortable, and solid.

The concept of a tall and short car-"Tall Boy"-emerged through an analogy between the concept of "man-maximum, machine-minimum" and an image of a sphere that contains the maximum volume within the minimum area of surface, which ultimately resulted in the Honda City.

The case of Canon's Mini-Copier is a good example of how an analogy was used effectively for product development. One of the most difficult problems faced by the development team was producing at low, cost a disposable cartridge, which would eliminate the necessity for maintenance required in conventional machines. Without a disposable cartridge, maintenance staff would have to be stationed allover the country, since the copier was intended for family or personal use. If the usage frequency were high, maintenance costs could be negligible. But that was not the case with a personal copier. The fact that a large number of customers would be using the machine only occasionally meant that the new product had to have high reliability and no or minimum maintenance. A maintenance study showed that more than 90 percent of the problems came from the drum or its surrounding parts. Aimed at cutting maintenance costs while maintaining the highest reliability, the team developed the concept of a disposable cartridge system in which the drum or the heart of the copier is replaced after a certain amount of usage.

The next problem was whether the drum could be produced at a cost low enough to be consistent with the targeted low selling price of the copier. A task force assigned to solve this cost problem had many heated discussions about the production of conventional photosensitive drum cylinders with a base material of aluminum-drawn tube at a 1ow cost. One day Riroshi Tanaka, leader of the task force, sent out for some cans of beer. Once the beer was consumed, he asked, "How much does it cost to manufacture this can?" The team then explored the possibility of applying the process of manufacturing the beer can to manufacturing the drum cylinder, using the same material. By clarifying similarities and differences, they discovered a process technology to manufacture the aluminum drum at a low cost, thus giving rise to the disposable drum.

These examples within Japanese firms clearly show the effectiveness of the use of metaphor and analogy in creating and elaborating a concept . As Honda's Watanabe commented, "We are more than halfway there, once a product concept has been created." In this sense, the leaders' wealth of figurative language and imagination is an essential factor in eliciting tacit knowledge from project members.

Among the four modes of knowledge conversion, externalization holds the key to knowledge creation, because it creates new, explicit concepts from tacit knowledge. How can we convert tacit knowledge into explicit knowledge effectively and efficiently? The answer lies in a sequential use of metaphor, analogy, and model. As Nisbet (1969) noted, "much of what Michael Polanyi has called 'tacit knowledge' is expressible-in so far as it is expressible at all-in metaphor" . Metaphor is away of perceiving or intuitively understanding one thing by imaging another thing symbolically.

Product (Company)	Metaphor/Analogy	Influence on Concept Creation
City (Honda)	"Automobile Evolution" (Metapor) The sphre (analogy)	Hint of maximizing passenger space as ultimate auto development "Man-maximum, machine-minimum" concept created. Hint of achieving maximum passenger space through minimizing surface area "Tall and short car (Tall Boy)" concept created
Mini-Copier (Canon)	Aluminum beer can (analogy)	Hin of similarities between inexpensive aluminum beer can and photosensitive drum manufacture "Low-cost manufacturing process" concept created
Home Bakery (Mathsushita)	Hotel bread (metaphor) Osaka International Hotel head baker (analogy)	Hint of more delicious bread "Twist dough" concept created

Metaphors are one communication mechanism that can function to reconcile discrepancies in meaning. Moreover, metaphor is an important tool for creating a network of new concepts. Because a metaphor is "two thoughts of different things...supported by a single word, or phrase, whose meaning is a resultant of their interaction".), we can continuously relate concepts that are far apart in our mind, even relate abstract concepts to concrete ones. This creative, cognitive process continues as we think of the similarities among concepts and feel an imbalance, inconsistency, or contradiction in their associations, thus often leading to the discovery of new meaning or even to the formation of a new paradigm.

Contradictions inherent in a metaphor are then harmonized by analogy , which reduces the unknown by highlighting the "commonness" of two different things. Metaphor and analogy are often confused. Association of two things through metaphor is driven mostly by intuition and holistic imagery and does not aim to find differences between them. On the other hand, association through analogy is carried out by rational thinking and focuses on structural/functional similarities between two things, and hence their differences. Thus analogy helps us understand the unknown through the known and bridges the gap between an image and a logical model.

Once explicit concepts are created, they can then be modeled. In a logical model, no contradictions should exist and all concepts and propositions must be expressed in systematic language and coherent logic. But in business terms, models are often only rough descriptions or drawings, far from being fully specific. Models are usually generated from metaphors when new concepts are created in the business con text.

Combination: From Explicit to Explicit

Combination is a process of systemizing concepts into a knowledge system. This mode of knowledge conversion involves combining different bodies of explicit knowledge. Individuals exchange and combine knowledge through such media as documents, meetings, telephone conversations, or computerized communication networks. Reconfiguration of existing information through sorting, adding, combining, and categorizing of explicit knowledge (as conducted in computer databases) can lead to new knowledge. Knowledge creation carried out in formal education and training at schools usually takes this form. An MBA education is one of the best examples of this kind.

In the business context, the combination mode of knowledge conversion is most often seen when middle managers break down and operationalize corporate visions, business concepts, or product concepts. Middle management plays a critical role in creating new concepts through networking of codified information and knowledge. Creative uses of computerized communication networks and large-scale databases facilitate this mode of knowledge conversion.

At Kraft General Foods, a manufacturer of dairy and processed foods, data from the POS (point-of-sales) system of retailers is utilized not only to find out what does and does not sell well but also to create new "ways to sell," that is, new sales systems and methods. The company has developed an information-intensive marketing program called "micro-merchandizing," which provides supermarkets with timely and precise recommendations on the optimal merchandise mix and with sales promotions based on the analysis of data from its micro-merchandising system. Utilizing Kraft's individual method of data analysis, including its unique classification of stores and shoppers into six categories, the system is capable of pinpointing who shops where and how. Kraft successfully manages its product sales through super-markets by controlling four elements of the "category management" methodology-consumer and category dynamics, space management, merchandizing management, and pricing management.

At the top management level of an organization, the combination mode is realized when mid-range concepts {such as product concepts) are combined with and integrated into grand concepts {such as a corporate vision) to generate anew meaning of the latter. Introducing anew corporate image in 1986, for example, Asahi Breweries adopted a grand concept dubbed "live Asahi for live people." The concept stood for the message that "Asahi will provide natural and authentic products and services for those who seek active minds and active lives."
Along with this grand concept, Asahi inquired into the essence of what makes beer appealing, and developed Asahi Super Dry beer based on the new-product concept of "richness and sharpness." The new-product concept is a mid-range concept that made the grand concept of Asahi more explicitly recognizable, which in turn altered the company's product development system. The taste of beer was hitherto decided by engineers in the production department without any participation by the sales department. The "richness and sharpness" concept was realized through cooperative product development by both departments.

Other examples of interaction between grand concepts and midrange concepts abound. For example, NEC's "C&C" (computers and communications) concept induced the development of the epoch-making PC-8000 personal computer, which was based on the mid-range concept of "distributed processing." Canon's corporate policy, "Creation of an excellent company by transcending the camera business," led to the development of the Mini-Copier, which was developed with the mid-range product concept of "easy maintenance." Mazda's grand vision, "Create new values and present joyful driving," was realized in the new RX-7, "an authentic sports car that provides an exciting and comfortable drive."

Internalization: From Explicit to Tacit

Internalization is a process of embodying explicit knowledge into tacit knowledge. It is closely related to "learning by doing." When experiences through socialization, externalization, and combination are internalized into individuals' tacit knowledge bases in the form of shared mental models or technical know-how, they become valuable assets.

All the members of the Ronda City project team, for example, internalized their experiences of the late 1970s and are now making use of that know-how and leading R&D projects in the company. For organizational knowledge creation to take place, however, the tacit knowledge accumulated at the individual level needs to be socialized with other organizational members, thereby starting anew spiral of knowledge creation.

For explicit knowledge to become tacit, it helps if the knowledge is verbalized or diagrammed into documents, manuals, or oral stories. Documentation helps individuals internalize what they experienced, thus enriching their tacit knowledge. In addition, documents or manuals facilitate the transfer of explicit knowledge to other people, thereby helping them experience the experiences of others indirectly (i.e., "re-experience" them). GE, for example, documents all customer complaints and inquiries in a database at its Answer Center in Louisville, Kentucky, which can be used, for example, by members of a new-product development team to "re-experience" what the telephone operators experienced. GE established the Answer Center in 1982 to process questions, requests for help, and complaints from customers on any product 24 hours a day, 365 days a year. Over 200 telephone operators respond to as many as 14,000 calls a day. GE has programmed 1.5 million potential problems and their solutions into its computerized database system. The system is equipped with an on-line diagnosis function utilizing the latest artificial intelligence technology for quick answers to inquiries; any problem-solution response

can be retrieved by the telephone operator in two seconds. In case a solution is not available, 12 specialists with at least four years of repair experience think out solutions on site. Four full-time programmers put the solutions into the database, so that the hew information is usually installed into the system by the following day. This information is sent to the respective product divisions every month. Yet, the product divisions also frequently send their new-product development people to the Answer Center to chat with the telephone operators or the 12 specialists, thereby "re-experiencing" their experiences.

Internalization can also occur even without having actually to "re-experience" other people's experiences. For example, if reading or listening to a success story makes some members of the organization feel the realism and essence of the story, the experience that took place in the past may change into a tacit mental model. When such a mental model is shared by most members of the organization, tacit knowledge becomes part of the organizational culture. This practice is prevalent in Japan, where books and articles on companies or their leaders abound. Freelance writers or former employees publish them, some-times at the request of the companies. One can find about two dozen books on Ronda or Soichiro Ronda in major bookstores today, all of which help instill a strong corporate culture for Honda.

An example of internalization through "learning by doing" can be seen at Matsushita when it launched a companywide policy in 1993 to reduce yearly working time to 1,800 hours. Called MIT'93 for "Mind and Management Innovation Toward 1993," the policy's objective was not to reduce costs but to innovate the mindset and management by reducing working hours and increasing individual creativity. Many departments were puzzled about how to implement the policy, which was clearly communicated as explicit knowledge. The MIT'93 promotion office advised each department to experiment with the policy for one month by working 150 hours. Through such a bodily experience, employees got to know what working 1,800 hours a year would be like. An explicit concept, reducing working time to 1,800 hours, was internalized through the one-month experience. Expanding the scope of bodily experience is critical to internalization. For example, Ronda City project leader Riroo Watanabe kept saying "Let's give it a try" to encourage the team members' experimental spirit. The fact that the development team was cross-functional enabled its members to learn and internalize a breadth of development experiences beyond their own functional specialization. Rapid prototyping also accelerated the accumulation of developmental experiences, which can lead to internalization.

Contents of Knowledge and the Knowledge Spiral

As already explained, socialization aims at the sharing of tacit knowledge. On its own, however, it is a limited form of knowledge creation. Unless shared knowledge becomes explicit, it cannot be easily leveraged by the organization as a whole. Also, a mere combination of discrete pieces of explicit information into anew whole-for example, a comptroller of a company collects information from throughout the company and puts it together in a financial report-does not really extend the organization's existing knowledge base. But when tacit and explicit knowledge interact, as in the Matsushita example, an innovation emerges. Organizational knowledge creation is a continuous and dynamic interaction between tacit and explicit knowledge. This interaction is shaped by shifts between different modes of knowledge conversion, which are in turn induced by several triggers (see Figure 3-3).

First, the socialization mode usually starts with building a "field" of interaction. This field facilitates the sharing of members' experiences and mental models. Second, the externalization mode is triggered by meaningful "dialogue or collective reflection," in which using appropriate metaphor or analogy helps team members to articulate hidden tacit knowledge that is otherwise hard to communicate. Third, the combination mode is triggered by "networking" newly created knowledge and existing knowledge from other sections of the organization, thereby crystallizing them into anew product, service, or managerial system. Finally, "learning by doing" triggers internalization.

The content of the knowledge created by each mode of knowledge conversion is naturally different (see Figure 3-4). Socialization yields what can be called "sympathized knowledge," such as shared mental models and technical skills. The tacit skill of kneading dough in the Matsushita example is a sympathized knowledge. Externalization out-puts "conceptual knowledge." The concept of "Tall Boy" in the Honda example is a conceptual knowledge created through the metaphor of "Automobile Evolution" and the analogy between a sphere and the concept of "man-maximum, machine-minimum." Combination gives rise to "systemic knowledge," such as a prototype and new component technologies.

The micro-merchandizing program in the Kraft General Foods example is a systemic knowledge, which includes retail management methods as its components. Internalization produces "operational knowledge" about project management, production process, new-product usage, and policy implementation. The bodily experience of working 150 hours a month in the Matsushita case is an operational knowledge of policy implementation.

These contents of knowledge interact with each other in the spiral f knowledge creation. For example, sympathized knowledge about consumers' wants may become explicit conceptual knowledge about a new-product concept through socialization and externalization. Such conceptual knowledge becomes a guideline for creating systemic knowledge through combination. For example, a new-product concept steers the combination phase, in which newly developed and existing component technologies are combined to build a prototype. Systemic knowledge (e.g., a simulated production process for the new product) turns into operational knowledge for mass production of the product through internalization. In addition, experience-based operational knowledge often triggers anew cycle of knowledge creation. For example, the users' tacit operational knowledge about a product is often socialized, thereby initiating improvement of an existing product or development of an innovation.

Thus far, we have focused our discussion on the epistemological dimension of organizational knowledge creation. As noted before, how-ever, an organization cannot create knowledge by itself. Tacit knowledge of individuals is the basis of organizational knowledge creation.

The organization has to mobilize tacit knowledge created and accumulated at the individual level. The mobilized tacit knowledge is "organizationally" amplified through four modes of knowledge conversion and crystallized at higher ontological levels. We call this the "knowledge spiral," in which the interaction between tacit knowledge and explicit knowledge will become larger in scale as it moves up the ontological levels. Thus, organizational knowledge creation is a spiral process, starting at the individual level and moving up through expanding communities of interaction that crosses sectional, departmental, divisional, and organizational boundaries.

This process is exemplified by product development. Creating a product concept involves a community of interacting individuals with different backgrounds and mental models. While the members from the R&D department focus on technological potential, those from the production and marketing departments are interested in other issues. Only some of those different experiences, mental models, motivations, and intentions can be expressed in explicit language. Thus, the socialization process of sharing tacit knowledge is required. Moreover, both socialization and externalization are necessary for linking individuals' tacit and explicit knowledge. Many Japanese companies have adopted brainstorming camps as a tool for that purpose.

The product created by this collective and cooperative process will then be reviewed for its coherence with mid-range and grand concepts. Even if the newly created product has superior quality, it may conflict with the divisional or organizational goals expressed by the mid-range and grand concepts. What is required is another process at a higher level to maintain the integrity of the whole, which will lead to another cycle of knowledge creation in a larger context.

LESSON 27

ENABLERS OF SECI PROCESS

Enabling Conditions for Organizational Knowledge Creation

The role of the organization in the organizational knowledge-creation process is to provide the proper context for facilitating group activities

Five-Phase Model of the Organizational Knowledge - Creation Process

Thus far we have looked at each of the four modes of knowledge conversion and the five enabling conditions that promote organizational knowledge creation. In this section we present an integrated, five-phase model of the organizational knowledge-creation process, using the basic constructs developed within the theoretical framework and incorporating the time dimension into our theory. The model, which should be interpreted as an ideal example of the process, consists of five phases: (1) sharing tacit knowledge; (2) creating concepts; (3) justifying concepts; (4) building an archetype; and (5) cross-leveling knowledge .

The organizational knowledge-creation process starts with the sharing of tacit knowledge, which corresponds roughly to socialization, since the rich and untapped knowledge that resides in individuals must first be amplified within the organization. In the second phase, tacit knowledge shared by, for example, a self-organizing team is converted to explicit knowledge in the form of anew concept, a process similar to externalization. The created concept has to be justified in the third phase, in which the organization determines if the new concept is truly worthy of pursuit. Receiving the go-ahead, the concepts are converted in the fourth phase into an archetype, which can take the form of a prototype in the case of "hard" product development or an operating mechanism in the case of "soft" innovations, such as anew corporate value, a novel managerial system, or an innovative organizational structure. The last phase extends the knowledge created in, for example, a division to others in the division, across to other divisions, or even to outside constituents in what we term cross-leveling of knowledge. These outside constituents include consumers, affiliated companies, universities, and distributors. A knowledge-creating company does not operate in a closed system but in an open system in which knowledge is constantly exchanged with the outside environment. We shall describe each of the five phases in more detail below.

The First Phase: Sharing Tacit Knowledge

As we have mentioned repeatedly, an organization cannot create knowledge by itself. Since tacit knowledge held by individuals is the basis of organizational knowledge creation, it seems natural to start the process by focusing on tacit knowledge, which is the rich, untapped source of new knowledge. But tacit knowledge cannot be communicated or passed onto others easily, since it is acquired primarily through experience and not easily expressible in words. Thus, the sharing of tacit knowledge among multiple individuals with different back-grounds, perspectives, and motivations becomes the critical step for organizational knowledge creation to take place. The individuals' emotions, feelings, and mental models have to be shared to build mutual trust.

To effect that sharing, we need a "field" in which individuals can interact with each other through face-to-face dialogues. It is here that they share experiences and synchronize their bodily and mental rhythms. The typical field of interaction is a self-organizing team, in which members from various functional departments work together to achieve a common goal. Examples of a self-organizing team include Matsushita's Home Bakery team and the Ronda City team. At Matsushita, team members apprenticed themselves to the head baker at the Osaka International Hotel to capture the essence of kneading skill through bodily experience. At Ronda, team members shared their mental models and technical skills in discussing what an ideal car should evolve into, often over sake and away from the office. These examples show that the first phase of the organizational knowledge-creation process corresponds to socialization.

A self-organizing team facilitates organizational knowledge creation through the requisite variety of the team members, who experience redundancy of information and share their interpretations of organizational intention. Management injects creative chaos by setting challenging goals and endowing team members with a high degree of autonomy. An autonomous team starts to set its own task boundaries and, as a "boundary-spanning unit," begins to interact with the external environment, accumulating both tacit and explicit knowledge.

The Second Phase: Creating Concepts

The most intensive interaction between tacit and explicit knowledge occurs in the second phase. Once a shared mental model is formed in the field of interaction, the self-organizing team then articulates it through further continuous dialogue, in the form of collective reflection. The shared tacit mental model is verbalized into words and phrases, and finally crystallized into explicit concepts. In this sense, this phase corresponds to externalization.

This process of converting tacit knowledge into explicit knowledge is facilitated by the use of multiple reasoning methods such as deduction, induction, and abduction. Particularly useful for this phase is abduction, which employs figurative language such as metaphors and analogies. In developing City, for example, the Ronda development team made ample use of figurative language such as "Automobile Evolution," "man-maximum, machine-minimum," and "Tall Boy." The quality of dialogue among team members can also be raised through the use of dialectics, which instills a creative way of thinking into the organization. It is an iterative and spiral process in which contradictions and paradoxes are utilized to synthesize new knowledge.

Concepts are created cooperatively in this phase through dialogue. Autonomy helps team members to diverge their thinking freely, with intention serving as a tool to converge their thinking in one direction. To create concepts, team members have to rethink their existing premises fundamentally. Requisite variety helps the team in this regard by providing different angles or perspectives for looking at a problem. Fluctuation and chaos, either from the outside or inside, also help members to change their way of thinking fundamentally. Redundancy of information enables team members to understand figurative language better and to crystallize their shared mental model.

The Third Phase: Justifying Concepts

In our theory of organizational knowledge creation, knowledge is defined as justified true belief. Therefore, new concepts created by individuals or the team need to be justified at some point in the procedure. Justification involves the process of determining if the newly created concepts are truly worthwhile for the organization and society. It is similar to a screening process. Individuals seem to be justifying or screening information, concepts, or knowledge continuously and unconsciously throughout the entire process. The organization, however, must conduct this justification in a more explicit way to check if the organizational intention is still intact and to ascertain if the concepts being generated meet the needs of society at large. The most appropriate time for the organization to conduct this screening process is right after the concepts have been created.

For business organizations, the normal justification criteria include cost, profit margin, and the degree to which a product can contribute to the firm's growth. But justification criteria can be both quantitative and qualitative. For example, in the Ronda City case, the "Tall Boy" concept had to be justified against the vision established by top management-to come up with a product concept fundamentally different from anything the company had done before and to make a car that was inexpensive but not cheap. It also had to be justified against the product-line concept articulated by middle management-to make the car "man-maximum, machine-minimum." More abstract criteria may include value premises such as adventure, romanticism, and aesthetics. Thus justification criteria need not be strictly objective and factual; they can also be judgmental and value-laden.

In a knowledge-creating company, it is primarily the role of top management to formulate the justification criteria in the form of organizational intention, which is expressed in terms of strategy or vision. Middle management can also formulate the justification criteria in the form of mid-range concepts. Although the key justification criteria are set by top management, and to some extent by middle management, this does not preclude other organizational units from having some autonomy in deciding their own sub criteria. For example, a committee comprised of 200 young employees within

Matsushita determined that Matsushita employees in the twenty-first century should become "voluntary individuals" to adapt to expected social changes, as will be discussed in more detail in the next chapter. To this extent, a company's justification criteria should be consistent with value systems or needs of the society at large, which should ideally be reflected in organizational intention. To avoid any misunderstanding about the company's intention, redundancy of information helps facilitate the justification process.

The Fourth Phase: Building an Archetype

In this fourth phase, the justified concept is converted into something tangible or concrete, namely, an archetype. An archetype can be thought of as a prototype in the case of a new-product development process. In the case of service or organizational innovation, an archetype could be thought of as a model operating mechanism. In either case, it is built by combining newly created explicit knowledge with existing explicit knowledge. In building a prototype, for example, the explicit knowledge to be combined could take the form of technologies or components. Because justified concepts, which are explicit, are converted into archetypes, which are also explicit, this phase is akin to combination.

Just as an architect builds a mock-up before starting the actual construction, organizational members engage in building a prototype of the real product or a model of the actual system. To build a prototype, they pull together people with differing expertise (e.g., R&D, production, marketing, quality control), develop specifications that meet everyone's approval, and actually manufacture the first full-scale form of a newly created product concept. To build a model, say, of anew organizational structure, people from the affected sections within the organization, as well as experts in different fields (e.g., human re-sources management, legal, strategic planning), are assembled to draw up a new organizational chart, job description, reporting system, or operating procedure. In a way, their role is similar to that of the architect-they are responsible for developing the blueprint as well as actually building the new form of an organizational concept. Attention to detail is the key to managing this complex process.

Because this phase is complex, dynamic cooperation of various departments within the organization is indispensable. Both requisite variety and redundancy of information facilitate this process. Organizational intention also serves as a useful tool for converging the various kinds of know-how and technologies that reside within the organization, as well as for promoting interpersonal and interdepartmental cooperation. On the other hand, autonomy and fluctuation are generally not that relevant at this stage of the organizational knowledge-creation process.

The Fifth Phase: Cross-Leveling of Knowledge

Organizational knowledge creation is a never-ending process that up-grades itself continuously. It does not end once an archetype has been developed. The new concept, which has been created, justified, and modeled, moves on to anew cycle of knowledge creation at a different ontological level. This interactive and spiral process, which we call cross-leveling of knowledge, takes place both intra-organizationally and inter-organizationally.

Intra-organizationally, knowledge that is made real or that takes form as an archetype can trigger anew cycle of knowledge creation, expanding horizontally and vertically across the organization. An example of horizontal cross-fertilization can be seen within Matsushita, where Home Bakery induced the creation of other "Easy & Rich" product concepts, such as a fully automatic coffee maker within the same division and anew generation of large-screen TV sets from another division. In these cases, cross-fertilization took place across different sections within a division as well as across different divisions. An example of vertical cross-fertilization also comes from Matsushita. The development of Home Bakery inspired Matsushita to adopt "Human Electronics" as the umbrella concept at the corporate level. This umbrella concept opened up a series of soul-searching activities within the company to address what kind of company Matsushita should be in the twenty-first century and how "human" Matsushita employees can be.
These activities culminated in the development of MIT'93 (Mind and Management Innovation Toward '93), which was instrumental in reducing the number of annual working hours at the front line to 1,800 hours, thereby freeing up time for people at the front line. In this case, knowledge created in one division led to the adoption of an umbrella concept at the corporate level, which in turn affected the lives of employees at the front line.

Inter-organizationally, knowledge created by the organization can mobilize knowledge of affiliated companies, customers, suppliers, competitors, and others outside the company through dynamic interaction. For example, an innovative new approach to budgetary control developed by one company could bring about changes in an affiliated company's financial control system, which in turn may trigger a new round of innovation. Or a customer's reaction or feedback to a new-product concept may initiate a new cycle of product development. At Apple Computer, for example, when product development engineers come up with ideas for new products, they build a prototype that embodies those ideas and bring it directly to customers to seek their reaction. Depending on the reaction or feedback, a new round of development may be initiated.

For this phase to function effectively, it is essential that each organizational unit have the autonomy to take the knowledge developed somewhere else and apply it freely across different levels and boundaries. Internal fluctuation, such as the frequent rotation of personnel, will facilitate knowledge transfer. So will redundancy of information and requisite variety. And in intra-organizational cross-leveling, organizational intention will act as a control mechanism on whether or not knowledge should be cross-fertilized within the company.

LESSON 28

PROCESS APPROACH TO KM AND INFO-COM TECHNOLOGY (ICT) IN KM SYSTEMS

KM Processes

KM processes are the broad processes that aid in discovering, capturing, sharing, and applying knowledge. These include combination, socialization, externalization, internalization, exchange, directions, and routines. For example, internalization processes benefit from simulations or experiments, which enable individuals to learn through experience, as well as from face-to-face meetings, on-the-job training, and demos.

KM Processes

1. Knowledge discovery may be defined as the development of new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. Combination and socialization, the two important ways of managing knowledge discovery, are discussed below.

The discovery of new explicit knowledge relies most directly on combination, wherein the multiple bodies of explicit knowledge, data, or information are synthesized to create new, more complex sets of explicit knowledge. Existing explicit knowledge, data, and information are reconfigured, recategorized and recontextualized to produce new explicit knowledge. For example, data mining techniques may be used to uncover new relationships amongst explicit data that may be lead to create predictive or categorization models that create new knowledge.

The discovery of new tacit knowledge, on the other hand, relies most directly on socialization, which involves the integration of multiple streams for the creation of new knowledge. It is the synthesis of tacit knowledge across individuals, usually through joint activities rather than written or verbal instructions. For example, a simple discussion among an organization's employees during a coffee break can help in group-wise knowledge sharing.

The discovery of new explicit knowledge relies most directly on combination, whereas the discovery of new tacit knowledge relies most directly on socialization. Combination leads to the discovery of new explicit knowledge wherein the multiple bodies of explicit knowledge are synthesized to create new, more complex sets of explicit knowledge. Socialization involves the integration of multiple streams for the creation of new knowledge.

2. Knowledge Capture – can be defined as the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or organizational entities. The knowledge capture process benefits most directly from two KM sub processes, externalization and internalization. Externalization and Internalization help capture the tacit knowledge and explicit knowledge, respectively.

3. Knowledge Sharing – refers to the process through which explicit or tacit knowledge is communicated to other individuals. Knowledge sharing involves effective transfer, so that the recipient of knowledge can understand it well enough to act on it. What is shared is knowledge rather than recommendations based on the knowledge. Knowledge sharing may take place across individuals as well as across groups, departments, or organizations. Depending on whether explicit or tacit knowledge is being shared, exchange or socialization processes are used.

4. Knowledge Application – refers to the use of knowledge to make decisions and perform tasks, thereby contributing to organizational performance. Knowledge application depends on the available knowledge, which in turn depends on the processes of knowledge discovery, capture, and storage. Applying knowledge does not necessarily mean that the party that uses it also understands it. All that is needed is that somehow the knowledge be used to guide decisions and actions. Knowledge

application benefits from two processes that do not involve the actual transfer or exchange of knowledge between the concerned individuals, routines and direction.

In knowledge application, the party that makes use of the knowledge, does not necessarily need to understand it, but should be able to use the knowledge to guide decisions and actions knowledge application benefits from two processes that do not involve the actual transfer or exchange of knowledge between the concerned individuals, routines and direction.

Direction refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to him the knowledge underlying the direction. This preserves the advantages of specialization and avoids the difficulties inherent in the transfer of tacit knowledge. An example of Direction would be when a computer programmer calls his software project manager to ask how to solve a particular problem with a piece of code, and then proceeds to solve the problem based on the instructions given by the project manager. He does this without acquiring the knowledge himself, so that if a similar problem reoccurs in the future, he would be unable to identify it as such and would therefore be unable to solve it himself without calling an expert.

Routines involve the utilization of knowledge embedded in procedures, rules, and norms that guide future behavior. Routines economize on communication more than directions as they are embedded in procedures or technologies. However, since they require constant repetition, they take time to develop. For example, a computerized inventory management system utilizes considerable knowledge about the relationship between demand and supply, but neither the knowledge nor the directions are communicated through individuals.

Comparison of internalization and externalization processes for managing knowledge.

Internalization is the conversion of explicit knowledge into tacit knowledge. The explicit knowledge may be in the form of action and practice, so that the individual acquiring the knowledge can re-experience what others have gone through. Alternatively, individuals could acquire tacit knowledge in virtual situations, either vicariously by reading manuals or others' stories, or experientially through simulations or experiments. An example of internalization would be a doctor, fresh out of medical school, reading a book on new surgery techniques, and learning from it. This learning helps the doctor, and the hospital he works for, capture the knowledge contained in the book.

Externalization involves converting tacit knowledge into explicit forms such as words, concepts, visuals, or figurative language. It helps translate individuals' tacit knowledge into explicit forms that can be more easily understood by the rest of their group. It is a complex process because tacit knowledge is often difficult to articulate. An example of externalization is a doctor transcribing and documenting his thoughts and observations while examining a patient so as to save it in the patient's medical file for future reference. This captures the tacit knowledge acquired by the doctor and makes it available for future use by the hospital.

Thus, internalization and externalization both add value to the knowledge capture process. However, externalization helps capture tacit knowledge while internalization helps capture explicit knowledge.

What is 'knowledge sharing" as opposed to "knowledge application"?

Knowledge sharing and knowledge application are two different steps in the KM process. They are described below:

Knowledge sharing is the process through which explicit or tacit knowledge is communicated to other individuals. Knowledge sharing involves the recipient acquiring the shared knowledge as well as being able to take action based on it, as opposed to recommendations based on the knowledge being shared, which only results in the utilization of knowledge without the recipient internalizing the shared knowledge. Knowledge sharing can occur across individuals as well as across groups, departments, or organizations. If knowledge exists at a location that is different from where it is needed, either knowledge sharing or knowledge utilization without sharing is necessary. However, sharing knowledge is clearly an important process in enhancing organizational innovativeness and performance. Depending on whether explicit or tacit knowledge is being shared, exchange or socialization processes are used. Socialization facilitates the sharing of tacit knowledge in cases in which new tacit knowledge is being

created, as well as when new tacit knowledge is not being created. Exchange, on the other hand, focuses on the sharing of explicit knowledge. It is used to communicate or transfer explicit knowledge among individuals, groups, and organizations. In its basic nature, the process of exchange of explicit knowledge does not differ from the process through which information is communicated.

Knowledge application depends on the available knowledge, which in turn depends on the processes of knowledge discovery, capture, and storage. The better the processes of knowledge discovery, capture, and storage, the greater the likelihood that the knowledge needed for effective decision making is available. In knowledge application, the party that makes use of the knowledge does not necessarily need to understand it, but should be able to use the knowledge to guide decisions and actions. Knowledge application thus benefits from two processes that do not involve the actual transfer or exchange of knowledge between the concerned individuals – routines and direction. Routines involve the utilization of knowledge embedded in procedures, rules, and norms that guide future behavior. Routines economize on communication more than directions as they are embedded in procedures or technologies. However, they take time to develop and rely on constant repetition. Direction, in contrast, refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to him the knowledge underlying the direction. This preserves the advantages of specialization and avoids the difficulties inherent in the transfer of tacit knowledge.

ICT in Knowledge Management

As we trace the evolution of computing technologies in business, we can observe their changing level of organizational impact. The first level of impact was at the point where work got done and transactions (e.g., orders, deposits, reservations) took place. The inflexible, centralized mainframe allowed for little more than massive number crunching, commonly known as electronic data processing. Organizations became data heavy at the bottom and data management systems were used to keep the data in check. Later, the management information systems were used to aggregate data into useful information reports, often prescheduled, for the control level of the organization - people who were making sure that organizational resources like personnel, money, and physical goods were being deployed efficiently. As information technology (IT) and information systems (IS) started to facilitate data and information overflow, and corporate attention became a scarce resource, the concept of knowledge emerged as a particularly high-value form of information.

Information and communication technology can play an important role in successful knowledge management initiatives. However, the concept of coding and transmitting knowledge in organizations is not new: training and employee development programs, organizational policies, routines, procedures, reports, and manuals have served this function for many years. What is new and exciting in the knowledge management area is the potential for using modern information technology (e.g., the Internet, intranets, extranets, browsers, data warehouses, data filters, software agents, expert systems) to support knowledge creation, sharing and exchange in an organization and between organizations. Modern information technology can collect, systematize, structure, store, combine, distribute and present information of value to knowledge workers.

The low cost of computers and networks has created a potential infrastructure for knowledge sharing and opened up important knowledge management opportunities. The computational power as such has little relevance to knowledge work, but the communication and storage capabilities of networked computers make it an important enabler of effective knowledge work. Through email, groupware, the Internet, and intranets, computers and networks can point to people with knowledge and connect people who need to share knowledge independent of time and place.

Regardless of definition of knowledge as the highest value of content in a continuum starting at data, encompassing information, and ending at knowledge, knowledge managers often take a highly inclusive approach to the content with which they deal. In practice, what companies actually manage under the banner of knowledge management is a mix of knowledge, information, and unrefined data — in short, whatever anyone finds that is useful and easy to store in an electronic repository. In the case of data and information, however, there are often attempts to add more value and create knowledge. This transformation might involve the addition of insight, experience, context,

interpretation, or the myriad of other activities in which human brains specialize.

Identifying, nurturing and harvesting knowledge is a principal concern in the information society and the knowledge age. Effective use of knowledge-facilitating tools and techniques is critical, and a number of computational tools have been developed. While numerous techniques are available, it remains difficult to analyze or compare the specific tools. In part, this is because knowledge management is a young discipline. The arena is evolving rapidly as more people enter the fray and encounter new problems.

In addition, new technologies support applications that were impossible before. Moreover, the multidisciplinary character of knowledge management combines several discipline, including business and management, computer science, cybernetics, and philosophy. Each of these fields may lay claim to the study of knowledge management, and the field is frequently defined so broadly that anything can be incorporated. Finally, it is difficult to make sense of the many tools available. It is not difficult to perform a search to produce a list of more than one hundred software providers. Each of the software packages employs unique visions and aims to capture its share of the market.

One of the views is that knowledge is a social process. As such, it asserts that knowledge resides in people's heads and that it is tacit. As such, it cannot be easily codified and is only revealed through its application. As tacit knowledge cannot be directly transferred from person to person, its acquisition occurs only through practice. Consequently, its transfer between people is slow, costly and uncertain. Technology, within this perspective, can only support the context of knowledge work. It has been argued that IT-based systems used to support knowledge management can only be of benefit if used to support the development and communication of human meaning. One reason for the failure of IT in some knowledge management initiatives is that the designers of the knowledge management systems fail to understand the situation and work practices of the users and the complex human processes involved in work.

While technology can be used with knowledge management initiatives, Ward and Peppard (2002) argue that it should never be the first step. Knowledge management is to them primarily a human and process issue. Once these two aspects have been addressed, then the created processes are usually very amenable to being supported and enhanced by the use of technology.

