KNOWLEDGE MANAGEMENT

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Paper Code:

Title of the Paper: Knowledge Management

Preamble: **L T P C**

1. To familiarize students with basic concepts of information and its communication in society.

2. To learn advanced information processing techniques and develop capability in retrieving information by applying different search techniques.

3. To acquaint students with the activities and services of different information systems and introduce the repackaging and consolidation techniques.

4. To introduce the different methods and techniques of research.

5. To identify and learn the major issues in the development of new technology in the libraries.

6. To develop skills in using computer and communication technology; and

7. To introduce modern management techniques to students to manage Libraries and Information Centres effectively.

Syllabus

Title of the Paper: Knowledge Management

Unit 1 - **Knowledge Economy**

Knowledge Economy — Definition and Meaning - Knowledge Economy — Characteristics - Implications to Business

(14L)

Unit 2**-Knowledge Management**

Knowledge Management – Variously Defined **-** Organizational Learning - Knowledge Innovation - Knowledge Creation - Knowledge Architect

(11L)

Unit 3 -**Knowledge Management-Strategies**

Need for Knowledge Management Strategies - Knowledge Mapping - The Methodology of Mapping - Results of Mapping Phase - Knowledge Transfer - Knowledge Transfer (KT) Methods

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Unit **4 - Knowledge Management System**

Distributed Knowledge Management Systems (DKMS) For Internet Age - Definition and Characteristics - Use Cases

(13L)

Unit 5- **Data Mining**

Data Mining and Text Mining - Text Analysis and Mining Techniques - Data Mining Tools and Techniques - Issues of Data Mining

(10L)

Total - 60L

Unit 1
KNOWLEDGE ECONOMY

1.1 INTRODUCTION

Many countries contributing to the foremost part of the world economy have started to recognise that knowledge is an important factor for determining the standard of living. About two hundred years ago, economics recognised only two factors of production — *labour* and *capital,* ignoring knowledge, productivity, education and intellectual capital. However, today's most of the technologically advanced economies are knowledge-based.

Further, economists like Paul Romer, Joseph Schumpeter, Robert Solov and others recognized that knowledge has an important factor for a country's long-term economic growth. They observed that technology development is the main factor for the change to neo-classical economics. They also identified that technology is knowledge-based and is the intrinsic part of the economic system. Thus, with all these significant transformation in the world's economic system, Knowledge has occupied the third-most prime factor of production.

According to Romer's economic theory of knowledge is the basic form of capital and accumulation of knowledge only drives a country's economic growth. He also strongly believes and supports the idea that new technological developments create technical platforms for further innovations and these technical platforms are the key drivers of economic growth.

According to Romer, technology is capable of raising return on investment. With this return, reinvestment from the returns obtained towards further effecting new technology shall result in more returns. Therefore, this virtuous cycle of investment making technology more valuable and technology affecting more returns improves the country's economic growth rate. This is the main reason for developed countries

to sustain growth, while developing economies are not able to attain growth despite employing ample labour and capital.

GDP measurer is an important indicator for assessing any country's economic growth. Romer observed that human capital is very critical for GDP for a country's economic growth. However, to have a sustained economic growth, it requires consistent investments in technology. For this purpose, a country must have an adequate human capital. Human capital is the formal education, training and on-the-job-leaning that calls for knowledge. Thus, today's global economy transforming to an "information society" is 'knowledge economy'. Therefore, knowledge economy is concerned with highlighting the role of knowledge or intellectual capital in business. Further, business started to measure intangible assets in addition to measuring their physical assets. Intangible assets include *knowledge* and *patents* because many accounting bodies and international agencies understood that knowledge is a crucial factor.

1.2 ECONOMY SHIFT

The present-times' business environment is clearly able to experience the economy shift — from *industrial economy* to *knowledge economy.* Industry economy's focus is on producing commercial products. Knowledge economy concentrates on service and expertise. This shift from industry economy to knowledge economy however, has increased the complexity of work activities. The work activities in knowledge economy include the value-recognition of diversity of expertise and knowledge relating to different work-sources for accomplishing common goals, understanding the concern for building strong interpersonal relationships with others and collaborating with work colleagues, customers and other stakeholders in other organizations through online net-work, emails and face-to-face meetings.

1.3 KNOWLEDGE ECONOMY — DEFINITION AND MEANING

A knowledge economy is one that creates, disseminates, and uses knowledge to enhance its growth and development — World Bank Institute's definition. A

knowledge economy generally denotes high- technology industries or information and communication technologies. Knowledge economy uses data as its raw material and converts it into knowledge and expertise using technology, analysis tools and human intelligence.

A knowledge-based economy is the one where knowledge is the main source of wealth, growth and employment, with a strong reliance on information technology — Housel and Bell.

Knowledge driven economy, generates and exploits knowledge. This knowledge plays a vital role in wealth creation. Industry economy used machines and replaced human labour while knowledge economy uses high technology and financial services to create wealth.

Thus, knowledge economy refers to the service sector aspects of the economy and the linkages of the operations in the service sector is associated with hardware part - such as chips, integrated circuits and technology used in biosciences. Information technology (IT) industry also occupies a space within the content of knowledge economy. However, knowledge economy has no proper definition and its boundaries have no clear-cut demarcations.

Therefore, from the above discussion it is clear that knowledge economy is more concerned with service industries than manufacturing or agriculture. Knowledge economy focuses on innovation, research, education, information and communication technologies. Further, knowledge economy attempts to shift its concentration from products to services.

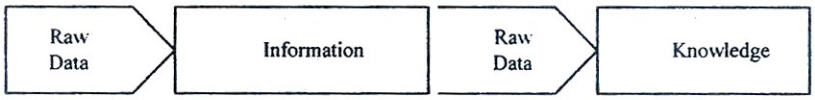

Figure - Knowledge Creation Process

1.4 EFFECT OF KNOWLEDGE IN KNOWLEDGE ECONOMY

Knowledge has the following impact on knowledge economy:

- ✓ Knowledge in knowledge economy proves to be non-rivalries because knowledge attempts to be a public good. Further, when discovered knowledge made available to public, there is a possibility of sharing the same by more users at zero marginal cost. At the same time the knowledge creators finds it difficult to prevent others from using it however, intellectual property protection measures such as trade secrets protection, patents, copyrights and trademarks help them to an extent.
- ✓ Knowledge economy experiences *tacit knowledge* largely than *explicit knowledge.* Tacit knowledge is a knowledge obtained from experience while' explicit knowledge obtained through formal education and proper training.

1.5 KNOWLEDGE ECONOMY — CHARACTERISTICS

Knowledge economy has several characteristic features to distinguish itself from traditional economy and they are as follows:

- ✓ Knowledge economy considers the world as global village for using virtual teams and appropriate technology virtual organisations. This results in performance of faster business operations.
- ✓ It is difficult to apply legal controls, tax regulations and other national barriers because in knowledge economy the businesses are global in nature.
- ✓ In knowledge economy, the leak of knowledge and information is highly unavoidable.
- ✓ In knowledge economy, the products produced and developed using knowledge entity fixed at premium price than the products produced and developed in traditional economy.
- ✓ In knowledge economy, the value and price of the products highly depends on contexts and situations because the same knowledge has different values to different people at different times.
- ✓ Knowledge economy often encourages downsizing and it is considered

positive because of its 'cost cutting' measure.

- ✓ In knowledge economy, human capital is a key component. Few organisations have started to report human competency levels in their annual reports.

1.6 FACTORS AFFECTING KNOWLEDGE ECONOMY

The following factors affect knowledge economy largely and often referred to as *key drivers of knowledge economy.*

- ✓ Intellectual capital
- ✓ Information and communication technology
- ✓ New economics of information
- ✓ Globalisation

In knowledge economy, intellectual capital is an important factor because intellectual capital is an organisation's source of competitive advantage. Organisations must learn to recognise changes in intellectual capital and only then, organisations shall be able to pose themselves to be knowledge driven. Intellectual capital of an organisation refers to the employees' knowledge, brainpower, technical knows how, processes and their ability to improve them continuously.

Information and communication technology exhibits work force's creative and potential knowledge. They are the best regarded as knowledge-creation facilitators in the innovative societies. Further, information and communication technology are the tools for generating creativity and knowledge embodied in work force. Wealth generation is more using information and communication technology that effects the growth of overall economy compared to manufacturing sector's effect on wealth generation.

Gorden Moore first formulated *Moore's Law* in the early 1970s to establish the cycle of technology development indicating the transition from *industrial age* to *information age. Moore's law* show that maximum processing power of a microchip at a given price doubles. In other words, computers become faster, but the price of a

given, level of computing power halves. *Metcalfe's Law* shows that the value of a network is proportional to the square of the number of nodes indicating that as a network grows, the value of connectivity grows exponentially, while the cost per user remains the same or even reduces. All these laws clearly prove the high pace of the rate of technological change to explain the economics of information.

With the advent of information and communication technologies, the present-day organisations are able to find out the prices of any product or service offered by all vendors around the world. This facilitates perfect competition and open up global markets. It also facilitates organisations to deliver their products over' a phone line anywhere in the world. Thus, globalisation coupled with information and communication technology is a significant factor of knowledge economy because knowledge spreads more quickly and therefore products with a high knowledge-component generate high returns. However, an organisation must be capable in innovating quickly than their competitors.

1.7 KNOWLEDGE ECONOMY IMPLICATIONS

Knowledge economy has several implications to:

- ✓ Local and national government policy makers
- ✓ International agencies and institutions concerned with growth and development of business concerned with knowledge creation.

1.7.1 Implications to Policy Makers

- ✓ Entrepreneurs under knowledge economy to encourage knowledge-based industries with incentives and rewards
- ✓ Economic development policy must focus on infrastructure towards sustaining 'knowledge enhancement'
- ✓ Development of policy must include efficient regulatory measures and taxation system for information and knowledge trading at international level.
- ✓ To frame economic policies in such a way to facilitate collaboration stimulating market development.

- ✓ Framing strict policy measures, for preventing information and knowledge frauds and thefts
- ✓ A wide range of policy to support knowledge-based industries for removing regional imbalances
- ✓ Policy-frame to recognise and support local talents in order to make them get into knowledge-based industries and prevent brain-drain
- ✓ Policy to promote research and development activities and policy to support for promoting education and training towards taking the challenges of knowledge economy.

1.7.2 Implications to Business

- ✓ Creating awareness about the significance of knowledge to the business organisations to the bottom line
- ✓ Designing and developing new schemes to enhance corporate performance measures based on knowledge
- ✓ Establishing new organisational structure for systematically improving learning process and knowledge to suit the changing global environment
- ✓ Installing a technological infrastructure to enhance knowledge creation and sharing such as installing an intranet for knowledge sharing throughout the company on a global basis.
- ✓ Facilitating organisations to create knowledge management programs and appointing Chief Knowledge Officers (CKO).
- ✓ Encourage organisation-wide knowledge dissemination through effective internet and intranet infrastructure.
- ✓ Recognising human contributions to knowledge.

1.8 KNOWLEDGE ECONOMY IN INDIA

Many visionary experts visualised through their farsightedness that India will become a leader in the global knowledge economy.

They supported their reports with the following reasons:

- ✓ India has a good strength of English-speaking professionals with engineering, mathematics and science degrees who are also capable and flexible of learning new skills in a short span of time when provided with an opportunity and an appropriate reward structure
- ✓ Indians, living in various parts of the world, especially in the United States and United Kingdom have achieved *thought leadership* in knowledge intensive fields. They possess a rich source of expertise and be sought to transfer knowledge and expertise to India and establish a new generation of India-based thought leaders.
- ✓ India has an energetic and capable entrepreneurial business community who are ready to take and face this challenge of producing thought-leaders. They also have the capacity to work closely with the government to remote barriers that prevent them from achieving this vision.
- ✓ Indians always are opening minded to learn the required analytical and interpersonal skills for achieving thought leadership in knowledge economy. A good number of the engineers and scientists from Indian reputed institutes like IITs and IIMs have devised their own schemes of becoming *world-class* knowledge workers and *thought leaders.*

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Unit 2

KNOWLEDGE MANAGEMENT

Knowledge Management – Variously Defined - Organizational Learning - Knowledge Innovation - Knowledge Creation - Knowledge Architect

(11L)

2.1 KNOWLEDGE MANAGEMENT (KM)

Knowledge Management (KM) is the activity of managing organisational knowledge.

Knowledge Management (KM) is an interdisciplinary approach for improving organisational outputs, outcomes and organisational learning through the maximisation of the use of knowledge by all concerned in the organisation. KM includes the design, implementation and review of all activities and processes in the organisation; to improve the processes of creation, sharing and application of knowledge in the organisation.

2.2 KM has been variously defined

- ✓ KM refers to policies, procedures and technologies employed for operating a continuously updated linked pair of networked databases.
- ✓ KM refers to the processes of capturing, distributing and effectively using knowledge.
- ✓ KM is the capability of a company to create new knowledge, disseminate it throughout the organisation and embody it in products, services and systems.
- ✓ KM is a systematic approach to find, understand and use knowledge to create value.
- ✓ KM caters to the critical issues of organisational adoption, survival and competence in the face of increasingly discontinuous environmental change. Essentially, it embodies organisational

processes that seek synergistic combination of the data and information processing capacity of information technologies and the creative and innovative capacity of human beings and

- ✓ KM is the process of increasing the efficiency of knowledge markets by generating, codifying, coordinating and transferring knowledge.

In general, "organisation" refers to any group, team, business unit, department, centre, community, government, charitable body, club or any other profit or nonprofit making unit which has more than one human entity in order to achieve collectively more complex tasks and knowledge based activities.

2.3 KNOWLEDGE MANAGEMENT (KM) - SCHOOLS OF THOUGHT-A SUMMARY VIEW

KM began to take shape as a distinctly new discipline during the 80's. Swedish practitioners like Karl-Erik Sveiby (and later Leif Edvinson) took note of the inadequacy of traditional measures of corporate assets. The importance of intellectual capital and the intellectual assets was recognised as also its need to be quantified.

1. Intellectual Capital: Intellectual Capital (and also Customer Capital) was recognised as an invisible asset of an Organisation. The central idea is that intellectual capital becomes the seed for commercial value. Human creativity produces innovation which can be commercialised to create commercial value. Pioneers of this approach, such as Patrick Sullivan, Gordan Petrash joined Edvinson and others to form the Intellectual Capital Movement or ICM gathering, with the declared objective of understanding how to manage invisible knowledge assets for creating value.

2. Organisational Learning: Again in the mid: 80's, another group in Boston had its orientation from systems dynamics: Peter Serge of MIT, Arie de Gems of Royal Dutch Shell and Chris of Harvard - formalised itself as Centre for Organisational Learning which in 1995 became Society for

Organisational Learning. These individuals concerned themselves on issues of organisational behaviour in learning - how the discipline of an organisation depends upon the way people think and relate to themselves and also how surfacing assumptions and mental models unravel the defences that block learning in an Organisation. David Garvin of Harvard Business School held up a more practical approach to organisational learning to be linked to business results.

3. Knowledge Transfer: Effective -Knowledge Transfer within an organisation is critical for KM in the organisation. As discussed elsewhere, the Knowledge Cycle comprises of sourcing/capturing/ organising/storing/ retrieving / sharing / transferring and finally using/reusing knowledge. This includes benchmarking, transfer of best practices and codification of work templates and optimum use of Intranets. IT groups and engineers are oriented towards this approach and the goal is alignment of KM with business goal and results. Important centres of such activity include Carla O' Dell of American Productivity and Quality Center, Robert Buchanas of Buchanan Laboratories, Nancy Diner of George Washington University and IBM's Lawrence Purask.

4. Knowledge Innovation: There is yet another approach which believes that creating knowledge and providing the environment or means to encourage innovation in a group is more important than managing explicit or codified knowledge. In this School of KM, it is perceived that the first step in innovation is basically tacit and human processes that require different perspectives and methods.

2.4 INTELLECTUAL CAPITAL

Knowledge-based assets or intellectual capital is now being identified as a key asset of an organisation.

"The limitless resources that can spring out of the infinite human ability to

create new knowledge" is the basis for the Intellectual Capital. In contrast with other physical assets which deplete upon sharing, the intellectual capital assets grow and get enhanced when shared.

The intangible or invisible assets of a company or organisation are many times more worthy than the physical or visible assets.

Since Sreiby wrote his seminal book "The Know- How Company" in 1986, many of his colleagues had formed a group called "Intellectual Capital Movement Group".

They held that the intangible intellectual or knowledge assets should be recognised, measured and managed to create value. Prominent individuals in this movement are: Leif Edvinson, Professor of Intellectual Capital, University of Lund, Sweden. He pioneered the measurement of intellectual capital and created the world's first corporate Intellectual Capital (IC) annual report.

David Teece, Professor of International Business and Finance, University of California, Berkeley wrote the book "Managing Intellectual Capital" in 2000. Earlier, he studied commercialisation and technology innovation.

Hubert St. Onge, CEO of Kosiverge Digital Solutions, first introduced the concept of "customer capital" or "stake holder capital" or "external capital" as a component of (three) intellectual capital components.

Patrick Sullivan, a founder of ICM group focussed on how to create value from intellectual assets. He wrote "Value division intellectual capital for: How to convert intangible corporate assets into Market value" (John Wiley, 2000).

Baruch Lev, Professor of Accounting and Finance at New York University Stern School of Business. He directs the Project for Research on Intangibles".

Thomas Stewart, on Board of Editors of Fortune Magazine" wrote popular book "Intellectual Capital: The New Wealth of Organisation" (Doubleday 1997).

2.5 ORGANISATIONAL LEARNING

Organisational learning and knowledge management are interrelated. They overlap in the difficult but challenging human dimensions affecting how knowledge is acquired in a group context.

Peter Senge's (of MIT) famous book "The Fifth Discipline: the Act and Practice of Learning

Organisations (1990) highlight the following:

- ✓ Organisations work the *way* they work depending on the way the people concerned think and how they interact.
- ✓ Behaviour of organisations can be understood better by using "Systems thinking" (System dynamics).

Learning in a group context required members to make explicit their unexpressed thoughts, mental models and ladders of inference.

If we cannot express our assumptions explicitly in ways that others can understand and build upon, there can be no longer a process of testing these assumptions and building public (group) knowledge - this is team dynamics.

Other important works in this school are "The Reflective Practitioner" by Jessey Bass 1987 "Overcaring Organisational Defences" by Chris Argyns. They collaborated to develop "action science" which looks at the difference between expressed values and values that actually underlie action ("Organisational Learning: a theory of Action Perspectives" Addison Wesley 1978). The central idea of this theory is the importance of unconscious "mental models" that affect how people behave and make decisions. William Isacs of MIT proposed a theory of how teams effectively inquire and decide together.

Garvin of Harvard focussed on systematising procedure applied over the

stages (acquiring, interpreting and applying) and types of learning (seeing/observation or intelligence gathering, practice of experience and experimentation). Garvin complemented Senge and created a bridge between organisational learning and mainstream knowledge management.

Later “learning in action” concept in workplace was brought in. In this, we can consider procedures that transform every action in the workplace into learning process.

2.6 KNOWLEDGE INNOVATION

This school of KM emphasises on Knowledge Innovation in an organisation. They emphasise that this should attract the attention of decision-makers in all levels: corporate, organisational, social and political at national and international levels. Innovation in knowledge is essential as innovation leads to better productivity in any given environment and it also results in new product development. Innovation often spawns new enterprises and new market niches.

Innovation leads to new knowledge. Creating new knowledge is more essential than managing existing knowledge.

Better managing the existing knowledge results in productivity gains but such gains are only incremental in nature. Quantum leaps of knowledge happen with descriptive knowledge creation which may be the sum- total of many knowledge innovations or even a one large knowledge innovation.

If we examine various innovations surrounding us in our daily life, each one of them started humbly with a simple invention and then got upgraded gradually with incremental knowledge innovations. Knowledge creation always began as a tacit process, individualistic in nature. Such knowledge may or may not be a subject of Knowledge Management. It may be too individualistic, too tacit and private to be managed by any KM team outside. It is individualistic knowledge innovation development.

Japanese have a large record and experience in managing tacit knowledge. They have largest experiences in the subtle act of "managing" the tacit stages of knowledge innovation process. Companies like Sony, Matsushita, Toshiba and Honda can be found in Books written by Ikujino Nonaka.

The works are by Nonaka, et al titled "The Knowledge Creating Company: How – Japanese

Companies create the Dynamics of Innovation", 1995 and also "Enabling Knowledge Creation: How to unlock the mystery of tacit knowledge and release power of innovation" (both by Oxford Universities Press, 1995 and 2000). They emphasise on traditional knowledge creation practices in Japan which innovate various practices.

Debra Amidon, American innovator-entrepreneur advocates the limitless potential of ICT networks to create, synergise and apply knowledge across all roots of global boundaries. She had set up Entovation (Enterprising Innovation) International — a nested network of KM practitioners in 90 countries — to demonstrate how a global "innovation superhighway" can tap the potential. According to Amidon, Entovation illustrates "not a value chain of activities but as a system dynamic, in which intellectual capital, reputation, learning and client success continuously feel (each other), progress in building access, credibility and competency. Everyone, individuals, enterprises and nations learn from the innovations of the other. Collaboration among parties is essential and collective wisdom is the only way to create new standards, rather than simply follow best practices".

Other distinguishing features of the school are:

- Attention to "ecology": appropriate organisational culture or working environment that facilitate and encourage innovation, improvement and improvisation.
- Importance given to "sensing" capabilities for correctly seeing and interpreting internal and external events and for arriving at fresh insights that may alter business strategy.

- Commitment to “learning”, nurturing competencies, processes and cultures for continuous exploration, discovery and experimentation throughout the organisation.
- People oriented management attitude and competencies for motivating people to act at their very best.

2.7 MOTIVATION FOR KNOWLEDGE MANAGEMENT

Today all organisations are very challenged in terms of the variety of problems - delivery, efficiency and effectiveness. Knowledge Management has a solution for many of the problems. While all problems cannot be solved by Knowledge Management, the solutions to such problems do have knowledge component in them.

The following are some of the challenges being faced by modern organisations:

- ✓ Structural reform or change in the organisation calling for the change management to adopt operationally and to innovate.
- ✓ A well networked organisation, but hindered by low levels of knowledge sharing.
- ✓ A domestic organisation aiming to diversify for international operations but facing competition.
- ✓ A new organisation with knowledgeable staff who lack trust or cohesive networking amongst them.
- ✓ A veteran and mature organisation facing ageing problem, trying to cope up with organisational memory loss and knowledge loss or obsolescence.
- ✓ A well networked organisation with a strong culture of knowledge sharing and team members looking to raise their performance to higher levels.

For all this above scenarios, Knowledge Management can be of great help.

Organisations which foster efficient knowledge networks and connections, explore processes and deploy people-centric technology are leveraged to manage the

complexity and the ambiguity that permeates the knowledge ecosystem-the pathways and connections between people, processes, technology and content which result in a rich web of relationships and interaction.

2.8 THE KNOWLEDGE LENS

The knowledge lens is a holistic way of viewing an organisation by considering all the components of the knowledge ecosystem and the knowledge needed to achieve strategic intent. By using the knowledge lens on these components, it is possible to view them from different perspectives so as to identify the actual and potential links and relationships which were not evident.

2.9 ORGANISATION AS A KNOWLEDGE ECOSYSTEM

In the current knowledge era, an organisation can be considered as an ecosystem that consists of a complex set of interactions amongst people, processes, technology and content - various entities in the ecosystem.

In such knowledge ecosystem, there is a path from information to knowledge to value b}' making use of individuals or groups. The knowledge-enabled organisation considers people and their knowledge as the primary assets (unlike the conventional model in Industrial Management where people behave as commodities in a command and control environment).

The knowledge ecosystem of an organisation can be viewed through the knowledge lens as follows:

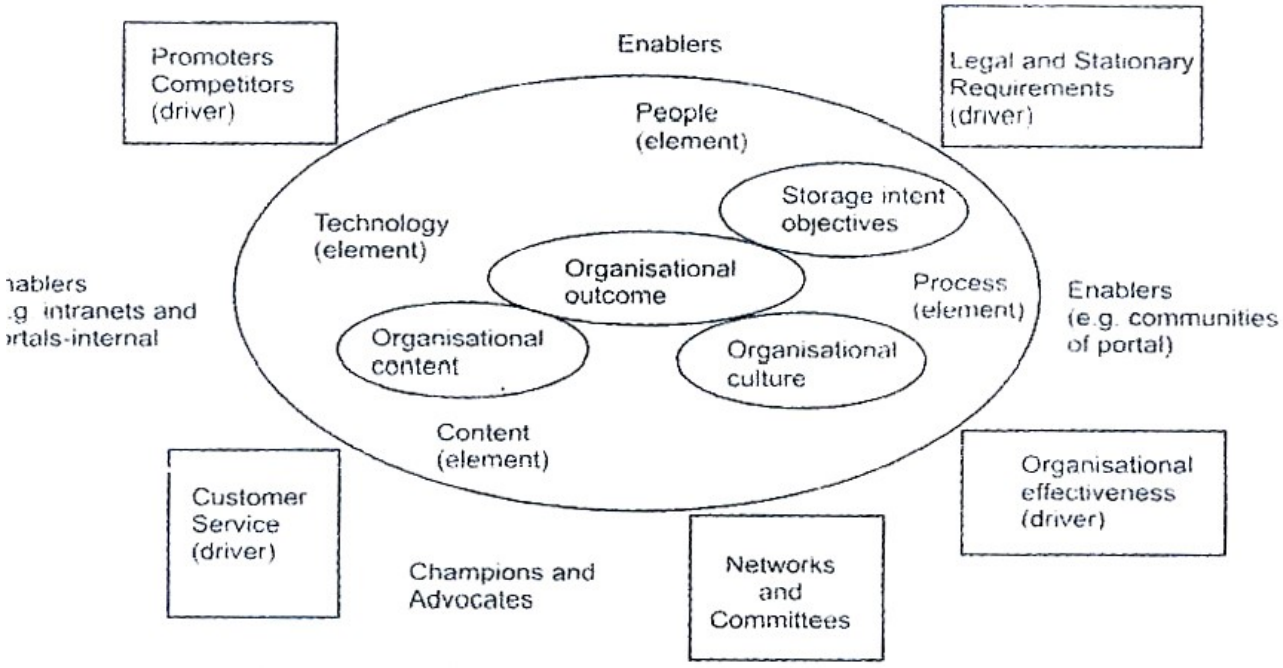


Figure: 2.1 **THE KNOWLEDGE ECOSYSTEM**

The main core of the knowledge eco-system (as above) is the organisational outcome. This flows from the contextual environment (organisational culture and strategic intent) and the manner in which the organisation operates, given its business environment.

2.9.1 Aim of Knowledge Management in the Knowledge Ecosystem of the Organisation

The major aim of Knowledge Management in an organisation is to stimulate and enhance the collective organisational skills and competencies within the organisation. To begin with, a deep understanding has* to be gained on why knowledge management should be implemented and where in the organisation it should start. For example, it is not correct to start with Intranets and internal portals, simply as technological tools without the corresponding content being prepared internally. Similarly, the effectiveness of the linkages people have with such tools (as

Intranets and internal portals) has to be ensured before actually developing and operating any such tools.

As in the above diagram (Fig. 1.1), the specific components of knowledge ecosystem are:

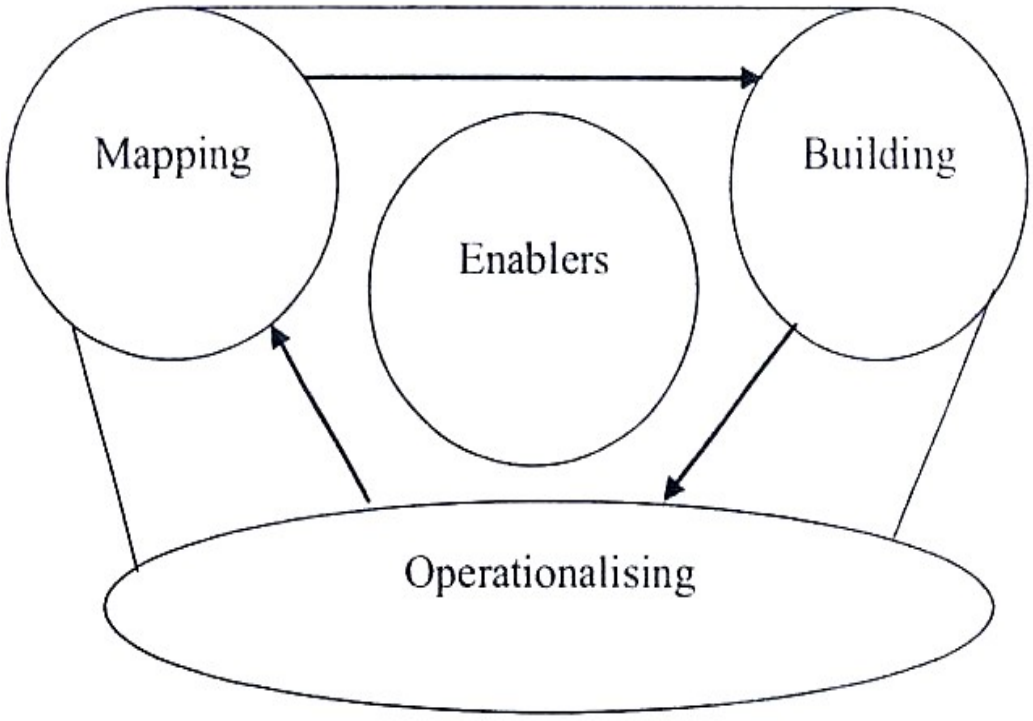
- ✓ Organisational outcomes are the business objectives which aim at creating an innovative and adaptive organisation.
- ✓ Organisational culture is the culture practiced in the organisation, both explicitly and implicitly. This depends on the management direction, philosophy and policy along with values and principles of the organisation. This is displayed in the collective behaviour and values, which are required to be understood in totality before any KM initiative is taken up.
- ✓ Context and strategic intent — every organisation has a specific context and a strategic intent — this shapes the knowledge initiative interventions and knowledge management. Knowledge intensive organisations have critical knowledge management requirements. Any knowledge intervention such as (Knowledge Management initiative) should be guided and moulded by this context and align with the strategic intent. Finally, when successfully effective, every knowledge management initiative has the ability to drive the strategic intent and alter the organisational context accordingly.
- ✓ Drivers are driving forces.
- ✓ Elements — the four elements are — People, Process, Technology and Content - they are present in all organisations. Appropriate balance has to be maintained across all the four — disproportionate emphasis on one or two can lead to imbalance in the organisation.
- ✓ Enablers are specific activities, tools or techniques that populate the ecosystem. The combination of enablers which will have effective impact depends on the structures in the organisation — the organisational capability, culture, content and strategic intent.
- ✓ Networks and communities are social configurations. They may be voluntary, self- organising and may adapt common tools, symbols, signs, artifacts, stories and histories, as they evolve and reach maturity. Knowledge flows between people involved in such network and communities and it surfaces in

conversations, discussions and interactions.

- ✓ Champions and advocates are people who actively promote knowledge-based activities, knowledge adoption and its use. These people provide the guidance, feedback, visibility, legitimacy and also resources for knowledge based activities to flourish and deliver results in the organisation.

2.10 IMPLEMENTING KNOWLEDGE MANAGEMENT INTERVENTIONS - THE MAP / BUILD / OPERATIONALISE CYCLE

Till now, we have seen the organisation through a knowledge lens and have also explored the knowledge ecosystem. How to implement the Knowledge Management interventions within the ecosystem?



The Cycle of Mapping, Building and Operationalising

Figure 2.2 : **THE CYCLE OF MAPPING, BUILDING AND OPERATIONALISING**

Each stage can be visited and revisited, according to the needs from time to time - the Enablers play a critical role to support these phases. Let us analyse each of these phases:

Mapping: The Mapping phase focuses on setting the background and the context for knowledge management.

It calls for the investigation and analysis of the knowledge ecosystem.

Building: In the building phase, adequate motivation is required to be given to the actors in the organisation to experiment with the new ideas in KM and pilot knowledge interventions. In this phase, the focus is on building experience and linkages between people, processes, technology and content.

Operationalising: In this phase, the focus shifts from experimenting and building to implementing and operationalising. It may involve, for example, rolling out selected pilots for large scale implementation.

The Enablers are at the centre and are used in all phases, i.e., Map/Build/Operationalise cycles. While these may be varying activities, there are certain common characteristics of the Map/Build/Operate cycleas:

- ✓ The state of readiness in knowledge ecosystem of the organisation.
- ✓ The scalability of each phase of the cycle.
- ✓ The ability to build a long-term, sustainable organisational capacity to respond to knowledge ecosystem.
- ✓ The continuous nature of the phase.

To conclude, in this chapter we have defined Knowledge Management (KM) in an organisation. We have analysed and understood what is knowledge lens and its role in knowledge ecosystem of the organisation. The role of enablers to populate and activate knowledge ecosystem has been identified. The Map/Build/Operate cycle is presented as a framework to implement knowledge interventions in an organisation.

2.11 KNOWLEDGE CREATION

Knowledge creation here refers to organisational knowledge- creation. In business, knowledge is an important entity. In organisations the capacity and ability to distribute and duplicate knowledge across a group of people is very vital to add value to it. Knowledge is an ongoing process that people develop through their work performance. Knowledge resides as personalised knowledge within an individual that be stored, retrieved as artifacts or accessible through others. It is also possible to reshape knowledge with information or with new events.

Artefacts in this context refer to facts, concepts, processes, procedures and principles. These facts, concepts, processes, procedures and principles help in knowledge creation. Artefacts are valuable mechanisms in knowledge management literature because they help to share the outcomes of knowledge creation.

Organizations increasingly regard knowledge creation and innovation as core business, as more people spend most of their work and time creating and innovating. Knowledge creation is thus a key component in developing organizational knowledge. Organisational knowledge relies on collective and individual contributions and evolves from original knowledge sources. In projects, meetings and think tanks, individual knowledge becomes a part of collective activity that seeks to build a bank of knowledge for use by the organization. There are five stages of organizational knowledge development:

- ✓ Knowledge sourcing
- ✓ Knowledge abstraction
- ✓ Knowledge conversion
- ✓ Knowledge diffusion, and
- ✓ Knowledge development and refinement

The process of knowledge development is dynamic and responsive, drawing cues and feedback from a range of sources throughout the stages. This feedback may influence subsequent knowledge construction with the cues and information considered and evaluated.