Our focus here, however, is on technology that captures, stores, and distributes structured knowledge for use by people. The goal of these technologies is to take knowledge that exists in human heads and partly in paper documents, and make it widely available throughout an organization.

Knowledge Management Processes and ICT

Alavi and Leidner (2001) have developed a systematic framework that will be used to analyze and discuss the potential role of information technology in knowledge management. According to this framework, organizations consist of four sets of socially enacted knowledge processes: (1) creation (also referred to as construction), (2) storage and retrieval, (3) transfer, and (4) application. The knowledge-based view of the firm represents here both the cognitive and social nature of organizational knowledge and its embodiment in the individual's cognition and practices as well as the collective (i.e., organizational) practices and culture. These processes do not represent a monolithic set of activities, but an interconnected and intertwined set of activities.

Knowledge Creation

Organizational knowledge creation involves developing new content or replacing existing content within the organization's tacit and explicit knowledge. Through social and collaborative processes as well as individuals' cognitive processes (e.g., reflection), knowledge is created. The model developed by Nonaka et al. (2001) involving SECI, ba and knowledge assets, views organizational knowledge creation as involving a continual interplay between the tacit and explicit dimensions of

knowledge and a growing spiral flow as knowledge moves through individual, group, and organizational levels. Four modes of knowledge creation have been identified: socialization, externalization, internalization and combination.

Nonaka et al. (2001) suggest that the essential question of knowledge creation is establishing an organization's ba, defined as a common place or space for creating knowledge. Four types of ba corresponding to the four modes of knowledge creation are identified: (1) originating ba, (2) interacting ba, (3) cyber ba, and (4) exercising ba. Originating ba entails the socialization mode of knowledge creation and is the ba from which the organizational knowledge creation process begins. Originating ba is a common place in which individuals share experiences primarily through face-to-face interactions and by being at the same place at the same time. Interacting ba is associated with the externalization mode of knowledge creation and refers to a space where tacit knowledge is converted to explicit knowledge and shared among individuals through the process of dialogue and collaboration. Cyber ba refers to a virtual space of interaction and corresponds to the combination mode of knowledge creation. Finally, exercising ba involves the conversion of explicit to tacit knowledge through the internalization process. Understanding the characteristics of various ba and the relationship with the modes of knowledge creation is important to enhancing organizational knowledge creation. For example, the use of IT capabilities in cyber ba is advocated to enhance the efficiency of the combination mode of knowledge creation. Data warehousing and data mining, document management systems, software agents and intranets may be of great value in cyber ba. Considering the flexibility of modern IT, other forms of organizational ba and the corresponding modes of knowledge creation can be enhanced through the use of various forms of information systems. For example, information systems designed for support or collaboration, coordination, and communication processes, as a component of the interacting ba, can facilitate teamwork and thereby increase an individual's contact with other individuals.

Electronic mail and group support systems have the potential of increasing the number of weak ties in organizations. This in turn can accelerate the growth of knowledge creation. Intranets enable exposure to greater amounts of online organizational information, both horizontally and vertically, than may previously have been the case. As the level of information exposure increases, the internalization mode of knowledge creation, wherein individuals make observations and interpretations of information that result in new individual tacit knowledge, may increase. In this role, an intranet can support individual learning (conversion of explicit knowledge to personal tacit knowledge) through provision of capabilities such as computer simulation (to support learning-by-doing) and smart software tutors.

Computer-mediated communication may increase the quality of knowledge creation by enabling a forum for constructing and sharing beliefs, for confirming consensual interpretation, and for allowing expression of new ideas. By providing an extended field of interaction among organizational members for sharing ideas and perspectives, and for establishing dialog, information systems may enable individuals to arrive at new insights and/or more accurate interpretations than if left to decipher information on their own.

Although most information repositories serve a single function, it is increasingly common for companies to construct an internal "portal" so that employees can access multiple different repositories and sources from one screen. It is also possible and increasingly popular for repositories to contain not only information, but also pointers to experts within the organization on key knowledge topics. It is also feasible to combine stored information with lists of the individuals who contributed the knowledge and who could provide more detail or background on it.

For knowledge creation, there is currently idea-generation software emerging. Idea-generation software is designed to help stimulate a single user or a group to produce new ideas, options, and choices. The user does all the work, but the software encourages and pushes, something like a personal trainer. Although idea-generation software is relatively new, there are several packages on the market. Idea Fisher, for example, has an associative lexicon of the English language that cross-references words and phrases. These associative links, based on analogies and metaphors, make it

easy for the user to be fed words related to a given theme. Some software packages use questions to prompt the user toward new, unexplored patterns of thought. This helps users to break out of cyclical thinking patterns and conquer mental blocks.

Knowledge Storage and Retrieval

According to Alavi and Leidner (2001), empirical studies have shown that while organizations create knowledge and learn, they also forget (i.e., do not remember or lose track of the acquired knowledge). Thus, the storage, organization, and retrieval of organizational knowledge, also referred to as organizational memory, constitute an important aspect of effective organizational knowledge management. Organizational memory includes knowledge residing in various component forms, including written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes and tacit knowledge acquired by individuals and networks of individuals.

Advanced computer storage technology and sophisticated retrieval techniques, such as query languages, multimedia databases, and database management systems, can be effective tools in enhancing organizational memory. These tools increase the speed at which organizational memory can be accessed.

Groupware enables organizations to create intraorganizational memory in the form of both structured and unstructured information and to share this memory across time and space. IT can play an important role in the enhancement and expansion of both semantic and episodic organizational memory. Semantic memory refers to general, explicit and articulated knowledge, whereas episodic memory refers to context-specific and situated knowledge. Document management technology allows knowledge of an organization's past, often dispersed among a variety of retention facilities, to be effectively stored and made accessible. Drawing on these technologies, most consulting firms have created semantic memories by developing vast repositories of knowledge about customers, projects, competition, and the industries they serve.

Grover and Davenport (2001) found that in Western organizations, by far the most common objective of knowledge management projects involves some sort of knowledge repository. The objective of this type of project is to capture knowledge for later and broader access by others within the same organization. Common repository technologies include Lotus Notes, Web-based intranets, and Microsoft's Exchange, supplemented by search engines, document management tools, and other tools that allow editing and access. The repositories typically contain a specific type of information to represent knowledge for a particular business function or process, such as:

- "Best practices" information within a quality or business process management function;
- Information for sales purposes involving products, markets, and customers;
- Lessons learned in projects or product development efforts;
- Information around implementation of information systems;
- Competitive intelligence for strategy and planning functions;
- "Learning histories" or records of experience with a new corporate direction or approach.

Knowledge retrieval can find support in content management and information extraction technology, which represent a group of techniques for managing and extracting information from documents, ultimately delivering a semantic meaning for decision makers or learners alike. This type of computer applications is targeted at capturing and extracting the content of free-text documents. There are several tasks that fall within the scope of content management and information extraction.

- Abstracting and summarizing. This task aims at delivering shorter, informative representations of larger (sets of) documents.
- Visualization. Documents can often be visualized according to the concepts and relationships that play a role. Visualization can be either in an introspective manner, or using some reference model/view of a specific topic.

- Comparison and search. This task finds semantically similar pieces of information.
- Indexing and classification. This considers (partial) texts, usually according to certain categories.
- Translation. Context-driven translation of texts from one language into another. Language translation has proven to be highly context specific, even among closely related languages. Some kind of semantic representation of meaning is needed in order to be able to make good translations.
- Question formulation and query answering. This is a task in human-computer interaction systems.
- Extraction of information. This refers to the generation of additional information that is not explicit in the original text. This information can be more or less elaborate.

Knowledge Transfer

Knowledge transfer occurs at various levels in an organization: transfer of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization. Considering the distributed nature of organizational cognition, an important process of knowledge management in organizational settings is the transfer of knowledge to locations where it is needed and can be used. However, this is not a simple process in that organizations often do not know what they know and have weak systems for locating and retrieving knowledge that resides in them. Communication processes and information flows drive knowledge transfer in organizations.
Knowledge transfer channels can be informal or formal, personal or impersonal. IT can support all four forms of knowledge transfer, but has mostly been applied to informal, impersonal means (such as discussion databases) and formal, impersonal means (such as corporate directories). An innovative use of technology for transfer is use of intelligent agent software to develop interest profiles of organizational members in order to determine which members might be interested recipients of point-to-point electronic messages exchanged among other members. Employing video technologies can also enhance transfer.

IT can increase knowledge transfer by extending the individual's reach beyond the formal communication lines. The search for knowledge sources is usually limited to immediate coworkers in regular and routine contact with the individual. However, individuals are unlikely to encounter new knowledge through their close-knit work networks because individuals in the same clique tend to possess similar information. Moreover, individuals are often unaware of what their cohorts are doing. Thus, expanding the individual's network to more extended, although perhaps weaker, connections is central to the knowledge diffusion process because such networks expose individuals to more new ideas.

Computer networks and electronic bulletin boards and discussion groups create a forum that facilitates contact between the person seeking knowledge and those who may have access to the knowledge. Corporate directories may enable individuals to rapidly locate the individual who has the knowledge that might help them solve a current problem. For example, the primary content of such a system can be a set of expert profiles containing information about the backgrounds, skills and expertise of individuals who are knowledgeable on various topics. Often such metadata (knowledge about where knowledge resides) prove to be as important as the original knowledge itself. Providing taxonomies or organizational knowledge maps enables individuals to rapidly locate either the knowledge or the individual who has the needed knowledge, more rapidly than would be possible without such IT-based support.

The term IT for information technology is used in this book. Some use ICT for information and communication technology to stress the importance of communication in knowledge management. Communication is important in knowledge management because technology provides support for both intraorganizational as well as interorganizational knowledge networks. Knowledge networks need technology in the form of technical infrastructure, communication networks and a set of information services. Knowledge networks enable knowledge workers to share information

from various sources.

Traditional information systems have been of importance to vertical integration for a long time. Both customers and suppliers have been linked to the company through information systems. Only recently has horizontal integration occurred. Knowledge workers in similar businesses cooperate to find optimal solutions for customers. IT has become an important vertical and horizontal interorganizational coordination mechanism. This is not only because of the availability of broadband and standardized protocols. It is also caused by falling prices for communication services and by software programs' ability to coordinate functions between firms.

Knowledge Application

An important aspect of the knowledge-based view of the firm is that the source of competitive advantage resides in the application of the knowledge rather than in the knowledge itself. Information technology can support knowledge application by embedding knowledge into organizational routines. Procedures that are culture-bound can be embedded into IT so that the systems themselves become examples of organizational norms.

Technology-enforced knowledge application raises a concern that knowledge will continue to be applied after its real usefulness has declined. While the institutionalization of best practices by embedding them into IT might facilitate efficient handling of routine, linear, and predictable situations during stable or incrementally changing environments, when change is radical and discontinuous, there is a persistent need for continual renewal of the basic premises underlying the practices archived in the knowledge repositories. This underscores the need for organizational members to remain attuned to contextual factors and explicitly consider the specific circumstances of the current environment.

Although there are challenges with applying existing knowledge, IT can have a positive influence on knowledge application. IT can enhance knowledge integration and application by facilitating the capture, updating, and accessibility of organizational directives. For example, many organizations are enhancing the ease of access and maintenance of their directives (repair manuals, policies, and standards) by making them available on corporate intranets. This increases the speed at which changes can be applied. Also, organizational units can follow a faster learning curve by accessing the knowledge of other units having gone through similar experiences. Moreover, by increasing the size of individuals' internal social networks and by increasing the amount of organizational memory available, information technologies allow for organizational knowledge to be applied across time and space.

IT can also enhance the speed of knowledge integration and application by codifying and automating organizational routines. Workflow automation systems are examples of IT applications that reduce the need for communication and coordination and enable more efficient use of organizational routines through timely and automatic routing of work-related documents, information, rules, and activities. Rule-based expert systems are another means of capturing and enforcing well-specified organizational procedures.

In summary;

Knowledge creation: Examples of supporting information technologies are data mining and learning tools, which enable combining new sources of knowledge and just in time learning.

Knowledge storage and retrieval: Examples of supporting information technologies are electronic bulletin boards, knowledge repositories, and databases, which provide support of individual and organizational memory as well as inter-group knowledge access.

Knowledge transfer: Examples of supporting information technologies are electronic bulletin boards, discussion forums, and knowledge directories, which enable more extensive internal networks, more available communication channels, and faster access to knowledge sources. Knowledge application: Examples of supporting information technologies are expert systems and

workflow systems, which enable knowledge application in many locations and more rapid application of new knowledge through workflow automation.

Knowledge Management Systems

There is no single information system that is able to cover all knowledge management needs in a firm. This is evident from the widespread potential of IT in knowledge management processes. Rather, knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. These systems are IT applications to support and enhance the organizational processes of knowledge creation, storage and retrieval, transfer, and application (Alavi & Leidner, 2001).

Requirements from Knowledge Management

The critical role of information technology and information systems lies in the ability to support communication, collaboration, and those searching for knowledge, and the ability to enable collaborative learning. We have already touched on important implications for information systems in previous chapters of this book:

1. Interaction between information and knowledge. Information becomes knowledge when it is combined with experience, interpretation and reflection. Knowledge becomes information when assigned an explicit representation. Sometimes information exists before knowledge; sometimes knowledge exists before information. One important implication of this two-way direction between knowledge and information is that information systems designed to support knowledge in organizations may not appear to be radically different from other forms of IT support, but will be geared toward enabling users to assign meaning to information and to capture some of their knowledge in information (Alavi & Leidner, 2001).
2. Interaction between tacit and explicit knowledge. Tacit and explicit knowledge depend on each other, and they influence each other. The linkage of tacit and explicit knowledge suggests that only individuals with a requisite level of shared knowledge are able to exchange knowledge. They suggest the existence of a shared knowledge space that is required in order for individual A to understand individual B's knowledge. The knowledge space is the underlying overlap in the knowledge base of A and B. This overlap is typically tacit knowledge. It may be argued that the greater the shared knowledge space, the less the context needed for individuals to share knowledge within the group and, hence, the higher the value of explicit knowledge. IT is both dependent on the shared knowledge space and an important part of the shared knowledge space. IT is dependent on the shared knowledge space because knowledge workers need to have a common understanding of available information in information systems in the organization. If common understanding is missing, then knowledge workers are unable to make use of information. IT is an important part of the shared knowledge space because information systems make common information available to all knowledge workers in the organization. One important implication of this two-way relationship between knowledge space and information systems is that a minimum knowledge space has to be present so that IT can contribute to growth in the knowledge space (Alavi & Leidner, 2001).
3. Knowledge management strategy. Efficiency-driven businesses may apply the stock strategy, in which databases and information systems are important. Effectiveness-driven businesses may apply the flow strategy, in which information networks are important. Expert-driven businesses may apply the growth strategy, in which networks of experts, work processes and learning environments are important (Hansen et al., 1999).
4. Combination in SECI process. The SECI process consists of four knowledge conversion modes. These modes are not equally suited for IT support. Socialization is the process of converting new tacit knowledge to tacit knowledge. This takes place in the human brain. Externalization is the process of converting tacit knowledge to explicit knowledge. The successful conversion of tacit knowledge into explicit knowledge depends on the sequential

use of metaphors, analogy and model. Combination is the process of converting explicit knowledge into more complex and systematic sets of explicit knowledge. Explicit knowledge is collected from inside and outside the organization and then combined, edited and processed to form new knowledge. The new explicit knowledge is then disseminated among the members of the organization. According to Nonaka et al. (2000), creative use of computerized communication networks and large-scale databases can facilitate this mode of knowledge conversion. When the financial controller collects information from all parts of the organization and puts it together to show the financial health of the organization, that report is new knowledge in the sense that it synthesizes explicit knowledge from many different sources in one context. Finally, internalization in the SECI process converts explicit knowledge into tacit knowledge. Through internalization, explicit knowledge created is shared throughout an organization and converted into tacit knowledge by individuals.

5. Explicit transfer of common knowledge. If management decides to focus on common knowledge as defined by Dixon (2000), knowledge management should focus on the sharing of common knowledge. Common knowledge is shared in the organization using five mechanisms: serial transfer, explicit transfer, tacit transfer, strategic transfer and expert transfer. Management has to emphasize all five mechanisms for successful sharing and creation of common knowledge. For serial transfer, management has to stimulate meetings and contacts between group members. For explicit transfer, management has to stimulate documentation of work by the previous group. For tacit transfer, management has to stimulate contacts between the two groups. For strategic transfer, management has to identify strategic knowledge and knowledge gaps. For expert transfer, management has to create networks in which experts can transfer their knowledge. These five mechanisms are not equally suited for IT support. Explicit transfer seems very well suited for IT support, as the knowledge from the other group is transferred explicitly as explicit knowledge in words and numbers and shared in the form of data, scientific formulae, specifications, manuals and the like. Expert transfer also seems suited for IT support when generic knowledge is transferred from one individual to another person to enable the person to solve new problems with new methods.
6. Link knowledge to its uses. One of the mistakes in knowledge management presented by Fahey and Prusak (1998) was disentangling knowledge from its uses. A major manifestation of this error is that knowledge management initiatives become ends in themselves. For example, data warehousing can easily degenerate into technological challenges. The relevance of a data warehouse for decisions and actions gets lost in the turmoil spawned by debates about appropriate data structures.
7. Treat knowledge as an intellectual asset in the economic school. If management decides to follow the economic school of knowledge management, then intellectual capital accounting should be part of the knowledge management system. The knowledge management system should support knowledge markets in which knowledge buyers, knowledge sellers and knowledge brokers can use the system.
8. Treat knowledge as a mutual resource in the organizational school. The potential contribution of IT is linked to the combination of intranets and groupware to connect members and pool their knowledge, both explicit and tacit.
9. Treat knowledge as a strategy in the strategy school. The potential contributions of IT are manifold once knowledge as a strategy is the impetus behind knowledge management initiatives. One can expect quite an eclectic mix of networks, systems, tools, and knowledge repositories.
10. Value configuration determines knowledge needs in primary activities. Knowledge needs can be structured according to primary and secondary activities in the value configuration. Depending on the firm being a value chain, a value shop or a value network, the knowledge management system must support more efficient production in the value chain, adding value to the knowledge work in the value shop, and more value by use of IT infrastructure in the value network.
11. Incentive Alignment. The first dimension of information systems design is concerned with software engineering (error-free software, documentation, portability, modularity & architecture, development cost, maintenance cost, speed, and robustness). The second dimension is concerned with technology acceptance (user friendliness, user acceptance, perceived ease-

of-use, perceived usefulness, cognitive fit, and task-technology fit). The third dimension that is particularly important to knowledge management systems is concerned with incentive alignment. Incentive alignment includes incentives influencing user behavior and the users' interaction with the system, deterrence of use for personal gain, use consistent with organizational goals, and robustness against information misrepresentation (Ba et al., 2001).

Benefits from Knowledge Management Systems IT are applied in knowledge management for several important reasons:

- IT is an enabler of improved individual performance among knowledge workers.
- IT is an enabler of improved organizational performance by new business processes.
- IT is an enabler of improved interorganizational performance by effective knowledge networks.

Knowledge management initiatives applying information technology occur for many different reasons. A survey in the U.S. produced the following ranking of reasons for IT in knowledge management (CIO, 2001):

1. Improve profitability and income (67%);
2. Secure talent and expertise (54%);
3. Improve customer service and customer satisfaction (52%);
4. Secure company market share against new competitors (44%);
5. Shorten time to market of new products (39%);
6. Enter new market segments (39%);
7. Reduce costs (38%);
8. Develop new goods and services (35%).

The survey research did also include questions concerning knowledge management systems. Responding companies ranked software based on dollar amount to be spent (CIO, 2001):

1. Infrastructure for knowledge management (61%);
2. Intelligent systems for knowledge search (39%);
3. Data warehouse (21%);
4. Document handling (17%);
5. Company portals (16%);
6. Groupware (13%);
7. Mail delivery (11%);
8. Intelligent agents for knowledge search (9%);
9. Workflow systems (8%);
10. E-learning (7%).

General Electric's CEO has suggested that knowledge sharing is important for organizations, Why ?

Knowledge sharing is the process through which explicit or tacit knowledge is communicated to other individuals. Knowledge sharing involves the recipient acquiring the shared knowledge as well as being able to take action based on it, as opposed to recommendations based on the knowledge being shared, which only results in utilization of knowledge without the recipient internalizing the shared knowledge. Knowledge sharing can occur across individuals as well as across groups, departments, or organizations. If knowledge exists at a location that is different from where it is needed, either knowledge sharing or knowledge utilization without sharing is necessary.

Depending on whether explicit or tacit knowledge is being shared, exchange or socialization processes are used. Socialization facilitates the sharing of tacit knowledge in cases in which new tacit knowledge is being created, as well as when new tacit knowledge is not being created. Exchange, on the other hand, focuses on the sharing of explicit knowledge. It is used to communicate or transfer explicit knowledge among individuals, groups, and organizations. In its basic nature, the process of exchange of explicit knowledge does not differ from the process through which information is communicated.

If knowledge exists at a location that is different from where it is needed, either knowledge sharing or knowledge utilization without sharing is necessary. Sharing knowledge is clearly an important process in enhancing organizational innovativeness and performance. Its importance is elucidated by the fact that it was one of the three business processes for which General Electric's CEO Jack Welch took personal responsibility, besides the allocation of resources and development of people.

LESSON 29

ORGANIZATIONAL ISSUES IN MANAGING KNOWLEDGE WORKER

Knowledge Workers

The typical knowledge worker in corporate sector works in marketing, intellectual property, engineering, programming, and other occupations that involve more thought than physical labor. For example, artists in the marketing division who produce the media files are typically considered knowledge workers, as media can constitute the intellectual capital of a company, whether the company is a knowledge organization or not. Knowledge workers typically add to the value of the corporation by contributing to the corporate knowledge assets, by documenting problems solving activities, by reporting best practices, and by disseminating information in newsletters, online, and in other publications. In each case, the knowledge worker is either the conduit for or the source of the information.

Customer support representatives are commonly considered knowledge workers because they work with information from customers through direct contact; through interactions through the phone, e-mail, or traditional mail; or through directly observing customer activity in a retail setting. Managers at all levels can be considered knowledge workers if they are involved in creating new revenues from existing knowledge by reformatting and repackaging information in existing markets or introducing existing products into new markets.

Most KM initiatives revolve around knowledge workers, whether they're interacting with customers directly, indirectly through computer systems, or with other knowledge workers and managers.

Knowledge Workers

- A knowledge worker is a person who transforms business and personal experience into knowledge.
- Usually a knowledge worker is found to be innovative, creative and he/she is fully aware of the organizational culture.
- A knowledge worker can be thought of as a product of values, experiences, processes, education, and training.

Personality/Professional Attributes

- Understands and adopts the organizational culture.
- Aligns personal/professional growth with corporate vision.
- Possesses the attitude of collaboration/sharing.
- Possesses innovative capacity/creative mind.
- Has got the clear understanding of the business (in which he/she is involved.
- Always willing to learn, and willing to adopt new methodologies.
- Possesses self-control and can learn by himself/herself.
- Willing to accommodate uncertainties
- Core competencies:
    - Thinking skills
    - Innovative teams/teamwork
    - Continuous learning
    - Innovation/Creativity
    - Risk taking/Potential success
    - A culture of responsibility towards knowledge
    - Decisive action taking

Knowledge Worker's Business Roles in Learning Organization

- A *Learning organization* is an organization of people with total commitment to improve their capacity, to create and to produce. It can respond to uncertainty, to challenges, and to the change in general.

- The rate of learning of an organization can turn out to be the most critical source of competitive advantage.

Management and Leadership

- In KM, we distinguish between *managers* and *leaders*.
- Traditional managers usually focus on the present. They are usually action-oriented and spend most of the time supervising, delegating, controlling, and ensuring compliance with set procedures.
- Traditional managers were once workers and were promoted to managers. When they manage subordinates, they are aware of each aspect of the business since they were once there.
- Smart managers usually focus on organizational learning in order to ensure operational excellence.
- Smart managers can not be expected to have mastered the work of the subordinates. They can take on the role of leaders where change is the primary goal.
- The challenge is to get the organization moving towards achieving goals (in line with the rate of change).
- The leader's role in a learning organization is more of a facilitator than a supervisor.
- He acts more like a teacher than like an order giver.
- In case of teaching, the focus is on the transfer of knowledge from the instructor to the learner. The instructor is supposed to be the expert and his/her role is to deliver quality content and to communicate the content with potential.
- Learning should essentially promote a way of thinking, not just convey facts.
- In a learning organization, the smart manager can play the role of the instructor, and the knowledge workers can play the role of learners.
- The smart manager provides opportunities for knowledge workers to brainstorm ideas, exchange knowledge, and come up with new and better ways of doing business.

Work Management Tasks

Work management tasks include the following:

- Retrieving, creating, sharing, and using knowledge in everyday activities.
- Managing knowledge workers and nurturing their knowledge-oriented activities.
- Ensuring readiness to work.
- Maintaining work motivation among knowledge workers.
- Allocating effort and switching control among tasks.
- Managing collaboration and concurrent activities among knowledge workers.
- Sharing information and integrating work among knowledge workers.
- Recruiting knowledge-seeking and bright individuals factors to be considered by the managers:
- Time constraint.
- Knowledge workers doing work that the organization did not hire them to do.
- Working smarter/harder.
- Work Schedule.

Technology and Knowledge Worker

- The primary activities of knowledge work:
    - Assessment
    - Decision Making
    - Monitoring
    - Scheduling
- A knowledge worker can act as a manager, a supervisor, or a clerk who is actively engaged in thinking, information processing, analyzing, creating, or recommending procedures based on experience and cumulative knowledge.
- IT plays a key role in the learning organization in the following processes:
    - Knowledge capture
    - Information distribution
    - Information interpretation
- There exists a multitude of equipment and software supporting knowledge worker's tasks. They include:

- E-mail
- LAN
- Intelligent Workstations

- Intelligent workstations automate repetitive, and tedious tasks. They should perform the following functions:
  - Administrative support functions
  - Personal computing functions
  - Managing intelligent databases

Knowledge Worker Loyalty

One of the corporation's major intangible assets, and one that can be enhanced through knowledge worker management, is knowledge worker loyalty. Although loyalty is difficult to quantify exactly, knowledge worker behavior that is consistent with loyalty can be quantified. This behavior can be modeled by considering factors that positively and negatively affect behaviors associated with loyalty, such as a worker continuing in a relationship with the corporation even when competing companies offer greater compensation for comparable work.
The issue of knowledge worker loyalty to the corporation typically arises when management is considering whether to invest additional resources in a particular knowledge worker or group of knowledge workers. In the computerized knowledge economy, where someone with knowledge and skills in demand can work from virtually anywhere with a computer and an Internet connection, the issue of loyalty is an important one.

Knowledge worker loyalty can be assessed by modeling loyalty based on the positive and negative contributors to behaviors. Positive contributors to knowledge worker loyalty include difficulty locating alternative employment, the emotional bond between the knowledge worker and the company, the knowledge worker's investment of time in the company, and compensation. For example, the greater the difficulty locating alternative employment, the greater the loyalty effect. Similarly, the more time and energy a knowledge worker invests in a relationship with a company, the more likely the relationship will continue. In addition, the greater the compensation, the more likely a knowledge worker will continue working with the company. The greatest contributor to knowledge worker loyalty, however, is a personal, emotional bond with other people in the company.

The negative contributors to loyalty behavior are numerous employment alternatives and a high level of frustration with the company. The more employment alternatives that are available, the less knowledge workers are likely to stay with the company. Finally, nothing spoils an otherwise ideal relationship faster than a knowledge worker's frustration with management or personal problems with other knowledge workers.

Modeling loyalty behavior shows how knowledge worker behavior can be influenced, depending on which elements in the model are stressed. For example, a generous compensation package and a friendly, supportive work environment contribute to a continued relationship with the company. Conversely, offering knowledge workers little or no increase in compensation at an annual review and ignoring their complaints and suggestions sends a clear message that they should look.

Test Your Understanding

1. ***What is a knowledge worker? Do you agree with any of the definitions in the chapter? Why or why not?***

   A knowledge worker is a person who transforms business and personal experience into knowledge through capturing, assessing, applying, sharing, and disseminating it within the organization to solve specific problems or to create value. Students may select any definition and comment on it.

2. List and briefly explain personality and professional attributes of knowledge workers.

- Holds unique values and understands and adopts the culture of the organization
- Aligns personal and professional growth with corporate vision and achievement of strategic goals

- Adopts an attitude of collaboration and sharing
- Have innovative capacity and a creative mind
- Has a clear understanding of the business he is a part
- Willing to learn, unlearn, and adopt new ways that result in better ways of doing a job
- In command of self-control and self-learning
- Willing to grow with the company

3. *The self-directed knowledge worker must consider several core competencies. Explain three core competencies of your choice. Why are they called core competencies?*

- **Thinking skills:** having a vision how the product or the company can be better
- **Continuous learning:** unlearning and relearning in tune with fast-changing conditions
- **Innovative teams:** via collaboration, cooperation, and coordination

They are called core because each one of them is a tool that the knowledge worker would definitely need to use in action.

4. *Elaborate on the business roles in the learning organization.*

When discussing business roles in the learning organizations, management and leadership become more important. Smart managers focus on organizational learning to ensure operational excellence. In contrast, the leader's role is more of a facilitator, a teacher, a steward of the collective knowledge of the staff, and a designer.

5. *In what ways are data and information considered as givens?*

The period between the 1960's and 1980's has witnessed success in data processing and information processing. The focus then was on efficiency, where computers replaced human redundant arithmetic work. There were quantitative savings and everyone benefited. In the 1990's information was collected, processed, and converted into relevant knowledge for the decision maker. At this level, the focus shifted from quantitative to qualitative performance-oriented value-added decision-making.

6. *What is the difference between management and leadership? Traditional managers and smart managers?*

The goal of management is stability on the job and meeting deadlines. While, The primary goal of leadership is change. The challenge is to get the department or organization moving in the direction of the goal(s) in line with the rate of change.

Traditional managers are action oriented, they spend most of the time delegating, supervising, controlling, and ensuring compliance with set procedures. When they manage subordinates, they know all aspects of the business because they were once there.

In contrast, smart managers focus on organizational learning to ensure operational excellence. Because of continuing change and improvement in workplace, they cannot be expected to have mastered the work of subordinates.

7. *How are learning and teaching related?*

Learning and teaching are two faces for the same coin. In teaching, the focus is on knowledge transfer from the instructor to the learner. The instructor is supposed to be the expert. The role is to deliver quality content and to communicate the content with potential. The interaction should instill serendipity and thinking about better ways of handling problems. Learning should promote a new way of thinking not just facts. The key is not listening and retaining ideas or knowledge, but raising questions that might trigger new ways of decision-making or problem solving.

8. *What do work management tasks focus on?*

- Managing knowledge workers
- Searching out, creating, sharing, and using knowledge regularly
- Maintaining work motivation among knowledge workers
- Ensuring readiness to work, especially during an emergency
- Allocating effort and switching control among tasks
- Sharing information and integrating work among knowledge workers
- Hiring or recruiting bright, knowledge-seeking individuals
- Managing collaboration, coordination, and concurrent activities among knowledge workers

9. *Explain the main factors that limit the knowledge worker productivity and ways to get around them.*

- **Time constraint**: time is the enemy of successful knowledge workers. There is always more work to do. As a result, either quality suffers or completion time lags. Obviously, such stress can work against ones motivation to contribute.
- **Working smarter and harder and accomplishing little**: this constrained is often triggered by limited time, limited staff support, or financial constraints. Management can do a lot to alleviate this type of productivity problem.
- **Knowledge workers doing work that the firm did not hire them to do:** the way to get around this is for the smart manager to explore the specificity of the task or the job, match the task to the knowledge of the worker, and eliminate nonessentials.
- ***Work schedule:*** the manager should be careful in planning work schedules and work rotation to assure cooperation and successful achievement of the job on schedule.
- ***Motivation against knowledge work productivity:*** Knowledge workers
  Are not all programmed to follow the ideals proposed by the management. Avoiding task uncertainty or job complexity can pose productivity problems and affect the productivity of other knowledge workers. Motivation is also affected in situations where urgency supercedes motivation. If productivity takes a nosedive, the knowledge worker can always blame it on the time constraint, lack of adequate input, and the like

10. *Briefly list the vocational needs and reinforces of knowledge workers.*

a. Achievement
b. Use of their abilities on matters related to problem solving and solutions rather than problem implementation based on predetermined, mechanistic tasks
c. Authority
d. High pay and prestige
e. The congenial atmosphere
f. Recognition for work done
g. The chance of exercising responsibility
h. The drive to do different things within the job scope from time to time
i. The social status (importance in the eye of the others)
j. Creativity

11. *How does creativity relate to achievement?*

An achievement is a result of creativity. Because creativity is trying out new ideas in performing complex tasks that lead to accomplishments.

12. Elaborate on smart leadership requirements.

- Assessing core competency of the firm
- Response to the firm's internal shortcomings
- Vivid knowledge of the external market and the tricky nature of the competition in the marketplace
- Online response to the company's external environment
- Measuring the return on time

13. What is meant by return on time? How does it relate to the knowledge chain?

When time and timing are the critical elements in a competitive environment, creativity in the way products are improved and enhancements in existing products are supposed to provide financial and strategic returns when they are introduced ahead of the competition. So, return on time addresses the benefits derived from time saving in early and timely introduction of a product. The intellectual capital of the firm is the backbone for return on time. It is the brain that generates creative products that can be offered in a competitive market in a timely manner.

14. Briefly explain the key steps in the knowledge chain.

The key steps in the knowledge chain are:

a. Assessment of the core competency of the organization
b. Response to the organization's internal shortcomings
c. Vivid knowledge of the external market and the tricky nature of competition in the marketplace.
d. Online response to the company's external environment
e. Measure the return on time

15. How does technology assist the knowledge worker?

- IT contributes to knowledge capture, information distribution, and information interpretation
- Ultimate goal of technology is to serve organizational memory and create a working environment that provides these conditions
- Knowledge worker expect to have technical know-how to access, update, and disseminate information from databases and knowledge bases

16. List the knowledge worker key skills. Do you agree with them?

- Technical skills and abilities
- Professional experience
- Soft traits such as a sense of cultural, political, and personal aspects of knowledge in the business
- Personal attributes
- Communication skills
- Educational background and college degree

Knowledge Exercises

1. *Discuss the similarities and differences between the traditional manager and the knowledge manager.*

The term manager refers to anyone performing managerial work. The main role is to maintain and enhance his department or division standards of competence. The classical job includes planning, organizing, supervising, and controlling people, procedures, and technology. When problems arise, they stay in to their area of operation and simply focus on maintaining the status quo.

In contrast, a knowledge manager plans, develops, and articulate knowledge management policy. He or she understands the relationship between knowledge sharing and business competitiveness. Such a manager writes articles and books on knowledge management. Another function is articulating results to senior management officials within and outside the firm and expands KM initiatives company-wide.

2. *Try to verify the personality and work attributes of the knowledge manager by doing research on the Internet. Report your findings to the class.*

This is a relatively new area on the management's end of knowledge management. Students should be encouraged to try out various search engines, especially google.com and put together a personality profile and work attributes of the knowledge manager. The authors aren't sure there is much on this topic on the Internet.

3. *Is a college degree important for knowledge work? Discuss your beliefs with the class.*

A college degree is normally considered the foundation of a career, whether it is in law, medicine, or business. When dealing with knowledge and knowledge work, academic preparation is a pre-requisite to gaining practical experience in this specialized work. Of course, one needs certain aptitude and skill set for certain jobs, but the combination of college education and practical experience is the combination that often leads to building a successful career. Yet, there are exceptions. Such exceptions are unusual and rare.