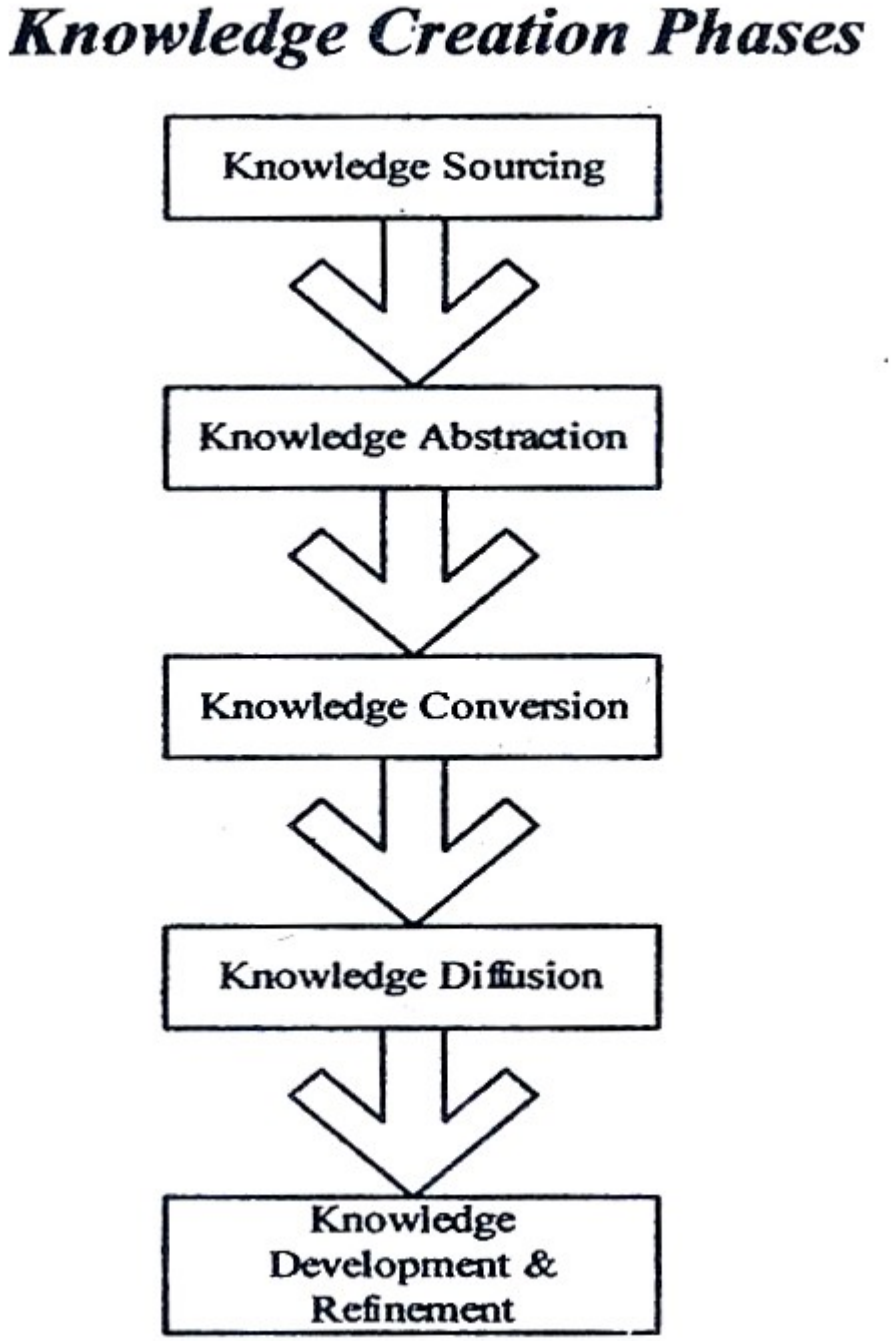


Figure 2.3: **Knowledge Creation phases**

2.11.1 Knowledge Sourcing

Knowledge gap identification is the starting point for stimulating knowledge creation. Knowledge gap is the gap between 'what is known' and 'what need to be known'. Therefore, in order to identify the *knowledge-gap* the organisations commonly review the guidance source held by individuals and other organisational

sources. This process of gathering and collecting various informed knowledge sources is *knowledge sourcing.* The various sources of knowledge include specialised knowledge, knowledge held by individuals out of experience within the organisation, knowledge from expert guidance (from consultants, knowledge from organisation's recorded source or from the firm's intranet. Kinaesthetic learning is a significant source of knowledge particularly when the situation (problem under investigation) has significant resource implications. Kinaesthetic learning means learning from an individual's previous experience.

Knowledge sourcing is the first stage and in fact, the significant stage in knowledge creation process. The calibre with respect to the availability, accessibility and richness of the knowledge source serves as a key factor for knowledge creation because they greatly influence the outcomes. For example, if an organization wants to introduce a new customer promotional scheme, it might seek the appropriate sources of guidance from customer feedback, marketing expert's opinion, data relating to the past promotional schemes' success and failures, suitable secondary data available and competitors' opinion about similar types of schemes.

Thus, knowledge sourcing is crucial for any organisation to establish its strategic competence. The following are some of the significant sources of knowledge used in knowledge sourcing:

- ✓ *Customer knowledge*
- ✓ *Knowledge in process*
- ✓ *Knowledge in people*
- ✓ *Organizational memory*

a) Customer knowledge

Customer knowledge is the most crucial source of knowledge that helps in knowledge sourcing. This fact, eventhough realised by business houses, they fail to create feedback systems to get valuable sources of knowledge about their customers. They also do not integrate the various sources of their customer knowledge that they already possess.

b) Knowledge in Process

An organisation generally identifies an activity and evolves it into a process, in course of time this process is automated and hence knowledge is embedded in a procedure or computer program. This action involves gathering and processing of information and then communicated to other people. This is a vital meta-knowledge. This meta-knowledge helps an organization to be more effective.

c) Knowledge in People

Ninety percent of the organisational knowledge remains with its people who are its valuable resource. In sharing its people's knowledge, it becomes even more valuable to the organization as a whole. Therefore, Knowledge Management facilitates knowledge sharing through knowledge accumulation.

d) Organizational Memory

Many organizations do not know what they already know. This is because it fails to record the knowledge gained for using it at another time or place. Effective knowledge programs will therefore put significant emphasis on capturing knowledge from every day work and from assignments. Decision diaries, reflection time at meetings and After Action Reviews (ARR) are commonly adapted tools for this purpose. An ARR, for example, is a technique first developed in the US Army to capture lessons from battlefield engagements. Similarly, an organization also conducts formal post-assignment reviews to derive lessons and put the knowledge gained into an accessible form for future assignments. Another useful technique is that of 'knowledge refining' with which a series of memos, e-mails or meeting minutes are collected for their relevant and reusable content, which is put into an evolving and structured knowledge base.

e) Knowledge Relationships

This is concerned with depth of personal knowledge arising out of relationship of two people who worked together for a long time and no one another's approach. When firms reorganize, this knowledge is lost. With the growing need for collaboration with external partners and agencies, organizations need to do more to capture this knowledge and provide forums where these relationships can be strengthened.

2.11.2 Knowledge Abstraction

Knowledge abstraction is a process involving the analysis of various sources of knowledge to generate general principles and concepts. These principles and concepts guide in the construction of new knowledge. Knowledge abstraction helps to frame the insights gained from knowledge sourcing and to extrapolate new knowledge from the basic guidelines and issues that have emerged.

2.11.3 Knowledge Conversion

From abstract foundations, knowledge converts into various forms of useful applications that can be tested and shared with others. Knowledge conversion describes the phase during which the various ideas and principles are refined into specific outcomes. It is quite possible to codify or embody knowledge. Knowledge codification facilitates recording and accessing whenever required. Codified knowledge also develops into artefacts, such as models, equations and guidelines. Embodied knowledge is the tacit knowledge of individuals and shared through stories, metaphors or personal advice as required. Embodied knowledge is more difficult to access without ongoing engagement with the knowledge creators. Example of codified knowledge relating to customer marketing scheme might be in the form of a marketing plan and implementation guidelines. Embodied knowledge is the knowledge drawn from such guidelines and insights. Many organizations typically rely on both the forms of knowledge conversion when creating new knowledge.

2.11.4 Knowledge Diffusion

When once knowledge codified and embodied, spread through communication media. This is knowledge diffusion. In organizational settings, diffusion occurs through communication media such as newsletters, the Intranet, meetings, seminars etc., modeling of new practices, and demonstrations or coaching in specialized procedures. The success of knowledge diffusion depends on the level of previous knowledge held by the audience and the effectiveness of the channels available to share the knowledge. Diffusion occurs best when the recipients can understand and integrate the insights into their own mental constructs. Embodied knowledge, which draws on significant expertise, learning and experience, may be harder to transfer to others. The main goal is to share the knowledge with those who will most benefit.

2.11.5 Knowledge Development and Refinement

Regularly reshaping knowledge and further testing through additional experience and feedback, leads to the implanting of knowledge development and refinement. This is one of the key features of knowledge management, ensuring the knowledge remains current and useful. However, this also place more challenges on organisations that seek to capture and hold knowledge for use by others; such organisations need to ensure that the created knowledge is constantly reviewed and updated to reflect new understanding.

2.12 KNOWLEDGE ARCHITECT

A Knowledge Architect is a SME with additional responsibilities including the structural of organizational knowledge bases and maintaining the even flow of the current development process. This position also liaises with the product and development managers to help determine the direction of the product.

Their primary' duties constitute:

- ✓ Ensure the proper coverage of a domain area by, for example, locating and including FAQ and common problems
- ✓ Maintain an even flow of symptoms to be further analyzed through research, including analyzing and processing licensed content
- ✓ Ensure a logical and user-friendly structure for knowledgebase to allow easy-to find solutions
- ✓ Ensure the quality of the structure by performing structural level quality assurance tasks
- ✓ Maintain broad knowledge of all the related domain areas.
- ✓ Assist in product planning by working with product and development managers, as well as customers and in-house SME.

The secondary duties:

- ✓ Maintain an in-depth understanding of the various knowledge-base platforms.
- ✓ Assist in packaging and releasing each edition of the content product, including requesting and attaching module icons, helping with release notes, etc.

The following are skills required:

- ✓ Broad knowledge of all domains areas for the designated product, if applicable, and in-depth knowledge of designated domain areas
- ✓ Ability to plan multiple projects
- ✓ Ability to analyze and translate user requirements
- ✓ In-depth knowledge of the platforms with which the content product is integrated

Job Levels

- ➢ Level 1: 1-3 years of experience using the above skills; Expert in a minimum of 2 domain areas
- ➢ Level 2: 3-5 years of experience; 3-5 domain areas
- ➢ Level 3: more than 5 years of experience; More than 5 domain areas

QUESTION

1. Define knowledge
2. Define knowledge management from an information system perspective

KEYWORDS

Abstract Knowledge: The form of knowledge that is characterised into essential features of meaning and' cause- and – effect relationships that can be communicated and codified. Abstraction provides structure and meaning to phenomena.

Knowledge Base: A computer accessible collection of knowledge about a subject in a variety of forms such as facts, rules of inference, frames, and objects.

Knowledge Management: The process of organising and sharing the diverse forms of business information created within an organisation. KM can include managing enterprise document libraries, intranet websites, and other types of knowledge bases.

Knowledge Management Systems (KMS): Knowledge - based systems that support the creation, organisation and dissemination of business knowledge within the organisation.

Knowledge Workers: People in an organisation whose primary activities include creating, using, and distributing information and knowledge.

Organisational Learning: The process improving actions through better knowledge and understanding and the process of detecting and correcting errors. It occurs through shared insights, knowledge, and mental models. It builds on past knowledge and experience.

Procedural Knowledge: Is how an activity is performed or happens. Procedural knowledge shared among people in organisations enables their actions to be coordinated smoothly.

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UNIT 3

KNOWLEDGE MANAGEMENT - STRATEGIES

3.1 INTRODUCTION

Modem business complexities compel organisations to face several challenges. These organisations, in order to overcome such marketplace pressures contemplate to use knowledge management. This initiative leads to the development of strategies and hence the emergence of knowledge management strategies.

Business enterprises adopt an approach to use its information and knowledge resources for building competitive strength and sustaining its growth. For this purpose, strategies are used and these strategies enable the organisations to reduce costs, cycle time, increase sales and help meet the customers' needs. Such strategies are knowledge management strategies.

Knowledge strategy maps the organisation's future, using knowledge effectively. An organisation's business strategy only serves as a guiding factor for framing knowledge strategy and therefore knowledge strategy follows business strategy. Effective knowledge management is of vital importance for any enterprise with a quest to ensure viability and survival. Enterprises need to develop a KM strategy, which impinges on all areas of the organization and requires a corporate approach to make it work. Thus, the first activity in setting up knowledge strategy is to understand the organisation's existing business strategy and fixing that strategy as a base for organisational analysis.

The knowledge strategy should clearly articulate why the organization should share its knowhow, what the organization will share, with whom the organization will share and how the organization will share. A knowledge strategy should start from existing strategies, plans and modus operandi of an organization. It should explicitly identify specific areas of inefficiency — lost opportunities, or costly mistakes — where a good KM practice would improve productivity and minimize risks. It should seek to support people throughout the organization in performing their daily tasks

efficiently and effectively. Knowledge strategy must be capable of identifying how knowledge shall create new opportunities in business processes, new products or services. Hence, knowledge management is a business strategy and can be successful only when certain fundamental requirements are satisfied. The fundamental requirements refer to the synthesizing of human resource elements, information technology information and strategic business process and incorporating into management and work-culture of the organisation. Thus, the knowledge management components' synthesis, create the ability to exploit the total information and knowledge potentials of the organisations.

3.2 NEED FOR KNOWLEDGE MANAGEMENT STRATEGIES

Knowledge management strategies are required to overcome certain situations and unique issues and hence the need for knowledge management strategies.

- ✓ Addressing call centres.
- ✓ For front-line staff interaction
- ✓ For making effective business decisions
- ✓ For encouraging innovations
- ✓ For aging workforce

Addressing call centres: Knowledge management has challenging role to play in starting, running and maintaining call centre business. In this business exercise, call centre employees require lots information and knowledge for quickly answering very many customer queries. Apart from this main challenge, knowledge management also has other challenges to face in this type business such as monitoring environment, high staff-turnover, costly and lengthy training programs for new staff. These issues highly depend upon knowledge management. Failure to address these issues shall lead to drastic repercussions affecting sales, public reputation or legal exposure.

For front-line staff interaction: There is a tradition still adhered to in business houses to install and maintain a front-office department involving a wide

range of front-line staff. Front-line staff interacts with business customers at the forefront providing lots of information needed for them. For this purpose, the front-line staff must have a sound knowledge about their business and its environment, internal and external customers, information about their human resources and other relevant business details. Hence, sound knowledge management system shall be of real help in this regard.

For making effective business decisions: There is another important challenge for the knowledge management ahead - the challenge of filtering out the key information that are barely required to support business decisions from a large volume of business information. Thus, knowledge management in this regard streamlines the Information overload' and improves the quality of business decisions. Accurate, complete and relevant information are required to make sound business decisions to cope with the current pace of organisational change. Since, knowledge management is capable of providing accurate, complete and relevant information its need and importance is recognised.

Aging workforce: Private sector and public sector organisations are recognising the impact of aging workforce in business. Aging workforce means assessing the contributions of the long- serving staff towards the growth and development of business operations. This exercise reveals the long-serving staff depth of knowledge towards promoting the business operations over a period. A loss of such key staff is likely due to superannuation, retirement, illness and other similar causes having an impact on the knowledge level within the organisation. In such a circumstance, organisations shall find it convenient to adopt a structured mechanism for knowledge transfer or knowledge capture to offset the knowledge gap of the retiring/relieving employees. Knowledge management is capable of providing a structured mechanism for knowledge transfer or knowledge capture and hence the need for knowledge management.

For encouraging innovations: In this present changing business environment, many entrepreneurs have started to realise the significance of innovation, which contributes for long-term growth and sustenance. Organisations look out for unfamiliar techniques to encourage innovation and Knowledge

management contributes to this aspect of supporting innovation and finding the means of nurturing it into the business environment.

3.3 DEVELOPING ORGANISATIONAL KM STRATEGIES

Generally, knowledge management focuses on developing a strategy for designing systems to create, capture, store and distribute knowledge. This strategy helps organisations to reduce cycle time and costs, enhance sales and effectively provide knowledge to the organisation about its customer needs. This strategy also helps to improve the quality of producing and distributing products and improve the quality of services by building effective teams, networks and relationships. This strategy also encourages collaborative knowledge transfer.

Knowledge management is also keen on developing customer- focussed knowledge strategy. This strategy is helpful in capturing, developing and transferring knowledge pertaining to customers' diverse needs, preferences and businesses.

Knowledge management strategy creates personal responsibility for knowledge and makes the individuals of the organisation accountable for identifying, maintaining and expanding their own knowledge and sharing their knowledge assets. Companies are now realizing the value of each knowledgeable and capable employee and recognize the key fact that the development of their skills lay with employee themselves and not with the organization. Some firms building incentives into their appraisal system and offering other motivators to encourage the development of a knowledge-intensive culture. Another important strategy revolves around leveraging assets such as patents, technologies, operational and management practices, customer relations, organizational arrangements, and other structural knowledge assets and concentrates on renewing, organizing, valuing, safekeeping, increasing availability of, and marketing these assets. Knowledge management strategy. The final strategy, innovation and knowledge creation emphasizes the creation of new knowledge through basic and applied research and development. Organisations adopting these strategies need to ascend the knowledge spiral and continually discover new and better ways of functioning and innovating. They recognize that innovation is central to growth and that unique knowledge and expertise enhances their competitive value

in the marketplace.

3.4 PRIORITISING KNOWLEDGE STRATEGIES

There are four phases for prioritising knowledge strategy:

- ✓ Identify and develop a business strategy and link initial knowledge needs to the strategy. In order to develop initial strategy, the organisations apply SWOT analysis, scenario planning sessions.
- ✓ The second phase analyses the current state of the business firm, identify the strategic gap, evaluates the rate of learning and assesses the strategic gap using gap analysis.
- ✓ The third phase of this exercise develops strategy for identifying strategic gaps redesigning process. The organisation, then priorities the strategic gap and develop action plans, align knowledge resources and practices according to the strategy.
- ✓ This phase establishes a plan for building knowledge architecture to support organisational participation and designs the same. Organisational participation involves bringing about a co-ordination among the plans, people and information resources for integrating knowledge strategy.

3.5 KNOWLEDGE AS A STRATEGIC ASSET

The present-times business enterprises recognise *knowledge* to be their most valuable *strategic asset.* These enterprises are of the notion that, for them to remain competitive, they must have the explicit capacity to manage their intellectual assets. In the present times knowledge is the most important strategic asset for every business unit. Organisations with their superior knowledge combine traditional assets and capabilities, in novel and distinct ways thereby providing more value to their customers than their competitors thereby creating a competitive advantage.

Hence, it becomes imperative for the current times business enterprises to acquire, integrate, store, share and apply *knowledge* for building and sustaining competitive advantage. Knowledge like any other tangible asset not purchased in

open market in a ready-to-use form. Knowledge acquired through experience, is context-specific tacit in nature and tends to be unique and difficult to imitate by competitors. Knowledge-based competitive advantage is sustainable because more a firm knows, the more it can learn. New knowledge integrated with existing knowledge develops organisational uniqueness, leading business enterprises to create knowledge that is more valuable providing for knowledge synergy. Knowledge provides *increasing returns* because more used, more valuable it becomes creating a self-reinforcing cycle. Therefore, if a business organisation identifies its strong knowledge area and applies it profitably, then it represents a powerful and sustainable competitive advantage. Hence, business organisations must strive hard to apply their learning experiences to build on knowledge positions that provide competitive advantage in future or at present. *Knowledge mapping* helps accessing knowledge throughout the organisation. Knowledge mapping is categorising and benchmarking organisational knowledge. Knowledge map also helps to prioritise and focus on enterprises' learning experiences for creating greater advantage towards its learning efforts and combining its learning experiences into a 'critical learning mass' around a particular knowledge area. Knowledge, as a strategic asset, has a challenge of facing technological shifts i.e., to support new technologies well before their competitors. This provides an opportunity for the organisation to evaluate the strengths, weakness, opportunities and threats of its current knowledge platform. Knowledge is dynamic and not static. Knowledge innovations are possible - today's innovative knowledge will become tomorrow's core knowledge. Therefore, the capability of an organisation to learn, accumulate knowledge from its experience and reinvest that knowledge for a creative purpose is itself a skill or competence that provides a strategic advantage. Therefore, considering all these perspectives, knowledge viewed as the most important strategic asset. Organisations experience the real value of knowledge management when it brings benefits in a holistic fashion. The benefits are increased knowledge-worker productivity, better customer service and the like.

The categories of benefits for the sake of convenience area as follows:

- ***Information And Knowledge Benefits*** — Storing All The Relevant Information At One Place For Quicker Retrieval And Easy Accessible.
- ***Intermediate Benefits*** - Sharing Knowledge throughout the Organisation and Minimizing Duplication and for a Faster Access.
- ***Organisational Benefits*** — Reducing Costs, Increasing Productivity, Innovation and Increasing Asset Valuation.
- ***Customer and Stakeholder Benefits*** - *Better* Value, High Quality and Better Products and Services.

3.6 KNOWLEDGE MAPPING

The Mapping phase of Knowledge Management (KM) focuses on setting the context for KM. It comprises investigation and full understanding of the knowledge ecosystem.

Firstly, a proper vision definition should be made for Knowledge Management. The vision should clearly bring out the motivation for KM in terms of the necessity and benefits with a force of vision which shall generate enthusiasm among all the stake holders. To make this happen, various enablers are to be identified and stimulated to ensure the execution.

During the mapping phase, the gaps in knowledge are required to be identified. It also comprises of identifying what knowledge — in terms of people, process, technology and content - will enable it to identify knowledge gaps and achieve the strategic interest of the organisation.

The Mapping phase can scale across the entire enterprise or a particular department or unit, or can even be limited to one or more particular business processes (e.g., project management).

The first step is to identify the status of knowledge in the target organisational unit/business process (i.e., knowledge ecosystem). The second step is to define the

strategic interest of the organisation - where the organisation wants to be? The third step is to identify the gap between one and two above. Fourth step is to draw a map of the targetted knowledge ecosystem - the goal. Finally we have to identify the processes and modified (old) processes required to achieve the target knowledge ecosystem as per the strategic interest of the organisation.

Accordingly, the top management has to initiate executive action with full ownership and commitment.

3.7 THE METHODOLOGY OF MAPPING

The knowledge ecosystem model shown in the Fig. 1.1 previously (in Chapter 1) focuses on the organisational outcomes.

With a clear understanding of the organisational outcomes aimed to be achieved, using the knowledge ecosystem as the background, the content of the organisation has to be well understood, in order to build a clear map of opportunities and constraints for activating knowledge in the organisation. While performing this exercise, the key consideration or questions will be as:

- ✓ Identity and the nature of the organisation (public/ private/profit making/non-profit making).
- ✓ What are the government and other regulations or Acts affecting/controlling the organisation (e.g., company law, public sector regulations, audit process, Right to Information Act, etc.).
- ✓ Structure of the organisation (formal/informal) — organisational hierarchy chart to be provided.
- ✓ What are the ethics and values of the organisation?
- ✓ Where the specific individual interests of various stake holders (e.g., government / partners or shareholders / public, etc.).
- ✓ Strengths and weaknesses of the organisation.
- ✓ Competition to the organisation.
- ✓ What are the relevant trends in political environment or international relations?
- ✓ What are the effects of globalisation on the organisation?

- ✓ Any other important information about the organisation.

The objective in such an analysis is to gain clear understanding of the implications of the strategic context for knowledge interaction which induce a desired strong change.

- ✓ What is the strategic interest of the organisation, its vision statement, mission statement, goals and action plans?
- ✓ What are the goals the organisation is trying to achieve?
- ✓ SWOT Analysis of the organisation. SWOT stands for Strengths, Weaknesses, Opportunities and Threats.
- ✓ How the top management is trying to articulate strategic interest?

By the above analysis, external processes or Drivers can be identified and understood. By analysing the Drivers through the knowledge lens, we can understand the impact of Drivers on knowledge ecosystem and their constraints and also possible outcomes.

3.8 EXISTING KNOWLEDGE ECOSYSTEM

Mapping can be taken up either for the entire organisation or for a single business unit (or department) or even only on a single business process.

How to Perform Mapping of an Existing Knowledge System?

By using a "knowledge lens" for looking at:

(a) people,

(b) process,

(c) technology, and

(d) context,

The following questions have to be answered:

(i) Who knows what?

(ii) How the sharing of knowledge happens?

(iii) How knowledge flows?

(iv) Who creates the knowledge and where?

(v) Where the knowledge is disseminated or received?

(vi) Which knowledge is valuable?

(vii) Which knowledge is critical?

(viii) Which critical knowledge is missing?

The answers to the above questions also depend upon the culture of the organisation which is responsible for the thinking traits, attitudes, behaviour and perceptions of individuals and groups.

For determining the above, it is useful to analyse the Related Areas of Practice (RAP) in the organisation and the work they are involved in (see Appendix on Related Area of Practice). For executing or supporting any knowledge initiative, the potential of leveraging the skills, initiatives and practices has to be considered.

3.9 ENABLERS FOR KNOWLEDGE ANALYSIS

The enabler which helps in identifying the existing knowledge and how knowledge flows (or does not flow) via the relationships between people in the knowledge ecosystem are:

(a) Auditing of knowledge (generation, flow and vacuum).

(b) Auditing of information (generation, flow and vacuum).

(c) Mapping of knowledge.

(d) Survey of organisational culture and climate.

(e) Analysis of social networks.

Analysis of social networking brings out the hidden or shadow knowledge flows in the organisation. Such flows will usually run in a direction opposite to those shown in organisational chart.

3.10 KNOWLEDGE MANAGEMENT MATURITY MODEL (KMMM)

Any organisation evolves in its knowledge management dimension. The evolution is always from simple or little maturity to advanced state of maturity. Very similar to other maturity models (e.g., SEI's CMM for software), the Knowledge Management Maturity Model also has four states of evolution in their complexity order:

(a) "Stand alone" organisation.

(b) Connected organisation.

(c) Networked organisation.

(d) Adaptive organisation.

Let us examine each of these states of organisation:

(a) "Stand alone" organisation: In a "stand alone" organisation, the individuals and groups in the organisation work in an isolated mode. They work independently and with minimal or rare interaction. Groups in the organisation do not have effective links of communication (even through within the group, the individuals may be well connected). Thus, very little knowledge, if at all, flows across the organisation. Evidently, this is the least evolved organisation in

(b) Connected organisation: Connections are established between groups or departments and they do result in sharing of knowledge. Even though most knowledge dissemination tends to occur in a top-down manner, there exist some project teams who share knowledge related to the projects.

(c) Networked organisation: In this organisation, such knowledge networks are formed around specific domains of knowledge. Such networks may be based on specific professional interests within the organisation. These networks facilitate sharing-not only of knowledge, but also experience and expertise. During their frequent or periodical meetings, they investigate new issues and problems and help create new knowledge. In such a networked organisation, the networks so established may overflow beyond the limits of the organisation, getting networked with other stake holders as well (e.g., Suppliers, Clients, and Customers).

(d) Adaptive organisation: The organisation which is well equipped with knowledge will automatically become adaptive to the needs of the external environment. It shall acquire new knowledge required, thereby adapt to the demands of the external environments, including the stake holders. In such an organisation, the structures are fluid and the organisation is agile enough to adapt to the external environment. The strong internal capacity is enhanced by the continuous interaction with the external experts, thereby including them also into the network. Such an agile network can be extended, modified or reconfigured at will, as per the demands of the external environment. Evidently, such an organisation shall be the most effective and efficient in its line of business. Success is automatic for such an organisation, as the knowledge and the work (with its results) will be fully aligned with strategic interest and strategic plan.

Any given organisation can be identified with one of the four above categories. Some of the organisations may be in intermediate states also, tending towards one of these four states, eventually. However, any organisation has to evolve in the forward direction in this line.

The goal of Knowledge Management in an organisation may not necessarily to make the organisation "perfect" or reach the fourth state of "Adaptive" organisation. The magnitude of such an effort and its cost may or may not be worthwhile or even feasible, given the strategic intent of the organisation. However, the slow evolution in these states may be possible through Knowledge Management initiatives.

Skipping the states is not recommended. Gradual evolution is recommended. "Slow and steady wins the race".

3.11 RESULTS OF MAPPING PHASE

Mapping phase concerns itself with acquiring a deep understanding of the knowledge ecosystem of the organisation. This helps in formulating the strategy and plan for Knowledge Management for the organisation. The identified gap between the

existing state and the desired state of knowledge ecosystem of the organisation helps in:

(a) setting goals,
(b) setting priorities,
(c) making a strategy for improvement and
(d) Making a plan for KM implementation and operationalisation.

Such strategic goals could be:

(a) promoting knowledge sharing,
(b) building linkage to faster knowledge transfer, and
(c) Improving innovation, knowledge creation and sharing.

Action steps for achieving the above could be:

- ✓ specific knowledge interventions,
- ✓ sustainable KM strategy well integrated into the ethos of the organisation,
- ✓ enhancing and leveraging existing knowledge environment, and
- ✓ starting new initiatives in the knowledge to fill the gaps.

In this chapter, we have presented the Methodology of Mapping of the existing knowledge eco system. We have also presented in brief the Knowledge Management Maturity Model (KMMM). Finally, we concluded with an analysis of the results of such Mapping. In the next chapter, we shall examine the “Build” phase.

3.12 KNOWLEDGE TRANSFER

Knowledge Management is considered to be a major focus area in knowledge and learning industry, especially the IT or software industry in the fast growing competitive world. Everyone among the developers and also organisations are making attempts at reducing cost and time for the decision-making process with the use of knowledge. This sector captures knowledge (tacit and explicit) of the past for using in problem solving in future. Knowledge workers — as software developers — develop and ascertain various aspects regarding the technological process resulting in valuable output. The KM based development and sharing helps the organisation to develop group dynamics and group activity in a systematic way giving the end product. The transfer and management of knowledge in an organisation should be emphasised in an organisation to create competitive advantage. The use of knowledge from various levels and transfer from one level to another should be developed. Generations to generations knowledge transfer should take place. Accumulated Enterprise knowledge is a new type of knowledge that can be retrieved by a generation employees from time to time.

3.13 SUCCESSIVE KNOWLEDGE TRANSFER (KT)

All knowledge workers desire for transfer of knowledge to successive groups of employees in a form which reduces time and cost.

Knowledge Transfer (KT) and its management take time and are also expensive. Upon utilisation, the cost reduces and thus becomes advantageous. By doing so, the organisation, especially knowledge industry, gets maximum benefits during the regular problem-solving and decision-making processes.

An organisation critically depends on various factors and resources among which human resource is the most critical, especially in knowledge industry. Human resource in an organisation is capable of handling and maintaining the idea of an instant and wise decision based on knowledge and other factors like environment. Value is represented by the use of expensive Knowledge Management Systems (KMSs). In software sector, the knowledge worker develops and ascertains various

aspects about the technological process, resulting in valuable output. Software development (both for applications and products) is a process in which group dynamics and group activity occur in a systematic way, delivering the end product. If the phases get disturbed in between, the output cannot be delivered and therefore, the overall effort input gets wasted.

The transfer of knowledge or code from one member to another helps the organisation earn revenue and gain advantages. Therefore, in a knowledge intensive environment, knowledge creation as the source of sustainable competitive advantage has become widespread among practitioners as well as researchers. During the process of each decision, each development and each activity are to be captured and stored to be used by the subordinates and new employees subsequently.

In the case of collaborations between two different organisations, strategic alliances have to be signed to identify and develop success formula by sharing knowledge as a major component of collaborations in planning. Sharing of knowledge can also be represented as Knowledge Transfer (KT), from one organisation to another, for mutual benefit. Due emphasis on KT and management will help the organisation to develop its programmes in large. The knowledge success factor and knowledge management cycle will help the organisation to achieve competitive advantage. Organisations can create knowledge, store, transfer, and manage environments by using various methods like incentives to the employees, using different approaches which help the employees to spread knowledge, develop regular appraisal techniques to the level of KT.

3.14 KNOWLEDGE SOURCES

What are various sources of knowledge? The following are some of the sources of knowledge:

1. Text documents
   - (a) Notes
   - (b) Books
   - (c) Reports

(d) Files

(e) Minutes of the Meetings

(f) Legislations

(g) Records of Proceedings

2. Comments

(a) Comments by Management

(b) Comments by Experts

3. Innovation of Processes

(a) Employee innovations of Processes

Knowledge can be accessed by individuals from various sources of data in the organisation (as libraries, record rooms, etc). The knowledge so accessed can be filtered to create "understanding", and "wisdom", later.

Figure 3.1- Hierarchy of Knowledge Transfer (KT), Dissemination, Sharing, Learning, Problem-Solving, Decision- Making and Gaining Knowledge

Wisdom comprises the very essence and epitome of essence of knowledge, acquired by a long period of thorough understanding and application of knowledge.

3.15 KNOWLEDGE DEVELOPMENT STAGES AND CYCLES

Below Figure represented Knowledge Development Stages and Cycles.

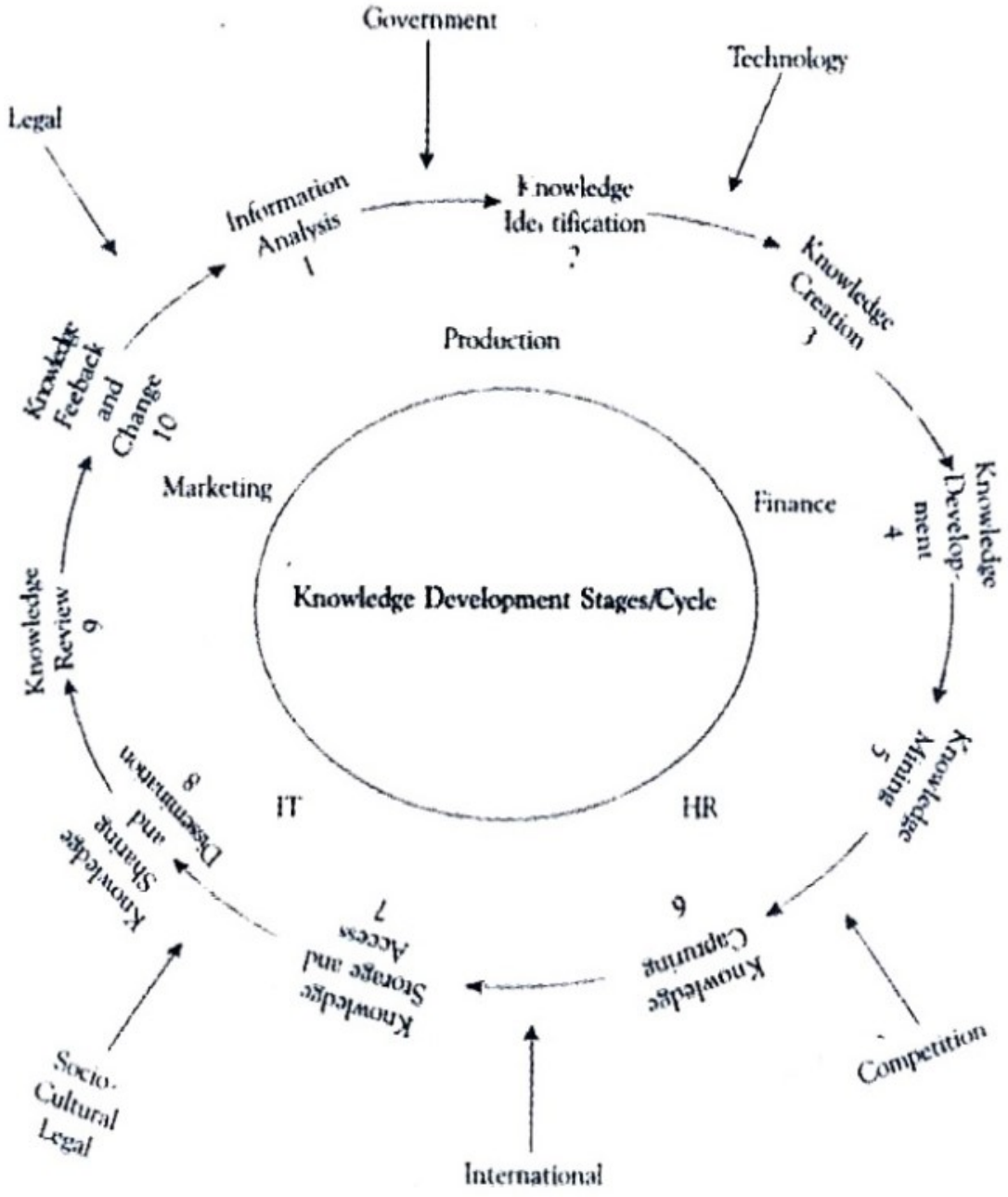

Figure 3.2 Knowledge Development Stages and Cycles

- **Information / Data Analysis:** Before starting the activities related to knowledge development in the organisation, one should look after the data/ information sources and usage of the material in the organisation. Sources of information refer to various questions like: Why it is collected? Who? When? How it can be used in a better way? Answering these questions may be termed as information auditing.