4. *Cite three companies that qualify as learning organizations. What makes them unique?*

General electric, Dupont, and IBM are leading learning organizations. There are many others, which students should be able identify and expound on their respective unique features. The ones mentioned here are generally known for coming out with creative products and services on a regular basis.

5. *Does a leader's job include management? If so, why do we need managers?*

Leadership is the basis for successful management. As shown above, it is part of management. It implies personality, poise, warmth, decisiveness, and trust by others to follow and comply with decisions.

LESSON 30

OVERVIEW OF KM SOLUTIONS AND PROCESSES

KM System Justification

It involves answers to the following questions:

- Is existing knowledge going to be lost through retirement, transfer, or departure to other organizations?
- Is the proposed KM system needed in multiple locations?
- Are experts available and willing to support the building of the proposed KM system?
- Does the concerned problem needs years of proper experience and cognitive reasoning to solve?
- While undergoing knowledge capture, would it be possible for the expert to articulate how the problem will be solved?
- How critical is the knowledge that is to be captured?
- Are the involved tasks non algorithmic in nature?
- Would it possible to find a champion within the organization?

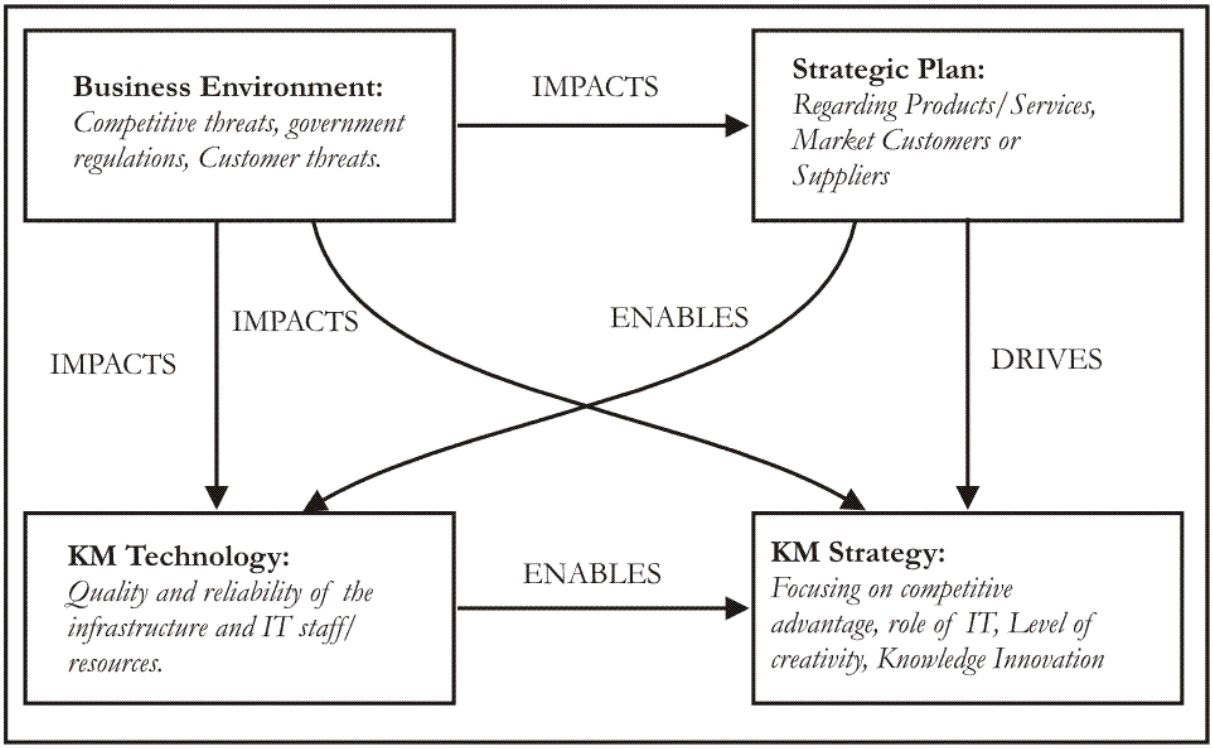
Challenges in KM Systems Development

- Changing Organizational Culture:
  - Involves changing people's attitudes and behaviors.
- Knowledge Evaluation:
  - Involves assessing the worth of information.
- Knowledge Processing:
  - Involves the identification of techniques to acquire, store, process and distribute information.
  - Sometimes it is necessary to document how certain decisions were reached.
- Knowledge Implementation:
  - An organization should commit to change, learn, and innovate.
  - It is important to extract meaning from information that may have an impact on specific missions.
  - Lessons learned from feedback can be stored for future to help others facing the similar problem(s).

- Key Differences
  - The systems analyst gathers data and information from the users and the users depend on analysts for the solution.
  - The knowledge developer gathers knowledge from people with known knowledge and the developer depends on them for the solution.
  - The main interface for the systems analyst is associated with novice users who know the problem but not the solution.
  - The main interface for the knowledge developer is associated with the knowledgeable person who knows the problem and the solution.
- Conventional systems development is primarily sequential, whereas KMSLC is incremental and interactive.
- In case of conventional systems, testing is usually done towards the end of the cycle (after the system has been built), whereas in KMSLC, the evolving system is verified and validated from the beginning of the cycle.
- Systems development and systems management is much more extensive for conventional information systems than it is for KMSLC.
- The conventional systems life cycle is usually process-driven and documentation-oriented whereas KMSLC is result-oriented.
  - The conventional systems development does not support tools such as rapid prototyping since it follows a predefined sequence of steps
  - KMSLC can use rapid prototyping incorporating changes on the spot.

Role of Strategic Planning in KM Solutions

- As a consequence of evaluating the existing infrastructure, the concerned organization should develop a strategic plan which should aim at advancing the objectives of the organization with the proposed KM system in mind.
- Areas to be considered:
    - Vision
    - Resources
    - Culture



Matching Business Strategies with KM strategies

Forming a KM team

Forming a KM team usually means

- Identifying the key units, branches, divisions etc. as the key stakeholders in the prospective KM system.
- Strategically, technically, and organizationally balancing the team size and competency.

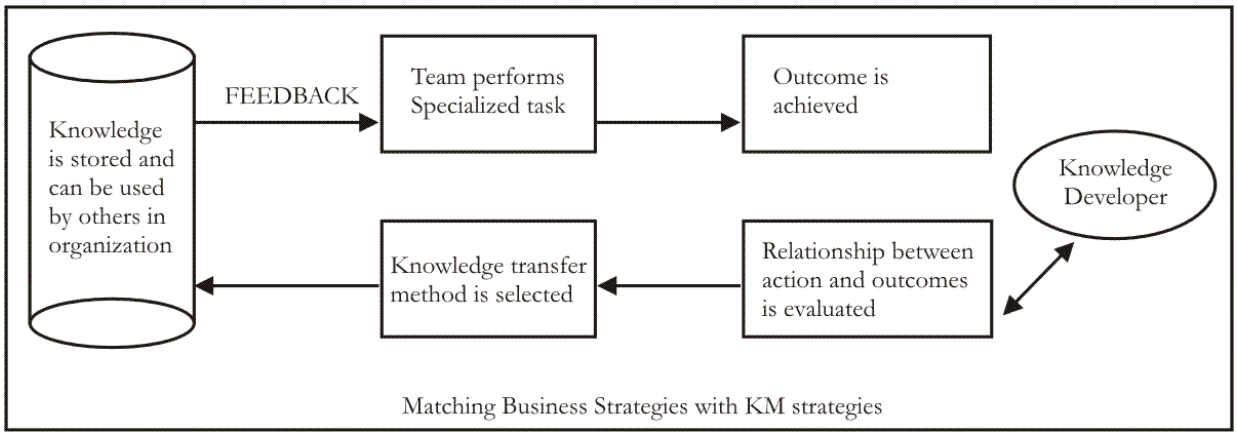
Factors impacting team success

- Quality and capability of team members (in terms of personality, experience, and communication skill).
- Size of the team.
- Complexity of the project.
- Team motivation and leadership
- Promising only what that can be actually delivered.

Capturing Knowledge

- Capturing Knowledge involves extracting, analyzing and interpreting the concerned knowledge that a human expert uses to solve a specific problem.
- Explicit knowledge is usually captured in repositories from appropriate documentation, files etc.
- Tacit knowledge is usually captured from experts, and from organization's stored database(s).
- Interviewing is one of the most popular methods used to capture knowledge.

- Data mining is also useful in terms of using *intelligent agents* that may analyze the data warehouse and come up with new findings.
- In KM systems development, the knowledge developer acquires the necessary heuristic knowledge from the experts for building the appropriate knowledge base.
- Knowledge capture and knowledge transfer are often carried out through teams.
- Knowledge capture includes determining feasibility, choosing the appropriate expert, tapping the expert's knowledge, retapping knowledge to plug the gaps in the system, and verify/validate the knowledge base.



Matching Business Strategies with KM strategies

The Role of Rapid Prototyping

- In most of the cases, knowledge developers use *iterative* approach for capturing knowledge.
- Foe example, the knowledge developer may start with a *prototype* (based on the somehow limited knowledge captured from the expert during the first few sessions).
- The following can turn the approach into rapid prototyping:
    - Knowledge developer explains the preliminary/fundamental procedure based on rudimentary knowledge extracted from the expert during the few past sessions.
    - The expert reacts by saying certain remarks.
    - While the expert watches, the knowledge developer enters the additional knowledge into the computer-based system (that represents the prototype).
    - The knowledge developer again runs the modified prototype and continues adding additional knowledge as suggested by the expert till the expert is satisfied.
- The spontaneous, and iterative process of building a knowledge base is referred to as *rapid prototyping*.

Expert Selection

The expert must have excellent communication skill to be able to communicate information understandably and in sufficient detail.

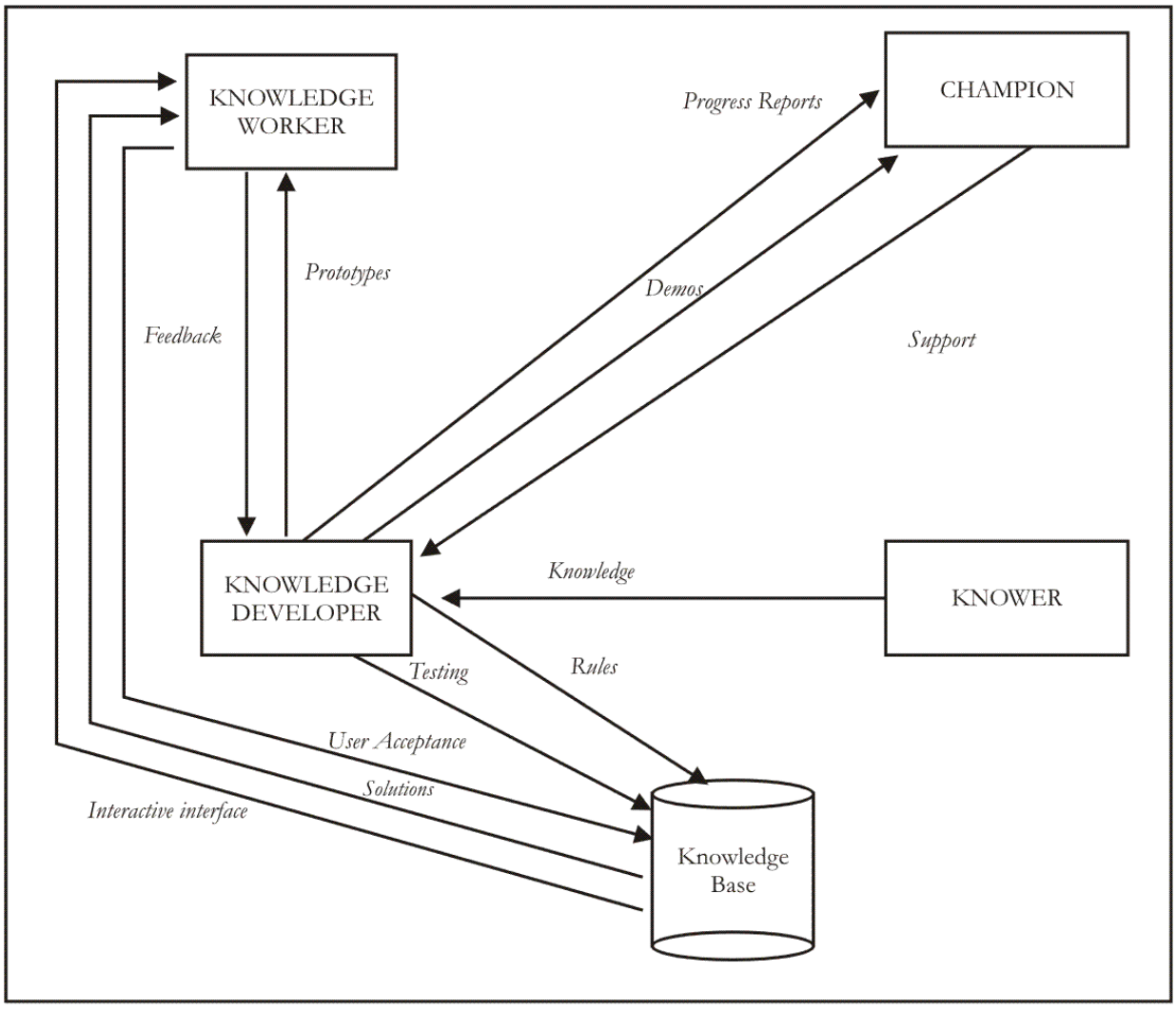
Some common questions that may arise in case of expert selection:

- How to know that the so-called expert is in fact an expert?
- Will he/she stay with the project till its completion?
- What backup would be available in case the expert loses interest or quits?
- How are the knowledge developer going to know what does and what does not lie within the expert's area of expertise?

The Role of the Knowledge Developer

- The knowledge developer can be considered as the architect of the system.
- He/she identifies the problem domain, captures knowledge, writes/tests the heuristics that represent knowledge, and co-ordinates the entire project.
- Some necessary attributes of knowledge developer:
    - Communication skills.

- Knowledge of knowledge capture tools/technology.
- Ability to work in a team with professional/experts.
- Tolerance for ambiguity.
- To be able it think conceptually.
- Ability to frequently interact with the champion, knowledge workers and knower in the organization.



Knowledge Developer's Role

Designing the KM Blueprint

This phase indicates the beginning of designing the IT infrastructure/ Knowledge Management infrastructure. The KM Blueprint (KM system design) addresses a number of issues.

- Aiming for system interoperability/scalability with existing IT infrastructure of the organization.
- Finalizing the scope of the proposed KM system.
- Deciding about the necessary system components.
- Developing the key layers of the KM architecture to meet organization's requirements. These layers are:
    - User interface
    - Authentication/security layer
    - Collaborative agents and filtering
    - Application layer
    - Transport internet layer
    - Physical layer
    - Repositories

Testing the KM System

This phase involves the following two steps:

- **Verification Procedure:** Ensures that the system is right, i.e., the programs do the task that they are designed to do.
- **Validation Procedure:** Ensures that the system is the right system - it meets the user's expectations, and will be usable on demand.

Implementing the KM System

- After capturing the appropriate knowledge, encoding in the knowledge base, verifying and validating; the next task of the knowledge developer is to implement the proposed system on a server.
- Implementation means converting the new KM system into actual operation.
- *Conversion* is a major step in case of implementation.
- Some other steps are *post implementation review* and *system maintenance*.

Quality Assurance

It indicates the development of controls to ensure a quality KM system. The types of errors to look for:

- Reasoning errors
- Ambiguity
- Incompleteness
- False representation

Post system Evaluation

Key questions to be asked in the post implementation stage:

- How the new system improved the accuracy/timeliness of concerned decision making tasks?
- Has the new system caused organizational changes? If so, how constructive are the changes?
- Has the new system affected the attitudes of the end users? If so, in what way?
- How the new system changed the cost of business operation? How significant has it been?
- In what ways the new system affected the relationships between end users in the organization?
- Do the benefit obtained from the new system justify the cost of investment?

Implications for KM

The managerial factors to be considered:

- The organization must make a commitment to user training/education prior to building the system.
- Top Management should be informed with cost/benefit analysis of the proposed system.
- The knowledge developers and the people with potential to do knowledge engineering should be properly trained.
- Domain experts must be recognized and rewarded.
- The organization needs to do long-range strategic planning.

Some questions to be addressed by the management regarding systems maintenance:

- Who will be the in charge of maintenance?
- What skills the maintenance specialist needs to have?
- What would be the best way to train the maintenance specialist?
- What incentives should be provided to ensure quality maintenance?
- What types of support/funding will be required?
- What relationship should be established between the maintenance of the KM system and the IT staff of the organization?

Test Your Understanding

1 Why is it helpful to view the building of a KM system as a life cycle?

It is important to have a life cycle in building knowledge management systems, because the life cycle provides structure and order to the process. Additionally, the life cycle provides a breakdown of the activities into manageable steps, good documentation for possible changes in the future, coordination of the project for a timely completion, and regular management review at each phase of the cycle.

2. In what ways do conventional and KM systems' development life cycles differ? How are they similar?

There are many differences between the conventional and knowledge management systems' development life cycle:

a. A conventional system is sequential (certain steps are carried out in sequence), while the knowledge management system life cycle is incremental and interactive

b. In the conventional system, testing generally occurs at the end of programming, while the knowledge management development life cycle provides for testing throughout various phases of system development as the system evolves

c. The conventional system is process-driven and documentation-oriented, with emphasis on the flow of data, while the knowledge management development life cycle is result-oriented

d. The conventional system does not support rapid prototyping or advanced languages, while the knowledge management development life cycle promotes rapid prototyping and incorporates changes on the spot

Along with these differences, however, are many similarities as well:

a. Both cycles begin with a problem and end with a solution.

b. Both cycles require the initial gathering of information (conventional) or knowledge (KMSDLC) for the process to begin and ending up with a tested system ready for use

c. Both the knowledge developer and the systems analyst need to choose a tool to design the system

3. Successful KM system implementation depends on several factors. Briefly, explain each factor

a. Level of motivation of the user. *Good documentation cannot compensate for low motivation or poor attitude toward the system. Promoting motivation and commitment takes time and must be planned in advance*

b. Computer literacy and technical background of the user. *A computer literate user can be easier to work with than someone who has no background at all. First-time users often require education and training before they are able to support development and use of knowledge-based system.*

c. Communication skills of the trainer. *Selling people on change is sometimes considered more an art than a science. Communication skills can make the difference between a user's acceptance or rejection of the installation.*

d. Time availability and funding for training. *A training program run on a shoestring is usually a loser. Also, squeezing training time to the bare minimum often results in trainee impatience, resistance to learning, or nonuse of the system. Training should be part of the implementation phase offered around the schedule of the user.*

e. Place of training. *The location of training can make a difference. On-site versus off-site training continues to be an issue with plusses and minuses for each alternative. Off-site training is generally dedicated uninterrupted learning. Its positive benefits include privacy and focus on the projects. The feasibility of off-site training depends on distance, location, and funding. In contrast, on-site training requires no out-of-town transportation or room and board expenses.*

f. Ease and duration of training. *This aspect depends on the caliber of the trainer and the attitude and motivation of the trainees. "Chemistry" often affects how well all parties work with each other. Also, the training period should be reasonable and able to meet measurable goals. A long, drawn-out three-week training period does not promote the same excitement and motivation as a one-week session.*

g. Ease of access and explanatory facilities of the knowledge management system. *Knowledge management systems should be easy to access and work with. A software package that provides adequate*

explanations is bound to satisfy most users. The explanatory facility of the package promotes ease of use and provides convincing evidence of the integrity of the solutions provided by the system

h. Ease of maintenance and system update. *At this stage, good documentation and easy-to-follow procedures in a module-oriented knowledge management system can make the difference between easy maintenance and a "nightmare." In this case, maintenance implies update, although update is more often considered enhancement.*

i. Payoff to the organization. *A system's benefit to the organization is usually measured in terms of cost reduction, improvement in sales or overall performance, and so on. Measurable payoff early in the development life cycle promotes successful implementation.*

j. Role of the champion. *Solid top management support and a champion pushing for system adoption can make a difference between a successful and a lukewarm installation*

4. How important are organizational factors in system implementation?

The primary organizational factor is top management commitment to the proposed knowledge management system. This is evident by the way it promotes the development effort through adequate funding, ensuring the availability of hardware and personnel, and allowing the champion to function within the development process.

The second organizational factor is user participation in the building process. Doing so tends to increase commitment and foster a sense of ownership of the system. Other organizational factors include organizational politics and organizational climate. Politics is jockeying for leverage to influence one's domain and control procedures, technology, or the direction of an area of operation. User readiness can also influence the success of implementation.

LESSON 31

KM SYSTEMS, SOLUTIONS, AND INFRASTRUCTURE

1. Describe the ways to facilitate KM, along with suitable examples.

KM is facilitated in a number of ways by means of KM solutions. These may be divided into four broad levels, : (1) KM Processes; (2) KM Systems; (3) KM Mechanisms and Technologies; and (4) KM infrastructure.

a. KM Processes -- are the broad processes that aid in discovering, capturing, sharing, and applying knowledge. These include combination, socialization, externalization, internalization, exchange, directions, and routines.. For example, internalization processes benefit from simulations or experiments, which enable individuals to learn through experience, as well as from face-to-face meetings, on-the-job training, and demos.
b. KM Systems -- are the integration of technologies and mechanisms, developed to support the above four KM processes. KM systems include expert-seeker systems, which help locate individuals possessing knowledge in a particular area, and rely on a combination of information technologies and mechanisms for classifying knowledge areas.
c. KM Mechanisms and Technologies -- are used in KM systems, each of which utilize a combination of multiple mechanisms and multiple technologies, which again in turn could, under differing circumstances, support multiple KM systems. Examples of KM mechanisms include on- the- job training and apprenticeship, while examples of KM technologies include databases and Internet.
d. KM Infrastructure -- reflects the long-term foundation for KM. KM mechanisms and technologies rely on the KM infrastructure for their success. Examples of KM infrastructure include the data contained in an organization's databases and the quality of the organization's employees (in terms of their tacit knowledge).

2. Explain the importance of KM mechanisms and KM technologies to KM systems. Give examples of each.

Both KM mechanisms and KM technologies support KM systems. Their differences however are explained below:

KM mechanisms are organizational or structural means used to promote KM. They enable KM systems, and are supported by KM infrastructure. KM mechanisms may or may not utilize technology. They involve some kind of organizational arrangement or social or structural means of facilitating KM. Examples of KM Mechanisms include learning by doing, on-the-job training, learning by observation, and face-to-face meetings. More long-term KM mechanisms include the hiring of a chief knowledge officer, interdepartmental projects, traditional hierarchical relationships, organizational policies, standards, initiation, and training process for new employees, and employee rotation across departments.

KM technologies support KM systems and also benefit from the KM infrastructure, especially the information technology infrastructure. KM technologies are a vital component of KM systems. Technologies that support KM include artificial intelligence (AI) technologies including case-based reasoning systems, electronic discussion groups, computer-based simulations, databases, decision support systems, enterprise resource planning systems, expert systems, management information systems, expertise locator systems, video-conferencing, and information repositories including best practices databases and lessons learned systems.

Examples of the use of KM technologies include World Bank's use of a combination of video interviews and hyperlinks to documents and reports to systematically record the knowledge of employees that are close to retirement. Similarly, at BP, desktop video-conferencing has improved communication and enabled many problems at offshore oil fields to be solved without extensive traveling.

3. Briefly explain the four kinds of classifications for KM systems based on the process supported.

Depending on the KM process most directly supported, KM systems can be classified into four kinds:

1) Knowledge Discovery Systems support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. These systems support two KM sub processes associated with knowledge discovery: combination, enabling the discovery of new explicit knowledge, and socialization, enabling the discovery of new tacit knowledge. Mechanisms and technologies can support knowledge discovery systems by facilitating combination and/or socialization. Mechanisms that facilitate combination include collaborative problem solving, joint decision making, and collaborative creation of documents. Technologies facilitating combination include knowledge discovery systems, databases, and Web-based access to data. Repositories of information, best practices, and lessons learned also facilitate combination. Technologies can also facilitate socialization, but to a smaller extent than they can facilitate combination.
2) Knowledge Capture Systems support the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or organizational entities. These systems can aid in the capture of knowledge that resides within or outside organizational boundaries, including within consultants, competitors, customers, suppliers, and prior employers of the organization's new employees. Knowledge capture systems rely on mechanisms and technologies that support externalization and internalization. KM mechanisms can enable knowledge capture by facilitating externalization, or internalization.
3) Knowledge Sharing Systems support the process through which explicit or implicit knowledge is communicated to other individuals. They do so by supporting exchange and socialization. Discussion groups or chat groups facilitate knowledge sharing by enabling an individual to explain her knowledge to the rest of the group. In addition, knowledge-sharing systems also utilize mechanisms and technologies that facilitate exchange. Some of the mechanisms that facilitate exchange are memos, manuals, progress reports, letters, and presentations. Technologies facilitating exchange include groupware and other team collaboration mechanisms, Web-based access to data, and databases, and repositories of information, including best practice databases, lessons learned systems, and expertise-locator systems.
4) Knowledge Application Systems support the process through which some individuals utilize knowledge possessed by other individuals without actually acquiring, or learning, that knowledge. Mechanisms and technologies support knowledge application systems by facilitating routines and direction.

4. State the roles of (a) organizational culture and (b) organizational structure for the development of a good KM infrastructure.

KM infrastructure is the foundation on which KM resides. Organization culture and organization structure are two of its main components.

Organizational Culture reflects the norms and beliefs that guide the behavior of the organization's members. It is an important enabler of KM in organizations. A supporting organization culture helps motivate employees to understand the importance and benefits from KM and to find time for it. Getting people to participate in knowledge sharing is considered the hardest part of KM, and a vital part of implementing KM is in making it a part of the organization's culture. A KM enabling culture is one that understands the value of KM practices, has support for KM at all managerial levels, provides incentives that reward knowledge sharing, and encourages organizational interaction for the creation and sharing of knowledge. In contrast, cultures that stress individual performance and hoarding of information within units encourage limited employee interaction, and lack of an involved top management creates inhibited knowledge sharing and retention.

Organizational Structure is another vital aspect on which KM depends on. Several aspects of organization structure are relevant. First, the hierarchical structure of the organization affects the people with whom each individual frequently interacts, and to or from whom he is consequently likely to transfer knowledge. Traditional reporting relationships influence the flow of data and information, the nature of groups who make decisions together, and consequently affect the sharing and creation of knowledge. By decentralizing or flattening their organization structures, companies aim to increase knowledge sharing with a larger group of individuals. Organization structures can facilitate KM through communities of practice, which is an organic and self-organized group of individuals who are dispersed geographically or organizationally but communicate regularly to discuss issues of mutual interest. They provide access to a larger group of individuals than possible within traditional departmental boundaries. Consequently, there are more numerous potential helpers, and this increases the probability that at least one of them will provide useful knowledge. Further, they also provide access to external knowledge sources.

5. In what way does information technology infrastructure contribute to KM within an organization?

An organization's information technology infrastructure greatly contributes to KM. While organizations could develop specialized IT infrastructure to pursue KM, usually the existing IT infrastructure, developed to support the organization's information systems needs, also facilitates KM.

Information technology infrastructure includes data processing, storage, and communication technologies and systems. It comprises the entire spectrum of an organization's information systems, including transaction processing systems and management information systems. It includes databases and data warehouses, as well as enterprise resource planning systems.

IT infrastructure provides capabilities in four important aspects: reach, depth, richness, and aggregation.

Reach pertains to access and connection, and the efficiency of such access. Depth, in contrast, focuses on the detail and amount of information that can be effectively communicated over a medium. The richness of a medium is based on its ability to provide multiple cues, quick feedback, personalize messages, and use natural language to convey subtleties. Finally, aggregation involves the collection of large volumes of information from multiple sources for processing.

Knowledge Exercises

1. How would you develop a KM system? What are the possible mechanisms and technologies you could utilize?

In developing KM systems to support KM processes, I would utilize a variety of KM mechanisms and technologies.

KM mechanisms involve some kind of organizational arrangement or social or structural means of facilitating KM. The possible KM mechanisms that could be utilized are learning by doing, on-the-job training, learning by observation, and face-to-face meetings. More long-term KM mechanisms include the hiring of a chief knowledge officer, co-operative projects across departments, traditional hierarchical relationships, organizational policies, standards, initiation process for new employees, and employee rotation across department

KM technologies benefit from the KM infrastructure, especially the information technology infrastructure. Examples of KM technologies are the use of a combination of video interviews and hyperlinks to documents and reports to systematically record the knowledge of employees close to retirement, desktop video-conferencing for communication and enabling problem solving at offshore locations without the need for extensive traveling.

2. How would you utilize knowledge discovery systems and knowledge capture systems in an organization that is spread across the globe? Does geographic distance hamper the utilization of these systems?

In an organization spread across the globe, the use of knowledge discovery systems and knowledge capture systems do tend to get hampered to some extent due to geographic distances, but due to the increasing use of technology, these problems are getting smaller and smaller.

Knowledge discovery systems support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. Mechanisms and technologies can support knowledge discovery systems by facilitating combination and/or socialization.

- Mechanisms that facilitate combination include collaborative problem solving, joint decision making, and collaborative creation of documents. In a global organization sharing documents among senior management results in the creation of new explicit knowledge, resulting in a better understanding of products and a corporate vision. Mechanisms that facilitate socialization include apprenticeships, employee rotation across areas, conferences, brainstorming retreats, cooperative projects across departments, and initiation process for new employees. In a global organization, this could become expensive, however, as it would involve the physical transfer of employees from one location to another.

- Technologies facilitating combination include knowledge discovery systems, databases, and Web-based access to data. Repositories of information, best practices and lessons learned would also facilitate combination in global organizations. Technologies can also facilitate socialization, but to a smaller extent than they can facilitate combination. Some of the technologies for facilitating socialization in a global organization include video-conferencing and electronic support for communities of practice.

  Knowledge capture systems support the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or organizational entities. Knowledge capture systems rely on mechanisms and technologies that support externalization and internalization.

- Mechanisms can enable knowledge capture by facilitating externalization, i.e., the conversion of tacit knowledge into explicit form, or internalization, i.e., the conversion of explicit knowledge into tacit form. The development of models or prototypes, and the articulation of best practices or lessons learned are some examples of mechanisms that might enable externalization in a global organization. Learning by doing, on-the-job training, learning by observation, and face-to-face meetings are some of the mechanisms that might facilitate internalization in a global organization.

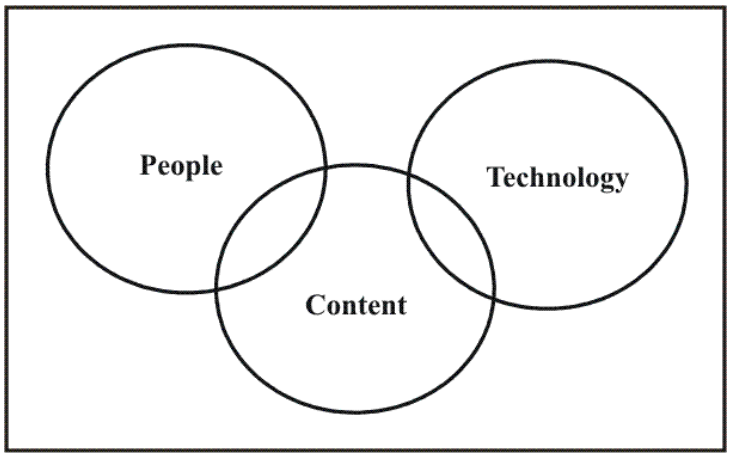
- Technologies can also support knowledge capture systems by facilitating externalization and internalization. Externalization through knowledge engineering is necessary for the implementation of intelligent technologies such as expert systems, case-based reasoning systems, and knowledge acquisition systems. Technologies that facilitate internalization include computer-based training and communication technologies.

LESSON 32

KNOWLEDGE ARCHITECTURE, INTERNET AND E-WORLD

Knowledge Architecture

- Knowledge architecture can be regarded as a prerequisite to knowledge sharing.
- The infrastructure can be viewed as a combination of people, content, and technology.
- These components are inseparable and interdependent



The People Core

- By *people*, here we mean knowledge workers, managers, customers, and suppliers.
- As the first step in knowledge architecture, our goal is to evaluate the existing information/ documents which are used by people, the applications needed by them, the people they usually contact for solutions, the associates they collaborate with, the official emails they send/receive, and the database(s) they usually access.
- All the above stated resources help to create an employee *profile*, which can later be used as the basis for designing a knowledge management system.
- The idea behind assessing the people core is to do a proper job in case of assigning job content to the right person and to make sure that the flow of information that once was obstructed by departments now flows to right people at right time.
- In order to expedite knowledge sharing, a knowledge network has to be designed in such a way as to assign people authority and responsibility for specific kinds of knowledge content, which means:
    - Identifying knowledge centers:
- After determining the knowledge that people need, the next step is to find out where the required knowledge resides, and the way to capture it successfully.
- Here, the term *knowledge center* means areas in the organization where knowledge is available for capturing.
- These centers supports to identify expert(s) or expert teams in each center who can collaborate in the necessary knowledge capture process.
    - Activating knowledge content satellites
- This step breaks down each knowledge center into some more manageable levels, satellites, or areas.
    - Assigning experts for each knowledge center:
- After the final framework has been decided, one manager should be assigned for each knowledge satellite that will ensure integrity of information content, access, and update.
- Ownership is a crucial factor in case of knowledge capture, knowledge transfer, and knowledge implementation.
- In a typical organization, departments usually tend to be territorial.
- Often, fight can occur over the budget or over the control of sensitive processes (this includes the kind of knowledge a department owns).

- These reasons justify the process of assigning department ownership to knowledge content and knowledge process.
- adjacent/interdependent departments should be cooperative and ready to share knowledge.

The Technical Core

- The objective of the technical core is to enhance communication as well as ensure effective knowledge sharing.
- Technology provides a lot of opportunities for managing tacit knowledge in the area of communication.
- Communication networks create links between necessary databases.
- Here the term *technical core* is meant to refer to the totality of the required hardware, software, and the specialized human resources.
- Expected attributes of technology under the technical core: Accuracy, speed, reliability, security, and integrity.
- Since an organization can be thought of as a knowledge network, the goal of knowledge economy is to push employees towards greater efficiency/ productivity by making best possible use of the knowledge they posses.
- A knowledge core usually becomes a network of technologies designed to work on top of the organization's existing network.

Knowledge Transfer in E-World

E-World

Intranet

- Serves the internal needs of an organization.
- Links knowledge workers and managers around the clock and automates intraorganizational traffic.
- An organization needs intranet if:
    - A large pool of information is to be shared among large number of employees.
    - Knowledge transfer needs to be done in hurry.