- **Knowledge Identification:** Information auditing should be capable of identifying and separating relevant set of instructions and processes, which can act as knowledge or be used as a base to solve the organisation problem. The major aspect of the stage is to define valuable knowledge, to make decision, so that it can be used to save cost and time.

- **Knowledge Creation/Development:** Identification of the knowledge can be done in a mixed form which may sometimes mismatch with others. Segregation and arranging a set of system can be readily used for solving the knowledge needs of the organisation. It also looks upon various areas and functions of business for the development of tools, for decision-making process.

- **Knowledge Mining and Filtering:** The organization uses previous knowledge for its decision-making and problem-solving process. Based on the situation and forces acting internally and externally, newer information can be used as knowledge for the business purpose. The knowledge bank can also be used again and filtered for extracting newer ideas and skills. Newer knowledge can also be developed according to the situation of the organisation.

- **Knowledge Capturing:** Changing environment and its forces differ from organisation to organisation and function to function. The newer skills, information, expertise should be captured and developed to improve the processes. The functional changes based on the environmental forces should be captured in the form of knowledge for long-run development.

- **Knowledge Storage and Access:** Technology plays a crucial role in the process of knowledge storage and access. Information Technology helps in data storage and retrieval process. Each decision-making process should be recorded and stored in such a form, which can be easily accessed by the subordinates for solving problem and making decision. The tacit knowledge which is difficult to store, should be framed by individual knowledge worker.

- **Knowledge Storing and Dissemination:** Knowledge storage should be accessible in shareable mode. The different functional units of the organisation should have the privilege to share and to create new ideas and disseminate for innovation process. Knowledge sharing can be done within different organisations, operating under different areas. It can be used to analyses the external forces like government, changing policy and the resulting effect on the organisation. Knowledge sharing can also be used for solving problems from different external forces like economic depression, environmental protection, poverty reduction, pollution control, and so on.

- **Knowledge Review, Transfer and Addition:** Knowledge can be reviewed and added after different opinions from organisation community. Sharing KT can be possible inside and outside the organisation. It needs organisation and scanning to anticipate knowledge needs. It will be possible by involving stakeholders in knowledge review and transferring processes.

- **Knowledge Feedback and Change Agents:** The stakeholders after reviewing the existing knowledge give feedback whether the knowledge leads to better decision-making and higher productivity and performance. The feedback will act as change agents and give information to analyses stage 1 which will follow knowledge development cycle.

3.16 EXTERNAL AND INTERNAL FACTORS AFFECTING KNOWLEDGE DEVELOPMENT CYCLE

The organisation is surrounded by both internal and external factors which affect the organisation and functions and working. The knowledge-managed organisation extracts information and knowledge from both internal and external environment. The internal environment comprises production, marketing, human capital, technology, warehousing, etc. The external factors comprising economic conditions, technology, competition, socio-cultural environment and changing forces are analysed by the organisation which forms a sort of knowledge guiding the organisation to develop new strategies. The organisation can follow alternatives or same strategies in the near future for the problems arisen in the environment. Various forces acting against organisation can be taken into consideration as information and can be further transformed into knowledge. Subsequent detailed information reanalyzed under knowledge development cycle can be used for problem-solving and decision- making process.

3.17 KNOWLEDGE TRANSFER

The major focus in this chapter is to engage the knowledge enterprises to transfer knowledge which is difficult in case of implicit knowledge. Nonaka and Takeuchi (1995) propose four knowledge processes that build on the distinctions between tacit and explicit knowledge: socialisation, internalisation, combination and externalisation. The transference of knowledge from an old and experienced employee to new and inexperienced, developing subordinated under various stages, process the information into knowledge by analysing, identifying, creating, capturing, storing and sharing among different functional groups.

Knowledge in an organisation exists at different levels. It includes:

(a) Enterprise level
(b) Employees level

(a) **Enterprise level:** It consists of wider and system-based knowledge which includes records of all the regular activities and operational processes happening in an institution. This explicit form of knowledge can be retrieved by the new employees at different levels, time and functional situations. It includes duties, responsibilities, procedure functions and operational areas and hierarchal level. The enterprises can store these data and information in any form which can be stored and disseminated among all employees and accessed at any point of time for learning and decision-making.

(b) **Employee's level:** Based on the available knowledge at enterprise level, employees use the understanding based on the functional specific area. The tacit form of knowledge differs from employee to employee and function to function. This difference is due to the skills, abilities and experience gained by the employee. The use of individual characteristics for the achievement of the organisation's objective and decision-making at institutional level should be captured and utilised. The process of capturing individual knowledge is difficult as it is shaded and also because sometimes decision-making is a group effort where every group member plays a vital role. For example, development of software product is done by a group where each individual puts his understanding and knowledge to achieve the output.

The synergy between the individual, group and enterprises should be developed to form the process of KT and management. The creation of such combination will create the knowledge bank or pool from which retrieval can be possible during the execution of various business processes.

The transfer of knowledge in both enterprises and individual levels can be formed as a knowledge bank which can be accessed by new and subordinate employees. Fig. 3.3 represents knowledge bank.

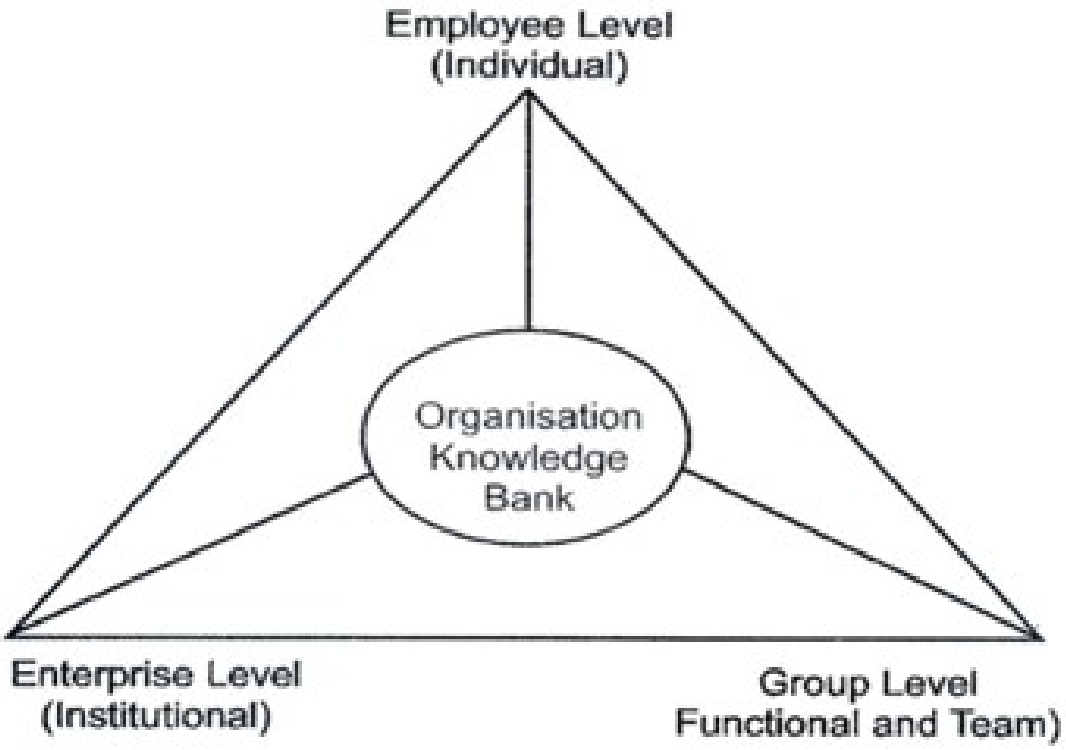

Figure 3.3 Creation of Knowledge Bank and its Components

The transfer of knowledge can be possible within and outside functional or departmental level. Fig. 3.4 represents knowledge sharing and transferring processes.

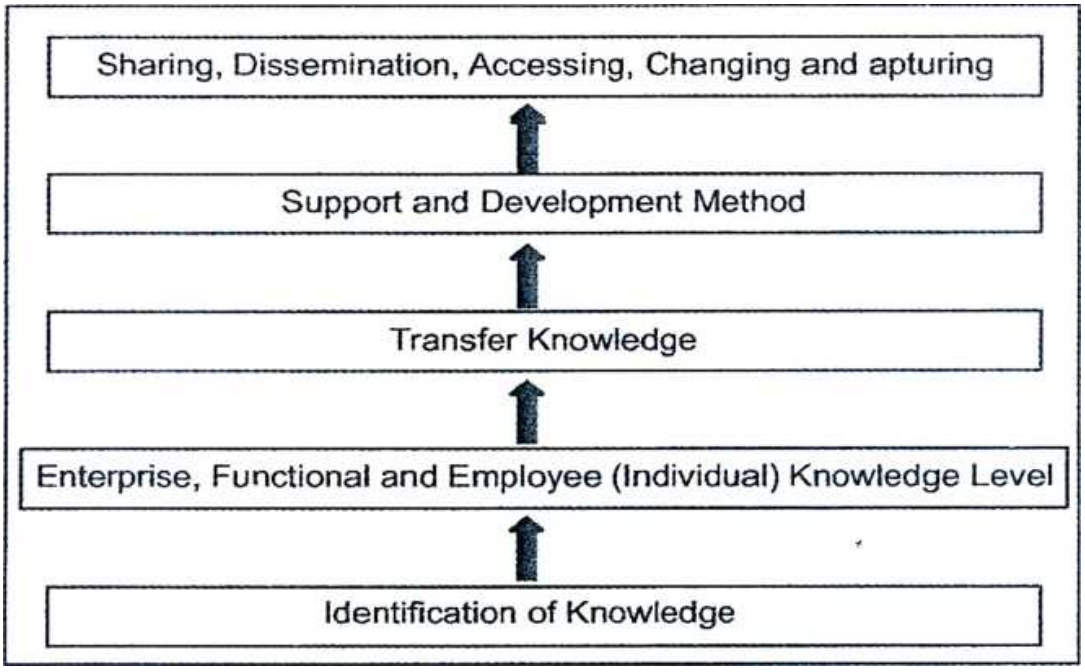

Figure 3.4: Knowledge Transfer Levels

KT starts from identifying and capturing knowledge at enterprises, functional as well as individual levels. The transfer of knowledge can be possible from knowledge bank by various components. These components refer to employees and enterprise group which reflect human resources as key aspects. Supportive and development method of KT can be adopted for capturing the knowledge at various levels. Supportive functions like, technology for KT should be emphasised in all aspects of an enterprise. For transferring, capturing and storing tacit knowledge, the organisation can adopt incentive or rewarding supportive activities. The main aim of the supportive activity is to encourage KT and store in such a way that it can be shared and used by others for the achievement of organisational objectives. Rewarding employees to actively participate in KT activity should be the main motive of the organisation.

The knowledge transformation and development stages will help the organisation to transform information into knowledge and promote understanding at each level. The transfer level starts from identification of information and knowledge which is done extensively at enterprises, employee and individual level. The creation and development of knowledge is done at each of these levels from where the knowledge is captured and analysed for its usefulness. Meanwhile, various environmental factors like competition, legal, political, government, etc., act as external factors and internally, marketing, production and other factors provide affecting factors. Supportive and development method (Fig. 8.4) and tools will help the organisation to capture and store the knowledge appropriately. This overall development model will help the organisation to transfer knowledge and disseminate, share, access, etc., for attaining organisational objectives.

KT can be done by various methods like interview, storytelling, essay writing, etc. The leaders must encourage and participate in informal exchange, discussions, supply of resources, and rewarding for successful KT. The successful KT should give productivity, achieve better performance and add value to decision-making process. The process of KT should be followed to ensure measurement of the output and capability of using better method of learning and sharing.

3.18 KNOWLEDGE TRANSFER (KT) METHODS

KT methods represented in this paper can be used in separate and in combination based on the need and system. KT method includes:

(a) Induction method
(b) Counseling method
(c) Employees rotation method
(d) Training and development method
(e) Group learning method

(a) Induction method: This method can be best used for transferring the explicit and enterprise knowledge to the newly recruited employees. Induction method acquaints the new employee with enterprise objectives, goals, mission, hierarchical structure, employment conditions, etc. Induction can also be used separately by different functional or departmental levels to transfer specific knowledge to an individual or employee (e.g., employee specification, responsibility, work area and environment, expected outcomes, benefits, compensation, incremental aspects, conduct, role, etc.). The former can be done on a group basis and transfer of knowledge can be from one to many and/or many to many. The latter can be achieved for many to one or one to one in an organisation setup. Fig. 8.5 shows the difference between both.

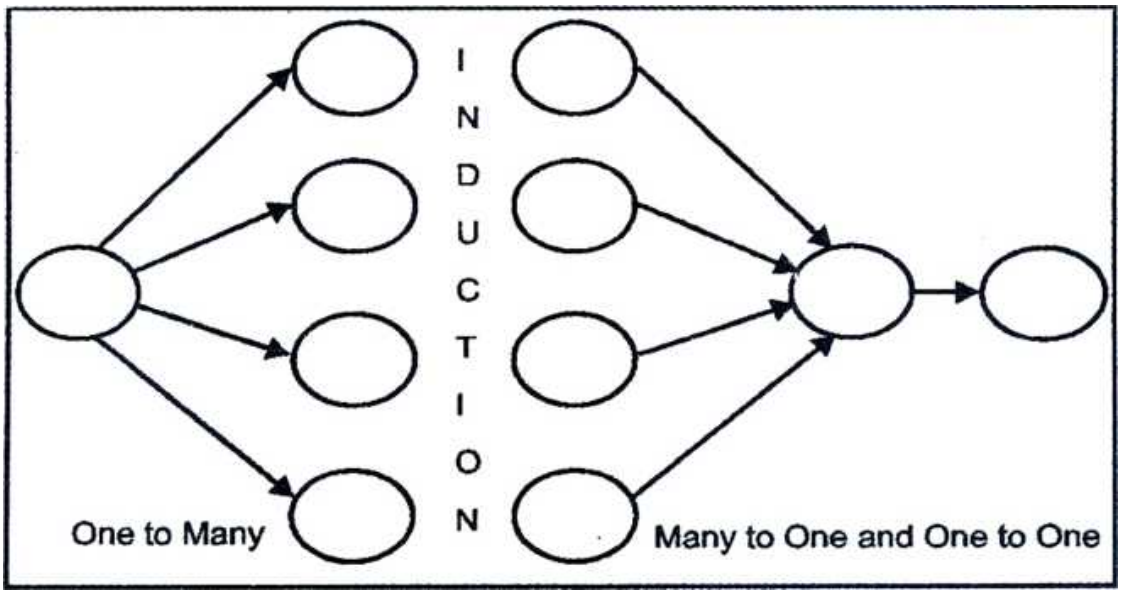

Figure 3.5: **Knowledge Transfer through Induction**.

Induction method in an organisation is one of the best methods for capturing the explicit and enterprises knowledge, to the newly recruited employee. The transfer of the explicit knowledge includes strategies, method of working, development of skill, organisational environmental conditions, etc., which differs from organisation to organisation. The newly employedmember may or may not have full idea and knowledge about the organisation. These methods will provide the employee with adequate knowledge about the organisation for his/her working. It includes knowledge about mission, vision, goals and objectives, etc. The capturing of the explicit knowledge can be possible in the form of presentations or recording the program in various forms.

Objective of Induction Method

The major objective of the induction method is to transfer knowledge which is likely to be kept in mind for a new employee and make adjustment to his/her job and the organisation. The method helps the employee to adapt to an organisational culture and environment. The major objectives served for the group and the employee are represented in the bellow table.

Objectives for the Group and the Employee

Group and Employee (Both)	Employee
Understanding Organisation's objectives, mission, policies, procedures, etc	Functional and Positional responsibility
Understanding group dynamics	Duties, Responsibilities and roles
Group knowledge sharing	Health and safety
Duties and position	Service, Incentives, benefits, etc
Association	Professional service

Induction method of KT can also be provided to all its stakeholders like

customers, suppliers, distributors, agents and employees by its webpage with different links to the organisation's functions and resources. It provides knowledge about various aspects like products and services, availability, activities, and so on. It is not only restricted to the internal people but also to the external public.

(b) Counseling Method: The method of KT is capable of giving immediate result to both explicit and tacit knowledge within the employees of the organisation. The process of counselling is intended to provide transfer of knowledge form one generation to another cluster form. This mechanism will help the organisation to create group dynamics and transfer of knowledge within shorter duration of time. The organisation attaches a new employee to his senior for professional development which helps the organisation to transfer explicit and tacit knowledge. The process of counselling can be recorded and stored during the time period. The major objective of the method is to develop group dynamics, build professional equality, enhance communication among different levels and promote continuous learning, improve performance and productivity at the initial phases of the employee, improve decision-making by transfer of skills, ability and experience.

The counselling method can be adopted in a transparent cultural diversity in the form of an extensive communication from senior level to junior level. The method has the potential to transmit expertise, extend support to senior level and develop the human resources to create high potential employee as an advantage to the organisation. The counselling method is used by various organisations to transfer the tacit knowledge from the senior level to the junior level of employees. The counselling method is also called mentoring process. The process can be captured by various methods like, storytelling in which the junior employee can explain his/her experience in the form of a story which they learn or gain during the process. This can be recorded as transforming tacit knowledge into explicit one. The new employee can gain knowledge of decision-making, problem-solving, etc., through this process. The essentials (know-edge) of decision-making and problem-solving can be gained by the counsellor or mentor to whom they are assigned. This indicates the KT process.

During the process of regular advancement of the senior and junior level

employee, the organisation develops additional human resource capital, transforming new employee to be productive and expert in his/her field. Most of the organisations adopt counselling method at the initial phases where the new employee is counselled by different people (many to one) and functional area to have overall development and is then attached to his specialised area supervisor to acquire his/her functional expertise (one to one). The follow-up evaluation is done for regular reporting to the organisation regarding performance, productivity, learning, by which the organisation estimates the amount of KT within the process with minimal cost and efforts. The organisation can adopt the method for long duration of time, based on cost.

(c) Employee Rotation Method: The employee within the organisation is transferred for shorter duration from one department/functional area to another, to get exposure to functional knowledge of the organisation. The definite program is developed for the specific number of days/months. Normally, the organisation selects particular number of employees for particular program without disturbing regular program. These programs are conducted with high level of input (knowledge) given to the participant in shorter duration. The major objective of the method is to improve efficiency and effectiveness by the transfer of knowledge in a way that allows the employee to move up in the hierarchy and includes:

- ✓ Improving professional and decision-making skills by providing exposure to different functional units for the upward movement.
- ✓ Improving relationship among different staff members who are correlated to each other for a particular set of activities.
- ✓ Expanding overall outlook and knowledge of the employee in a broad way and at organisational level helping the employee to understand and develop potential for higher position.

The employee rotation method is based on the human resources available within the organisation. Limited amount of cost will be incurred for adoption of this method. The major stress is to effectively transfer understanding and knowledge assessing the capability and skills for upward mobility of employee in an organisational hierarchy.

(d)Training and Development Method: The traditional method of KT includes enhancing skills, professional ability, knowledge and learning, productivity, motivation, adjusting to the work environment and improving overall performance of the employee. The method is usually adopted at different stages, levels and cost. The major objective is to develop skills and improve performance by retaining the employees and achieving higher level of output.

The organisation allocates budgets and initiates training and development on a regular basis, assessing each employee's performance and investing time and cost for continuous, structured and specific program. The method serves for:

- ✓ Promoting employee to achieve higher performance,
- ✓ Developing and supporting new employees to adjust in organisation environment and developing relationship among other employees,
- ✓ Enhancing efficiency and effectiveness,
- ✓ Improving productivity and quality, and
- ✓ Acquainting employees with new strategies, policies and procedures.

Training method is not only useful for improving performance but also acts as a KT method in which the trainee will undergo the process of doing things under the guidance of the experienced and knowledgeable trainer. The trainer will develop the trainee by transferring the knowledge during the process, which the trainee applies to achieve or improve the performance. For example, if the trainee from marketing sales department will be assigned to the trainer from marketing packaging and distribution area, the trainer will develop and add knowledge of the packaging and distribution, i.e., the transfer of knowledge through training.

The organisation can achieve a number of advantages by training and development method of KT like:

- ✓ Easy knowledge transfer,
- ✓ Retain employees who are skilled and trained,
- ✓ Reduce employees turn over,
- ✓ Employee's motivation and satisfaction,

- ✓ Improve quality of work, and
- ✓ Adopt newer techniques and processes.

(e) Group Learning Method: The group learning method of KT can be widely used in an organisation at different levels. It can be informal as well as formal method of learning. The organisation can develop a program each working week among functional group/ teams, branch and even organisational level for group learning. The KT is possible with a group of people who come together to transfer knowledge with different experience and share learning. During the process, high level executive will analyse the problem and discuss the same which develops common understanding and promote KT among the employees. The insight on various issues and practices will exceptionally transfer knowledge and achieve group learning.

During the process, implicit knowledge can be easily transferred and can be disseminated to a larger group of employees at the same time. The major advantages of the group learning method includes: within the organisation and functional area it will review performance standards, sustain strength and relation within the employees and group can review lessons learnt during last decision-making and problem handling. It will lead to group dynamics and learning within organisation. It will also develop team motivation and strive for better result formally and sometimes informally. The group learning method helps informal and small community to learn and acquire knowledge, aligning with the organisation's goals and objectives.

The organisation should structure the group learning method by identifying strong, committed, experienced professional within the organisation as a leader, to drive the group in reaching particular knowledge gaining result. Each knowledge transmission and sharing should be recorded and disseminated across the organisation. The technology will provide support for knowledge sharing, capturing and dissemination. The effective KT will help the organisation for creating awareness in the organisation regarding the knowledge sharing. The process of group learning establishes "trust" and creates "transparency" within the organisation and explores new opportunities to review the old lesson learning, reduces error and instills potential into new techniques and process.

The method helps the organisation to reduce cost and time for disseminating knowledge among employees as knowledge base is shared captured and created at the same time. Organising group learning will help the working community to build knowledge in less time and cost and will induce a strong commitment among employees as a team.

3.19 Knowledge Sharing Culture in an Organisation

Knowledge sharing culture in an organisation can be developed in various forms based on the availability of resources. The methods discussed above like training method, group learning, employees rotation, counselling method are successful when there is some incentive involved behind the activity to the employees. Most of the organisations have the incentive method for the purpose of conducting the activities. Other methods include:

KEYWORDS

Shared Development: Encourages developing shared understanding on various issues in an organisation. The individual efforts should be transferred and encouraged in group/team efforts which develop shared knowledge. The shared development with the employee in relation to mission, target performance, productivity, organisational development and success should be encouraged.

Focus on Knowledge Development Cycle: The managers should be efficient enough to practice the knowledge development cycle regularly as it identifies information and uses that information to get knowledge, giving a better understanding and problem solving approach. Knowledge development cycle will act as a transformation tool.

Knowledge Supportive Environment: Encouraging knowledge supportive environment within the organisation will improve the success. The information generated in any functional area should be arranged and recorded, to be transmitted in knowledge development cycle, which provides support for the problem solving.

Knowledge Flow: The organisation should practice the frequent flow of knowledge at

different levels in proper quality and quantity. The flow of knowledge should be certain and should be organised, used and widely leveraged.

QUESTIONS

1. Define ‘knowledge management’.
2. What is intellectual capital?
3. What are the components of knowledge cycle?
4. List down the domains of knowledge management.
5. List down and explain the various objectives of knowledge management.
6. What is the need for KM initiation in today’s context in an organization?
7. Explain the KM cycle with an example.
8. List out the uses of KM for an organization.
9. Trace the history and evolution of knowledge management.
10. Compare ‘industrial economy’ with ‘knowledge economy’.
11. What are the characteristics of knowledge economy?
12. What are the implications of knowledge economy to business and policy makers?
13. Analyse the chances of India becoming world’s leading knowledge economy.
14. Explain the various key technologies needed for the KM programs.
15. Why KM strategy is the need of the hour in today’s competitive environment?
16. Explain the four-phased approach for prioritizing the knowledge strategy.
17. “Knowledge is considered as the most important strategic assets” Do you agree? Why?

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Unit 4

KNOWLEDGE MANAGEMENT SYSTEM

The Internet age is characterised by distributed objects spread over the Internet. Accordingly, architecture of Distributed Knowledge Management Systems based on distributed objects became important.

4.1 DISTRIBUTED / OBJECT ORIENTED DATA WAREHOUSE/ DISTRIBUTED KNOWLEDGE MANAGEMENT SYSTEM (DKMS)

Distributed Data Warehousing (DDW)".

In the Internet scenario, data warehousing development comprises evolutionary development of distributed objects. The concept of data warehousing to describe the activity of enterprise-wise distributed processing leads to the concept of "Distributed Data Warehousing (DDW)". Being distributed objects/ components, we may also use the term "Object Oriented Data Warehousing" (OODW). The term "Distributed Knowledge Management System" may be used to denote all this.

4.2 DKMS - DEFINITION AND CHARACTERISTICS

By definition, DKMS is one that manages the integration of distributed objects into a single functioning entity, producing, maintaining and enhancing a business knowledge base. A business knowledge base[2] comprises set of data, including rules, procedures and criteria, validated models, meta models and application software used for maintaining or processing them, pertaining to the enterprise. It may be produced either by using a DKMS or imported from other sources after creation of a DKMS. Thus, DKMS requires a knowledge base to begin operation. However, it enhances its own knowledge base, progressively, as a self-correcting system, continuously testing itself against real experience.

The scope of DKMS goes beyond a database or a data warehousing, as data is

only a part of knowledge. It appeals to business domain as it can be used for better decision-making in business activities.

Individual islands of knowledge may be spread over the Internet. Just as a web-based data warehouse integrates data marts distributed over Internet, DKMS integrates knowledge bases, spread over the Internet. Thus, the problems of islands of knowledge will be overcome by DKMS.

Individual islands of data are expected to be integrated into one single enterprise database by a DBMS. Individual data marts are expected to be integrated into a single Data Warehouse. Individual knowledge repositories are to be merged into one — these goals are not so easily met. Hence, DKMS is aimed at achieving this integration.

4.3 How to Create a DKMS?

DKMS can be created *ab initio*, or starting from a pre-existing base of varied applications and relatively disparate (unintegrated) components. To create DKMS from the scratch will be quite expensive and more time consuming and more resource consuming than the process of creating a Data Warehouse. Therefore, it is more prudent to create DKMS by integrating existing components. Subsequently, we can add new components such as a Data Warehouse or a set of data marts as necessary from time to time. In the long term, an incremental approach to enhance a DKMS can be adopted to increase its size and complexity.

An incremental approach shall concentrate and focus on segmenting the DKMS process by process, sub-process by sub-process and use case by use case. Batch increment could then represent an implementation of a set of use cases found within a process, a sub-process or spanning across many sub processes.

Similar to Software Development Life Cycle (SDLC), DKMS creation will comprise:

a) Requirement identification and analysis,
b) Identification of business objectives and goals of the Enterprise,
c) Identification of process and sub process involved, and
d) Identification of use cases.

4.4 IDENTIFYING BUSINESS OBJECTIVES AND GOALS OF THE ENTERPRISE

The business objectives and the goals of the Enterprise become the fundamental basis on which the architecture of business processes, including processes and sub-processes can be defined. Processes and sub processes are value streams whose purpose is to accomplish the declared business objectives and goals of the Enterprise. The strategic and actual goals may be expressed as an analytic hierarchy.[3] Analytic hierarchy orders a number of disjoint set of goals and objectives according to the absolute dominance of one set over the other. In Enterprise level planning, it is always better to specify first the tactical and strategic goals and objectives, then group these objectives into disjoint sets and then order these disjoint sets according to their dominance relations. By using the well-known ratio scaling methods[4], particular states of objectives in the analytic hierarchy may be given numerical ratio scaled values. After such an analytic hierarchy is formed with values, business processes and uses cases (formed separately); these may individually be evaluated in terms of their actual contribution and impact on the tactical objectives. This exercise at the Enterprise level may be very large and significant in its importance.

4.5 MAJOR SUB-SYSTEM DEFINITION

The organisational sub-divisions are the major subsystems of the Enterprise. Primary business processes flow through such sub-divisions of the organisation (e.g., Headquarters, Regional Office, State level offices, District level offices, etc., account for a National level organisation with country wide spread). All the end sub-systems

may be involved in delivering a particular service, e.g., IT Services.

4.6 BUSINESS PROCESS

A Business Process is a sequence of inter-related activities that transform given inputs into specified outputs.'

Processes are value streams as they produce value to the organisation. They produce outcomes that are positively or negatively valued.

Different Enterprises have different processes. In an IT service, Enterprise delivery of different types of IT Services comprise different processes such as delivery of training to users, delivery of network services, delivery of software services, etc.

4.7 SUB - PROCESS AS A PROCESS

Any business process has at least four sub-processes: Planning, Acting, Monitoring and Evaluation.

Planning comprises of setting goals, objectives and priorities, making forecasts, performing cost/benefit experiments, reengineering a business process, documenting them, etc.

- ✓ Acting comprises the performance or the actual execution of the business process.
- ✓ Monitoring means tracking and describing the execution of the business process.
- ✓ Evaluating comprises assessment of the performance of the business process as a value stream.

4.7.1 Actors

a) **User:** An external user of a business system is an individual or organisation outside the logical boundary of the area of Enterprise business being modelled, which uses a business process or a system e.g., a customer of a IT services organisation is outside the organisation but makes use of the services of the organisation.

b) **Business System Actor:** A Business System Actor is a particular coherent cluster of activities adopted by a user in relation to a business system - process. These structured sets of activities or roles played by users are what are termed as Business System Actors. Actor concept is an abstraction from the basic notion of user and refers to an external delivery such as a source.

c) **Information System Actors:** A Business Process may be supported by a sub-process or sub-system called Information System. Information System Actors are users who are external to the logical boundary of the Information System and who play coherent roles in the business system. Such business system actors may never use the information system directly but may always interface with others who, in turn, interface with information system. The original business system actors are not information system actors because they do not directly use the system. The individuals they may interface with may not be the business system actors because they may play roles in the business system that place them inside its logical boundaries, e.g., emplo3^ees of the organisation.

The “business objects” who interface with the information system on behalf of the business system actors are actors relative to the information system, i.e., they are the users who play definable roles in connection with the information system and they are external to it, even if they are inside the business system.

4.7.2 Use Cases

A business system use case is defined by Jacobson as “a sequence of transactions in a system whose task is to yield a result of measurable value to an individual actor of the business system”.

An information system use case, on the other hand, is defined by Jacobson as “a behaviourally related sequence of transactions performed by an actor in a dialogue with a system to provide some measurable value to the actor”.

A behaviourally related set of information system use cases, in turn, constitutes an information systems application supporting a business process through its use cases (This application may or may not extend over the four sub-processes depending on its scope).

A use case is intended to accomplish some tactical objective of an actor or to aid in accomplishing a tactical objective. The use case concept focuses on the user’s view point about what the system is supposed to give back in response to user’s input, i.e., it is supposed to give back a response or output and that output will have value relative to a hierarchy of tactical and strategic objectives and goals.

The use case provides an external view of the system from the viewpoint of the users and their business processes. If a system is built on the foundation of use cases specified by the users, then these use cases lead us to objects and interactions and give rise to objects defined at higher levels be traceable down to the level of implemented code. Thus, it can be stated that the whole system architecture will be determined by the use cases and ultimately by the users who specified them. To recognise or modify the system, we can ask users to make the desired changes in use cases (add/delete/modify). Then, we can determine the schedule of development in iterative cycles by asking users about the priority among the various use cases defined.

Use Case Modelling is essential in constructing DKMS, because it leads to the identification of the actors performing the execution of the use cases and objects

supporting it. Once the objects are identified, they, their relations, their interactions and dynamics can be modeled. Code can then is generated or hand written and then tested against the use cases, until an acceptable application results. Use cases are also essential in arriving at increments of the DKMS, in the incremental approach.

4.8 Requirement Analysis

Requirement Analysis comprises partitioning use cases into various objects supporting them. Modeling objects including their structural relations is required to be done.

4.8.1 Object Model for the Enterprise

Object model for the Enterprise is developed through four sub-models as indicated below:

- ✓ The Enterprise Business Object Sub-Model,
- ✓ The Local Business Object Sub-Model,
- ✓ The Interface Object Sub-Model, and
- ✓ The Storage Object Sub-Model

We shall delve deeper into each of these.

The Enterprise Business Object Sub-Model (EBOM) shows the various object classes in the Enterprise System and their relations. An object is an identifiable unit of analysis of which properties may be predicated. The properties of an object are its attributes. We can also say an object is an entity in the enterprise with its attributes. All entities are to be identified as objects with attributes. Objects can be interrelated e.g., as an aggregation or as a class-subclass hierarchy with inheritance of attributes. Objects can have activity related to each other. These activities could be Processes in the Enterprise.

An input object will be processed by a process and an output object will be produced. A process can be a service or even represented as a web service. This

model is given as Object Knowledge Model (OKM). Whatever be the model Enterprise, objects within attributes and interrelationship have to be defined. Activities or processes involving sub-objects also have to be defined. An object type is a description of a set of objects (instances) sharing the same attributes, operations and relationships. Object types have sub- types (classes are implementation of types in software). Objects are instances of types and are instances of classes in software.

The objects described as above, therefore, when generalised, are also examples of object types and when implemented become instances of classes.

A well-known abstract typology of objects is that of interface, control and entity objects. Interface objects are those that manage inputs to and outputs from an information system. Control objects coordinate objects interaction in one or more use cases. Entity objects manage information, resources and access to them within an information system.

More generally, object types encapsulate data and therefore have attributes. Objects are instances of object types whose attributes have values. Objects perform and also have operations performed on them. Objects also encapsulate methods that perform their operation which may be specified in code.

4.9 Components

A component is a large grained object. A component may be comprised of clusters of highly related small or smaller grained objects. Alternatively, a legacy procedure could be wrapped with a component providing an object interface and encapsulation to the legacy application.

Object Modelling begins with identifying and specifying Enterprise level business objects supporting business processes, sub-processes and use cases. Specification means identifying and describing object attributes behaviour (operation) and methods. Objects specified will include the goals and objectives of the analytic hierarchy, as these are linked to other objects through the business processes and use cases and enterprise level business policies expressed as business rules.