Extranet

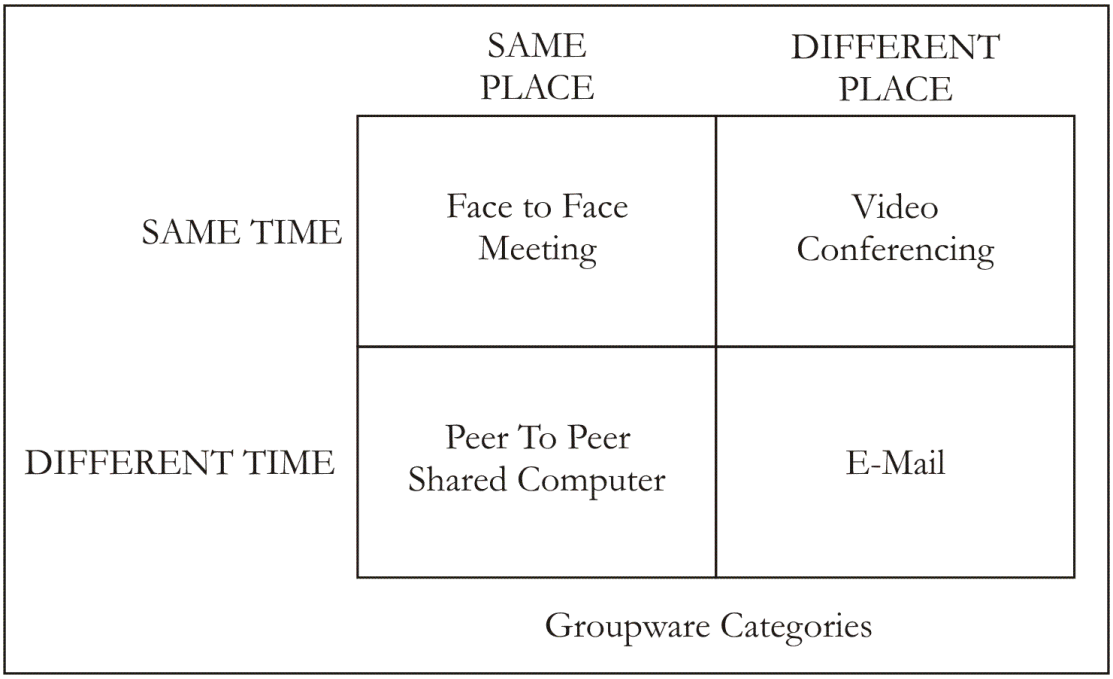
- Links limited and controlled trading partners and allows them to interact for different kinds of knowledge sharing.
- Intranets, extranets, and e-commerce do share common features.
- Internet protocols are used to connect business users; on the intranet administrators prescribe access and policy for a specific group of users; on a Business-to-Business (B2B) extranet, system designers at each participating company collaborates to make sure there is a common interface with the company they are dealing with.
- Extranets can be considered as the backbone of e-business.
- The benefits are faster time to market, increased partner interaction, customer loyalty, and improved processes.
- Security varies with type of user, the sensitivity type of the transferred knowledge and the type of communication lines used.
- Access control deals with what the users can and what they can not access.
- The issue of the level of authentication for each user should be considered.
- Extranet helps the organization in ensuring accountability in the way it does business and exchanges knowledge with its partners.
- It promotes collaboration with partners and improves the potential for increased revenue.

Groupware

- A software helping people to collaborate (especially for geographically distributed organizations).
- Supports to communicate ideas, cooperate in problem solving, coordinate work flow and negotiate solutions.
- Categorized according to:

- Users working in the same place or in different locations.
- Users working together at the same time or different times.

- To consider:
  - Group concepts
  - How group members behave in a group setting.



- Reasons for using:
  - Works well with groups having common interests and where it is not possible for the individuals to meet face to face.
  - Some problems are better solved by group than by individuals.
  - Groups bring multitude of opinions/expertise to a work setting.
  - Facilitates telecommuting (time saver)
  - Often faster and more effective than face to face meetings.
- Critical prerequisites for system success:
  - Compatibility of software.
  - Perceived benefit to every group member.
- For a face-to face session, the protocol is standard and the communication is highly structured. If the communication structure is known, then a groupware can take advantage of it to speed up the communication and improve the performance of the exchange. This communication environment is called *technologically mediated communication structure*.
- An alternative communication structure is known as a *socially mediated communication structure* where the individuals send a request (e-mail) through technology without any control over how soon or whether the recipient will respond.
- A *session* represents a situation where a group of individuals agrees to get together to conduct a meeting in person, over the telephone, or by videoconferencing etc.
- Groupware systems require that the sessions be conducted within the framework of protocols designed to ensure integrity, privacy and successful completion of each session.
- Session control determines who can enter and exit the session, when they can enter and how. Some rules used in case of session control:
  - Making sure that users do not impose a session on others.
  - Identifying conversational group members before allowing them into a session.
  - Controlling unnecessary interruptions or simultaneous transmissions (that might result in chaos/confusion).
  - Allowing group members to enter and exit at any time.
  - Determining the maximum number of participants and the length of the session(s).
  - Ensuring accountability, anonymity and privacy during the session(s).
- Applications:

- E-mail/Knowledge transfer
- Newsgroups/Work-Flow Systems
- Chat Rooms
- Video Communication
- Group Calendaring/Scheduling
- Knowledge Sharing

E-Business

- Brings the worldwide access of the internet to the core business process of exchanging information between businesses, between people within a businesses, and between a business and its clients.
- The focus is on knowledge transfer/sharing.
- It connects critical business systems to critical constituencies (customers, suppliers, vendors etc) via the internet, intranets, and extranets.
- E-Business helps to attain the following goals:
  - Developing new products/services
  - Gaining recent market knowledge
  - Building customer loyalty
  - Enriching human capital by direct and instant knowledge transfer
  - Making use of existing technologies for research and development
  - Gaining competitive edge and market leadership.

Value Chain

- It is a way of organizing the primary and secondary activities of a business in a way that each activity provides productivity to the total business operation.
- Competitive advantage is gained when the organization links the activities in its value chain more cheaply/effectively than its competitors do.
- The knowledge-based value chain provides away of looking at the knowledge activities of the organization and how various knowledge exchange adds value to adjacent activities and to the organization in general.
- Everywhere value is added is where knowledge is created, shared or transferred.
- By the process of examining the elements of the value chain, executives can find the ways to incorporate IT and telecommunications to improve the overall productivity of the firm.
- In case of E-Business, we integrate the KM life cycle from knowledge creation to knowledge distribution via
  - Business to Consumer
  - Business to Business
  - Business within Business

Supply Chain Management (SCM)

- Incorporates the idea of having the right product in the right place, at the right time, in the right condition and at the right price.
- This is an integral part of Business to Business framework.
- This employs tools that allows the organization to exchange and update information in order to reduce cycle times, to have quicker delivery of orders, to minimize excess inventory and to improve customer service.

Customer Relationship Management (CRM)

- Helps the organization to improve the quality of its relationship management with customers.
- It is a business strategy used to learn more about customer needs and customer bevaviour patterns in order to develop better and stronger relationship with them.
- It can improve/change an organization's business processes for supporting new customer focus and apply emerging technologies to automate these new processes.
- The technologies can allow multiple channels of communication with customers (and supply chain partners) and can use customer information stored in corporate databases and knowledge-bases to construct predictive models for customer purchase behaviour.

- Benefits:
    - Increased customer satisfaction.
    - Enhancing efficiency of call centers.
    - Cross selling products efficiently.
    - Simplifying sales processes.
    - Simplifying marketing processes.
    - Helping sales staff to close deals faster.
    - Finding new customers
- Critical elements of CRM software:
    - Operational technology:

Uses portals that facilitate communication between customers, employees, and supply chain partners. Basic features included in portal products:

- Personalization services
- Secure services
- Publishing services
- Access services
- Subscription services
    - Analytical technology:

Uses data-mining technologies to predict customer purchase patterns.

- Architectural imperative for CRM is to do:
    - Allowing the capture of a very large volume of data and transforming it into analysis formats to support enterprise-wide analytical requirements.
    - Deploying knowledge.
    - Calculating metrics by the deployed business rules.

Q: 1. ***What is the main difference between intranet and extranet? Where does the Internet fit in?***

The Intranet is used for sharing information within an organization. While, *The Extranet* connects separate companies with shared databases through the Internet. Hence, intranets are more localized within a firm and move data quicker than the more distributed extranets. The use of Internet (primarily Web) is to connect public at large, mostly business users and branches.

Q: 2. ***Explain in your own words the functions of middleware. How does it differ from the user interface?***

The middleware provides connections between legacy applications and existing and new systems i.e. (old and new data formats).While, **The user interface** standardizes exchanges between the ultimate user and the system.

Q: 3. What does it mean to leverage technology?

It means leveraging an organization's technological infrastructure to meet the data requirements of users and customers.

Q: 4. ***Why is it a critical requirement that a successful knowledge management system be tagged to collaboration?***

Because it would be superfluous to think of knowledge sharing, knowledge transfer, or continued creativity without collaborative success.

LESSON 33

CORPORATE INTRANET, EXTRANET, AND PORTAL

KM Tools and Knowledge Portals

Portals

Portals are Web-based applications which provide a single point of access to online information. These can be regarded as virtual workplaces which

- promotes knowledge sharing among end-users (e.g., customers, employees etc).
- provides access to data (structured) stored in databases, data warehouses etc.
- helps to organize unstructured data.

Evolution

- Initially portals were merely search engines.
- In the next phase they were transformed to *navigation sites*.
- In order to facilitate access to large amount of information, portals have evolved to include advanced search capabilities and taxonomies.
- They are also called *Information portals* because they deal with information.
- Organizations are becoming increasingly aware of the opportunities obtained by using and adding value to the information lying dormant in scattered information systems.
- Portals can integrate applications by the way of combining, analyzing, and standardizing relevant information.
- *Knowledge portals* provides information about all business activities and they are capable of supplying metadata to support decision making.
- In case of knowledge portal, we do not focus on the content of the information, but we focus on how it will be used by the knowledge workers.
- Knowledge portals have two kinds of interface:
    - Knowledge consumer interface
    - Knowledge producer interface
- *Enterprise Knowledge Portals* (EKP) can distinguish knowledge from information and can produce knowledge from raw data and information.

Business Challenge

- In case of most of the businesses, usually there exists an inherent pressure to optimize the performance of operational processes in order to reduce cost and enhance quality.
- Customer-oriented systems allow organizations to understand the customer behaviour pattern(s) and helps them to offer the right product at the right time.
- Often, organizations need to commercialize their products at the lowest possible price.

Portals and Business Transformation

- Usually problems arise from the following two fundamental aspects underlying the present computing technology:
    - The explosion in the quantity of business information already captured in electronic documents leads many organizations to lose their grip on the information as they upgrade their processes and transform to new systems.
    - The fast speed with which the quantity (and kinds) of information content is growing, indicates that what is needed to meet the challenges is a strict internal discipline which can help to expose and integrate the sources of enterprise knowledge.
- Types of pressures faced by most organizations:
    - Shorter time to market
    - More demanding investors/customers
    - Knowledge worker turnover

Market Potential

- Knowledge portals are emerging as key tools for supporting the knowledge workplace.
- The infrastructure components of the Enterprise Information Portal (EIP) market:
    - Business intelligence
    - Content management
    - Data management
    - Data warehouses/data marts

Knowledge Portal Technologies Functionality

- Gathering
- Categorization
- Collaboration
- Distribution
- Personalization
- Publishing
- Searching/Navigation

Collaboration

- The aim for using the collaboration tools is to create a collaborative KM system which supports sharing and reusing information.
- In the context of KM, collaboration implies the ability for more than one people to work together in a coordinated fashion over time (and space) using electronic devices.
- Types of collaboration:
    - Asynchronous collaboration: Human-to-human interactions via computer systems having no time/space constraints.
    - Synchronous collaboration: Human-to-human interactions (via computer systems) that occurs instantly.
- Push Technology:
  Places information in a place where is it easily visible.
- Pull Technology:
  Requires to take specific actions in order to retrieve information.

Content Management

- Requires directory/indexing capabilities to automatically mange the ever growing warehouses of enterprise data.
- Addresses the problem of searching for knowledge in all information sources of the enterprise. This knowledge can include structured as well as unstructured internal information objects like office documents, collaborative data, MIS, experts, and also external information.
- *Metadata* is required to define the types of information.
- Content management component needs to publish information in the knowledge-base.
- Content management can handle the way the documents are analyzed, categorized, and stored.
- *Categorizing*: As the volume of documents (under management) grows, it becomes rather important to organize similar documents into smaller groups and to name the groups.
- Since document collections are not static, hence portals must provide some form of taxonomy maintenance. As new documents are added, they must be added to the taxonomy at proper places (using a classification technology). As the clusters grow and as the conceptual content of the new documents change over time, it can become necessary to subdivide clusters or to move documents from one clustered to another.

Intelligent Agents

- *Agents* are software which are able to execute a wide range of functional tasks (e.g, comparing, learning, searching etc).
- *Intelligent agents* are tools that can be applied in the context of EKP's.

- They are still in their infancy, most applications are yet experimental and have not reached the actual commercial stage.
- As the relationships between the organizations and their customers become more complex, the organization needs more information regarding what these relationships mean and the way to exploit them. Intelligent agent technology can help to address these needs.
- Customers usually set certain priorities while purchasing products (or using services). Intelligent agents can master the individual customers' demand priorities by learning from experience with them, and most of all they can qualitatively and quantitatively analyze these priorities.
- Some of the customer services that can be benefited by intelligent agents:
    - Customer assistance (customized) with online services.
    - Customer profiling and integrating profiles of customers into a group of marketing activities.
    - Forecasting customer requirements.
    - Executing transactions (financial) on the behalf of customers.
    - Negotiating prices/payment schedules.

TEST YOUR UNDERSTANDING

1. *Why is there a need for portals? How are portals similar to the concept of data warehouses and data marts?*

Almost all organizations are facing challenges that impose the need for integrated and exposed knowledge. These pressures are as follows:

- *Shorter time to market.* New products and services have to be conceived, developed, and delivered in months, or even weeks.
- *Knowledge worker turnover.* When a pivotal person leaves, the pain is widely and quickly felt. "It's becoming increasingly difficult to acquire and retain employees, and a company's strongest asset is its people," says Chris Moore, chief technology officer at Training Server, Inc. "Organizations that do not tap into their mind share and take advantage of the knowledge within will quickly fall behind."
- *More demanding customers and investors.* For virtually every organization, the squeeze is on customers wanting to pay less while investors want more value from their portfolios. This means that all the resources to which an organization can lay claim, including its intellectual resources, must be managed for the best result.

    Data warehouses and data marts give access to data collected from different databases. Portals provide the interface to reach, and manipulate data in data warehouses in addition to other collaboration services.

2. *What are the advantages and disadvantages of having your portal on the Internet instead of an intranet?*

An enterprise portal is designed to provide the same interface for employees, managers, customers, and suppliers. It allows anybody involved in the enterprise to have access to the portal from anywhere from the world. It is not restricted to local use. Therefore, it is better to deploy portals over the Internet rather than the Intranet.

3. *List the differences between knowledge and information portals. Discuss the benefits of each.*

Enterprise Information Portals	Enterprise Knowledge Portals
• Use both "push" and "pull" technologies to transmit information to users through a standardized Web-based interface • Integrate disparate applications including content management, business intelligence, data warehouse/data mart, data management, and other data external to these applications into a single system that can "share, manage, and maintain information from one central user interface" • Have the ability to access both external and internal sources of data and information; and the ability to support a bi-directional exchange of information with these sources	• Are goal-directed toward knowledge production, knowledge acquisition, knowledge transmission, and knowledge management • Are focused on enterprise business processes such as sales, marketing, and risk management • Provide, produce, and manage information about the validity of the information they supplies • Include all EIPs functionalities

The main benefits of each:

Knowledge portals

- Provide information on various topics, and can be customized to meet a user's individual needs.
- Portals make it easy to access knowledge because of their universal interface—a Web browser.
- Online portal systems let IT organizations access a variety of back-end systems (such as process management soft-ware and methodology databases).
- Knowledge portals provide two kinds of interfaces:
- *The knowledge producer interface.* It facilitates the knowledge worker's job of gathering and analyzing information, collaborating with peers or colleagues, and finally generating new knowledge.
- *The knowledge consumer interface.* It facilitates the dissemination of knowledge across the enterprise. A key feature of knowledge portals is a sophisticated personalization facility that takes into account the consumer profile.

Information Portals

- Benefits for companies include Lowered costs, increased sales, and better deployment of resources.
- Portals integrate applications by combining, standardizing, analyzing, and distributing relevant information and knowledge to end users, whether they are customers, employees, or partners.

4. *Discuss the strategic and technological fit required for an organization to implement a portal.*

Companies must develop strategies and processes designed to best utilize intellectual resources at both the strategic and operational levels. Companies already began using groupware (such as e-mail, discussion forums, and document libraries) for coordinating activities. Now, deploying next-generation information, application platforms (such as enterprise portals), and real-time tools (such as instant messaging, Web conferencing, and streaming audio/video) are required.

5. *Discuss the differences between static and dynamic portals. When would you use each?*

A Static portal is a unified interface providing access to enterprise applications. A dynamic portal has collaboration and interactivity features.

6. *Discuss how you can use content management to sort knowledge from external and internal sources. Illustrate with examples.*

Content management in the EKP context requires directory and indexing capabilities to automatically manage the ever-growing store of structured and unstructured data residing in data warehouses, Web sites, ERP systems, legacy applications, and so forth. Using metadata to define types of information, good content management can serve as the backbone for a system of corporate decision-making where business intelligence tools mine data and report findings back to key players in the enterprise. Content management may also involve going outside the enterprise, employing crawlers that find pertinent data via the Internet, incorporating it into existing systems, indexing it, and delivering it to appropriate analysts, knowledge workers, or decision makers.

7. *Discuss the issues that can arise when implementing a portal. Focus on technology, management, corporate strategy, and end users.*

For globally distributed organizations (that is, most international development organizations) that rely on the Internet as a medium for the sharing of knowledge, the issue of bandwidth is fundamental. At this point in the evolution of the Internet, bandwidth is a chief constraining factor for many applications.

8. *Give examples and uses of portals for B2B, B2C, B2G, C2C, and C2G.*

- Amazon.com is an example of B2C portals
- Plasticexchanche.com, ChemConnect.com, Paperloop.com are examples of B2B portals for the plastics chemical and paper industries
- www.e-government.govt.nz/ is a C2G portal allowing people to find and use New Zealand government information and services
- www.firstgov.gov is the official U.S. gateway to all government information. First Gov is a comprehensive portal connecting citizens, businesses, and agencies to the government.

9. *List a number of possible ways a portal can be made accessible, given current technological trends. Focus on five of these technologies and discuss their strengths and weaknesses.*

- Internet
- Intranet
- Extranet
- Mobility portals
- Learned Lessons

11. An audit firm needs to develop a system that allows auditors and public accountants to search accounting standards, share knowledge, communicate, and share Word and Excel files between the head office and clients' sites. As a consultant, you have been asked to recommend such a system. What would you suggest?

The suggested system is an enterprise knowledge portal (EKP) with the following functionalities:

- *Gathering:* This function captures all accounting standard in a common repository.
- *Categorization:* This function profiles information and organizes it in an understandable and presentable way such as Word and Excel files. This categorization is supported at all levels (employees, managers, and clients)
- *Distribution:* This facility supports the distribution of structured and unstructured information in the form of electronic documents.
- *Collaboration*: This function is used to share the knowledge between the head office and client's sites through asynchronous collaboration such as e-mails, discussion forum, etc.
- *Search/Navigate:* Which will help clients and employees to reach required information?

12. A hardware retailer wishes to offer real-time support to customers via the Internet. Suggest how a knowledge portal, equipped with chat and CRM, can be used to accomplish this. What additional support can the hardware retailer offer? What information can he give to the manufacturer?

By using a knowledge portal equipped with a synchronous collaboration tools, the retailer can accomplish the following customer support, he will improve costumer retention and satisfaction by solving their problems online and immediately.

He will be able to reduce costs through decreasing phone calls and site visiting. Also, he will be able to penetrate new market segments by attracting new customers who will find the service an attractive and easy to adapt to one.

The retailer can add an FAQ section that enlists the most common defects that encounter hardware, with the ability of updating it regularly using input from customers. This will add value to the costumer as she can find what she is looking for without the need to type a massage also it will be beneficial for the manufacturer who will use the costumers' feedback to improve quality of his products.

13. Discuss how synergy between different strategic business units can be harnessed and utilized by knowledge portals.

By using a knowledge portal, different business units can interact and collaborate to reach the best results. It enables the employees to use a web-based workplace for drag and drop file sharing, multithreaded discussions, real time messaging, and polling. Also, productivity can be increased because users of the portals from different business units know what is happening across the enterprise and can stay on top of there costumers, products and markets, driving sales. Additionally, employees can communicate with one another and discuss various issues without consuming much resources and time.

LESSON 34

KM SYSTEMS AND TECHNICAL LAYERS

Knowledge Transfer in E-World

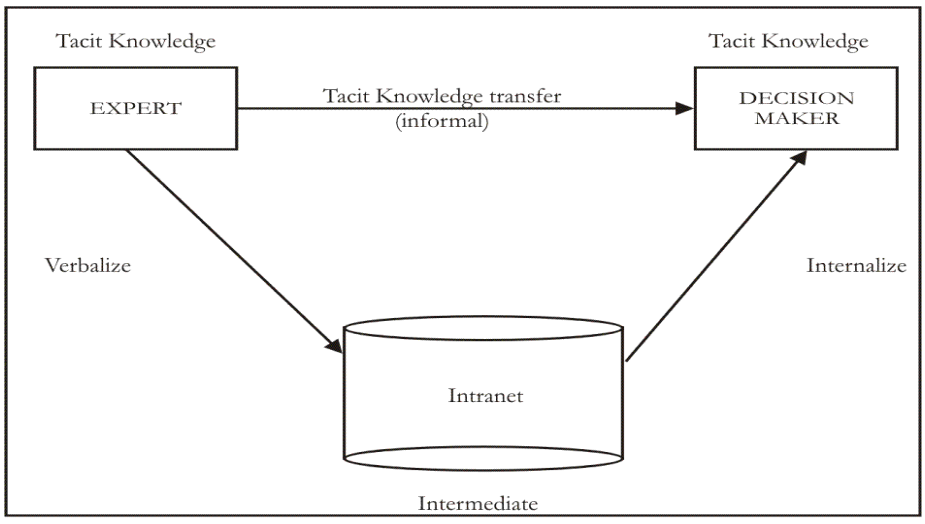
The Technical Core

The objective of the technical core is to enhance communication as well as ensure effective knowledge sharing.

- Technology provides a lot of opportunities for managing tacit knowledge in the area of communication.
- Communication networks create links between necessary databases.
- Here the term *technical core* is meant to refer to the totality of the required hardware, software, and the specialized human resources.
- Expected attributes of technology under the technical core: Accuracy, speed, reliability, security, and integrity.
- Since an organization can be thought of as a knowledge network, the goal of knowledge economy is to push employees towards greater efficiency/ productivity by making best possible use of the knowledge they posses.
- A knowledge core usually becomes a network of technologies designed to work on top of the organization's existing network.

User Interface Layer

- Usually a web browser represents the interface between the user and the KM system.
- It is the top layer in the KM system architecture.
- The way the text, graphics, tables etc are displayed on the screen tends to simplify the technology for the user.
- The user interface layer should provide a way for the proper flow of tacit and explicit knowledge.
- The necessary knowledge transfer between people and technology involves capturing tacit knowledge from experts, storing it in knowledge base, and making it available to people for solving complex problems.
- Features to be considered in case of user interface design:
    - Consistency
    - Relevancy



The Transfer of knowledge

    - Visual clarity
    - Usability
    - Ease of Navigation

Authorized Access Layer

- This layer maintains security as well as ensures authorized access to the knowledge captured and stored in the organization's repositories.
- The knowledge is usually captured by using internet, intranet of extranet.
- An organization's intranet represents the internal network of communication systems.
- Extranet is a type of intranet with extensions allowing specified people (customers, suppliers, etc.) to access some organizational information.
- Issues related to the access layer: access privileges, backups.
- The access layer is mostly focused on security, use of protocols (like passwords), and software tools like firewalls.
- Firewalls can protect against:
    - E-mails that can cause problems.
    - Unauthorized access from the outside world.
    - Undesirable material (movies, images, music etc).
    - Unauthorized sensitive information leaving the organization.
- Firewalls can not protect against:
    - Attacks not going through the firewall.
    - Viruses on floppy disks.
    - Weak security policies.

Collaborative Intelligence and Filtering Layer

- This layer provides customized views based on stored knowledge.
- Authorized users can find information (through a search mechanism) tailored to their needs.
- Intelligent agents (active objects which can perceive, reason, and act in a situation to help problem solving) are found to be extremely useful in some situations.
- In case of client/server computing, there happens to be frequent and direct interaction between the client and the server.
- In case of mobile agent computing, the interaction happens between the agent and the server.
- A mobile agent roams around the internet across multiple servers looking for the correct information. Some benefits can be found in the areas of:
    - Fault tolerance.
    - Reduced overall network load.
    - Heterogeneous operation.
- Key components of this layer:
    - The registration directory that develops tailored information based on user profile.
    - Membership in specific services, such as sales promotion, news service etc.
    - The search facility such as a search engine.
- In terms of the prerequisites for this layer, the following criteria can be considered:
    - Security.
    - Portability.
    - Flexibility
    - Scalability
    - Ease of use.
    - Integration.

Knowledge-Enabling Application Layer (Value-Added Layer)

- This creates a competitive edge.
- Most of the applications help users to do their jobs in better ways.
- They include knowledge bases, discussion databases, decision support etc.

Transport Layer

- This is the most technical layer.
- It ensures to make the organization a network of relationships where electronic transfer of knowledge can be considered as routine.
- This layer associates with LAN (Local Area Network), WAN (Wide Area Network), intranets, extranets, and internet.

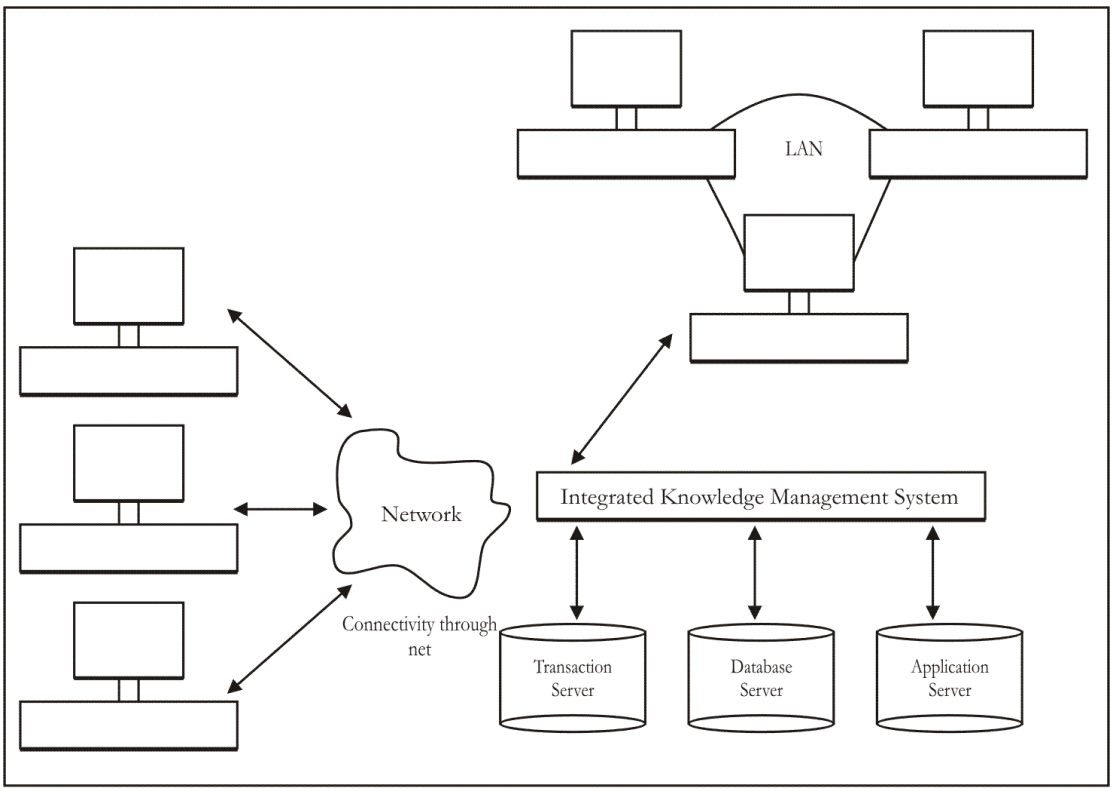
- In this layer we consider multimedia, URL's, connectivity speeds/bandwidths, search tools, and consider managing of network traffic.

Middleware Layer

- This layer makes it possible to connect between old and new data formats.
- It contains a range of programs to do this job.

Repositories Layer

- It is the bottom layer of the KM architecture which represents the physical layer in which repositories are installed.
- These may include, legacy applications, intelligent data warehouses, operational databases etc.
- After establishing the repositories, they are linked to form an integrated repository.



Integrated Knowledge Management System

Distinguish between

a. Transport layer and application layer
b. Usability and portability
c. Profiling and repository
d. Collaborative intelligence and intelligent agent

The Transport Layer is the layer that standardizes exchanges between the operating systems of the computers in the system. It includes local area networks (LANs), wide area networks (WANs), intranets, extranets, and the Internet. . While, the **Application Layer** is the applications that provide the user with better ways to do their jobs. They include knowledge bases, discussion databases, sales force automation tools, yellow pages, decision support, and imaging tools.

b. **Usability** ensures user-friendly software. **Portability** is a measure of how well the software will run on different computers.
c. **Profiling:** In knowledge management systems, it is generating a graphic or
d. Textual representation of people in terms of criteria such as skills, personality traits, etc. While, r**epository** is a storage subsystem, such as a database for data, information, or knowledge storage.

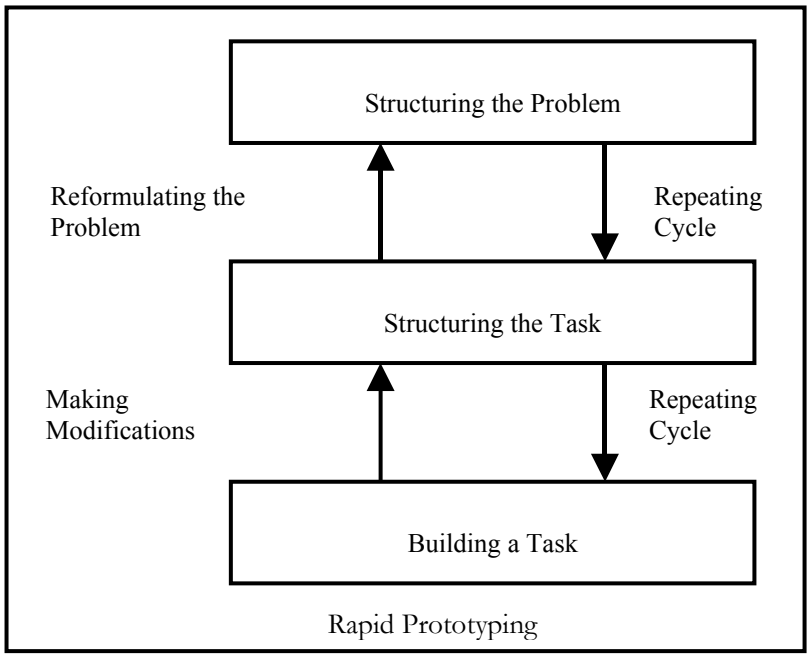
e. **Collaborate Intelligence** provides customized or personalized view based on stored knowledge. It is designed to reduce search time for information by combining the knowledge sought and the user's profile. While, i**ntelligent agents** are active objects that can perceive, reason (learn from past mistakes), and act in a situation that assists in problem solving, retrieving the right information. It behaves as a personal assistant that cooperates with the human users.

LESSON 35

KM SYSTEM AND LIFE CYCLE APPROACH: CONVENTIONAL VS KM

Key Differences between Conventional vs. KM Systems

- The systems analyst gathers data and information from the users and the users depend on analysts for the solution.
- The knowledge developer gathers knowledge from people with known knowledge and the developer depends on them for the solution.
- The main interface for the systems analyst is associated with novice users who knows the problem but not the solution.
- The main interface for the knowledge developer is associated with the knowledgeable person who knows the problem and the solution.
- Conventional systems development is primarily sequential, whereas KMSLC is incremental and interactive.
- In case of conventional systems, testing is usually done towards the end of the cycle (after the system has been built), whereas in KMSLC, the evolving system is verified and validated from the beginning of the cycle.
- Systems development and systems management is much more extensive for conventional information systems than it is for KMSLC.
- The conventional systems life cycle is usually process-driven and documentation-oriented whereas KMSLC is result-oriented.
- The conventional systems development does not support tools such as rapid prototyping since it follows a predefined sequence of steps
- KMSLC can use rapid prototyping incorporating changes on the spot.



Key Similarities

- Both cycles' starts with a problem and end with a solution.
- The early phase in case of conventional systems development life cycle starts with information gathering. In KMSLC the early phase needs knowledge capture.
- Verification and validation of a KM system is often very similar to conventional systems testing.
- Both the systems analyst and the knowledge developer needs to choose the appropriate tools for designing their intended systems.

ATTRIBUTES	USER	EXPERT
Dependence on System	High	Low
Ambiguity Tolerance	Low	High
Co-Operation	Required	Not Required
Knowledge about the Problem	High	Average
Uses the	Yes	No
Contribution	Information	Expertise/Knowledge
Availability	Yes, Readily available	No, not readily available

Users and Experts: A Comparison

KMSLC Approaches

- Primarily due to lack of standardization, a number of approaches have been proposed for KMSLC.
- The conventional systems development approach can still be used for developing KM systems, but it is usually being replaced by iterative design, prototyping etc.

Evaluating the Existing Infrastructure

KM systems are developed in order to satisfy the need for improving productivity and potential of employees and the company as a whole. The existing knowledge infrastructure is evaluated so that it can give the perception that the present ways of doing things are not just abandoned in preference for a new system.

Test Your Understanding

1. Why is it helpful to view the building of a KM system as a life cycle?

It is important to have a life cycle in building knowledge management systems, because the life cycle provides structure and order to the process. Additionally, the life cycle provides a breakdown of the activities into manageable steps, good documentation for possible changes in the future, coordination of the project for a timely completion, and regular management review at each phase of the cycle.

2. **In what ways do conventional and KM systems' development life cycles differ? How are they similar?**

There are many differences between the conventional and knowledge management systems' development life cycle:

e. A conventional system is sequential (certain steps are carried out in sequence), while the knowledge management system life cycle is incremental and interactive
f. In the conventional system, testing generally occurs at the end of programming, while the knowledge management development life cycle provides for testing throughout various phases of system development as the system evolves

g. The conventional system is process-driven and documentation-oriented, with emphasis on the flow of data, while the knowledge management development life cycle is result-oriented
h. The conventional system does not support rapid prototyping or advanced languages, while the knowledge management development life cycle promotes rapid prototyping and incorporates changes on the spot

Along with these differences, however, are many similarities as well:

d. Both cycles begin with a problem and end with a solution.
e. Both cycles require the initial gathering of information (conventional) or knowledge (KMSDLC) for the process to begin and ending up with a tested system ready for use
f. Both the knowledge developer and the systems analyst need to choose a tool to design the system

3. **Distinguish between:**

a. verification and validation
b. knowledge developer and systems analyst
c. pupil user and tutor user
d. projection and avoidance

Verification determines if the system was built right, while validation ensures that the correct system was built to meet the user's expectations.

A **knowledge developer** is a specialists in building knowledge-based systems He or she is the key architect of such systems. In contrast, a **systems analyst** is a specialist in building information systems. He or she is the architect of such systems, which includes designing testing, and installing the system.

A **pupil-user** is an unskilled worker trying to learn or gain some understanding of the captured knowledge. A **tutor-user** is a user with a working knowledge of the knowledge management system and is responsible for system maintenance

Projection is resistance to knowledge management system development through employee display of hostility toward peers. **Avoidance** is resistance to a knowledge management system through employee withdrawal from the job or scene.