When such rules have to be expressed explicitly, it can be done using OKM (Object Knowledge model) more elegantly than expressing in a rule base or an expert system or knowledge base system. OKM (5) can serve as a common model for both object model definitions and also knowledge representation. Prior to OKM, only the independent methodology had to be used to represent data objects and knowledge comprising rules, frames, etc.

OKM provides a common means to model and represent both knowledge and objects.

The Enterprise Business Object Sub-Model (EBOM) has to be defined showing relations among the enterprise business objects. It should include possible cause-effect relations (a type of an association) among objects, as these will be relevant later in identifying causal dimensions of the data warehouse and creating the necessary background of data mining activity (cause-effect is an important relationship between objects).

The Local Business Object Sub-Model (LBOM) shows the various objects in a business area system and their relationships. It comprises the same kinds of relations as in the enterprise wide model, but is specific to the business system under consideration for development or reengineering. Business Rules are an important aspect. An important sub-system of LBOM is the Information System Sub-Model.

Developing LBOM begins with identifying and specifying local business objects supporting the business processes, sub-processes and use cases. These are objects specific to the business area being analysed or the data mart. Specification means identifying and describing object attributes behaviour (operation) and methods. Objects specified will include goals and objectives of the extended analytical hierarchy as these are linked to other objects through business processes and use cases and policies expressed as rules.

Next, we have to build LBOM showing relations among LBOs, including cause and effect relations.

The Interface Object Sub-Model (IOM) specifies the forms, controls, input fields, buttons and other objects in the GUI environment that users interact with when they begin work through and end use cases. It also specifies interface mechanisms such as mouse(s), through diagrams, animated prototypes, GUIs and also as rapid prototypes with a real GUI developed in an IDE. Data Warehouse/data mart reporting and OLAP tools are also used to prototype IOM.

4.10 Storage Object Modeling

The Storage Object Modeling (SOM) specifies how storage is provided for data used by all objects inside the Information System. The model may be specified with ER relationships, data dictionaries, DDL Schemes, data locations and transaction relations. If an OODBMS is utilised for storage management, the storage object model is just a revised version of LBOM, optimised for performance.

If DBMS being used is relational i.e., RDBMS or extended RDBMS, then the model SOM can be as a Dimensional Data Model (DDM). Alternatively, we can use an OODBMS[7] or MDDBMS with a dimensionally oriented SOM specified to support rapid query performance. Object Oriented Software Engineering (OOSE) [8] approach with its associated object modelling provides a particularly systematic viewpoint for both conventional E-R and dimensional data modelling. Some relations developed in the object model provide a specific guide to the tables and relationships in a conventional ER model, other relations can provide a guide to tables and relationships in a dimensional data model. Identification of causal dimension in DDMs is particularly facilitated by object modelling, because tracing use cases to objects supporting them naturally leads to identifying the entity objects whose attributes may possibly determine the transactional sequences on tactical objectives.

4.11 System Design

System design invokes the process of adopting the requirements analysis to the specific physical environment of DKMS application. This begins with object interaction modelling and then continues with dynamic modelling of the life cycle of

important objects, includes detailed design of architecture (client/server or central server) more detailed specification of previous models developed, including physical specification of database models and selecting tools for system development.

4.12 Object Interaction Modelling (OIM)

Object Interaction Modelling (OIM) specifies data flow, communication flow and transaction flow among the LBOM, EBOM, IOM and SOM objects or external actor supporting a use case. OIM is expressed when we specify use cases in detail through sequence diagrams correlating use case component tasks with message flows between the objects. The OIM cross references use cases and the objects supporting them. It is a key modelling constraint linking use cases and the four object sub models (described above).

Build an Object Interaction Model specifying data and other transactions and communication flow among the LBOM, EBOM, IOM and SOM objects or external actors supporting a use case. OIM may include object from LBOM to support use cases where data or causal measurement and predictive models are communicated from the business area data marts to the data warehouse.

4.13 Dynamic Modelling

Dynamic Model specifies the responses business and information system objects make to events. It models the “life cycle” of the objects. A set of State Transaction Diagrams (STDs) are used by the Dynamic Model. A State Diagram is a network of states and events; just an object diagram is a network of classes and relationships. One STD is developed for each object type where dynamic activity we think is important to represent. The arcs of a state diagram are activities and nodes are specific events.

While the object model describes the states of a system, such as a data warehousing information system at a point in time, the dynamic model describes changes in objects over time in response to events (messages transmitted from one object to another). Causal relationships identified in the Object Model may be

implicated in the Dynamic Model by specifying Causal events and depicting the changes in state they produce. The causal relationship with the most significant effect attributes viewed from a business standpoint is the ones most important to explicate the dynamic model. We can pick these out by examining the analytic hierarchy and evaluating candidate relationships or hypothesis, according to whether they express goals and objectives in the hierarchy as effects.

The STDs should include the dynamic of process of extracting, transforming, transporting data to the data warehouse or data mart or application (as data mining).

4.14 Detailed Design of Object Types, Relationships and Interactions

We need to specify EBOM and/or LBOMs, OIMs and Dynamic Models in great detail. We also need to utilize other design techniques as Use Case Maps (a virtual notation aid to represent and reason about large grained behaviour patterns in system and to provide high level design tool to develop a better basis for specifying OIDs and collaboration groups to specify more details of use cases). We need to create more detailed Dynamic Models, review Use Case Maps and Sequence Diagrams as a foundation for extending Dynamic Models through more detailed STDs.

4.15 SOM Database Dictionaries and Schema

We need to create physical SOM database dictionaries and schema, specifying the physical dimensional data model or object model (if an OODBMS is used).

4.16 Detailed IOM Prototypes

We need to create detailed IOM Prototypes for user validation of the various IOMs defined in Enterprise level and/or business area analysis. As detailed IOM prototypes are implemented, the prototype begins to approach GUI implementation.

4.18 System Development

Using a variety of tools including Interactive Development Environment (IDE), code generators, coding system development can be completed along with system integration, data manipulation and processing, database turning, testing, installing and validating tasks such as Extracting, Transforming and Loading data (ETL).

4.19 Standard Dialogues

A list of categories of standard dialogues could include:

- ✓ Analytic hierarchies of goals and objectives,
- ✓ Planning scenarios connecting action options to tactical objectives and indirectly to strategic objectives,
- ✓ Work flows assembling action sequences into strategic and tactical plans,
- ✓ Model applications to derive new predictions from data using existing models,
- ✓ Maintenance, basic information and complex segmentation responding to quick count and ad hoc queries,
- ✓ Impact analysis and/or forecasting of the properties and outcomes of previous activity,
- ✓ Assessing outcomes against tactical objectives,
- ✓ Assessing forecast outcomes against tactical objectives and forecast tactical objectives,
- ✓ « Assessing benefits and costs of past and current activities and outcomes,
- ✓ Assessing forecast benefits and costs of future activities and outcomes,
- ✓ Batch data maintenance and updates,
- ✓ Batch cleaning and consolidation of server databases,
- ✓ Application partitioning and load balancing, and
- ✓ Security and access.

In this chapter, we have presented DKMS architecture, modelling and processes.

KEYWORDS

DKMS : Distributed Knowledge Management System (DKMS)
DDW: Distributed Data Warehousing (DDW)".
OODW: Object Oriented Data Warehousing" (OODW).
SDLC : Software Development Life Cycle (SDLC),
LBOM: Local Business Object Sub-Model (LBOM)

Storage Object Modeling :The Storage Object Modeling (SOM) specifies how storage is provided for data used by all objects inside the Information System.

Object Interaction Modelling (OIM): Object Interaction Modelling (OIM) specifies data flow, communication flow and transaction flow among the LBOM, EBOM, IOM and SOM objects or external actor supporting a use case.

Dynamic Modelling : Dynamic Model specifies the responses business and information system objects make to events.

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Unit 5
DATA MINING

5.1 DATA MINING AND TEXT MINING

During the past couple of decades many papers have been devoted to Knowledge Discovery (KD) through information retrieval systems. Various software packages for data and text mining and related processes are available as aids to KD. Roy Davies (1989) has reviewed the literature on the relation between information retrieval and classification and KD. Don Swanson in a series of papers has argued "that some knowledge which has never been stated explicitly or even implicitly (though it may be implicit in the literature as a whole) may be readily inferred from what has already been published. Other authors too have discussed similar ideas. They have used source linking, citation indexes and related tools and methods in their studies. Application of statistical techniques especially in citation studies, bibliometric coupling, correlation, pattern recognition and other areas of informetrics and scientometrics helps in KD.

"Knowledge discovery in databases (KDD) revolves around the investigation and creation of knowledge, processes, algorithms, and the mechanisms for retrieving potential knowledge from data collections." [Norton, 1999]. "Classification schemes have properties that enable the representation of entities and relationships in structures that reflect knowledge of the domain being classified." In this context, hierarchies, trees, paradigms, and faceted classification can reflect structures, discover, and create new knowledge [Kwasnik, 1999]. How to find interesting previously unknown implicit information in scientific literature is examined in the paper "Implicit text linkages between medicine records: using Arrowsmith as an aid to scientific discovery" by Swanson and Smallheiser (1999). "Extracting hidden knowledge from humanities databases is especially problematic because the literature, written in 'everyday' rather than technical language, lacks the precision required for efficient retrieval, and because humanities scholars seek new analogies rather than causes ... an illuminating new humanities analogy was found by constructing a search

statement in which proper names were coupled with associated concepts [Cory, 1977]. Small (1999) presents a "methodology for creating pathways through the scientific literature following eo-citation links." Also discusses the "implications of information pathways for retrieval, the unity of science, discovery, epistemology and evaluation." Quin He (1999) discusses eo-word analysis. Based on the eo-occurrence frequency of pairs of words or phrases, for discovering links among subjects. Such studies can also help in tracing the development of science. Ahonen (1999) discusses "a method of extracting Maximal Frequent Sequences [MFS] in a set of documents." An MFS is a "sequence of words that is frequent in the document collection ... that is not contained in any other longer frequent sequence ... A sequence is considered to be frequent if it appears in at least *n* documents where *n* is the frequency threshold given." The technique is used to discover other regularities and similarity mapping in document collections. This could assist information retrieval, hypertext linking, clustering, and discovery of frequent occurrences. Pinto and Lancaster (1999) conclude: "the wide availability of complete text in electronic form does not reduce the value of abstracts for information retrieval activities even in such more sophisticated applications as knowledge discovery." In "Template Mining for Information Extraction from Digital Documents", Chowdhury (1999) points out that with the rapid growth of digital information resources, a number of information extraction (lE) systems from natural language text particularly in the areas of news/fact retrieval and in domain-specific areas, such as in chemical and patent information retrieval, have been developed. Template mining approach involving a natural language processing (NLP) technique to extract data directly from text if either the data and/or text surrounding the data form recognizable patterns. When text matches a template, the system extracts data according to instructions associated with that template. Reviews template mining research and also shows how templates are used in Web search engines (e.g. Alta Vista), and in meta-search engines (e.g. Ask Jeeves) for helping end-users generate natural language search expressions. Some potential areas of application of template mining for extraction of different kinds of information from digital documents are highlighted, and how such applications are used is indicated. It is suggested that, in order to facilitate template mining, standardisation in the presentation and layout of information within digital documents has to be ensured, and this can be done by generating various templates that authors

can easily download and use while preparing digital documents. An overview of KD literature and some case studies are presented by Neelameghan.

5.3 DATA MINING

Data mining is a step within the Knowledge Discovery in Databases (KDD) process through which an organisation's data assets are processed and analysed to gain insights to assist decision-making. KDD originates with data held in the organisation's data management systems or data warehouses. The steps to knowledge discovery include data selection, processing, transformation, data mining, interpretation and evaluation leading to discovery of new intelligence or knowledge. In an institution, the internal data assets and those obtained from external sources and warehoused are processed and analysed in depth to gain insights on the research object, event or situation. Data mining techniques used have to be specific to the domain and also depend on the area of application. Important requirements are that the data collected should be relevant and of a high-quality. *(See also* Text Mining). Analytical techniques used in data.mining include statistical methods, such as, regression analysis, discriminant analysis, factor analysis, principal component analysis, word usage and eo-occurrence analysis, and time-series - as well as mathematical modeling. In-depth classification and related indexes are also helpful in data mining.

5.4 TEXT MINING

Text .mining is receiving considerable research and development attention. Content searching using a search engine based on a search term - keyword or string - does not address the information overload problem adequately enough even with methods that list the retrievals according to one or other ranking methods. This has led to the need to differentiate between search and discovery. A search engine's main function is to locate documents based on the user's keywords. A discovery engine on the other hand attempts to extract relevant textual data from a corpus of text and then provides a graphical, dynamic and navigable index. The visual presentation of concepts is aimed at promoting a better understanding of the underlying content and

structure of the textual data, leading hopefully to improved retrieval and hence productivity of the knowledge worker.

Text mining is best suited for "discovery" purposes, i.e., learning and discovering information hidden in the documents of an organisation's unstructured repositories. Reasons for using text mining include:

- ✓ Uncovering a "narrative" in an unstructured mass of text;
- ✓ Learning about a topic;
- ✓ Exploring how an environment, e.g. market, is evolving; and
- ✓ Looking for new ideas or relations in topics.

Text mining is useful because of the enormous amount of knowledge, either within an organisation or outside of it, that resides in text documents. Since most organisations rely on textual information, both from outside and inside the organisation, working with this sea of text can become extremely difficult. The whole collection of text is simply too large to read and analyse easily. Furthermore, it changes constantly and requires ongoing review and analysis if one is to stay current. Text mining addresses these problems, providing tools to analyse and learn from this kind of dynamic information.

However, text mining is not an end in itself; it is a support tool and complements search engines. A text-mining product supports and enhances the knowledge worker's creativity and innovation with *open-ended* exploration and discovery. The individual applies intelligence and creativity to endow *meaning* and *relevance* to information, turning information into knowledge. Text mining advances this process, empowering the knowledge worker to explore and gain knowledge from a knowledge base.

There are several types of industry players in text mining: IR vendors, such as, Verity, Excalibur, and Data ware are refining their product functionalities from text retrieval to text mining. There are also niche document management players, such as, PCDOC and Document who have developed successful products for managing document content and workflows. Large IT platform companies such as Oracle,

Lotus, and Microsoft are aiming to improve the KR functionalities of their database or workgroup products. These companies may lack in significant linguistic and analytical abilities. The last type of vendor consists of small, new companies such as Autonomy, Perspecta, InXight, Semio and KCC. These have new analytical and Iinguistic technologies but may lack in execution experience and integration ability.

According to Chen, the approaches of consultants and refinements bemg sought by IT vendors, described briefly above, are evidence of the trend away from the use of simple and basic search and retrieval techniques to KR using text mining technologies.

Text processing and analysis is significantly more difficult than processing and analysis of structured data as in DBMS systems. The status of text mining today is much like that of DBMS twenty years ago. The real challenges and the potential payoffs for an effective universal text solution are equally appealing. It is inevitable that whoever dominates this space will become the Oracle (in text).

The above formulation is obviously targeted to text-oriented sources of krrowledge. When it comes to multimedia products, which are likely to be predominant in the future, text mining alone will not be adequate.

5.5 TEXT ANALYSIS AND MINING TECHNIQUES

First, text mining requires natural language processing abilities. Second, while data mining attempts to .identify causal relationships through classification or supervised learning techniques, text mining aims to create organizational knowledge maps or concept yellow pages. Third, text mining deals more with diverse and eclectic collections of systems and formats (email, web pages, Notes databases, few groups, etc.). Both data mining and text mining adopt significant analytical methods and their results and are often highly visual and graphical. Data visualisation and information visualisation techniques attempt to create an interface that is well suited for human decision-making.

At the heart, text mining is a cross between IR and AI. IR has gone through several generations of development. In the 1970s, computational techniques based on inverted indexes and vector spaces were developed and tested on computer systems. Also, probabilistic retrieval methods based on Bayesian statistics were developed. Although more than 30 years old, this still forms the basis of modern IR systems. In the 1980's, coinciding with the developments of new AI techniques, know ledge-based and expert systems that aim to emulate domain specialists were developed. User modeling and natural language processing (NLP) techniques were developed to assist in representing users and documents. These were applied to improve online searching.

Realising the difficulties of creating domain-specific knowledge bases and heuristics, researchers in the 1990's adopted new machine-learning techniques for information analysis. AI techniques such as neural networks, genetic algorithms, and symbolic leaming were tested in IR [Chen, 2001], Text analysis includes such features as natural or statistical language processing, indexer or phrase creator, entity extraction, conceptual associations (automatic thesauri),domain-specific knowledge filter (using vocabularies or ontologies), automatic taxonomy creation (clustering),multi-document and multi-language support. Core text mining analysis can be classified into four main layers: linguistic analysis and NLp, statistical or eooccurrence analysis, statistical and neural networks clustering/categorisation, and visualisation.

At the lowest level, linguistic analysis and NLP techniques aim to identify key concept descriptors (who/what/where/when) embedded in textual documents. Different types of linguistic analysis techniques have been developed. Word and inverted indexing can be combined with stemming, morphological analysis, Boolean, proximity, range and fuzzy search. The unit of analysis is ‘word’. Phrasal analysis, on the other hand, aims to extract meaningful noun phrase units or entities (e.g., people names, organisation names, location names). Both linguistic and statistical analysis techniques are plausible. In addition, semantic analysis based on techniques, such as, semantic grammar and case grammar can be used to represent semantics (meaning) in sentences. Semantic analysis is domain specific and lacks scalability. This often requires a significant knowledge base or a domain lexicon creation effort and hence it

may not be suitable for general-purpose text mining across a wide spectrum of domains.