LESSON 36

KM SYSTEM JUSTIFICATION AND FEASIBILITY ISSUES, IMPLEMENTATION ISSUES AND RESISTANCE

KM System Justification

It involves answers to the following questions:

- Is existing knowledge going to be lost through retirement, , transfer, or departure to other organizations?
- Is the proposed KM system needed in multiple locations?
- Are experts available and willing to support the building of the proposed KM system?
- Does the concerned problem needs years of proper experience and cognitive reasoning to solve?
- While undergoing knowledge capture, would it be possible for the expert to articulate how the problem will be solved?
- How critical is the knowledge that is to be captured?
- Are the involved tasks no algorithmic in nature?
- Would it possible to find a champion within the organization?

Scoping: S*coping* means *limiting the breadth and depth of the project within the financial, human resource, and operational constraints*.

Feasibility: Feasibility study involves addressing the following questions:

- Is it possible to complete the project within the expected timeframe?
- Is the project affordable?
- Is the project appropriate?
- How frequently the system would be consulted at what will be associated cost?

The traditional approach used to conduct a feasibility study can be used for building a KM system. This involves the following tasks:

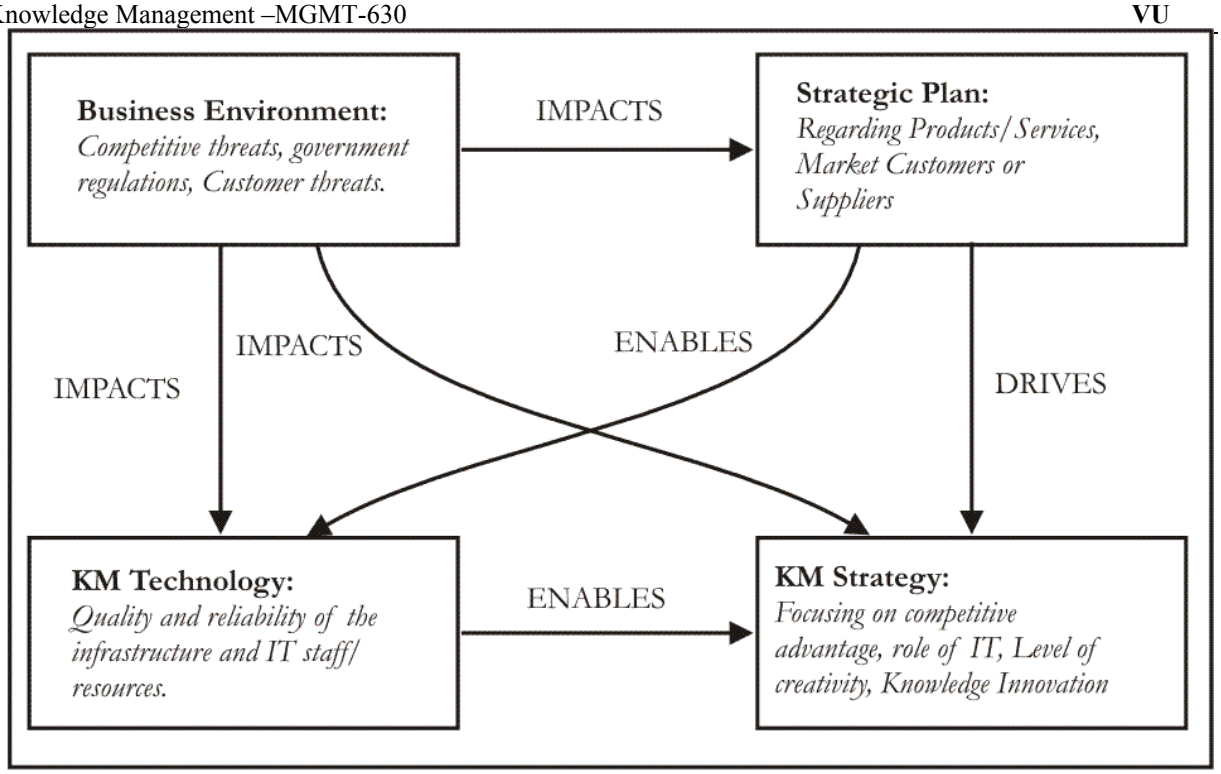
- Forming a knowledge management team.
- Preparing a master plan.
- Performing cost/benefit analysis of the proposed system.
- Quantifying system criteria and costs.

User Support

- Is the proposed user aware of the fact that the new KM system is being developed? How it is perceived?
- How much involvement can be expected from the user while the building process continues?
- What type of users training will needed when the proposed system is up and running?
- What kind of operational support should be provided?

Role of Strategic Planning

- As a consequence of evaluating the existing infrastructure, the concerned organization should develop a strategic plan which should aim at advancing the objectives of the organization with the proposed KM system in mind.
- Areas to be considered:
    - Vision
    - Resources
    - Culture



Matching Business Strategies with KM strategies

Forming a KM team

Forming a KM team usually means:

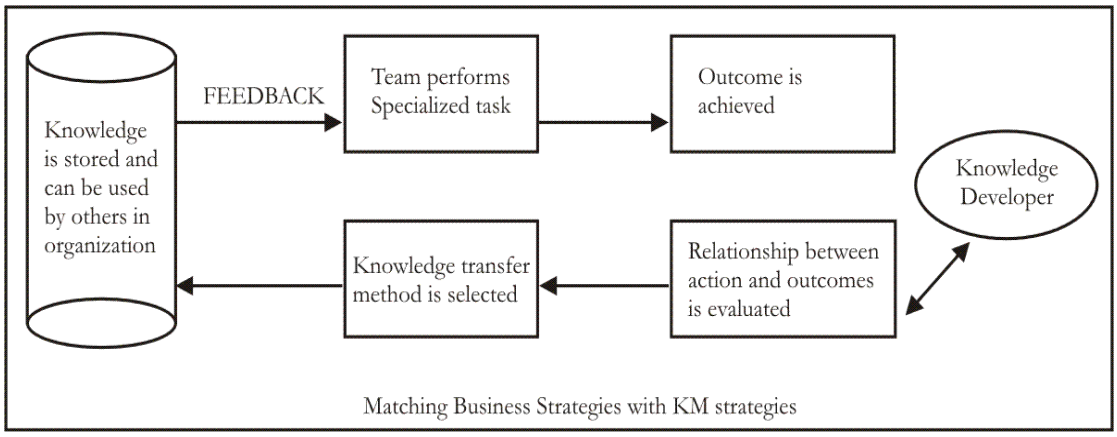
- Identifying the key units, branches, divisions etc. as the key stakeholders in the prospective KM system.
- Strategically, technically, and organizationally balancing the team size and competency.

Factors impacting team success:

- Quality and capability of team members (in terms of personality, experience, and communication skill).
- Size of the team.
- Complexity of the project.
- Team motivation and leadership
- Promising only what that can be actually delivered.

Capturing Knowledge

- Capturing Knowledge involves extracting, analyzing and interpreting the concerned knowledge that a human expert uses to solve a specific problem.
- Explicit knowledge is usually captured in repositories from appropriate documentation, files etc.
- Tacit knowledge is usually captured from experts, and from organization's stored database(s).
- Interviewing is one of the most popular methods used to capture knowledge.
- Data mining is also useful in terms of using *intelligent agents* that may analyze the data warehouse and come up with new findings.
- In KM systems development, the knowledge developer acquires the necessary heuristic knowledge from the experts for building the appropriate knowledge base.
- Knowledge capture and knowledge transfer are often carried out through teams (refer to Figure 2.4).
- Knowledge capture includes determining feasibility, choosing the appropriate expert, tapping the experts knowledge, retapping knowledge to plug the gaps in the system, and verify/validate the knowledge base (refer to Table 3.4 in page 76 of your textbook).



Matching Business Strategies with KM strategies

The Role of Rapid Prototyping

- In most of the cases, knowledge developers use *iterative* approach for capturing knowledge.
- Foe example, the knowledge developer may start with a *prototype* (based on the somehow limited knowledge captured from the expert during the first few sessions).
- The following can turn the approach into rapid prototyping:
    - Knowledge developer explains the preliminary/fundamental procedure based on rudimentary knowledge extracted from the expert during the few past sessions.
    - The expert reacts by saying certain remarks.
    - While the expert watches, the knowledge developer enters the additional knowledge into the computer-based system (that represents the prototype).
    - The knowledge developer again runs the modified prototype and continues adding additional knowledge as suggested by the expert till the expert is satisfied.
- The spontaneous, and iterative process of building a knowledge base is referred to as *rapid prototyping*.

Expert Selection

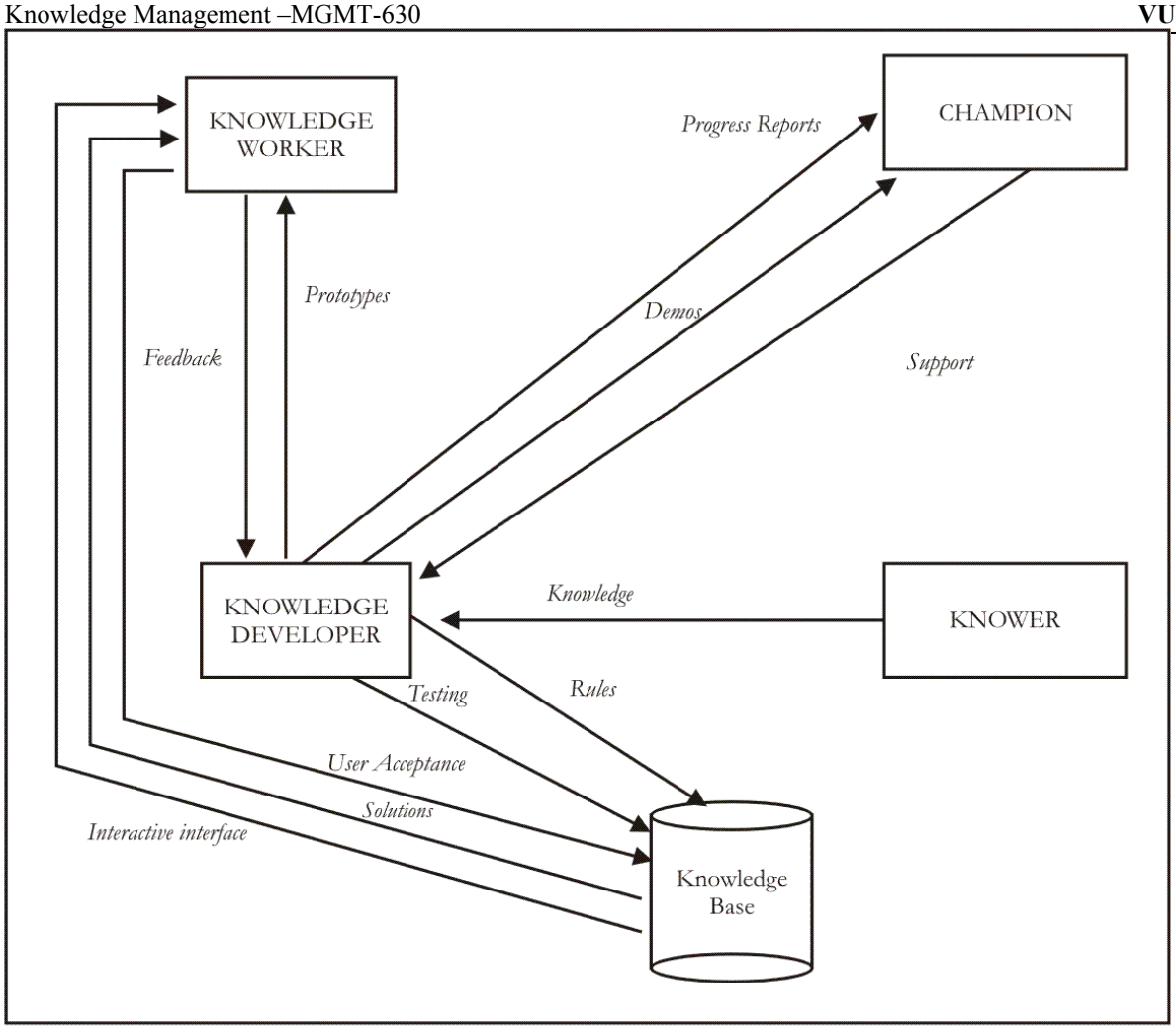
The expert must have excellent communication skill to be able to communicate information understandably and in sufficient detail.

Some common questions that may arise in case of expert selection:

- How to know that the so-called expert is in fact an expert?
- Will he/she stay with the project till its completion?
- What backup would be available in case the expert loses interest or quits?
- How is the knowledge developer going to know what does and what does not lie within the expert's area of expertise?

The Role of the Knowledge Developer

- The knowledge developer can be considered as the architect of the system.
- He/she identifies the problem domain, captures knowledge, writes/tests the heuristics that represent knowledge, and co-ordinates the entire project.
- Some necessary attributes of knowledge developer:
    - Communication skills.
    - Knowledge of knowledge capture tools/technology.
    - Ability to work in a team with professional/experts.
    - Tolerance for ambiguity.
    - To be able it think conceptually.
    - Ability to frequently interact with the champion, knowledge workers and knower in the organization.



Knowledge Developer's Role

Designing the KM Blueprint

This phase indicates the beginning of designing the IT infrastructure/ Knowledge Management infrastructure. The KM Blueprint (KM system design) addresses a number of issues.

- Aiming for system interoperability/scalability with existing IT infrastructure of the organization.
- Finalizing the scope of the proposed KM system.
- Deciding about the necessary system components.
- Developing the key layers of the KM architecture to meet organization's requirements.
  These layers are:
  - User interface
  - Authentication/security layer
  - Collaborative agents and filtering
  - Application layer
  - Transport internet layer
  - Physical layer
  - Repositories

Testing the KM System

This phase involves the following two steps:

- **Verification Procedure:** Ensures that the system is right, i.e., the programs do the task that they are designed to do.
- **Validation Procedure:** Ensures that the system is the right system - it meets the user's expectations, and will be usable on demand.

Implementing the KM System

- After capturing the appropriate knowledge, encoding in the knowledge base, verifying and validating; the next task of the knowledge developer is to implement the proposed system on a server.
- Implementation means converting the new KM system into actual operation.
- Conversion is a major step in case of implementation.
- Some other steps are post implementation review and system maintenance.

Quality Assurance

It indicates the development of controls to ensure a quality KM system. The types of errors to look for:

- Reasoning errors
- Ambiguity
- Incompleteness
- False representation

Training Users

- The level/duration of training depends on the user's knowledge level and the system's attributes.
- Users can range from novices (casual users with very limited knowledge) to experts (users with prior IT experience and knowledge of latest technology).
- Users can also be classified as tutors (who acquires a working knowledge in order to keep the system current), pupils (unskilled worker who tries to gain some understanding of the captured knowledge), or customers (who is interested to know how to use the KM system).
- Training should be geared to the specific user based on capabilities, experience and system complexity.
- Training can be supported by user manuals, explanatory facilities, and job aids.

Managing Change

Implementation means change, and organizational members usually resist change. The resistors may include:

- Experts
- Regular employees (users)
- Troublemakers
- Narrow minded people

Resistance can be seen in the form of following personal reactions:

- Projection, i.e., hostility towards peers.
- Avoidance, i.e., withdrawal from the scene.
- Aggression.

Post system Evaluation

Key questions to be asked in the post implementation stage:

- How the new system improved the accuracy/timeliness of concerned decision making tasks?
- Has the new system caused organizational changes? If so, how constructive are the changes?
- Has the new system affected the attitudes of the end users? If so, in what way?
- How the new system changed the cost of business operation? How significant has it been?
- In what ways the new system affected the relationships between end users in the organization?
- Do the benefit obtained from the new system justify the cost of investment?

Implications for KM

The managerial factors to be considered:

- The organization must make a commitment to user training/education prior to building the system.
- Top Management should be informed with cost/benefit analysis of the proposed system.
- The knowledge developers and the people with potential to do knowledge engineering should be properly trained.
- Domain experts must be recognized and rewarded.
- The organization needs to do long-range strategic planning.

Some questions to be addressed by the management regarding systems maintenance:

- Who will be the in charge of maintenance?
- What skills the maintenance specialist needs to have?
- What would be the best way to train the maintenance specialist?
- What incentives should be provided to ensure quality maintenance?
- What types of support/funding will be required?

What relationship should be established between the maintenance of the KM system and the IT staff of the organization?

Q. 1 Successful KM system implementation depends on several factors. Briefly, explain each factor

k. Level of motivation of the user. Good documentation cannot compensate for low motivation or poor attitude toward the system. Promoting motivation and commitment takes time and must be planned in advance

l. Computer literacy and technical background of the user. A computer literate user can be easier to work with than someone who has no background at all. First-time users often require education and training before they are able to support development and use of knowledge-based system.

m. Communication skills of the trainer. Selling people on change is sometimes considered more an art than a science. Communication skills can make the difference between a user's acceptance or rejection of the installation.

n. Time availability and funding for training. A training program run on a shoestring is usually a loser. Also, squeezing training time to the bare minimum often results in trainee impatience, resistance to learning, or nonuse of the system. Training should be part of the implementation phase offered around the schedule of the user.

o. Place of training. The location of training can make a difference. On-site versus off-site training continues to be an issue with plusses and minuses for each alternative. Off-site training is generally dedicated uninterrupted learning. Its positive benefits include privacy and focus on the projects. The feasibility of off-site training depends on distance, location, and funding. In contrast, on-site training requires no out-of-town transportation or room and board expenses. Yet, it can be interrupted by telephone calls, secretaries, and uninvited "gawkers."

p. Ease and duration of training. This aspect depends on the caliber of the trainer and the attitude and motivation of the trainees. "Chemistry" often affects how well all parties work with each other. Also, the training period should be reasonable and able to meet measurable goals. A long, drawn-out three-week training period does not promote the same excitement and motivation as a one-week session.

q. Ease of access and explanatory facilities of the knowledge management system. Knowledge management systems should be easy to access and work with. A software package that provides adequate explanations is bound to satisfy most users. The explanatory facility of the package promotes ease of use and provides convincing evidence of the integrity of the solutions provided by the system

r. Ease of maintenance and system update. At this stage, good documentation and easy-to-follow procedures in a module-oriented knowledge management system can make the difference between easy maintenance and a "nightmare." In this case, maintenance implies update, although update is more often considered enhancement.

s. Payoff to the organization. A system's benefit to the organization is usually measured in terms of cost reduction, improvement in sales or overall performance, and so on. Measurable payoff early in the development life cycle promotes successful implementation.
t. Role of the champion. Solid top management support and a champion pushing for system adoption can make a difference between a successful and a lukewarm installation

Q. 2 How important are organizational factors in system implementation?

The primary organizational factor is top management commitment to the proposed knowledge management system. This is evident by the way it promotes the development effort through adequate funding, ensuring the availability of hardware and personnel, and allowing the champion to function within the development process.

The second organizational factor is user participation in the building process. Doing so tends to increase commitment and foster a sense of ownership of the system. Other organizational factors include organizational politics and organizational climate. Politics is jockeying for leverage to influence one's domain and control procedures, technology, or the direction of an area of operation. User readiness can also influence the success of implementation.

LESSON 37

CAPTURING TACIT KNOWLEDGE AND EXPERT'S EVALUATION

Capturing the Tacit Knowledge

- **Knowledge Capture** can be defined as the *process using which the expert's thoughts and experiences can be captured.*
- In this case, the knowledge developer collaborates with the expert in order to convert the expertise into the necessary program code(s).
- Important steps:
    - Using appropriate tools for eliciting information.
    - Interpreting the elicited information and consequently inferring the experts underlying knowledge/reasoning process.
    - Finally, using the interpretation to construct the necessary rules which can represent the experts reasoning process

Expert Evaluation

Indicators of expertise:

- The expert commands genuine respect.
- The expert is found to be consulted by people in the organization, when some problem arises.
- The expert possess self confidence and he/she has a realistic view of the limitations.
- The expert avoids irrelevant information, uses facts and figures.
- The expert is able to explain properly and he/she can customize his/her presentation according to the level of the audience.
- The expert exhibits his/her depth of the detailed knowledge and his/her quality of explanation is exceptional.
- The expert is not arrogant regarding his/her personal information.

Expert's qualifications

- The expert should know when to follow hunches, and when to make exceptions.
- The expert should be able to see the big picture.
- The expert should posses good communication skills.
- The expert should be able to tolerate stress.
- The expert should be able to think creatively.
- The expert should be able to exhibit self-confidence in his/her thought and actions.
- The expert should maintain credibility.
- The expert should operate within a schema-driven/structured orientation.
- The expert should use chunked knowledge.
- The expert should be able to generate enthusiasm as well as motivation.
- The expert should share his/her expertise willingly and without hesitation.
- The expert should emulate an ideal teacher's habits.

- Experts levels of expertise:
    - Highly expert persons.
    - Moderately expert problem solvers.
    - New experts.
- Capturing single vs. multiple experts' tacit knowledge:
    - Advantages of working with a single expert:

- Ideal for building a simple KM system with only few rules.
- Ideal when the problem lies within a restricted domain.
- The single expert can facilitate the logistics aspects of coordination arrangements for knowledge capture.
- Problem related/personal conflicts are easier to resolve.
- The single expert tends to share more confidentiality.

- Disadvantages of working with a single expert:

- Often, the experts knowledge is found to be not easy to capture.
- The single expert usually provides a single line of reasoning.
- They are more likely to change meeting schedules.
- The knowledge is often found to be dispersed.
  - Advantages of working with multiple (team) experts:
- Complex problem domains are usually benefited.
- Stimulates interaction.
- Listening to a multitude of views allows the developer to consider alternative ways of representing knowledge.
- Formal meetings are sometimes better environment for generating thoughtful contributions.
  - Disadvantages of working with multiple (team) experts:
- Disagreements can frequently occur.
- Coordinating meeting schedules are more complicated.
- Harder to retain confidentiality.
- Overlapping mental processes of multiple experts can result in a *process loss*.
- Often requires more than one knowledge developer.

Developing Relationship with Experts

- Creating the right impression: The knowledge developer must learn to use psychology, common sense, technical as well as marketing skills to attract the experts respect and attention.
- Understanding of the expert's style of expression:
- Experts are usually found to use one of the following styles of expression:
  - Procedure type: These type of experts are found to be logical, verbal and always procedural.
  - Storyteller type: These type of experts are found to be focused on the content of the domain at the expense of the solution.
  - Godfather type: These type of experts are found to be compulsive to take over.
  - Salesperson type: These type of experts are found to spend most of the time dancing around the topic, explaining why his/her solution is the best.
- Preparation for the session:
  - Before making the first appointment, the knowledge developer must acquire some knowledge about the problem and the expert.
  - Initial sessions can be most challenging/critical.
  - The knowledge developer must build the trust.
  - The knowledge developer must be familiar with project terminology d he/she must review the existing documents.
  - The knowledge developer should be able to make a quick rapport with the expert.
- Deciding the location for the session:
  - Protocol calls for the expert to decide the location.
  - The expert is usually more comfortable in having his/her necessary tools and information available close to him/her.
  - The meeting place should be quiet and free of interruptions.
- Approaching multiple experts:
  - Individual approach: The knowledge developer holds sessions with one expert at a time.
  - Approach using primary and secondary experts:
- The knowledge developer hold sessions with the senior expert early in the knowledge capture program for the clarification of the plan.
- For a detailed probing, he/she may ask for other experts' knowledge.
  - Small groups approach:
- Experts gather together in one place, discuss the problem domain, and usually provide a pool of information.
- Experts' responses are monitored, and the functionality of each expert is tested against the expertise of the others.
- This approach requires experience in assessing tapped knowledge, as well as cognition skills.
- The knowledge developer must deal with the issue of power and its effect on expert's opinion.

Interviewing as a Tacit Knowledge Capture Tool

- Advantages of using interviewing as a tacit knowledge capture tool:

- It is a flexible tool.
- It is excellent for evaluating the validity of information.
- It is very effective in case of eliciting information regarding complex matters.
- Often people enjoy being interviewed.

- Interviews can range from the highly unstructured type to highly structured type.
  - The unstructured types are difficult to conduct, and they are used in the case when the knowledge developer really needs to explore an issue.
  - The structured types are found to be goal-oriented, and they are used in the case when the knowledge developer needs specific information.
  - Structured questions can be of the following types:
- Multiple-choice questions.
- Dichotomous questions.
- Ranking scale questions.
  - In semi structured types, the knowledge developer asks predefined questions, but he/she allows the expert some freedom in expressing his/her answer.
- Guidelines for successful interviewing:
  - Setting the stage and establishing rapport.
  - Phrasing questions.
  - Listening closely/avoiding arguments.
  - Evaluating the session outcomes.
- Reliability of the information gathered from experts:
  - Some uncontrolled sources of error that can reduce the information's reliability:
  - Expert's perceptual slant.
  - The failure in expert's part to exactly remember what has happened.
  - Fear of unknown in the part of expert.
  - Problems with communication.
  - Role bias.
- Errors in part of the knowledge developer: validity problems are often caused by the *interviewer effect* (something about the knowledge developer colors the response of the expert). Some of the effects can be as follows:
  - Gender effect
  - Age effect
  - Race effect
- Problems encountered during interviewing
  - Response bias.
  - Inconsistency.
  - Problem with communication.
  - Hostile attitude.
  - Standardizing the questions.
  - Setting the length of the interview.
- Process of ending the interview:
  - The end of the session should be carefully planned.
  - One procedure calls for the knowledge developer to halt the questioning a few minutes before the scheduled ending time, and to summarize the key points of the session.
  - This allows the expert to comment a schedule a future session.
  - Many verbal/nonverbal cues can be used for ending the interview. (refer to Table 5.2, in page 148 of your textbook).
- Issues: Many issues may arise during the interview, and to be prepared for the most important ones, the knowledge developer can consider the following questions:
  - How would it be possible to elicit knowledge from the experts who can not say what they mean or can not mean what they say.
  - How to set up the problem domain.
  - How to deal with uncertain reasoning processes.
  - How to deal with the situation of difficult relationships with expert(s).
  - How to deal with the situation when the expert does not like the knowledge developer for some reason.
- Rapid Prototyping in interviews:
  - Rapid prototyping is an approach to building KM systems, in which knowledge is added with each knowledge capture session.

- This is an iterative approach which allows the expert to verify the rules as they are built during the session.
- This approach can open up communication through its demonstration of the KM system.
- Due to the process of instant feedback and modification, it reduces the risk of failure.
- It allows the knowledge developer to learn each time a change is incorporated in the prototype.
- This approach is highly interactive.
- The prototype can create user expectations which in turn can become obstacles to further development effort.

LESSON 38

KNOWLEDGE ELICITATION: DATA MINING AND KNOWLEDGE CODIFICATION METHODS

1) what are some of the purposes for doing a data mining or web mining study?
There are two basic purposes: 1) to describe and 2) to predict. Descriptive data mining is done to try to understand patterns in people of things. For example, purchasing habits of people during super bowl week, the financial dealings of people suspected of money laundering, the incidence of lighting in a region with specific geological features (e.g., a mountain lake). This can serve to explain the behavior of the individuals or phenomena involved. Predictive data mining, on the other hand, is done to attempt to predict the behavior of a person or thing by looking at its history. By building a model of this entity (person, system or thing), one can predict future performance and thereby better react to future occurrences of the pattern sought to identify. One example is to build a model of the stock market in order to predict its future performance.

Knowledge Elicitation Methods

On-Site Observation (Action Protocol)

- It is a process which involves observing, recording, and interpreting the expert's problem-solving process while it takes place.
- The knowledge developer does more listening than talking; avoids giving advice and usually does not pass his/her own judgment on what is being observed, even if it seems incorrect; and most of all, does not argue with the expert while the expert is performing the task.
- Compared to the process of interviewing, on-site observation brings the knowledge developer closer to the actual steps, techniques, and procedures used by the expert.
- One disadvantage is that sometimes some experts to not like the idea of being observed.
- The reaction of other people (in the observation setting) can also be a problem causing distraction.
- Another disadvantage is the accuracy/completeness of the captured knowledge.

Brainstorming

- It is an unstructured approach towards generating ideas about creative solution of a problem which involves multiple experts in a session.
- In this case, questions can be raised for clarification, but no evaluations are done at the spot.
- Similarities (that emerge through opinions) are usually grouped together logically and evaluated by asking some questions like:
    - What benefits are to be gained if a particular idea is followed.
    - What specific problems that idea can possibly solve.
    - What new problems can arise through this.

  The general procedure for conducting a brainstorming session:
    - Introducing the session.
    - Presenting the problem to the experts.
    - Prompting the experts to generate ideas.
    - Looking for signs of possible convergence.
- If the experts are unable to agree on a specific solution, they knowledge developer may call for a vote/consensus.

Electronic Brainstorming

- It is a computer-aided approach for dealing with multiple experts.
- It usually begins with a pre-session plan which identifies objectives and structures the agenda, which is then presented to the experts for approval.
- During the session, each expert sits on a PC and get themselves engaged in a predefined approach towards resolving an issue, and then generates ideas.

- This allows experts to present their opinions through their PC's without having to wait for their turn.
- Usually the comments/suggestions are displayed electronically on a large screen without identifying the source.
- This approach protects the introvert experts and prevents tagging comments to individuals.
- The benefit includes improved communication, effective discussion regarding sensitive issues, and closes the meeting with concise recommendations for necessary action (refer to Figure 5.1 for the sequence of steps).
- This eventually leads to convergence of ideas and helps to set final specifications.
- The result is usually the joint ownership of the solution.

Nominal Group Technique (NGT)

- This provides an interface between consensus and brainstorming.
- Here the panel of experts becomes a *Nominal Group* whose meetings are structured in order to effectively pool individual judgment.
- *Idea writing* is a structured group approach used for developing ideas as well as exploring their meaning and the net result is usually a written report.
- NGT is an idea writing technique.

Delphi Method

- It is a survey of experts where a series of questionnaires are used to pool the experts' responses for solving a specific problem.
- Each experts' contributions are shared with the rest of the experts by using the results from each questionnaire to construct the next questionnaire.

Concept Mapping

- It is a network of concepts consisting of nodes and links.
- A node represents a concept, and a link represents the relationship between concepts (refer to Figure 6.5 in page 172 of your textbook).
- Concept mapping is designed to transform new concepts/propositions into the existing cognitive structures related to knowledge capture.
- It is a structured conceptualization.
- It is an effective way for a group to function without losing their individuality.
- Concept mapping can be done for several reasons:
    - To design complex structures.
    - To generate ideas.
    - To communicate ideas.
    - To diagnose misunderstanding.
- Six-step procedure for using a concept map as a tool:
    - Preparation.
    - Idea generation.
    - Statement structuring.
    - Representation.
    - Interpretation
    - Utilization.
- Similar to concept mapping, a *semantic net* is a collection of nodes linked together to form a net.
    - A knowledge developer can graphically represent descriptive/declarative knowledge through a net.
    - Each idea of interest is usually represented by a node linked by lines (called *arcs*) which shows relationships between nodes.
    - Fundamentally it is a network of concepts and relationships (refer to page 173 of your textbook for example).

Black boarding

- In this case, the experts work together to solve a specific problem using the blackboard as their workspace.
- Each expert gets equal opportunity to contribute to the solution via the blackboard.
- It is assumed that all participants are experts, but they might have acquired their individual expertise in situations different from those of the other experts in the group.
- The process of black boarding continues till the solution has been reached.
- Characteristics of blackboard system:
    - Diverse approaches to problem-solving.
    - Common language for interaction.
    - Efficient storage of information
    - Flexible representation of information.
    - Iterative approach to problem-solving.
    - Organized participation.
- Components of blackboard system:
    - The Knowledge Source (KS): Each KS is an independent expert observing the status of the blackboard and trying to contribute a higher level partial solution based on the knowledge it has and how well such knowledge applies to the current blackboard state.
    - The Blackboard : It is a global memory structure, a database, or a repository that can store all partial solutions and other necessary data that are presently in various stages of completion.
    - A Control Mechanism: It coordinates the pattern and flow of the problem solution.
- The inference engine and the knowledge base are part of the blackboard system.
- This approach is useful in case of situations involving multiple expertise, diverse knowledge representations, or situations involving uncertain knowledge representation.

Knowledge Capture Systems:
Systems that Preserve and Formalize Knowledge

1. *What are the methods for eliciting stories?*

   Stories may be elicited through anthropological observation, which is using a naïve but interested interviewer. The interviewer's naïveté will facilitate the natural volunteering of stories by the knowledgeable potential storyteller. The interest or curiosity of the interviewer will increase storytellers' sense of importance and will result in higher levels of story volunteering. Using a group that has a common context such as a community of practice to form storytelling circles is another step towards anecdote elicitation. Other methods useful in storytelling circles are: fish tales since individuals enjoy enhancing previously shared stories, alternative histories, shifting characters or context to gain different perspectives on a story, and indirect stories to foster a feeling of security and privacy. Finally, the use of metaphors to start a story telling process provides a common context or reference for the group.

2. *Describe how concept maps represent knowledge.*

   Concept maps aim to represent knowledge through concepts or main subjects/ideas that are represented as text inside of some type of geometric shape, usually a rectangle or circle. The concepts are patterns or regularities in objects or events. Different concepts are related to each other and this is represented by connecting two of the geometric shapes containing the related concepts via a line, which represents a proposition. The propositions are labeled, usually with a verb phrase or preposition that indicates the nature of the relationship between the two concepts. The more general concepts appear at the top of the map, with specialization progressing towards the bottom of the map. Inter-domain relations between concepts can be represented by a line called a cross-link.

3. *What are the organizational situations that context-based reasoning is designed to model and what are the basic tenets of context-based reasoning?*

   CxBR models tactical situations and the operations needed to be performed during special tactical situations. CxBR is based on the following three tenets:

1. Tactical situations call for a set of actions and procedures that address the current situation.
2. Situations are dynamic (subject to change) and a transition to a new situational context or set of actions may be required to address the new situation.
3. What is likely to happen in a situation is limited by the situation itself.

Knowledge Codification

- Knowledge codification means converting tacit knowledge to explicit knowledge in a usable form for the organizational members.
- Tacit knowledge (e.g., human expertise) is identified and leveraged through a form that is able to produce highest return for the business.
- Explicit knowledge is organized, categorized, indexed and accessed.
- The organizing often includes decision trees, decision tables etc.
- Codification must be done in a form/structure which will eventually build the knowledge base.
- The resulting knowledge base supports training and decision making.
    - Diagnosis.
    - Training/Instruction.
    - Interpretation.
    - Prediction.
    - Planning/Scheduling.
- The knowledge developer should note the following points before initiating knowledge codification:
    - Recorded knowledge is often difficult to access (because it is either fragmented or poorly organized).
    - Diffusion of new knowledge is too slow.
    - Knowledge is nor shared, but hoarded (this can involve political implications).
    - Often knowledge is not found in the proper form.
    - Often knowledge is not available at the correct time when it is needed.
    - Often knowledge is not present in the proper location where it should be present.
    - Often the knowledge is found to be incomplete.

Modes of Knowledge Conversion

- Conversion from tacit to tacit knowledge produces socialization where knowledge developer looks for experience in case of knowledge capture.
- Conversion from tacit to explicit knowledge involves externalizing, explaining or clarifying tacit knowledge via analogies, models, or metaphors.
- Conversion from explicit to tacit knowledge involves internalizing (or fitting explicit knowledge to tacit knowledge.
- Conversion from explicit to explicit knowledge involves combining, categorizing, reorganizing or sorting different bodies of explicit knowledge to lead to new knowledge.