Based on significant research in the IR and the computational linguistics communities, it is generally agreed that phrasal-level analysis is more suited for coarse but scalable text mining applications. Word-level analysis is noisy and lacks precision. Sentence level is too structured and lacks practical applications. It is not coincidental that most of the subject headings and concept descriptors adopted by library classification schemes are noun phrases. Based on statistical and eo-occurrence techniques, link analysis is performed to create automatic thesauri or conceptual associations of extracted concepts. Existing human-created thesauri can also be integrated with system-generated thesauri.

Statistical and neural network-based clustering and categorisation techniques are often used to group similar documents, queries or communities in subject hierarchies, which could then serve as corporate knowledge maps. Hierarchical clustering (single link or multi-link) and statistical clustering (multi-dimensional scaling, factor analysis) techniques are precise but often computationally expensive. Neural network clustering by Self-Organising Map (SOM) technique (cf.Teuvo Kohonen's self-organising .networks, and visualisation), performs well and is fast and is most suited for large scale text mining tasks. In addition, SOM lends itself to intuitive graphical visualization based on such visual parameters as size (a large region represents a more important topic) and proximity (related topics are grouped in adjacent regions). Visualisation and Human-Computer Interaction (HCI) help to reveal concept associations and visualise knowledge maps. Different representation structures (tree, network) and interaction techniques (e.g., zooming, spotlight) can be adopted to reveal knowledge more completely.

5.6 DATA MINING TOOLS AND TECHNIQUES

Data mining Techniques are: Extracting important knowledge from a very large amount of data can be crucial to organizations for the process of decision making. Some data mining techniques are:

1. Association
2. Classification
3. Clustering
4. Sequential patterns
5. Decision Tree

1. Association Technique: Association helps to find out the pattern from huge data, based on the relationship between two or more items of the same transaction. The association technique is used to analyse market means it helps us to analyse people's buying habits.

Example: you might identify that a customer always buys ice cream whenever he comes to watch movie so it might be possible that when customer again comes to watch movie, he might desire to purchase an ice cream again.

2. Classification Technique: Classification technique is most common data mining technique. In classification method we use mathematical technique such as decision trees, neural network and statistics in order to predict unknown records. This method derives important information about the data. Let assume you have set of records, each record contains a set of attributes and depending upon these attributes you will be able to predict unseen or unknown records. Consider an organization, predict the list of employees who left the organization and who may leave the organization in the future with classification technique.

3. Clustering Technique: Clustering techniques used in the process of data mining. The main aim of clustering technique is to makes cluster (groups) from piece of data which shares common characteristics. Clustering technique helps to identify the differences and similarities between the data.

Take an example, A shop in which many items are for sales, now the challenge is how to keep those items in such a way that a customer can easily find his required item. By using the clustering technique, you can keep some items in one comer that have some similarities and other items in another corner that have some different similarities.

4. Sequential Patterns: Sequential patterns are a useful method for identifying trends and similar patterns. For example, in cluster data you identify that a customer buys particular product on particular time of year, you can use this information to suggest customer these particular product on that time of year.

5. Decision Tree: Decision tree is one of the most common used data mining techniques because its model is easy to understand for users. In decision tree you start with a sample questions which has two or more answers. Each answer leads to a further two or more question which helps us to make a final decision. Question can be formed with the help of the root node of decision tree. Take example of flood warning system: First check water level, if water level is >50ft then alert is sent. If water level is<50ft then check water level if water level is >30ft then send warning and if water is <30ft then water is in normal range.

5.7 DATA MINING TOOLS AND TECHNIQUES ARE AS FOLLOWS

Rapid Miner, Orange, Weka, KNIME, Sisense, SSDT, Apache Mahout, Oracle Data mining, Rattle, Data Melt, IBM Cognos, IBM SPSS Modeler, SAS Data Mining, Teradata, Board, Dundas BI, Python, Spark, and H_20.

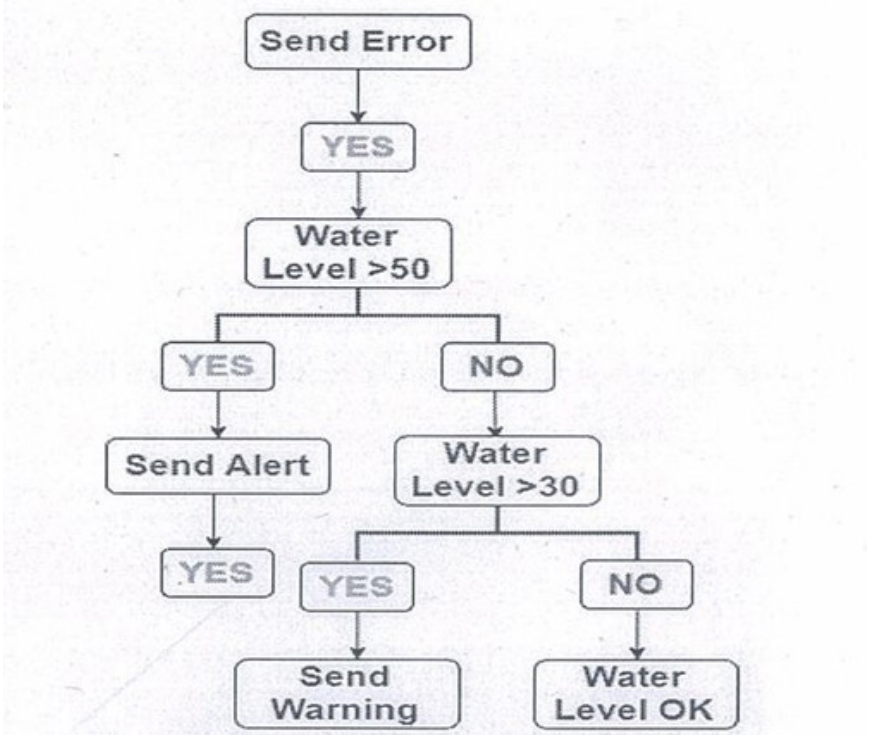

Figure 5.1 : Decision Tree for Flood Warning System

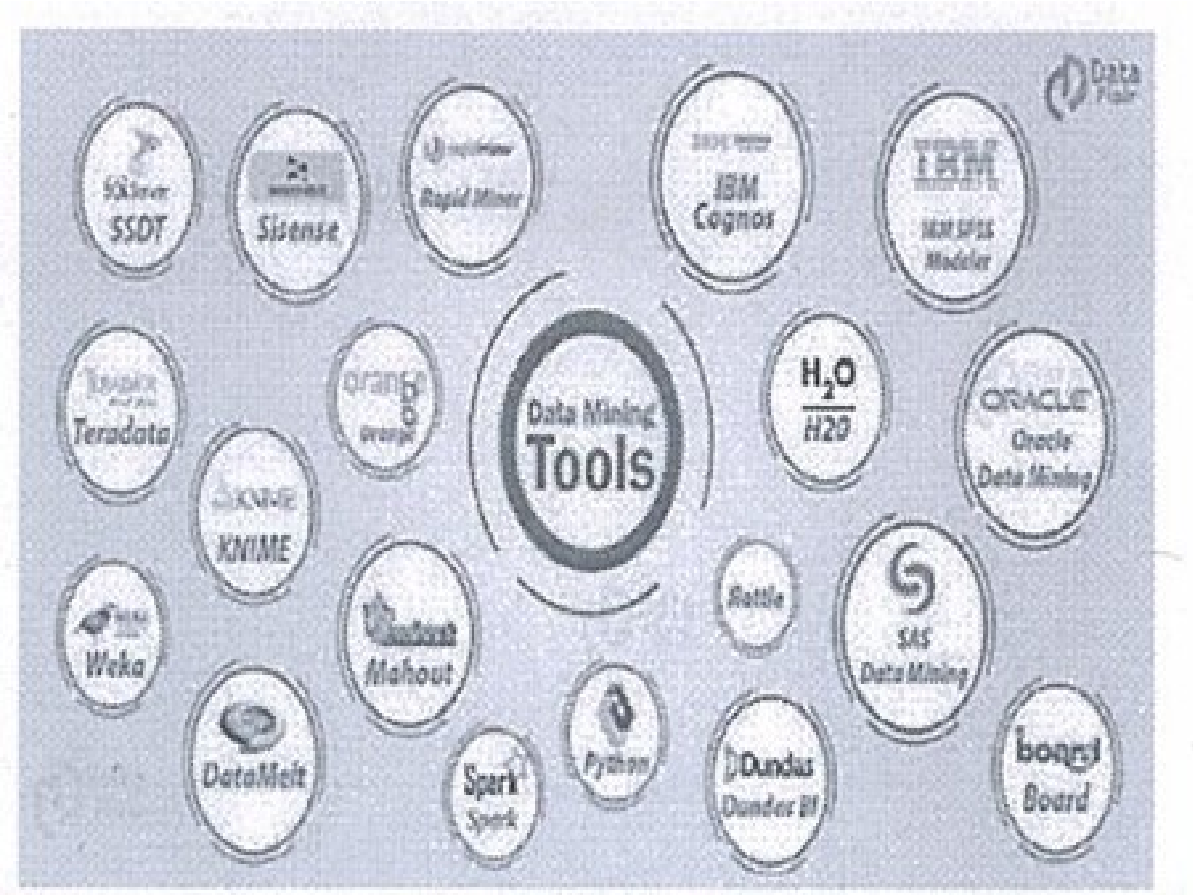

Figure 5.2 : Data Mining Tools

5.8 INTEGRATION OF DATA WITH DATABASE OR DATA WAREHOUSE SYSTEM:

Data Integration is a data pre-processing technique that combines data from multiple sources and provides user a unified view of these data. If the data mining system is not integrated with any database or data warehouse system, then there will be no system to communicate with. This scheme is known as coupling scheme. In this scheme the main focus is on data mining design and for developing efficient and effective algorithms for mining the available data sets.

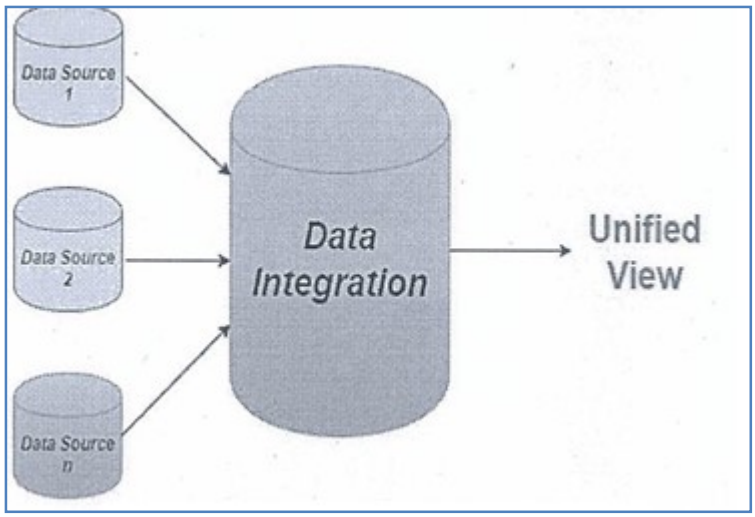

Figure 5.3 : Data Integration in Data mining

5.9 THE LIST OF INTEGRATION SCHEME IS AS FOLLOWS

No Coupling: It will not use any of the data mining .database or data warehouse functions. It fetches the data from a particular source and processes that data using mining algorithms. Results of data mining system will be stored into a file.

Loose coupling: In this scheme, it uses the techniques of data mining system, database and data warehouse system. It fetches the data from the data respiratory managed by these systems and perform data mining on the data and then stores the mining result either in a database or in a data warehouse.

Semi-tight Coupling: In this scheme, the data mining system is linked with a database or a data warehouse system and in addition to that, in the database, efficient implementations of the few data mining primitives can be provided.

Tight Coupling: it is an integration of database with the data mining or data warehouse system. The functional component of a data mining system is data mining sub system.

5.10 APPLICATIONS OF DATA MINING:

Communications: Data mining techniques are used in communication sector to predict customer behaviour to offer highly targeted and relevant campaigns.

Insurance: Data mining helps insurance companies to price their products are profitable. They promote new offers to the existing customers and new customers.

Education: Data mining benefits educators to access student data predicts achievements levels and find students or groups of students which need extra attention. Consider that some of the students have less knowledge in their respective subjects such as Information Retrieval Systems.

Manufacturing: With the help of Data mining Manufacturers can predict wear and tear of production assets. They can anticipate maintenance which helps them reduce them to minimize downtime.

Retail: Data Mining Techniques helps retail malls and grocery stores identify and arrange most sellable items in the most attentive positions. It helps store owner to come up with the offer which encourages customers to increase their spending.

Banking: Data mining helps finance sector to get a view of market risks and manage regulatory compliance. To issue new loans, credit cards banks need to identify the defaulters, etc.

Service providers: Service providers like mobile phone utility industries use Data Mining to predict the reasons when a customer leaves their company. They analyses billing details, customer services interactions, complaints made to the company to assign each customer probability score and Offers incentives.

E-commerce: E-commerce websites use Data mining to offer cross sells to predict their website

Super Markets: Data mining allows supermarkets develop rules to predict if their

shoppers were like to be expecting. They can start target is to start targeting products like: baby, baby shop, diapers and can start

Crime Investigation: **Data mining helps crime** investigation agencies to deploy police workforce (When is a most crimes likely to happen and when?) who to search at a border crossing.

Bioinformatics: Data mining helps to mine biological data from massive datasets gathered in biology and medicine.

5.11 ISSUES OF DATA MINING

Data mining is not that easy, the algorithms used are very complex. The data is not available at one place it needs to be integrated from the various heterogeneous data sources. These factors also create some issues. Here we will discuss the major issues regarding:

1. Mining methodology and user interaction
2. Performance issues
3. Diverse data type issues

The following below are some issues:

5.11.1 Mining methodology and user interaction issues:

- ✓ Mining different kinds of knowledge in database: The need of different users is not the same, and Different users may be in interested in different kind of knowledge. Therefore, it is necessary for data mining to cover broad range of knowledge discovery task.
- ✓ Interactive mining of knowledge at multiple levels of abstraction: Data mining process is interactive and it allows the users to focus on search patterns and refines data mining requests based on the generated results.
- ✓ Incorporative of background knowledge: To guide discovery process and to express the discovered patterns, the background knowledge can be used.

Background knowledge may be used to discovered patterns, the discovered patterns not only in concise terms but at multiple level of abstraction.

- ✓ Data mining query languages and hoc data mining: Data Mining query language gives the permission to the users to describe the adhoc mining tasks and integrates with a Data mining query language. It produces flexible and efficient data mining.
- ✓ Visualization and Presentation of data mining Results: Discovered patterns arc expressed in a high level language and it is displayed in visual representations to easily understandable by the users.
- ✓ Handling noisy or incomplete data: To handle the incomplete objects, noise and mining with regularities data cleaning techniques are used. It maintains the Data Quality. If the data cleaning methods are not there the n the accuracy of the discovered patterns will be poor.
- ✓ Pattern evolution: It refers to interestingness of the problem; the pattern discovered should be interesting because either they represent common knowledge.

5.11.2 Performance issues

- ✓ Efficiency and scalability of data mining algorithms: To extract the information from massive databases, data mining algorithms must be applied .These are efficient and scalable.
- ✓ Parallel, distributed and incremental mining algorithm: The factors such as huge size of databases, wide distribution of data, complexity of data mining methods motivates the development of parallel and distributed data mining algorithm. These algorithms dived the data into partitions which are further processes parallel. Then the result from the partitions is merged. The incremental algorithms are used to update the databases .These databases may contain the noisy data.to clear the noisy data, these incremental algorithms are used.

5.11.3 Diverse data type issues

Relational and Complex types of data: It contains the multimedia data objects,

temporal data complex data objects and spatial data. It is not possible for one system to mine all these kinds of data.

Mining information from heterogeneous database and global information systems: The data is available at different data sources on LAN or WAN. These data sources may be structured, semi structured or unstructured. Therefore, mining knowledge from them adds challenges to data mining.

5.12 TRENDS OF DATA MINING

Here are some trends in data mining that reflects pursuit of the challenges such as construction of integrated and interactive data mining environments, design of data mining languages:

- ✓ Focus on Multimedia
- ✓ Applications Exploration
- ✓ Artificial intelligence and IoT
- ✓ Data mining based on meta data
- ✓ Scalable and interactive data mining methods
- ✓ Interaction of data mining with database systems, data warehouse systems and web database systems.
- ✓ Standardization of data mining query language
- ✓ Visual Data Mining
- ✓ New methods for mining complex types of data
- ✓ Biological data mining
- ✓ Data mining and software engineering
- ✓ Web Mining
- ✓ Distributed Data Mining
- ✓ Real time Data Mining
- ✓ Multi Database Data Mining
- ✓ Privacy protection and information security in Data Mining.
- ✓ Location based data mining

KEYWORDS:

Concrete Knowledge: Knowledge can be made concrete when it, is embedded in physical artifacts like products, production processes, equipment's, and technology.

Data Mining (DM): Data Mining (DM) is part of a process by which information can be extracted from data and databases and used to uniform decision-making in a variety of contexts. DM includes a range of tools and methods for extracting' information. DM incorporates not only data analysis but also involves determining appropriate questions and interpreting the results.

Declarative Knowledge: The .basics of a shared and explicit understanding of concepts, ideas, relationships, and categories that enables effective communication among people in organisations. It is characterised by know what of an event or task.

Explicit Knowledge: Knowledge that is transmittable in formal, systematic language.

Knowledge: Knowledge is a fluid mix of framed experience, values, contextual information, expert in and grounded intuition that provides environment and framework for, evaluating and integrating new experiences and information. It originates and is applied in the minds of the knower.

QUESTIONS

What are the techniques used for data mining?
Distinguish between search engine and discovery engine.
Describe the usefulness of text mining.

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