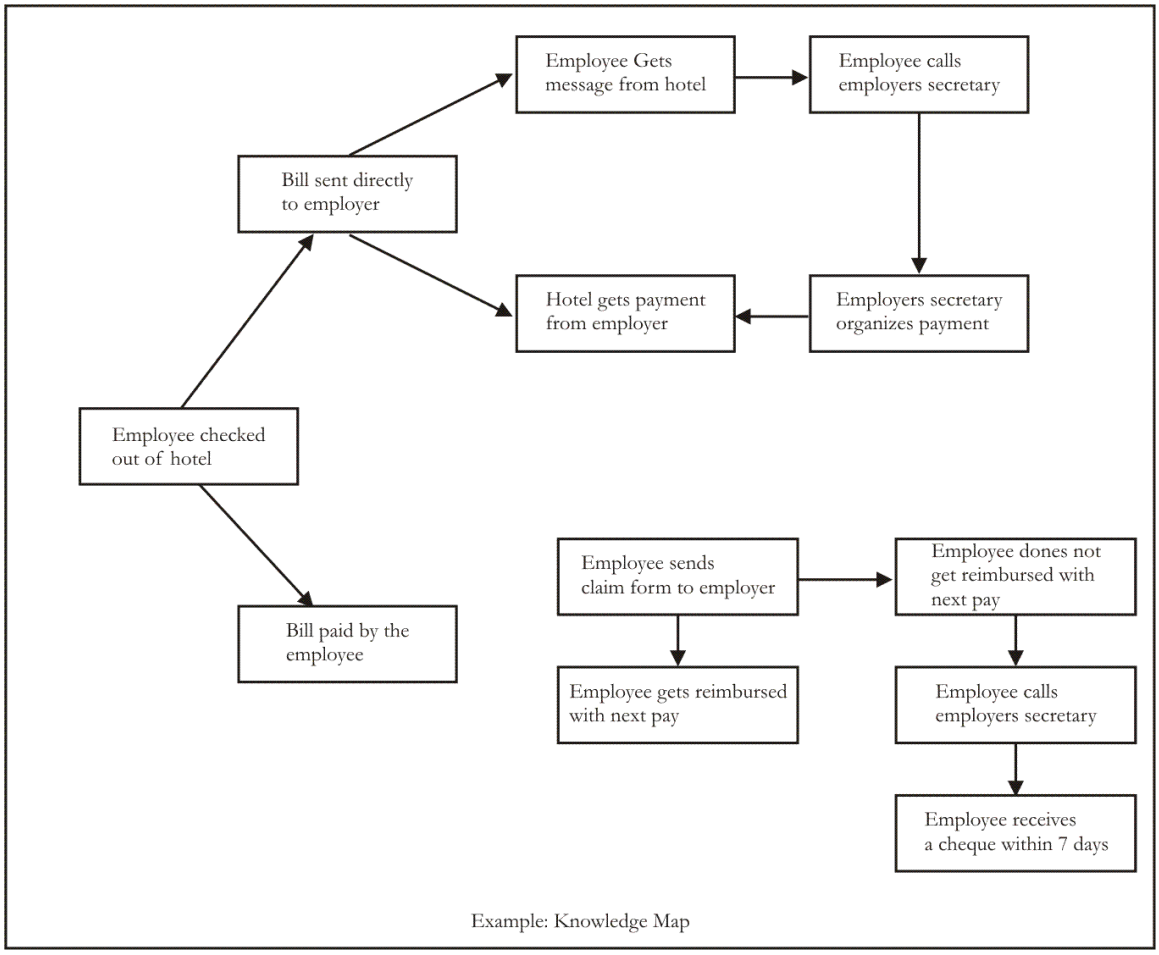
Codifying Knowledge

- An organization must focus on the following before codification:
    - What organizational goals will the codified knowledge serve?
    - What knowledge exists in the organization that can address these goals?
    - How useful is the existing knowledge for codification?
    - How would someone codify knowledge?
- Codifying tacit knowledge (in its entirety) in a knowledge base or repository is often difficult because it is usually developed and internalized in the minds of the human experts over a long period of time.

Codification Tools/Procedures

Knowledge Maps

- Knowledge maps originated from the belief that people act on things that they understand and accept.
- It indicates that self-determined change is sustainable.
- Knowledge map is a visual representation of knowledge.
- They can represent explicit/tacit, formal/informal, documented/undocumented, internal/external knowledge.
- It is not a knowledge repository.
- It is a sort of directory that points towards people, documents, and repositories.



Example: Knowledge Map

- It may identify strengths to exploit and missing knowledge gaps to fill.
- Knowledge Mapping is very useful when it is required to visualize and explore complex systems.
- Examples of complex systems are ecosystems, the internet, telecommunications systems, and customer-supplier chains in the stock market.
- Knowledge Mapping is a multi-step process.
- Key can be extracted from database or literature and placed in tabular form as lists of facts.
- These tabled relationships can then be connected in networks to form the required knowledge maps.

A popular knowledge map used in human resources is a skills planner in which employees are matched to jobs. Steps to build the map:

- A structure of the knowledge requirements should be developed.
- Knowledge required of specific jobs must be defined.
- You should rate employee performance by knowledge competency.
- You should link the knowledge map to some training program for career development and job advancement.

Decision Table

- It is another technique used for knowledge codification.
- It consists of some conditions, rules, and actions.

A phone card company sends out monthly invoices to permanent customers and gives them discount if payments are made within two weeks. Their discounting policy is as follows:

"If the amount of the order of phone cards is greater than $35, subtract 5% of the order; if the amount is greater than or equal to $20 and less than or equal to $35, subtract a 4% discount; if the amount is less than $20, do not apply any discount."

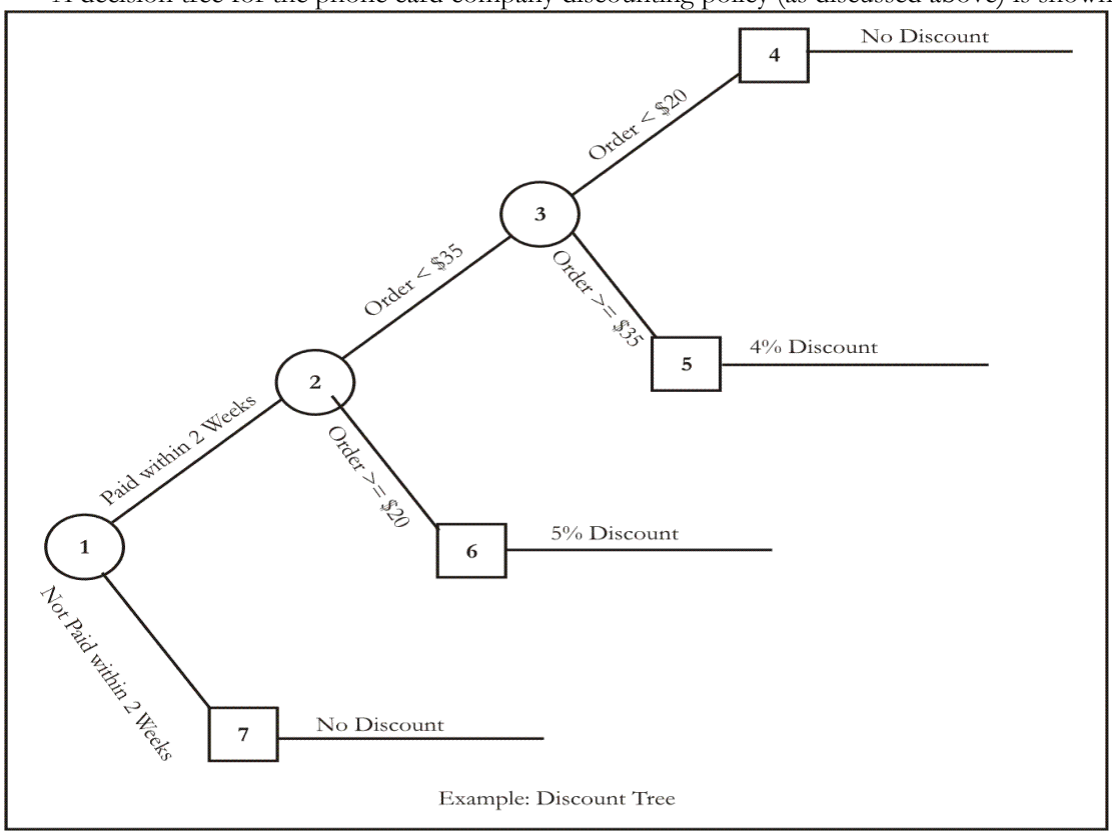
We shall develop a **decision table** for their discounting decisions, where the condition alternatives are `Yes' and `No'.

CONDITIONS AND ACTIONS	**RULES**			
	1	2	3	4
Paid within 2 weeks	Y	Y	Y	N
Order>$35	Y	N	N	-
$20<= Order<=$35	N	Y	N	-
Order<$20	N	N	Y	-
5% discount	X			
4% discount		X		
No discount			X	X

Example: Decision Table

Decision Tree

- It is also a knowledge codification technique.
- A decision tree is usually a hierarchically arranged semantic network.
- A decision tree for the phone card company discounting policy (as discussed above) is shown next.



Example: Discount Tree

Frames

- A frame is a codification scheme used for organizing knowledge through previous experience.

- It deals with a combination of declarative and operational knowledge.
- Key elements of frames:
    - Slot: A specific object being described/an attribute of an entity.
    - Facet: The value of an object/slot.

Production Rules

- They are conditional statements specifying an action to be taken in case a certain condition is true.
- They codify knowledge in the form of premise-action pairs.
- Syntax: IF (premise) THEN (action)
- Example: IF income is `standard' and payment history is `good', THEN `approve home loan'.
- In case of knowledge-based systems, rules are based on heuristics or experimental reasoning.
- Rules can incorporate certain levels of uncertainty.
- A certainty factor is synonymous with a confidence level , which is a subjective quantification of an expert's judgment.
- The premise is a Boolean expression that should evaluate to be true for the rule to be applied.
- The action part of the rule is separated from the premise by the keyword THEN.
- The action clause consists of a statement or a series of statements separated by AND's or comma's and is executed if the premise is true.

In case of knowledge-based systems, planning involves:

- Breaking the entire system into manageable modules.
- Considering partial solutions and liking them through rules and procedures to arrive at a final solution.
- Deciding on the programming language(s).
- Deciding on the software package(s).
- Testing and validating the system.
- Developing the user interface.
- Promoting clarity, flexibility; making rules clear.
- Reducing unnecessary risk.

Role of inferencing:

- *Inferencing* implies the process of deriving a conclusion based on statements that only imply that conclusion.
- An *inference engine* is a program that manages the inferencing strategies.
- *Reasoning* is the process of applying knowledge to arrive at the conclusion.
    - Reasoning depends on premise as well as on general knowledge.
    - People usually draw informative conclusions.

Case-Based Reasoning

- It is reasoning from relevant past cases in a way similar to human's use of past experiences to arrive at conclusions.
- Case-based reasoning is a technique that records and documents cases and then searches the appropriate cases to determine their usefulness in solving new cases presented to the expert.
- The aim is to bring up the most similar historical case that matches the present case.
- Adding new cases and reclassifying the case library usually expands knowledge.
- A case library may require considerable database storage as well as an efficient retrieval system.

Knowledge-Based Agents

- An intelligent agent is a program code which is capable of performing autonomous action in a timely fashion.
- They can exhibit goal directed behaviour by taking initiative.
- they can be programmed to interact with other agents or humans by using some agent communication language.

- In terms of knowledge-based systems, an agent can be programmed to learn from the user behaviour and deduce future behaviour for assisting the user.

Knowledge Developer's Skill Set
Knowledge Requirements

- Computing technology and operating systems.
- Knowledge repositories and data mining.
- Domain specific knowledge.
- Cognitive psychology.

Skills Requirements

- Interpersonal Communication.
- Ability to articulate the project's rationale.
- Rapid Prototyping skills.
- Attributes related to personality.
- Job roles.

LESSON 39

KNOWLEDGE SHARING AND TRANSFER SYSTEMS

Knowledge Sharing Systems: Systems that Organize and Distribute Knowledge

1. Describe the crucial requirements for the successful implementation of knowledge-sharing systems.

a. *Collection and systematic organization of information from various sources.* Most organizational business processes require information and data including CAD drawings, e-mails, electronic documents such as specifications, and even paper documents. This requisite information may be dispersed throughout the organization. This first step requires the collection of this information throughout the organization.

b. *Minimization of up-front knowledge engineering.* Knowledge-sharing systems must take advantage of explicit organizational information and data, such that these systems can be built quickly, generate returns on investment, and be able to adapt to new requirements. This information and data is mostly found in databases and documents.

c. *Exploiting user feedback for maintenance and evolution.* Knowledge-sharing systems should concentrate on capturing the knowledge of the organization's members. This includes options for maintenance and user feedback so the knowledge can be kept fresh and relevant. Furthermore, knowledge-sharing systems should be designed to support user's needs and their business process workflows.

d. *Integration into existing environment.* Knowledge-sharing systems must be integrated into an organization's information flow, by integrating with the IT tools currently used to perform the business tasks. Humans, by nature, will tend to avoid efforts to formalize knowledge (ever met a computer programmer that enjoys commenting her code?). In fact, as a rule of thumb, if the effort required in formalizing knowledge is too high, it should be left informal, to be described by humans, and not attempt to be made explicit. For instance, consider the possibility of capturing the "how–to" knowledge, of how to ride a bicycle. Clearly an understanding of the laws of physics can help explain why a person stays on the bicycle while it's moving, but few of us recall these laws while we ride. Other than the proverbial "keep your feet on the pedal," which doesn't explicate much about the riding process, most of us learned to ride a bicycle through hours of practice, and many falls, while we were kids. It would be impractical to try to codify this knowledge and make it explicit. On the other hand, it might be useful to know who's a good bicycle rider, in particular if one is looking to put together a cycling team.

e. *Active presentation of relevant information*. Finally, the goal of an active knowledge-sharing system is to present its users with the required information when and wherever it's needed. These systems are envisioned to become intelligent assistants, automatically eliciting and providing knowledge that may be useful in solving the current task, whenever and wherever it's needed.

2. Discuss which the different types of knowledge-sharing systems are.

a. *Incident report databases:* used to disseminate information related to incidents or malfunctions, for example, of field equipment (like sensing equipment outages) or software (like bug reports). Incident reports typically describe the incident together with explanations of the incident, although they may not suggest any recommendations.

b. *Alert systems*: were originally intended to disseminate information about a negative experience that has occurred or is expected to occur. However, recent applications also include increasing exposure to positive experiences.

c. *Best practices databases***:** describe successful efforts, typically from the reengineering of business processes that could be applicable to organizational processes. Best practices differ from lessons learned in that they capture only successful events, which may not be derived from experience.

d. *Lessons learned systems (LLS):* the goal of LLS is "to capture and provide lessons that can benefit employees who encounter situations that closely resemble a previous experience in a similar situation. LLS could be pure repositories of lessons or sometimes intermixed with other sources of information (e.g., reports).

e. Expertise Locator Systems (ELS): serve the purpose to identify experts in the organization. Experts may need to be identified to help solve technical problems or staff project teams, to match employee competencies with positions within the company, or to perform gap analysis that point to intellectual capital inadequacies within the organization. The intent of these systems is to catalog knowledge competencies, including information not typically captured by human resources systems, in a way that could later be queried across the organization.

LESSON 40

CORPORATE MEMORY; TYPES OF KNOWLEDGE REPOSITORIES

Briefly define corporate memory and how KM is related to corporate memory.

Corporate memory is the collection of all explicit and tacit knowledge that may or may not be explicitly documented, but is specifically referenced. Corporate memory is crucial to the operation and competitive advantage of an organization. A focus of KM is the development of mechanisms and technologies that prevent corporate memory loss through knowledge sharing mechanisms, technologies, and applied systems. Such loss may result from the lack of appropriate technologies for the organization and exchange of explicit information and a lack of support for communication.

3. Explain the lessons learned process.

1) ***Collect the lessons***: This task involves collecting the lessons (or content) that will be incorporated into the LLS. There are six possible lesson content collection methods:

a) *Passive* - the most common form of collection. Contributors submit lessons through a paper or Web-based form.
b) *Reactive* - where contributors are interviewed by a third party for lessons. The third party will submit the lesson on behalf of the contributor**.**
c) *After-action collection* - where lessons are collected during a mission debriefing, as for example, in military organizations.
d) *Proactive collection* - where lessons are automatically collected by an expert system, which may suggest that a lesson exists based on analysis of a specific content. For example, an expert system could monitor individual's e-mail and prompt him/her when it understands that a lesson is described.
e) *Active collection* - where a computer-based system may scan documents to identify lessons in the presence of specific keywords or phrases,
f) *Interactive collection* – where a computer-based system collaborates with the lesson's author to generate clear and relevant lessons.

2) ***Verify the lessons*:** Typically a team of domain experts performs the task required by this component, which requires the verification of lessons for correctness, redundancy, consistency, and relevance. The verification task is critically important, but sometimes introduces a significant bottleneck in the inclusion of lessons into the LLS, since it's a time-consuming process. Some systems, like for example Xerox's Eureka LLS, provide a two-staging process.

3) ***Store the Lesson*:** This task relates to the representation of the lessons in a computer-based system. Typical steps in this task include the indexing of lessons, formatting, and incorporating into the repository. In terms of the technology required to support this task, LLS could be based on structured relational or object-oriented databases as well as case libraries (case-based reasoning) or semi-structured document management systems. LLS can also incorporate relevant multimedia such as audio and video, which may help illustrate important lessons.

4) ***Disseminate the Lesson*:** This task relates to how the information is shared to promote its reuse. Six different dissemination methods have been identified:
a) *Passive dissemination* -- where users look for lessons using a search engine.
b) *Active casting* – where lessons are transmitted to users that have specified relevant profiles to that particular lesson.
c) *Broadcasting* – where lessons are disseminated throughout an organization.
d) *Active dissemination* – where users are alerted to relevant lessons in the context of their work (for example by a software help-wizard that alerts a user of related automated assistance).

e) *Proactive dissemination* – where a system anticipates events used to predict when the user will require the assistance provided by the lesson.
f) *Reactive* dissemination – when a user launches the LLS in response to a knowledge need, for example when he launches a *Help* system in the context of specific software.

5) ***Apply the Lesson*:** This task relates to whether the user has the ability to decide how to reuse the lesson. There are three categories of reuse:

a) *Browsable* – where the system displays a list of lessons that match the search criteria.
b) *Executable* – where users might have the option to execute the lesson's recommendation (like when the Word processor suggests a specific spelling for a word).
c) *Outcome reuse* – when the system prompts users to enter the outcome of reusing a lesson, in order to assess if the lesson can be replicated.

4. Explain the role that taxonomies play in knowledge-sharing systems.

Taxonomies, also called classification or categorization schemes, are considered to be knowledge organization systems that serve to group objects together based on a particular characteristic. Knowledge taxonomies are used to organize knowledge (or competencies) relevant to the organization. In the case of ELS, the knowledge taxonomy is used to describe the organization's critical knowledge areas used to index people's knowledge.

5. Explain the differentiating characteristics of the ELS developed at HP, NSA, and Microsoft.

The following table summarizes the differentiating characteristics for the ELS developed at the three organizations:

ELS Name	CONNEX (HP)	KSMS (NSA)	SPuD (Microsoft)
Purpose of the system	To share knowledge, for consulting and to search for experts	To staff projects and match positions with skills	To compile the knowledge and competency of each employee
Self-Assessment	Yes	Yes, supervisors also participate in data gathering	No, supervisors rate employee's performance
Participation	Only those who are willing to share	Whole personnel	Whole personnel in the IT group
Knowledge Taxonomy	US Library of Congress INSPEC Index Own	Department of Labor (O*NET)	Own
Levels of Competencies	No	Yes	Yes
Data Maintenance	User (nagging)	User and Supervisor	Supervisor
Company Culture	Sharing, Open	Technology, Expertise	Technology, Open
Platform	HP-9000 Unix Sybase Verity	OS/2, VMS, and Programming Bourne shell	SQL MS Access

6. Discuss the role that communities of practice play in sharing tacit knowledge.

A community of practice, also known as a *knowledge network*, is an organic and self-organized group of individuals who are dispersed geographically or organizationally but communicate regularly to discuss issues of mutual interest. Communities of practice are supported through technology that enables interaction and conversations amongst its members.

Application Exercises

1. Identify examples of knowledge-sharing systems in use in your organization. What are some of the intelligent technologies that enable those systems?

A consulting organization utilizes several knowledge-sharing systems both for the ability of data contribution as well as for research initiatives. Some of the knowledge-sharing systems in use in most consultancies include: best practice databases, lessons learned systems, and expertise locators. Moreover, additional searchable repositories may exist which facilitate the sharing of information by market unit (government, financial, products, etc.), description of technologies implemented at the client, and document type (proposals, design documents, etc.).

All of these knowledge-sharing systems can be easily accessed from a centralized Web portal. When users request information from the portal via a query, relevant information is retrieved from the appropriate repository. Some of the information technologies that enable these systems are ASP, HTML, Visual Basic, and SQL Server. Intelligent technologies include the functionality provided by the search engine.

2. Design a knowledge-sharing system to support your business needs.

A lessons learned system specific to a client, but not specific to a project would be useful. In other words, multiple projects should be able to access, retrieve, and enter their lessons learned experiences. Maintaining lessons specific to a client would ensure a similar context (or corporate culture) for all the projects. A lesson learned system will enable current and future projects to research and/or identify experiences gained during a project's lifecycle. The system can contain positive project experiences, issues encountered as well as their respective resolutions, and finally documentation that may accompany these experiences.

3. Describe the non-technical issues that you will face during the implementation of the system designed in the previous question.

Users will be expected to access the system when they need to find a similar lesson, as well as contributing lessons to the system. One of the biggest hurdles will be that employees may be too busy to either contribute or use the system. In addition, what kind of rewards will be put in place so that employees find it worthwhile to share their knowledge through the lessons learned system?

What is a document management system? How does it support knowledge sharing?

Document management systems are composed of two pieces: a repository of documents and technology support for classifying, organizing, storing, and retrieving documents. The repository itself may be centralized or distributed and access points into the repositories are normally distributed. Most document management systems provide a knowledge portal that is a common, yet customizable, platform independent interface to distributed repositories. The common interface and support for finding information through document classification and organization and support for retrieval make finding information and getting information easier for individuals within the organization.

What are the barriers to use of knowledge sharing systems?

A business culture may exist in which an organizational unit considers information from outside the unit as worthless. Typically this culture discourages knowledge consumers from participating in the knowledge market and organizational rewards are tied to creating knowledge (even when unnecessary) and not to sharing or knowledge re-use. Additionally, those organizations that separate knowledge from the knowledge owners/producers tends to discourage knowledge owners from volunteering knowledge to be shared. On the human side, knowledge sharing was anathema to traditional hierarchical organizations where knowledge was equated to power hence employees need to be properly motivated to engage in knowledge sharing initiatives. Without proper management support and motivation to share, knowledge sharing is not likely to occur.

What are the five specific types of knowledge sharing systems? Give a brief description of how each is meant to facilitate knowledge sharing.

1. Incident report databases record and disseminate information related to either incidents or malfunctions.
2. Alert systems disseminate information regarding either negative or positive experiences.
3. Best practices databases describe successful (winning) efforts, typically regarding business process reengineering.
4. Lessons learned systems capture and disseminate lessons that benefit users that encounter similar situations.
5. Expertise locator systems catalogue knowledge competencies.

LESSON 41

KNOWLEDGE SHARING STRUCTURE AND SERVICES, CULTURE AND KNOWLEDGE COMMUNITIES

Electronic Tools for Knowledge Management

Identifying, nurturing, and harvesting knowledge is a principal concern in the Information Age. Effective use of knowledge-facilitating tools and techniques is critical, and a number of computational tools have been developed.

While numerous techniques are available, it remains difficult to analyze or compare the specific tools. In part, this is because knowledge management is young discipline. The arena is evolving rapidly as more people enter the fray and encounter new problems.

In addition, new technologies support applications that were impossible before. Moreover, the multidisciplinary character of knowledge management combines several disciplines, including business and management, computer science, cybernetics, and the field is frequently defined so broadly that anything can be incorporated. Finally, it is difficult to make sense of the many tools available.

KSS: Knowledge Structure and Services

Two dimensions are central to analyzing and comparing knowledge management tools: knowledge structure and knowledge service. These two dimensions can be used to from a matrix in which specific knowledge management tools are positioned.

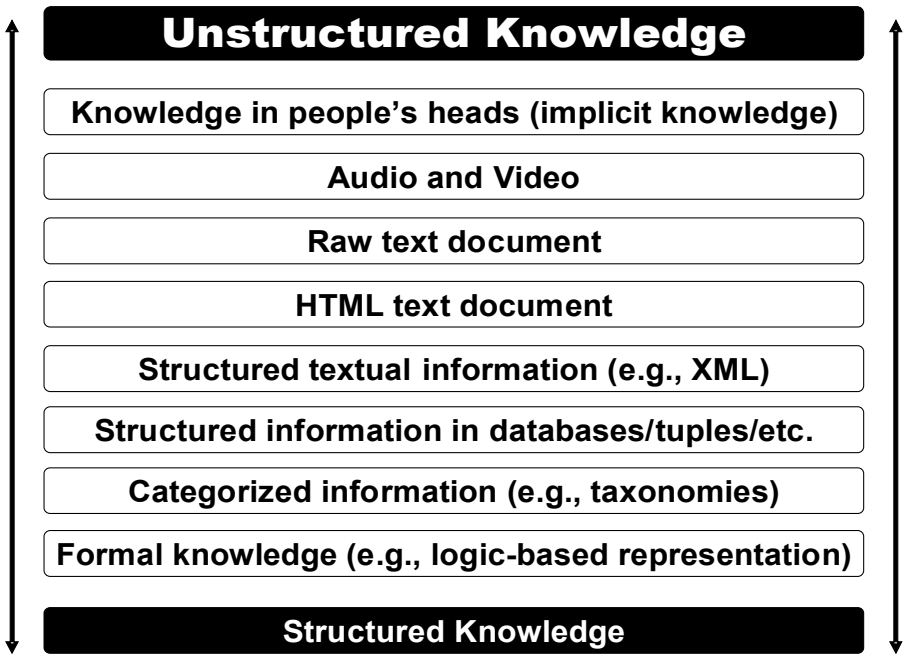
Knowledge Structure

There is a wide range of levels of formalization or structure in the ways knowledge is represented in knowledge management systems.

The knowledge forms listed in figure below are not discrete, or exhaustive, and other levels could be added. Examples of the knowledge forms are:

- Creative knowledge is intrinsically nonformalizable and may not be represent able in any formalization.
- Audio and video contain multiple "streams" of knowledge such as music, voices, faces, and objects. Humans recognize these features but creating machine recognition is an extremely complex undertaking.
- A raw text documents is the formal equivalent of an audio track and is comparable to natural language that is also difficult for machines to understand.

Dimensions of Knowledge Structure.



From top to bottom we increase the formalization and precision of knowledge, while from bottom to top we accommodate more informality and ambiguity. Knowledge forms toward the bottom increasingly demand knowledge engineering and incremental analysis.

- In contrast, an HTML document with markup tags can display the texts' structure. Irregularities in the structure can aid in interpreting the content. For example, "wrappers" convert structural marks into semantic descriptions and may interpret the HTML markups on a country name to display its population, as in the pages of the CIA fact book.
- Structured documents using formats like XML or its ancestor, SGML, explicate the semantics implicit in HTML markups. For example, instead of deducing that a certain tag such as <H1>USA</H1> indicates the "USA" is the name of a country, an XML document could contain a tag such as <country name>USA</country name> that makes the text an explicit country name.
- XML documents are linear representations of "tuples" of data, the essence of information stored in databases. For example, a sequence of tags can contain a <population> tag inside a <country> tag to indicate a relationship between the country and its population. This facilitates efficient storage and retrieval of the information, but the tags are invisible to users.
- Categorized information is at roughly the same level as structured information in databases. Taxonomies such as the ones we use in biology are examples of categorized information. This kind of knowledge is used extensively by directory sites such as Yahoo! to provide taxonomies of concepts, ideas, or subjects.
- We use the term "formal knowledge" in the mathematical sense. Logical statements such as theorems and equations are used in a very rigorous way to make sure all semantics are explicit and rules are followed. This makes it easy for machines to interpret this kind of knowledge.

The level of structure in the knowledge directly affects the amount of automated processing that can be performed because more structured knowledge employs powerful semantics. As a result, it is much easier to process the information contents of an XML than an HTML page.

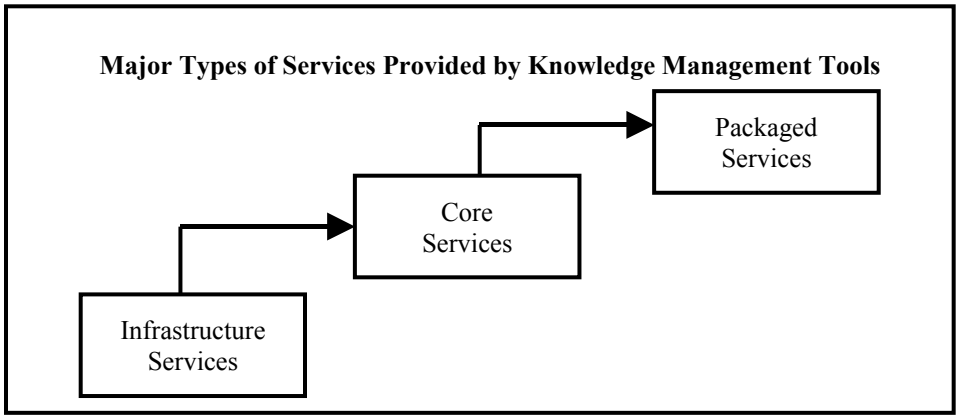
Managing highly unstructured knowledge requires more structured descriptions of the content, just as vide indexing employs close-captioned text and HTML pages are index by metatags. Most knowledge found on the Web falls near the top of the scale, and it is no coincidence that most knowledge management tools concentrate on this range.

In addition, semantics and interpretation of less structured forms of knowledge depend on contextual knowledge. Raw text files representing a speech eliminate many of the possible ambiguities in speech recognition. In this case, contextual knowledge about the subject, the person, and the person's voice are

used to "reduce" less structured forms of knowledge to more structured forms. After the transformation process, we need less additional contextual knowledge to be able to use the desired knowledge.

Knowledge Services

Another useful dimension is the range of services knowledge management tools provide. By services, we mean tasks or activities in handling knowledge that can be at least partially automated. While not all services are comparable, analysis of the knowledge services provided includes things ranging from e-mail to intranets to data mining and customer relationship management. To make sense of these disparate services, knowledge services may be divided into three main types: infrastructure services, core services, and packaged services build on one another such that packaged services make use of core services, which employ infrastructure services. For example, software that provides core services depends upon infrastructure services. This relationship is displayed in Figure below.

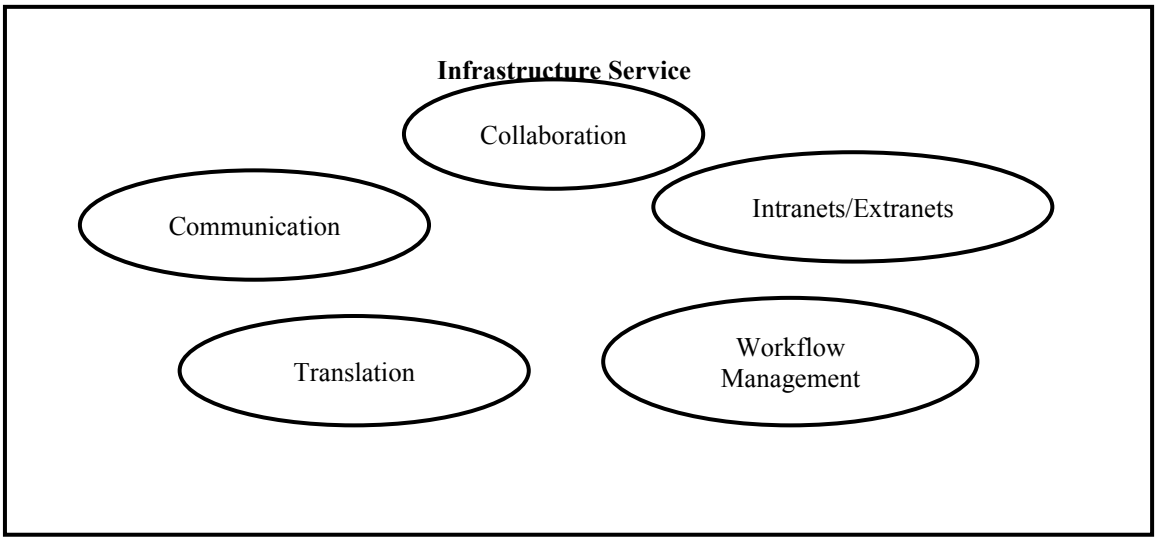


Each main type of service contains several major or typical services supporting knowledge management tools. The lists are not exhaustive, but rather present a collection of typical offerings.

Infrastructure Services

Infrastructure services are usually needed to implement any such knowledge management solution. Five basic types of infrastructure services are listed below in Figure.

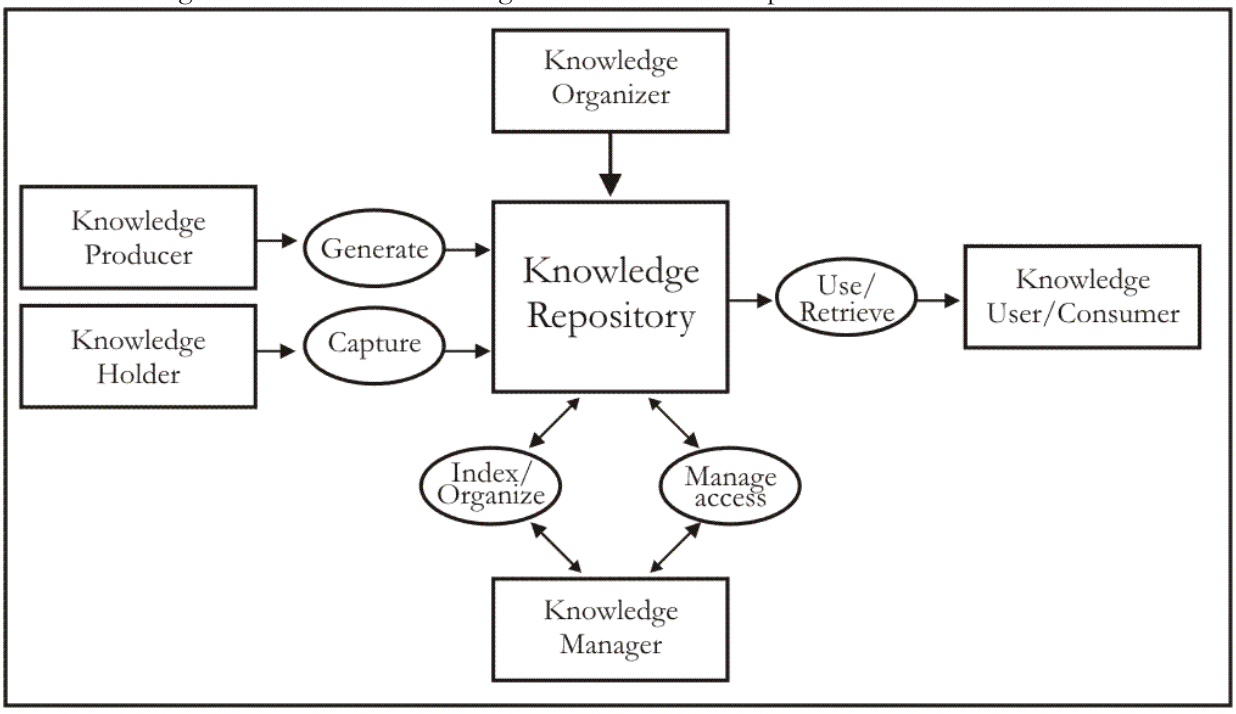
- **Communication services** enable electronic communication between users through e-mail, file transfer, chats, and similar vehicles.
- **Collaboration services** allow for groups of people to communicate through online meetings, shared whiteboards, and discussion groups, as well as directory services. Buildings upon communication services, these tools are also known as groupware, and the best known example is Lotus Notes.
- **Translation services** transform knowledge from one file format to another or from one language to another.
- **Workflow management services** define workflows and support online execution and control of workflows. Typical applications allow users to execute and enter the results of subtasks and view the status of other subtasks. Workflow management services build upon collaboration services.
- **Intranets and extranets** include other infrastructure services. Intranets are Web-based applications restricted to specific organization while extranets connect several organizations by providing access from one organization to another's content and services. Both intranets and extranets extend or aggregate other infrastructure services and add additional services such as user management, personalization, and configuration.



- **Intelligent agents** are software components that are capable of accomplishing tasks on behalf of a user. They go beyond "information on demand" and make selected decisions based on predetermined environmental scanning methods. They can also summarize relevant data by aggregating and performing some synthesizing functions before presenting it to executive decision makers.

Core services

Core services define knowledge management solutions because they explicitly and directly access knowledge repositories. Figure 8.4 shows how these core services are built around core processes of creating, organizing, and using a knowledge repository. Different core processes involve people or systems with different roles, including knowledge producer, holder, organizer, and user. Knowledge producers create knowledge while knowledge holders learn from other sources. Knowledge organizers work like librarians and allow producers to add knowledge in an orderly fashion to facilitate retrieval by users. Knowledge user's consumer knowledge to execute tasks and processes of their interest.



Key features of the five core services include the following:

- **Knowledge generation** services produce knowledge in forms that can be stored in the knowledge repository. Used by knowledge producers, these tools distill, refine, or simply create new knowledge that is then entered into the repository. These tools typically involve some kind of automated

learning and include data mining techniques and pattern recognition. Collaborative creation of a document is an example, and commercial versions include Interscape.com.

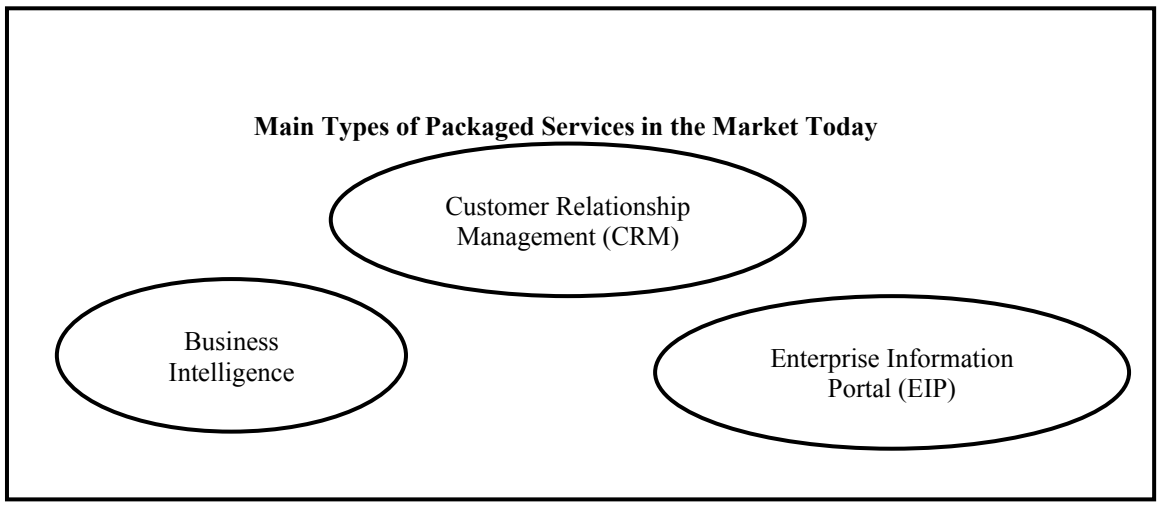
- **Knowledge capture** services facilitate addition to repositories. For example, capture tools allow users to enter new documents and may employ meta-information for indexing purposes. A simple example is the "document properties" mechanism of Microsoft Word, which contains information about the document being edited including author, revision number, subject, and date.
- **Knowledge organization (indexing)** services help knowledge managers arrange items in a repository to facilitate retrieval and use. Typical knowledge organization services add to or modify knowledge about repository indexes, taxonomies, and directories.
- **Access management services** determine who can access elements of the repository. They control access to the knowledge repository and are usually based on a directory of users. They may restrict who has access by permission levels.
- **Retrieval services** include searching and navigating functions as well as translation, visualization, and integration. They create value by making knowledge available for specific uses and may provide personalization and configuration services.

Packaged Services

Packaged services aggregate lower-level services to solve specific types of problem such as customer relationship management. Much knowledge management literature concentrates on these packaged services. This focus is attributable to the fact that these types of problems are clearly connected to end-user needs. For example, it is easier for a CIO to justify purchase of customer relationship tools than a search engine.

The literature concentrates on three classes of packaged services.

- **Customer Relationship Management (CRM) service** provide information about a company's clients in an integrated way. They typically allow internal channels to share and add to the same central knowledge base. Siebel and People-Soft are leading providers of CRM services. (CRM is covered in greater depth in Chapter 9.)
- **Business Intelligence services** manage knowledge about competitors and partners. They usually aggregate and provide unified interfaces to information from news agencies, public and private databases, economics and social information, and the World Wide Web. They also filter and classify information into categories.
- **Enterprise Information Portals** are specialized gateways providing access to internal and external sources of knowledge. They provide one-stop access, and typical examples include search engines and My Yahoo! (http://my.yahoo.com).



The Knowledge Structure and Services (KSS) Matrix and the KSS Checklist

Different tools provide distinct arrays of services and manage specific types of knowledge. We visualize relationships between knowledge management tools in terms of the types of knowledge they handle and the types of services they offer. Two diagrams display these relationships: the KSS Matrix and the KSS Checklist. These diagrams position the kinds of solutions provided by given products or vendors. Of course, more complete analysis could include additional elements such as hardware and software platforms, the quality of its customers support, and price.

The KSS Matrix

The KSS Matrix assures that the types of knowledge handled are intimately connected with the core services provided. Tools may support different sets of services for each type of knowledge.

The KSS Matrix is displayed in Figure below. The horizontal axis recognizes the five core knowledge services while the vertical axis displays the eight basic levels of knowledge structure dimension.

One KSS Matrix is used for each tool analyzed. A KSS Matrix is filled by adding small or large squares to each of the cells. Filling a cell indicates that the tool provides a specific service that manipulates knowledge with a given level of structure. The size of the square filling a cell represents the scope of the service offered by the tool. A large square denotes a major offering with a comprehensive set of features, while a small square marks a service that is offered in either a restricted scope or restricted functionality.

Basic KSS Matrix to Analyze and Compare Different Tool Offerings

		Knowledge Structure							
		Formal Knowledge	Categorized information	Structured information	Structured text	Marked up text	Raw text	Audio/Video	Implicit knowledge
Core Knowledge Services	Generate								
	Capture								
	Index/Organize								
	Manage access								
	Use/Retrieve								

The KSS Checklist

The KSS Checklist recognizes services beyond the core services. A checklist is employed because infrastructure and packaged services are independent of the types of knowledge managed. The KSS Checklist, as in following figure , lists the five infrastructure services and the three packaged services. To the right, we add squares indicating that a service is provided. As with the KSS Matrix, the size of the square represents the scope of the service offered, with a large square indicting major offerings and small squares representing incomplete or restricted offerings.

Basic KSS Checklist Used to Analyze and Compare Different Tool Offerings

Infrastructure Services	Communication	
	Collaboration	
	Translation	
	Workflow Management	
	Intelligent Agents	
	Intranets/Extranets	
Packaged Services	Enterprise Information Portal	
	Business Intelligence	
	Customer Relationship Management	

The KSS Matrix and the KSS Checklist provide quick assessments of each tool and can also be used to compare tools quickly. More importantly, the matrix and checklist can be used to evaluate knowledge management tools. Filling in the diagrams forces users to explore and analyze tools in detail. At the same time, the KSS framework can be used to select tools for specific uses. Specifications can be represented as "target" diagrams for ideal offerings to be matched with the capabilities of specific tools.

Using the KSS Matrix and Checklist to Compare Current Knowledge Management Tools

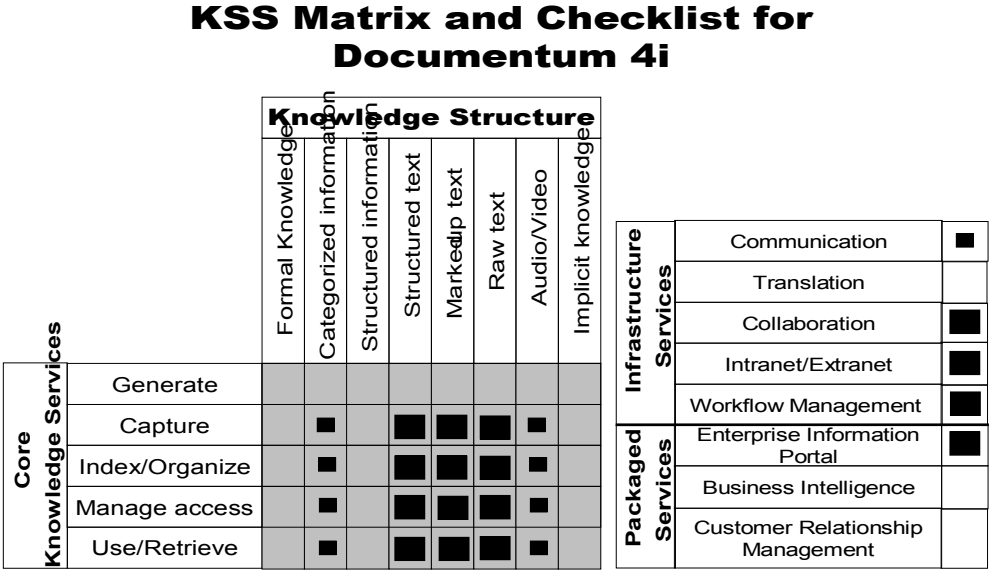
As examples, this section compares five leading knowledge management tools. We selected tools that represent the range of commercial tools and show the status of current practices.

Our analysis concentrates on specific tools and does not represent the set of tools provided by specific companies.

The five tools we analyze are Documentum 4i, OpenText LiveLink, Autonomy Knowledge Server, Lotus R5, and People Soft Customer Relationship Management.

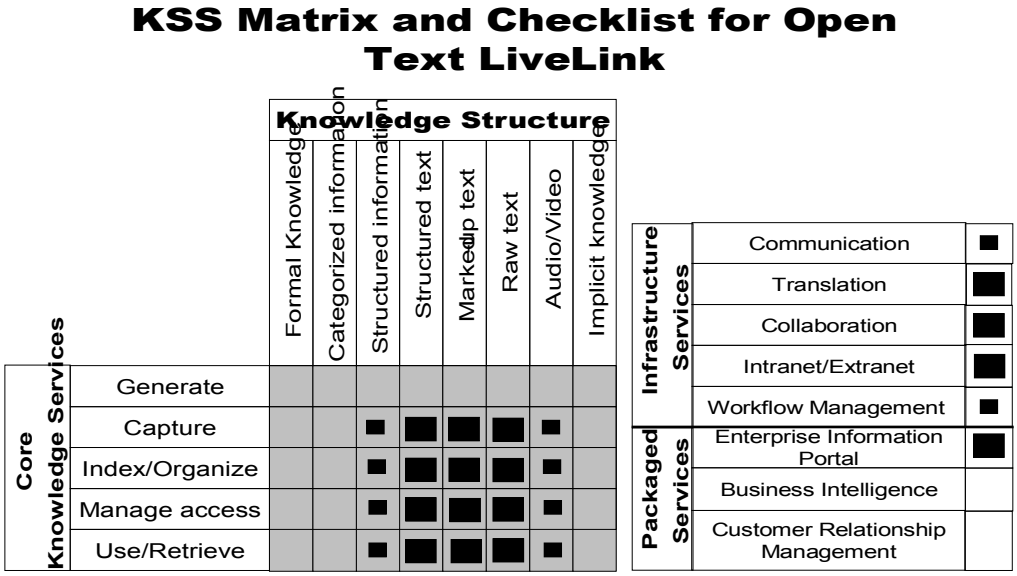
Documentum 4i

Documentum 4i[4] is an integrated software suite that serves a large spectrum of services and structures. It is centered on document management, and its core strengths are in dealing with documents. It supports audio/video and taxonomy, as well as some coverage of categorized information. It does not support knowledge generation services or formal knowledge, structured information, or implicit knowledge. Te services checklist following Figure shows that Documentum 4i is intended to be an Enterprise Information Portal tool, and it supports workflow management and collaboration.



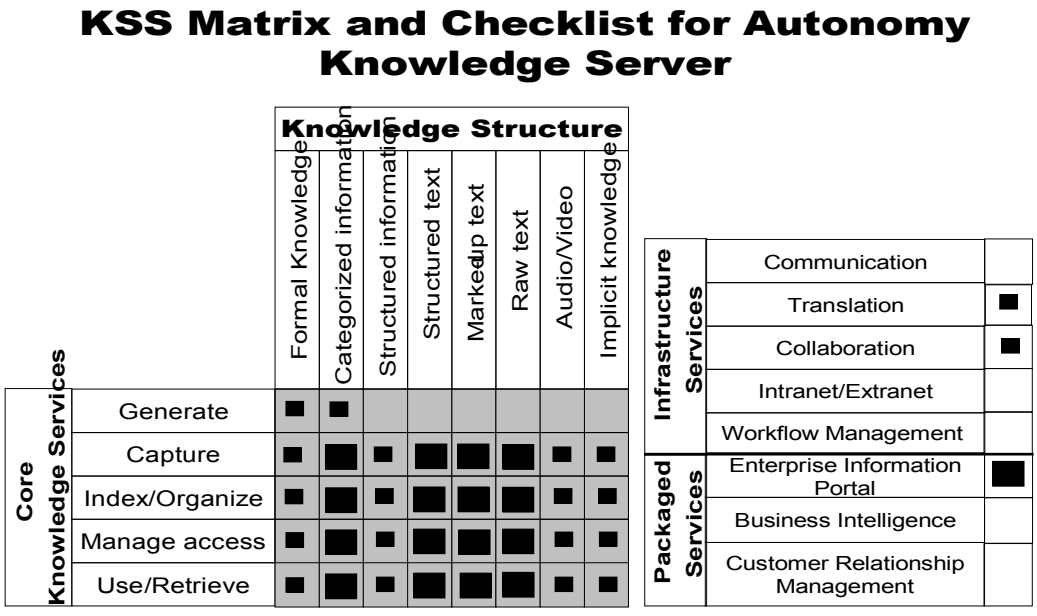
Open Text Live Link

Open Text LiveLink5 is also an integrated software suite focused on document management. The KSS Matrix below shows that it provides a core set of services to handle document management and structured information from databases. The services checklist shows that Live Link is an Enterprise Information Portal tool and that it supports translation and collaboration, including discussion groups and group scheduling.



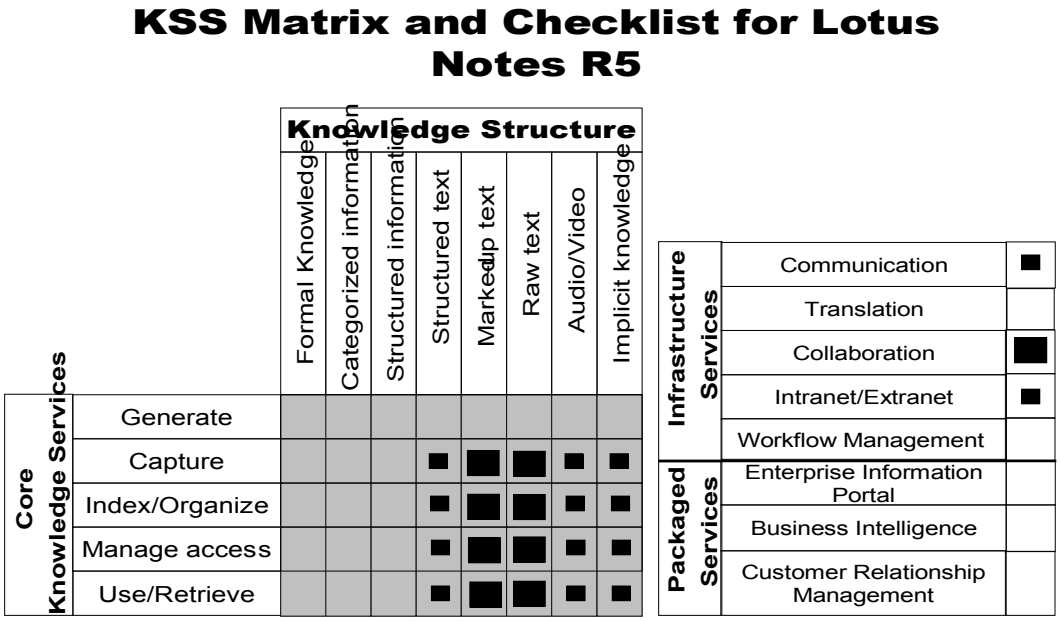
Autonomy Knowledge Server

Autonomy KnowledgeServer[6] is yet another software suite for content management. In addition, it provides sophisticated services for classifying material based on the content of documents. It is unique in that it covers formal knowledge. We can see that Knowledge Server's use of learning algorithms facilities some knowledge generation services. Note in following that it also has some translation and collaboration services but does not incorporate workflow management.



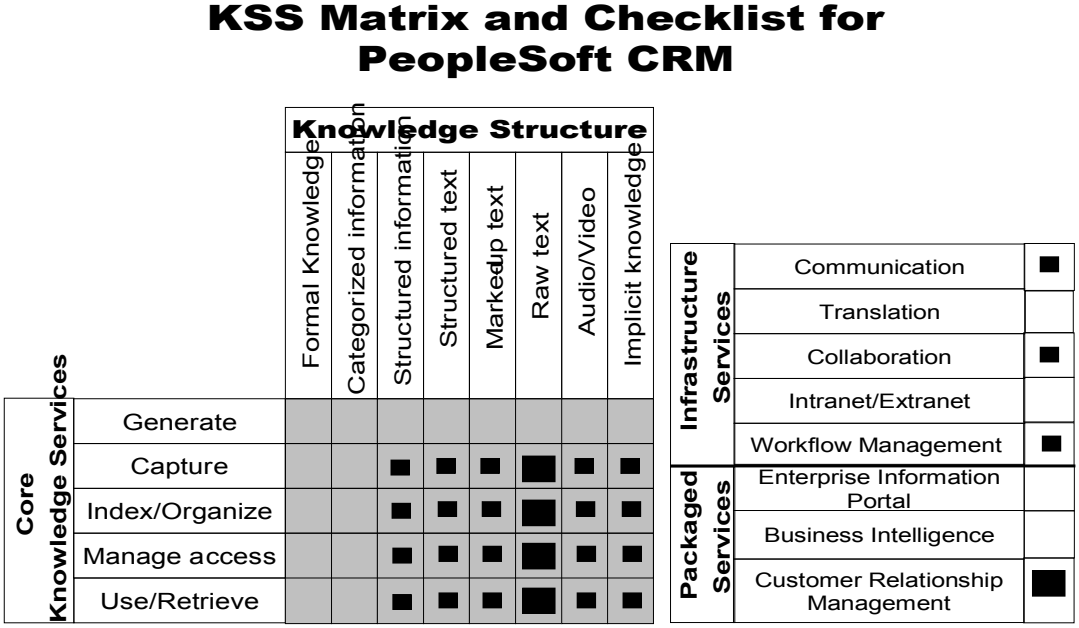
Lotus Notes R5

Lotus Notes R5 is virtually synonymous with groupware. This characterizes both it s strengths and weaknesses because R5 handles only unstructured types of knowledge. It supports implicit knowledge through use of detailed descriptions of people's information and skills. Lotus R5 does not attempt to be a packaged service as defined here, because it focuses exclusively on collaboration.



PeopleSoft Customer Relationship Management

PeopleSoft Customer Relationship Managements is typical vertical solution software that specializes in customer relationship management. People Soft acquired the product when it purchased Vantive, and its "vertical" bias determines the way it provides services all geared toward specific needs o CRM processes. While PeopleSoft CRM supports structured information, it only handles information about customers. This specialization makes it a good choice for CRM, but a poor choice for general knowledge management problems. (See figure 8.12.)



Conclusion

Modern-day alchemy is about turning information into knowledge. Whereas ancient alchemists aimed to turn lead into gold, today's alchemists are turning information into knowledge. The combination of knowledge management tools with databases and knowledge in the minds of employees is fostering

knowledge groups, knowledge enterprises, and knowledge industries. These tools are a key component in unleashing the value of knowledge management processes.

The KSS framework provides a convenient way to characterize knowledge management tools by defining the types of knowledge they can handle and the types of services they provide to support knowledge management processes.

The KSS Matrix and the KSS Checklist help visualize the coverage of specific tools and are, therefore, a convenient way to quickly compare and distinguish different tools offerings. They can be used to evaluate specific needs and match them to the services provided by available tools. Further, they separate different types of knowledge management tools and avoid comparing apples to oranges.

Services are key elements in understanding knowledge management tools, but complete evaluations should include other aspects. Users should specify the benefits they want to obtain and take into account hardware, software, and budget constraints. Also, more complex tools may require expensive and time-consuming installation and configuration processes.

Above all, electronic tools provide necessary "horsepower" and number-crunching ability to deal with the daunting complexity of real-world situations. As tempting as it is to rush to broad, Platonic theories of what knowledge is and what it does, we may be better served by pursuing and empirical course. The processing path of electronic knowledge events. Electronic tools are needed to cope with the bewildering number and variety of events and to yield results consistent with the perceptual and cognitive powers of the human mind. In short, electronic tools assess difficult problems and give us simple answers, but we must exercise caution in creating capable tools and in demanding answers that are simple rather than simplistic.

LESSON 42

KNOWLEDGE APPLICATION SYSTEMS AND CRM

1. Design a knowledge application system to support your business needs. Describe the type of system and the foundation technologies that you would use to develop such system.

A knowledge-application system that can support one organization's business needs would be a case-based knowledge application for the software support teams (up to 4 tiers) to address issues with the software platforms they support. Many organizations currently use a tool to control and track issues and requests made by internal and external users. For example, one of those tools allows for storage of the ticket history and has reporting features to generate metrics about our support teams. These metrics allow users to determine many of their issues and/or request have occurred in the past, but the support teams are not using the history of tickets to ensure a rapid resolution of issues. In other words, the tracking tool objective is to track issues, and does not have the mechanisms in place to aid in the solutions of them.

In order to design a case based application one could apply the Case Method Cycle:

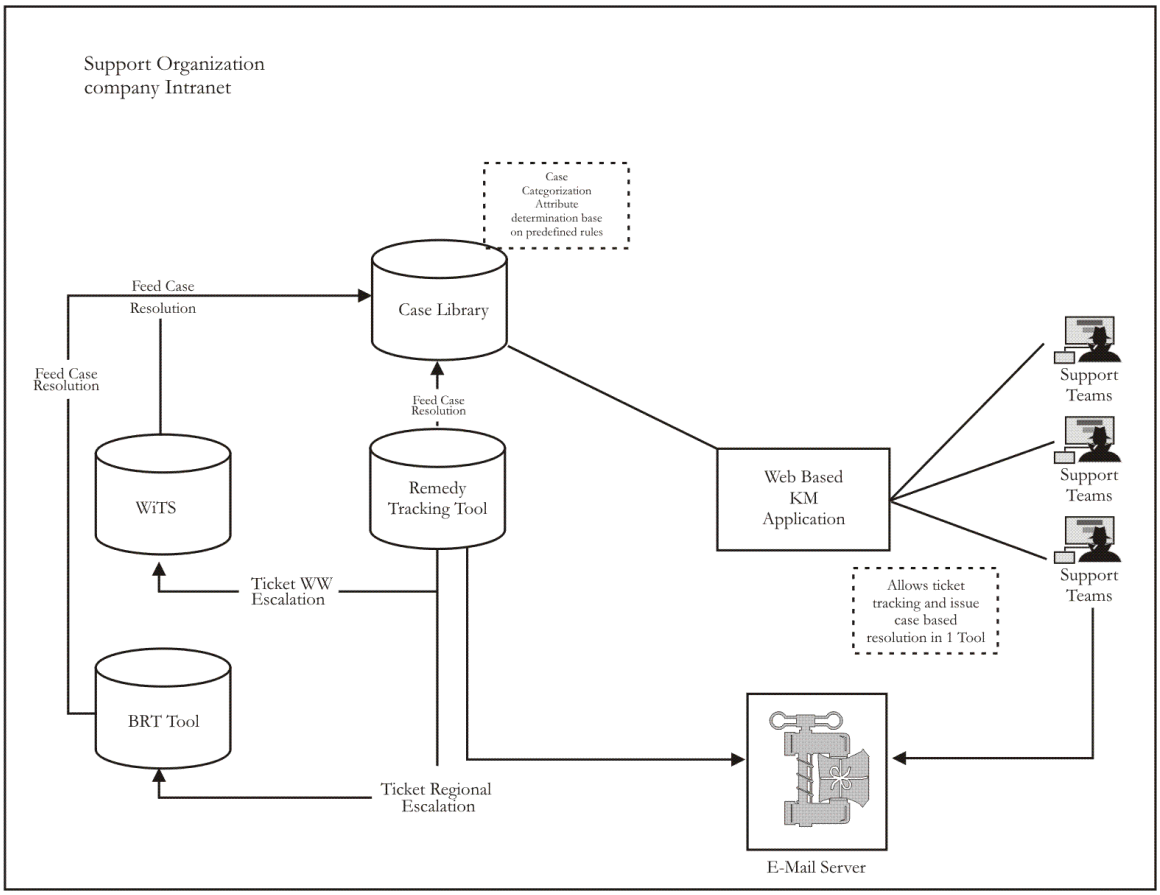
- System development process: develop an application that will store the cases and allows retrieving them based on similar historic cases, and shows the process to resolve the issue or request. The system would needs to be integrated with current tracking tool as well as with business request tools to allow for proper retrieval of updated information
- Case library development: collect the case library information from current case history from Remedy repository and develop the mechanisms to maintain it.
- System operation process: define the installation, implementation and support of the knowledge application system, following the standard development processes.
- Database mining: analyze the collected case information, to assist in the process of inferring the relationship between cases and define the resolution process.
- Management process: to ensure organizational support to the project
- Knowledge transfer: to ensure users maintain and add cases to the case library

To develop the cases one would follow these sub-processes:

- Case collection: determine the cases for each application supported by the support teams. This process can be aided through the experience of the support personnel as well as with the history information stored in the remedy system.
- Attribute-value extraction: to organize the support case library by identifying the attributes or characteristics of each case. Determine relationships between cases to allow for similar cases searching features. It is important in this phase to take into consideration the interdependencies that exist between the different applications supported (an issue in application A can result in added issues to application B) and resolution for each case. Also includes mapping the hierarchy into the database.
- Feedback: ensure that the personnel that maintain the system has the necessary feedback to ensure the quality of the information provided. This is especially important since the quality of the cases and process of resolution will minimize the time a ticket or request is open.

The technologies that would be used to develop this system include databases, Web-based technologies, search engines, and a case-based reasoning engine.

2. Design the system architecture for the system described above.



3. Identify three recent examples in the literature of knowledge application systems.

The vehicle manufacturing division of Daimler Chrysler, chose a case-based approach to develop a diagnosing system. Diagnostic problems in the field, such as trucks running hot or school buses that vibrate, require a troubleshooting routine, but it was difficult to connect the symptom with a particular solution. After all, most of Freightliner's vehicles are customized and have different histories, making exact matches to service problems been impossible. "We determined that case-based reasoning gave us the chance to deal with things that were not so concrete," says Carlo Nardini, director of technical support. For discrete problems such as electrical wiring, a model-based reasoning system might have been useful, but with so many indeterminate variables, a case-based approach offered the greatest flexibility for the technician in the service bay. Problems for which there are no finite descriptions or definitions demand case-based reasoning technology. Case-based reasoning also makes it possible to incorporate much less structured data so experiences in the field can be easily absorbed. For example, a rough-ride problem in a truck with a similar but not matching transmission and engine type is connected to a previous instance using case-based reasoning. Using a Web-based interface, Freightliner offers its system to dealers and franchisees, as well as third-party operators such as FedEx Corp. The software accepts legacy information from Freightliner's call center and engineering group, giving users an already rich resource. http://www.acknosoft.com/customers/freightliner.htm,

Faced with the problems of losing two key support staff, Andy King, joint Managing Director of Shuttleworth Business Systems, decided that his business would yield long-term benefits from implementing a knowledge application system solution. "My vision was to give our customers the ability to answer their own questions by accessing the technical knowledge base, so it made sense to upgrade our help desk at the same time. Hence we were looking for a state-of-the-art help desk solution that was closely integrated with the best knowledge management technology. We needed a knowledge base that would learn, be easy to use, and be accessible to internal staff and customers via the Web." Shuttleworth implemented a help desk system first, which enabled Andy to gain an in-depth understanding of his support team's operations and workload. For example, now the causes of the problems that people call in with – some of which originate in other departments, such as sales,

development or training – can be identified and eliminates at the source. http://www.vision4.co.uk/indexf.htm.

General Electric developed an application called *ICARUS: Design and Deployment of a Case-Based Reasoning System for Locomotive Diagnostics*. GE uses CBR for several applications. As is so often the case, many large companies use CBR. This application involved analyzing fault logs from locomotives to predict and preempt serious faults. Previously, they had tried a rule-based system but it was too hard to maintain. It took around four person years to get to the system to a stage where they realized it wouldn't work. The CBR system (as is so often the case) used a simple approach, costing around $250,000 and 14 person-months to build. The system solves 75% of the known faults across 600 locomotives, and estimated saving are in the order of $5 million per year. http://www.crd.ge.com/cooltechnologies

Knowledge Communities

In his book of 1998 - Communities of Practice - Etienne Wenger defines these communities as social units of learning even in the context of much larger systems forming constellations of interrelated communities of practice. However, the subtitle of the book - Learning, meaning and identity -shows that Wenger is most interested in the dimension of the community which comprises identity, belonging and boundaries. In a subsequent article entitled 'Communities of practice and social learning systems', Wenger (2000: 229) is even more explicit when he writes that communities of practice are the social containers of the competences that make up a social learning system. Three elements define competence:

- the sense of joint enterprise: to be competent is to understand the enterprise well enough to be able to contribute to it;
- mutuality: to be competent is to be able to engage with the community and to be trusted as a partner in these interactions;
- a shared repertoire of communal resources: language, routines, sensibilities, tools, stories, etc. To be competent is to have access to this repertoire and to be able to use it appropriately.

In a community of practice, knowing involves two components: the competence that the community has established over time, and the subjective experience of the world as a member. Wenger distinguishes among different forms of participation according to three modes of belonging:

- engagement: doing things together - the way in which we engage with each other shapes our experience of who we are;
- imagination: constructing an image of ourselves, of our communities - these images of the world are essential for our sense of self and for our interpretation of our participation in the social world;
- alignment: making sure that our local activities are sufficiently aligned with other processes so that they can be effective beyond our own engagement. Alignment has to do with coordinating perspectives, interpretations and actions.

LESSON 43

ROLE OF COMMUNITIES IN LEARNING AND PRODUCT DEVELOPMENT

Knowledge Communities

Teams interact with wider knowledge networks. Their members will frequently be members of communities of practice that span the organization. George Por describes communities as 'connecting islands of knowledge into self-organizing, knowledge sharing networks'. While some communities focus on a particular profession or discipline, the most powerful communities are customer or problem focused. They transcend disciplines and bring in different perspectives. They exchange, develop and apply knowledge. Just as a knowledge team is more cohesive than a work group, a knowledge community is a more cohesive cluster within a diffuse knowledge network. Following table highlights the essential differences between groups, teams, networks and communities.

Knowledge communities contrasted with other groups

	Work group	Team	Knowledge Network (Col)	Knowledge community (CoP)
Typical size	3-30	5-8	30-300	15-150
Membership	Recruited for job	Recruited for team fit	Self-selecting	Self-selecting
Focus	Tasks	Output	Knowledge exchange	Applied Knowledge
Goals	Explicit, given	Mutually agreed	Imprecise or implicit	Evolving and purposeful
Boundaries	Precise	Permeable	Fluid	Mutually adjusting

Note: Col = community of interest; CoP = community of practice

The main difference compared to a team in that the membership is self-selecting. Like a self-managed team they cannot be strongly directed or over directed. In fact the best management style for an in-house knowledge community is hands-off, but providing a climate in which they thrive. Communities are more social than structural. Etienne Wenger (an originator of communities of practices), and Bill Snyder list the following stage of community development.

1. Latent: there is potential for such a community within the organization.
2. Coalescent: members come together and recognize their collective potential.
3. Active: engaged in developing a practice.
4. Legitimized: recognized as a valuable entity.
5. Strategic: central to the success of an organization.
6. Transformational: capable of redefining its environment.
7. In Diaspora: dispersed but still alive as a force.
8. Member able: no longer very relevant, but still remembered as part of member's identities.

Compared to a knowledge team, the size of community means that it loses some of the cohesiveness and commitment. However, good communities retain as many characteristics of effective knowledge teams as possible, including a shared sense of purpose, intensive external networking, effective knowledge management and trust. Many communities embody such considerations into their guiding principles. The two most important parameters are a high flow of communications and passionate community leaders. In the virtual environment this role is performed by a person known as the conference host or moderator.

Virtual moderation for knowledge development

The role of a conference moderator is to stimulate virtual discussion and to guide the community forwards in its thinking and knowledge development. A good moderator has enthusiasm for their subject and likes networking. For most, moderating is not their primary job, but an important added daily activity. They activate knowledge development by:

- Setting up conferences – admitting members, assigning privileges etc.
- Defining the scope and agenda for discussion – posing key questions.
- Defining the ground rules, e.g. no personal insults, no advertising.
- Keeping conversations developing – stimulating discussion, revisiting earlier topics.
- Summarizing – periodically reviewing progress and key contributions and maintaining a coherent structure.
- Cross-linking – connecting different conversational threads; this cross-fertilization often sparks new ideas and momentum.
- Managing inappropriate contributions or behavior – defusing arguments (more of this is done behind the scenes with private emails or telephone conversations).
- Engaging people in conversation – actively seeking contributions from those they know have something worthwhile to contribute; visibly acknowledging good contributions.

Good conference leaders will identify important and challenging tasks that will benefit the whole community and keeps the knowledge following, e.g. preparation of a best practice guidebook, a resources database, etc.

Sustaining communities

Those organizations that encourage communities as an integral part of corporate knowledge programs will gain significant benefits. Good knowledge communities will be thought leaders, generating new product ideas and aggregating the collective thinking of a talented group of individuals to tackle difficult problems. They will significantly increase an organization's knowledge capital.

A potential threat to communities is that the very focus on knowledge management introduces a degree of formalization that could, if not dealt with sensitively, stifle them. How can organization minimize this risk?

- Provide facilities that make it easy for these communities to meet and exchange: web space, internal newsgroups, mail lists; as well as physical meeting places where tacit knowledge conversion can take place.
- Offer facilitation to help them improve current processes – too often communities bogged down in the content, not stepping back and seeing the effectiveness of their ongoing processes, e.g. when enrolling new members.
- Provide connection information – help others who share their interests apply to join, help them publicize their existence to the outside world, e.g. via community directories.
- Encourage note taking methods for meetings – have community members synthesize 'knowledge nuggets', that can be recalled and shared with those not at the meeting.
- Synthesize and edit email discussions – create 'knowledge editor' roles, people who respect their norms and values – some communities may want to remain small and intimate, and restrict membership.

Communities need a supportive organizational environment. An easy way to kill a community is to discourage people from spending time at it, or even, as some managers have tried, to suppress this 'non-essential work'. Reward systems and culture must support community participation. Endorsement, not enforcement, is the watchword. The whole ethos of a successful community is based much more on knowledge ecology rather than a knowledge management emphasis. A good example of knowledge ecology in action is that of the Knowledge Ecology Fair.

The Knowledge Ecology Fair

Knowledge Ecology Fair 1998 was an on-line event that attracted over 300 virtual attendees and ran for three weeks. The World Wide Web provided an entry point for the various activities of the conference:

- Keynote presentation – given by knowledge leaders such as Leif Edison of Skandia, Karl Erik Sveiby, and Bipin Junnarkar of Monsanto.
- Workshops – led by subject experts, including Verna Allee on 'Knowledge and self organization', Etienne Wenger 'Learning Communities: the ecology of knowing', Arian Ward on futurizing and Michael Rey on creativity.
- Discussion groups such as workplace communities.
- Community Café – more informal discussion e.g. on shared interests, on books we love.
- The Open Space Circle – 'an open space for participant generated discussions; get first hand experience facilitating a learning conversation . . . . explore questions of most interest to you'.

In the Open space Circle forty-two discussion items were created, which covered topics as varied as organizational intelligence in family-owned businesses, knowledge artifacts and communities of practice in health care settings. As a result of discussion at the fair, new initiatives have evolved, such as KEN (Knowledge Ecology Network) and the Knowledge Ecology University.

LESSON 44

LEARNING ORGANIZATION

Knowledge is not something that people possess in their heads, but rather, something that people do together.

(Gergen, 1991)

To play the violin - 'it is necessary to possess certain habits, skills, knowledge, and talent, and to be in the mood to play, and (as the old joke goes) to have a violin. But violin playing is neither the habits, skills, knowledge, and so on, nor the mood, nor (the notion believers in "material culture" apparently embrace) the violin'. Violin playing is an easily recognizable practice; it is more troublesome to recognize 'an organizational practice' or to detect how and when 'knowing in practice' occurs.

Conventional wisdom

Our society is dominated by a view of learning, education and training as an endeavour of 'knowledge delivery' based on a notion of learning as a process of information delivery from a knowledgeable source (either a teacher or a text book) to a target lacking that information . From this perspective, learning amounts essentially to the acquisition of the body of data, facts and practical wisdom accumulated by all the generations that have preceded us. This knowledge is 'out there', stored in some form of memory (usually books), and the main effort of the learner is to acquire it and to store it in the proper compartment of his/her mind for future use or reference as needed.

To a certain extent, when learning is viewed in this way it may be equated to eating or to banking: knowledge is food for the mind, and the learner seeks to find the right or necessary sort of food and to ingest or consume it. Teaching and learning consist in the transfer of the 'gold' to the pupils' heads. Learning therefore takes place mainly during our early development, as we move through schooling, instruction and training. People usually receive their training at the end of their educational careers, so that it is considered a specific and goal-oriented form of instruction which provides newcomers with the knowledge they require to perform their roles appropriately in some organization. Training may be acquired later, if for some reason (e.g., updating existing knowledge or preparing for a job change or a new assignment), new learning becomes necessary. Generally speaking, in such cases training takes the form of a supplementary dose of instruction and schooling.

Although this familiar conception of learning may seem quite reasonable, it is a highly reductive account of both how people learn in general and of how people learn in organizations, for at least two reasons.

In the first place, it suggests that learning is separate from - and to some extent opposed to - any other activity. According to the traditional view, not only do we learn solely in certain periods of our lives, but also our learning is restricted to specific occasions, such as when we take a class, or read a book, or watch an instructional video. However, this is an inaccurate description of how matters stand. Study and instruction 'per se' are indeed important, but learning is also deeply rooted in other everyday activities and experiences as well. Most of the relevant know how that distinguishes an expert from a novice is acquired on a day-to-day basis by acting and reflecting, i.e., by thinking about what we are doing and why, and talking about it with others (Schön, 1983).

In the second place, the view of learning as a totally individual activity, like ingesting food, can be misleading. Learning is much more than, and very different from, finding and acquiring items of organizational knowledge. As much in everyday life as in work organizations, people and groups create knowledge by negotiating the meaning of words, actions, situations and material artefacts. They all participate in and contribute to a world which is socially and culturally structured and constantly reconstituted by the activities of all those who belong to it. Cognitive and practical activity can thus be pursued only within this world, and through this social and cultural networking. Knowledge is not what

resides in a person's head or in books or in data banks. To know is to be capable of participating with the requisite competence in the complex web of relationships among people, material artefacts and activities (Gherardi, 2001b). On this definition it follows that learning is always a practical accomplishment 'knowledge is something people do together' and it is done in every mundane activity, in organizations when people work together and in academic fields like organization studies, even if we make distinctions between lay, practical and theoretical knowledge. But also the practices of science - like any other social process - are intrinsically reflexive, and they are practices situated in specific contexts of power/knowledge. Situated practices are both pre-reflexive (depending on unstated assumptions and shared knowledge for the mutual achievement of sense) and reflexively constitutive of the situated members' contexts from which they arise. The term 'organizational learning' not only acquires meaning from the context in which it appears but it also reflexively creates that context.

The institutionalization of the field: the birth of the learning organization

The field of OL has developed and been institutionalized as 'problem driven', as the production of instrumental knowledge. But the knowledge thus produced sets the conditions for research to shift to 'mystery-driven' learning (Gherardi, 1999) which - in Derrida's (1967) terms - is supplementary to cognitive reflexivity. An episode (Gherardi, 1999) is paradigmatic of what happens in the community of scholars that studies organizational learning:

I was at an international conference on Organizational Learning and had taken part in discussion of a paper presented by a colleague from a university in a developing country which empirically tested whether the most successful firms in her country were, or were not, learning organizations. Unfortunately, her data showed a low correlation between being an economically successful firm and being a learning organization, and she was puzzled by her findings.

This episode is paradigmatic of the social process of 'manufacturing knowledge': a heuristic concept - OL - acquires legitimacy in the scientific community, it spreads through the community of consultants and practitioners, it produces the 'characteristics' that distinguish the phenomenon (and thus proves its existence), and it coins the label 'learning organization'. This label travels though time and space (Czarniawska and Sèvon, 1996) and is appropriated by some organizations, which incorporate it into their identities. At this point a social phenomenon has been produced: a realist assumption replaces a heuristic device, and learning is defined a 'real' phenomenon which takes place 'out there' in organizations and can be measured, compared and validated. There 'really' exist learning organizations in the world - organizations which are presumably different from non-learning ones - and as corporate actors they learn by themselves,[2] either from each other or by being immersed in ecology of learning. The touchstone with which to determine whether, how and in what circumstances learning has been produced is the concept of change. Organizational change is the outcome of a more or less rational procedure of the production of knowledge and its practical application. If this does not come about, something 'has gone wrong' and dysfunctional learning has taken place.

This episode gives cause for much thought, but I shall examine only the aspect that concerns the social process internal to a community of scholars which - around 20 years ago - marked out an area of study by means of a metaphorical operation: that is, by juxtaposing the concept of learning with that of organization. A new area of study requires resources of legitimation (Astley, 1985; Whitley, 1984) not only internally to the restricted occupational community of academics or consultants but also to firms and to society in general. This process of mobilizing credibility creates cultural artefacts - books, conferences, university courses - as well as new identities: learning organizations (LO) are born. Companies with outstanding reputations - Shell, Mercedes Benz, Isvor Fiat - baptize themselves LOs and devote enormous resources to creating a 'corporate' identity that is recognizable, recognized and trustworthy in the eyes of its members and of society at large.

This social process of the creation of a new subjectivity for the firm and of the legitimation of new expert knowledge singles out a series of distinctive features of the LO[4] and of OL which, in their turn, find coherence within a normative model. It is often a short step from description to prescription in organizational studies, even more so if historical memory is lost.

The existence of the LO has become 'natural' because it has been institutionalized, and institutions give

identity. Therefore the features of the LO have become attributes of the being of a category of firms. Mary Douglas (1986: 83-6) argues that institutions are founded on an analogy with nature. The naturalization of social classifications protects the institution when it is still at the stage of fragile convention: by being naturalized, it becomes part of the order of the universe and is therefore ready to function as a basis for argument. And this is when organization scholars - of the second generation, or forgetful, or subordinate to those who produce 'knowledge', or decentralized or marginal with respect to them - arm themselves with questionnaires, measuring scales and other scientific tools and set off to verify these distinctive features.

This account is simplistic and crude. It does not claim to be 'true'; it merely serves to highlight some of the turning points that have made the languages of Babel no longer mutually intelligible. A scientific community can therefore be identified as forming around the concept of LO, around realist ontology, around a positivist epistemology, around a prescriptive intent, and around continued research into applied rationality. It should be borne in mind, in fact, that the term OL was first used in decision-making theory (Cyert and March, 1963), which subsequently developed the notion of learning as adaptation.

We may for the moment assume that the distinction between LO and OL is based on the dichotomy between prescriptive and descriptive research, as proposed by Tsang (1997: 73) for example. But, in my view, the issue is not the fact that some (academics) 'fail to generate useful implications for practitioners' and the others 'seldom follow rigorous research methodologies', therefore there is a need 'to integrate the two streams of research'. This too is rhetoric of scientific writing which urges the search for a universal language. Consequently, in my opinion, it is not a matter of producing 'constructs [that] can be operationalized in empirical research' (ibid. p. 78) or of producing 'empirical evidence' (ibid. p. 77) when the contrast is between a realist ontology - which assumes learning as an empirical phenomenon - and a constructionist one. These are problems of knowledge that concern a realist ontology, but if organizational learning is a 'live metaphor' (Tzoukas, 1991), a metaphorical operation performed by the researcher (Gherardi, 1995b) - that is, a means to represent the organization as if it were a system that learns - then the problem of knowledge is not to establish what constitutes 'effective learning' but to determine the amount of further knowledge yielded by the metaphor proposed.

Therefore the interest of knowledge (Habermas, 1971) shifts from the question 'how does an organization learn or should learn?' to the question 'if we depict an organization as a system which learns, are we able to see something new and to see something that we already know differently?' The former question mainly concerns explanation of OL, while the latter more closely relates to understanding (Verstehen) of it (Weber, 1922).At this crossroads in the social sciences, the former community goes in quest of the founding myth of objectivity, while the latter pursues the myth of adequacy (Ricolfi, 1997: 38). Ricolfi writes 'explanation and understanding, positivism and hermeneutics, the primacy of method and the primacy of the subject-matter, are antitheses that were born together with the social sciences, and they have persisted because they represent different but functionally equivalent answers to the need for identity of the social sciences themselves'. From this latter perspective we may therefore enquire as to the 'goodness' of the models of knowledge produced when a scientific community is socially constructed around a topic.

Organizational learning as a disciplinary discourse

The literature on LO has been suspected of colluding with the 'ruling courts' which govern organizations (Coopey, 1995) and of employing ideologically a discourse of democracy and liberation (Snell and Chak, 1998). Easterby-Smith (1997: 1086) defines the literature on LO as having 'an action orientation', and being 'geared toward creating an ideal type, an organization in which learning is maximized'.

But it would be naive to create and represent a distinction between OL as a heuristic view and LO as a realistic one, when both converge on the same social practice which legitimizes the managerial techniques based on their claims of scientific knowledge. They share the same bias and both contribute to the institutionalization of the field as a disciplinary discourse and to its superseding through the process of constant reinterpretation of the previous interpretation known as 'institutional reflexivity'.

We may therefore view the manufacturing of a body of knowledge - a discipline - under the labels 'OL' and 'LO' as a situated practice in a community of organizations, in a community of practitioners, in a community of academics, in a society. We may explore that practice as a 'disciplinary discourse' which sustains forms of normative behaviour, supports knowledge claims and provides resources for normalization.

From a Foucauldian perspective, discourses are systems of thought which are contingent upon material practices and which inform those practices through particular power techniques. Much of nineteenth-century social science (social welfare, administration, statistics) was almost wholly shaped by the 'disciplinary gaze' (Foucault, 1977) of surveillance. In organization studies, for example, the personnel function, under the guidance of 'human relations', had a similar tutelary role (Hardy and Clegg, 1996), and 'organizational learning' is now following suit.

Foucault's concept of discipline has been usefully applied in post-modern analysis of power/knowledge relations (Alvesson, 1993, 1994; Deetz, 1996; Townley, 1993) in the area of knowledge firms or in the construction of the subjectivity of knowledge workers. Also the exploitative ethos of many organizational learning discourses has been under-lined by postmodern scholars (Boje, 1994) and other critical scholars (Huysman, 1999). I do not wish to pursue this line of analysis further; rather, I shall restrict my treatment to illustration of a set of premises implicit in OL and LO theorization in order to highlight how they sustain a disciplinary discourse which disciplines concrete behaviours:

1. OL is always ameliorative and disinterested.

Learning is regarded as always positive, in the spirit of 'the more, the better'. OL as a discourse implicitly assumes an ameliorative vision in which learning is incremental and knowledge is a cumulative product which undergoes constant development (Miner and Mezias, 1996). The alleged universality, neutrality and transparency of knowledge presume that humankind is its beneficiary, thereby neglecting the role of power in structuring organizational knowledge. What is deemed worth learning has already been selected: only those in power learn the right things.

2. OL is intentional.

If learning resembles a process of appropriation and capitalization of something external, or of a known product, then also the ways in which it is appropriated/produced can be specified and normatively sustained. OL may be embodied in SOPs (standard operating procedures), which are periodically overhauled and updated (Kieser, Beck and Taino, 2001). It may thus be envisaged as 'the one best way of learning'.

3. OL is an extorted result.

The LO requires of work groups that they 'learn' and transfer the knowledge thus acquired to organizational structures, and that learning leads to an improvement in performance. The use of power in transferring knowledge is silenced and OL is conceived as grounded on free transfer, on transparency, on voluntariness and on the chain of authority, rather than residing in the murky depths of micro-conflictuality, micro-negotiation and the systematic and more or less deliberate distortion/extortion of knowledge.

4. OL presumes change but not its understanding.

Learning proposes a change in the behaviour - actual or potential - of individuals or groups, or perhaps a cognitive change. It does not necessarily require individuals to understand the logic that has led to a change in SOPs (Child and Markoczy, 1993).This amounts to saying that if some change is manifest, then a learning process has taken place, but also that change does not require any learning.
The problem thus arises of how the empirical evidence can be collected to demonstrate the relationship between change and learning.

Learning, writes Rorty (1989), is a term often part of a final vocabulary: it is a value in itself which cannot be further questioned. It is associated with improvement in performance, the rapid correction of errors and a fast reaction to environmental changes. The positive connotation associated with the word induces the a priori assumption of what needs to be empirically demonstrated. Learning, as the founding myth of the scientific community of OL scholars, obscures the myopia of learning from experience (Levinthal and March, 1993).

In short, we have described the theoretical construction of OL and LO as a discourse of disciplining when it is reselected as a managerial technique which contains a bias towards systematic and purposeful learning, a bias towards improvement, and a normative bias. These biases are composed of a specific structuring of power/knowledge which sustains them and perpetuates them as a discourse of power.

This is even more evident when we consider the literature on knowledge management.

1.4 The reification of knowledge in the knowledge management literature

A quantitative bibliographical survey (Scarbrough, Swan and Preston, 1998) shows that since 1997 the term 'knowledge management' has supplanted 'organizational learning', and that the interest of the scientific community has switched from questions concerning the appropriation of knowledge by individuals and organizations to ones concerning the techniques and technologies of knowledge management. The academic disciplines now predominant in the organizational learning debate are not psychological but economic, and a new alliance has arisen between the economics of knowledge and information technology which now monopolizes the term 'knowledge management' (KM).

The concepts of 'knowledge work' and 'knowledge worker' were first introduced by Peter

Drucker (1939), who set them in contrast to those of manual work and service work. Brief inspection of the relation between knowledge and wealth creation between the eighteenth and twentieth centuries reveals a series of epochal changes: first, knowledge was applied to artefacts, processes and products through technologies, patents and tacit knowledge; then it was applied to human labour through the scientific analysis of work; and finally knowledge was applied to knowledge itself, thus constituting knowledge work. Based on this new type of work is the endeavour to manage knowledge as if

LESSON 45

THE FUTURE OF KNOWLEDGE MANAGEMENT

What makes a KM initiative successful?
What are the strategic and operational things one must do?
How do you value knowledge assets?
What role does culture, both national and organizational, play?
What is the future of KM?

The following golden nuggets, derived from the KM research, are only the beginning of this quest:

- KM requires the integration and balancing of leadership, organization, learning and technology in an enterprise-wide setting.
- KM must not only recognize requirements and conditions for success, but also support the desired benefits and expectations of the enterprise.
- Streamlined organizational structure, with strong cultures, has a higher chance of KM success.
- An atmosphere/culture of trust is necessary to sharing knowledge.
- National culture affects the values and practices of every organization in Knowledge Management implementation, especially at the lower levels.
- KM technologies contribute to organizational growth only if the flow and con text of knowledge are supported.
- KM technologies are useful in managing and leveraging intellectual capital, but the size of the organization is a major variant.
- Successful KM technology implementation requires an organizational culture that promotes a blend of product and people orientation.
- KM success factors are dominated by management ones, such as culture, process, and organization, with technology as the least important.
- KM criteria for success should include both soft and hard measures if top leadership is to support KM initiatives.
- Knowledge assets are strategic, and must be accounted for and valued accordingly.

Managers concerned with implementing knowledge management in their organizations today face a number of challenges in developing sound methods for this still emerging area of management practice. Both the growing literature on knowledge management and the advice offered by various knowledge management consultants; however, seem to advocate forms of knowledge management practice that often appear incomplete, inconsistent and even contradictory.

Tacit knowledge versus explicit knowledge approaches

Even a casual review of the many articles and consulting recommendations on knowledge management practice today soon reveals a plethora of recommended processes and techniques. Unfortunately - especially for the many managers looking to researchers and consultants for insights to guide development of sound knowledge management practices - many of these recommendations seem unconnected to each other, and in the worst cases many seem to be quite at odds with each other. Close analysis of these recommendations, however, usually reveals that the many ideas for practice being advanced today can be grouped into one of two fundamentally different views of knowledge itself and of the resulting possibilities for managing knowledge in organizations. These two views are characterized here as the 'tacit knowledge' approach and the 'explicit knowledge' approach.

The tacit knowledge approach

The salient characteristic of the tacit knowledge approach is the basic belief that knowledge is essentially personal in nature and is therefore difficult to extract from the heads of individuals. In effect, this approach to knowledge management assumes, often implicitly, that the knowledge in and available to an

organization will largely consist of tacit knowledge that remains in the heads of individuals in the organization.

Working from the premise that knowledge is inherently personal and will largely remain tacit; the tacit knowledge approach typically holds that the dissemination of knowledge in an organization can best be accomplished by the transfer of people as 'knowledge carriers' from one part of an organization to another. Further, this view holds that learning in an organization occurs when individuals come together under circumstances that encourage them to share their ideas and (it is hoped) to develop new insights together that will lead to the creation of new knowledge.

Basic beliefs in tacit versus explicit knowledge management approaches

Tacit knowledge approach	Explicit knowledge approach
Knowledge is personal in nature and very difficult to extract from people. Knowledge must be transferred by moving people within or between organizations. Learning must be encouraged by bringing the right people together under the right circumstances.	Knowledge can be articulated and codified to create explicit know-ledge assets. Knowledge can be disseminated (using information technologies) in the form of documents, drawings, best practices, etc. Learning can be designed to remedy knowledge deficiencies through structured, managed, scientific processes.

To make wider use of the tacit knowledge of individuals, managers are urged to identify the knowledge possessed by various individuals in an organization and then to arrange the kinds of interactions between knowledgeable individuals that will help the organization perform its current tasks, transfer knowledge from one part of the organization to another, and/or create new knowledge that may be useful to the organization.

Most managers of organizations today do not know what specific kinds of knowledge the individuals in their organization know. This common state of affairs is reflected in the lament usually attributed to executives of Hewlett-Packard in the 1980s: 'If we only knew what we know, we could conquer the world.' As firms become larger, more knowledge-intensive, and more globally dispersed, the need for their managers to 'know what we know' is becoming acute. Thus a common initiative within the tacit knowledge approach is usually some effort to improve understanding of who knows about what in an organization - an effort that is sometimes described as an effort to create 'know-who' forms of knowledge. An example of such an effort is the creation within Philips, the global electronics company, of a 'yellow pages' listing experts with different kinds of knowledge within Philips' many business units. Today on the Philips intranet one can type in the key words for a specific knowledge domain - say, for example, knowledge about the design of optical pickup units for CD/DVD players and recorders - and the yellow pages will retrieve a listing of the people within Philips worldwide who have stated that they have such knowledge. Contact information is also provided for each person listed, so that anyone in Philips who wants to know more about that kind of knowledge can get in touch with listed individuals.

An example of the tacit knowledge approach to transferring knowledge within a global organization is provided by Toyota. When Toyota wants to transfer knowledge of its production system to new employees in a new assembly factory, such as the factory recently opened in Valenciennes, France, it typically selects a core group of two to three hundred new employees and sends them for several months' training and work on the assembly line in one of Toyota's existing factories. After several months of studying the production system and working alongside experienced Toyota assembly-line workers, the new workers are sent back to the new factory site. These repatriated workers are accompanied by one or two hundred long-term, highly experienced Toyota workers, who will then work alongside all the new employees in the new factory to assure that knowledge of Toyota's finely tuned production process is fully implanted in the new factory.

Toyota's use of Quality Circles also provides an example of the tacit knowledge approach to creating new knowledge. At the end of each work week, groups of Toyota production workers spend one to two hours analyzing the performance of their part of the production system to identify actual or potential problems in quality or productivity. Each group proposes 'countermeasures' to correct

identified problems, and discusses the results of countermeasures taken during the week to address problems identified the week before. Through personal interactions in such Quality Circle group settings, Toyota employees share their ideas for improvement, devise steps to test new ideas for improvement, and assess the results of their tests.
This knowledge management practice, which is repeated weekly as an integral part of the Toyota production system, progressively identifies, eliminates and even prevents errors. As improvements developed by Quality Circles are accumulated over many years, Toyota's production system has become one of the highest-quality production processes in the world (Spear and Bowen 1999).

The explicit knowledge approach

In contrast to the views held by the tacit knowledge approach, the explicit knowledge approach holds that knowledge is something that can be explained by individuals - even though some effort and even some forms of assistance may sometimes be required to help individuals articulate what they know. As a result, the explicit knowledge approach assumes that the useful knowledge of individuals in an organization can be articulated and made explicit.

Working from this premise, the explicit knowledge approach also believes that formal organizational processes can be used to help individuals articulate the knowledge they have to create knowledge assets. This approach also holds that explicit knowledge assets can then be disseminated within an organization through documents, drawings, standard operating procedures, manuals of best practice, and the like. Information systems are usually seen as playing a central role in facilitating the dissemination of explicit knowledge assets over company intranets or between organizations via the Internet.

Usually accompanying the views that knowledge can be made explicit and managed explicitly is the belief that new knowledge can be created through a structured, managed, scientific learning process. Experiments and other forms of structured learning processes can be designed to remedy important knowledge deficiencies, or market transactions or strategic partnering may be used to obtain specific forms of needed knowledge or to improve an organization's existing knowledge assets.

The recommendations for knowledge management practice usually proposed by researchers and consultants working within the explicit knowledge approach focus on initiating and sustaining organizational processes for generating, articulating, categorizing and systematically leveraging explicit knowledge assets. Some examples of knowledge management practice in this mode help to illustrate this approach.

In the 1990s, Motorola was the global leader in the market for pagers. To maintain this leadership position, Motorola introduced new generations of pager designs every 12-15 months. Each new pager generation was designed to offer more advanced features and options for customization than the preceding generation.[3] In addition, a new factory with higher-speed, more flexible assembly lines was designed and built to produce each new generation of pager. To sustain this high rate of product and process development, Motorola formed teams of product and factory designers to design each new generation of pager and factory. At the beginning of their project, each new team of designers received a manual of design methods and techniques from the team that had developed the previous generation of pager and factory. The new team would then have three deliverables at the end of their project: (1) an improved and more configurable next-generation pager design, (2) the design of a more efficient and flexible assembly line for the factory that would produce the new pager, and (3) an improved design manual that incorporated the design knowledge provided to the team in the manual it received - plus the new and improved design methods that the team had developed to meet the product and production goals for its project. This manual would then be passed on to the next design team given the task of developing the next generation of pager and its factory. In this way, Motorola sought to make explicit and capture the knowledge developed by its engineers during each project and to systematically leverage that knowledge in launching the work of the next project team.

In addition to its tacit knowledge management practice of moving new employees around to transfer knowledge of its production system, Toyota also follows a highly disciplined explicit knowledge management practice of documenting the tasks that each team of workers and each individual worker is asked to perform on its assembly lines. These documents provide a detailed description of how each task is to be performed, how long each task should take, the sequence of steps to be followed in performing each task, and the steps to be taken by each worker in checking his or her own work (Spear

and Bowen 1999). When improvements are suggested by solving problems on the assembly line as they occur or in the weekly Quality Circle meetings of Toyota's teams of assembly-line workers, those suggestions are evaluated by Toyota's production engineers and then formally incorporated in revised task description documents.

In addition to developing well-defined and documented process descriptions for routine, repetitive production tasks, some organizations have also created explicit knowledge management approaches to support more creative tasks such as developing new products. In the Chrysler unit of DaimlerChrysler Corporation, for example, several 'platform teams' of 300-600 development engineers have responsibility for creating the next-generation platforms[4] on which Chrysler's future automobiles will be based. Each platform team is free to actively explore and evaluate alternative design solutions for the many different technical aspects of their vehicle platform. However, each platform team is also required to place the design solution it has selected for each aspect of their vehicle platform in a 'Book of Knowledge' on Chrysler's intranet. This catalogue of developed design solutions is then made available to all plat-form teams to consult in their development processes, so that good design solutions developed by one platform team can also be located and used by other platform teams.

Other firms have taken this explicit knowledge management approach to managing knowledge in product development processes even further. For example, GE Fanuc Automation, one of the world's leading industrial automation firms, develops design methodologies that are applied in the design of new kinds of components for their factory automation systems. In effect, instead of leaving it up to each engineer in the firm to devise a design solution for each new component needed, GE Fanuc's engineers work together to create detailed design methodologies for each type of component the firm uses. These design methodologies are then encoded in software and computerized so that the design of new component variations can be automated.

Desired performance parameters for each new component variation are entered into the automated design program, and GE Fanuc's computer system automatically generates a design solution for the component. In this way, GE Fanuc tries to make explicit and capture the design knowledge of its engineers and then to systematically re-use that knowledge by automating most new component design tasks.

Advantages and disadvantages of tacit versus explicit knowledge approaches
Like most alternative approaches to managing, each of the two knowledge management approaches we have discussed has advantages and disadvantages.

Advantages and disadvantages of the tacit knowledge approach

One of the main advantages of the tacit knowledge approach is that it is a relatively easy and inexpensive way to begin managing knowledge. The essential first step is relatively simple - identify what each individual in the organization believes is the specific kind of knowledge he or she possesses. Managers Advantages and disadvantages of tacit versus explicit knowledge management approach

Tacit knowledge approach	**Explicit knowledge approach**
Advantages:	**Advantages:**
Relatively easy and inexpensive to begin.	Articulated knowledge (explicit knowledge assets) may be moved instantaneously anytime anywhere by information technologies.
Employees may respond well to recognition of the (claimed) knowledge.	Codified knowledge may be pro-actively disseminated to people who can use specific forms of Knowledge.
Likely to create interest in further knowledge management processes.	Knowledge that has been made explicit can be discussed, debated and improved.
Important knowledge kept in tacit form may be less likely to 'leak' to competitors.	Making knowledge explicit makes it possible to discover knowledge deficiencies in the organization.
Disadvantages:	**Disadvantages:**
Individuals may not have the knowledge they claim to have.	Considerable time and effort may be required to help people articulate their knowledge.
Knowledge profiles of individuals need frequent updating.	Employment relationship with key knowledge workers may have to be redefined to motivate knowledge articulation.
Ability to transfer knowledge constrained to moving people, which is costly and limits the reach and speed of knowledge dissemination within the organization.	Expert committees must be formed to evaluate explicit knowledge assets.
An organization may lose key knowledge if key people leave.	Application of explicit knowledge throughout an organization must be assured by adoption of best practices.
	Handbook on the knowledge economy

can then use this knowledge to assign individuals to key tasks or to compose teams with appropriate sets of knowledge to carry out a project, to improve performance in current processes, or to try to create new knowledge in the organization. As Philips did with its intranet-based 'yellow pages,' managers may also elect to create an open database listing the knowledge claimed by individuals in the organization to facilitate knowledge sharing between individuals.

A tacit knowledge approach may also lead to improvements in employee satisfaction and motivation when an organization 'officially' recognizes and makes visible in the organization the kinds of knowledge that individual workers claim to have. In addition, the tacit knowledge approach is likely to avoid some of the practical and motivational difficulties that may be encountered in trying to secure the cooperation of individuals in making their knowledge explicit (discussed below).

A further advantage often claimed for tacit knowledge management approaches derives from the view that making knowledge explicit increases the risk that knowledge will be 'leaked' from an organization, so that leaving knowledge in tacit form also helps to protect a firm's proprietary knowledge from diffusing to competing organizations. (The potential disadvantages of leaving knowledge in tacit form are summarized below.)

Most seriously, leaving knowledge tacit in the heads of key individuals creates a risk that the organization may lose that knowledge if any of those individuals becomes incapacitated, leaves the organization, or - in the worst case - is recruited by competitors.

Advantages and disadvantages of the explicit knowledge approach

In general, the advantages and disadvantages of the explicit knowledge approach constitute a 'mirror image' of the advantages and disadvantages of the tacit knowledge approach. Whereas the tacit knowledge approach is relatively easy to start and use, but has important limitations in the benefits it can bring, the explicit knowledge approach is much more challenging to start, but offers greater potential benefits in the long term. Let us first consider the long-term advantages of the explicit knowledge management approach, and then the challenges that have to be overcome to start and sustain this approach in an organization.

Perhaps the main advantage of the explicit knowledge approach is that once an individual articulates his or her knowledge in a document, drawing, process description, or other form of explicit knowledge asset, it should be possible through use of information systems to quickly disseminate that knowledge throughout an organization or indeed anywhere in the world. In effect, converting tacit knowledge into explicit knowledge creates an asset that is available 24/7 and is free from the limitations of time and space that constrain the dissemination of tacit knowledge by moving individuals.

Moreover, knowledge that has been made explicit within an organization can often be more carefully codified and more effectively leveraged than tacit knowledge assets. To codify some forms of knowledge is to categorize and order the knowledge so that important interrelationships between different kinds of knowledge within the firm can be identified. For example, forms of knowledge that are related by sharing a similar theoretical or practical knowledge base can be identified, as can forms of (complementary) knowledge that are interrelated by being used together in an organization's processes. Once the various forms of explicit knowledge in an organization are codified in this way, knowledge created in one part of an organization can be proactively leveraged through information systems to people and groups elsewhere in the organization that can benefit from having that knowledge.

Moreover, by disseminating some instance of explicit knowledge to other individuals who have expertise in that knowledge domain, the explicit knowledge can be discussed, debated, tested further and improved, thereby stimulating important 'incremental' forms of organizational learning processes. Such processes also help to identify which individuals in the organization are capable of making significant contributions to the organization's knowledge base, and which are not.
An important further advantage of systematically articulating and codifying an organization's knowledge is that this process makes an organization's current knowledge base more visible and analyzable, and this helps an organization to discover deficiencies in its knowledge assets. In effect, by making an organization's current knowledge base more visible, so that the organization
can begin to see more clearly what knowledge it does have, it should be possible for that organization to begin to see more clearly what knowledge it does not have. Focused, structured, managed learning processes to remedy important knowledge deficiencies can then be launched and may lead to more 'radical' forms of organizational learning.

Once an organization establishes processes for articulating, codifying and leveraging explicit knowledge assets, the systematic dissemination of explicit knowledge within the organization should minimize the risk that it will lose vital knowledge if key individuals become unavailable or leave the organization.

To obtain the potentially significant benefits of an explicit knowledge management approach, however, a number of organizational challenges must be overcome. These challenges arise primarily in assuring adequate articulation, evaluation, application and protection of knowledge assets.

Individuals may not have sufficient skill or motivation to articulate their useful knowledge. Individuals vary greatly in the precision with which they can state their ideas, and some individuals - perhaps many - may need organizational support to adequately articulate their knowledge into useful knowledge assets. Providing organizational support to individuals to articulate their knowledge may have a significant financial cost and inevitably takes time.

An even more fundamental challenge arises when an individual is capable of articulating his or her knowledge, but resists requests by the organization to do so. At the heart of such resistance is usually a belief that an individual's job security or position of influence in an organization depends on the tacit knowledge that he or she has and that the organization needs. Such beliefs result in fear that full revelation of an individual's important knowledge will be followed by dismissal or loss of influence in an organization, because - presumably - the individual will no longer be as necessary or important to the organization. Overcoming such fears is likely to require a profound rethinking of the employment relationship in many organizations, especially with regard to key knowledge workers. New employment norms may have to be defined and institutionalized that both seek and reward ongoing learning by individuals and their continuing contributions of explicit knowledge to the organization.
Organizations must also meet the challenge of adequately evaluating knowledge that has been made explicit by individuals. Individuals with different backgrounds, education and organizational roles may have varying sets of knowledge, with resulting differences in their deeply held ideas about the most effective way to get something done. Such differences will be revealed in the process of making their ideas and knowledge explicit, and managers implementing explicit knowledge approaches must establish

a process for evaluating the individual knowledge that has been made explicit and for resolving conflicting knowledge beliefs of individuals. Organizations with experience in managing this process have found that the people involved in such evaluation processes must be respected within the organization for their expertise, objectivity and impartiality. In most organizations, the time of such people is usually both very valuable and in short supply, and involving such people in evaluating explicit knowledge in many forms may impose a significant cost on the organization (although the resulting benefits may far outweigh the costs).

Since knowledge is useful to an organization only when it is applied, a further challenge in implementing explicit knowledge management approaches is assuring that knowledge articulated in one part of the organization is not rejected or ignored by other parts of the organization simply because they prefer to stay close to their own familiar knowledge base - that is, because of an intra-organizational 'not invented here' syndrome. One approach to managing this concern is the implementation of organizational 'best knowledge' and 'best practice' practices.

In this practice, the committee of experts responsible for a knowledge evaluation process(discussed above) examines both the theoretical knowledge and practical applications of knowledge articulated within the organization, and defines the 'best knowledge' and 'best practice' in applying that knowledge currently available within the organization. The various groups within the organization to whom this knowledge or practice applies are then required either to adopt and use the currently defined 'best knowledge' and 'best practice', or to demonstrate convincingly to the committee of experts that they have developed better knowledge or better practice in applying knowledge. If a group persuades the expert committee that their knowledge or practice is better than the currently defined 'best knowledge' or 'best practice' in the organization, the expert committee then modifies the current 'best knowledge' or 'best practice' for the organization in light of the new knowledge they have received from the group. Implementing such a process for assuring that an organization's best knowledge and practice are actually used requires a high degree of organizational discipline in adhering to the organization's current best knowledge and best practice, and such discipline will normally require building a high degree of organizational trust that the process of the expert committee for deciding best knowledge and best practice is objective, impartial and transparent.

Finally, an organization that creates explicit knowledge assets must take care that those assets remain within the boundaries of the organization and do not 'leak' to other organizations, especially competitors. Security measures of the type most organizations now routinely use to protect their databases must be extended to provide security for the organization's explicit knowledge base.

