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# Knowledge Management Systems Lecture Notes

## Outline

This unit provides a detailed coverage of knowledge management concepts and methodologies which includes knowledge creation, knowledge architecture, and knowledge codification. The knowledge management tools and knowledge portals as well as the notions of knowledge transfer in the E-world are discussed.

## Aims

The aims of this unit includes the broad understanding of the following areas of Knowledge Management Systems:

- Knowledge Management Systems Life Cycle.
- Knowledge Creation and Knowledge Architecture.
- Capturing Tacit Knowledge
- Knowledge Codification
- System Testing and Development
- Knowledge Transfer and Knowledge Sharing
- Knowledge Transfer in the E-World
- Learning from Data
- Knowledge Management Tools and Knowledge Portals
- Managing Knowledge Workers

## Textbook

Elias M. Awad, Hassan M. Ghaziri, Knowledge Management, Pearson Education Inc., Prentice Hall (2004).

**Please note that these `Lecture Notes' (including all figures and tables) are adapted from the above mentioned textbook.**

## Reference Book

Knowledge Management Systems Theory and Practice, Editor: Stuart Barnes, Thomson Learning (2002).

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- Organizational factors
- More factors
- Champion's Role
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  - Preparing for System Training
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- Review after Implementation
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# Understanding Knowledge

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

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# Cognitive Psychology

- **Cognitive psychology** tries to identify the cognitive structures and processes that closely relates to skilled performance within an area of operation.
- It provides a strong background for understanding knowledge and expertise.
- In general, it is the interdisciplinary study of human intelligence.
- The two major components of cognitive psychology are:
  - **Experimental Psychology:** This studies the cognitive processes that constitutes human intelligence.
  - **Artificial Intelligence(AI):** This studies the cognition of Computer-based intelligent systems.
- The process of eliciting and representing experts knowledge usually involves a *knowledge developer* and some *human experts* (domain experts).
- In order to gather the knowledge from human experts, the developer usually interviews the experts and asks for information regarding a specific area of expertise.
- It is almost impossible for humans to provide the completely accurate reports of their mental processes.
- The research in the area of cognitive psychology helps to a better understanding of what constitutes knowledge, how knowledge is elicited, and how it should be represented in a corporate knowledge base.
- Hence, cognitive psychology contributes a great deal to the area of knowledge management.

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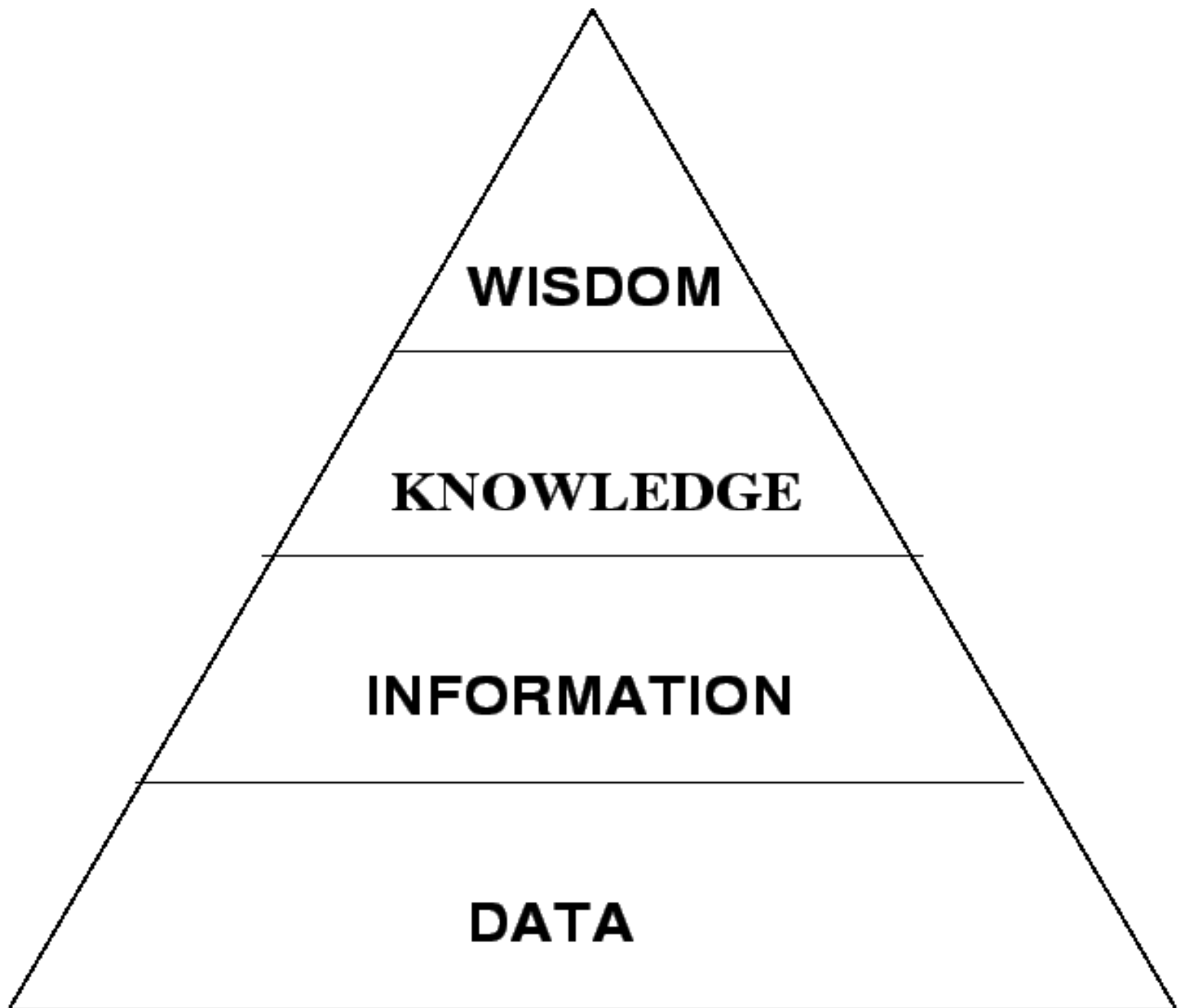
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# Data, Information and Knowledge

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



**Figure 1.1:**Data, Information, Knowledge and Wisdom

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# Kinds of Knowledge

- Deep Knowledge: Knowledge acquired through years of proper experience.
- Shallow Knowledge: Minimal understanding of the problem area.
- Knowledge as Know-How: Accumulated lessons of practical experience.
- Reasoning and Heuristics: Some of the ways in which humans reason are as follows:
  - Reasoning by analogy: This indicates relating one concept to another.
  - Formal Reasoning: This indicates reasoning by using *deductive* (exact) or *inductive* reasoning.
    - Deduction uses major and minor premises.
    - In case of deductive reasoning, new knowledge is generated by using previously specified knowledge.
    - Inductive reasoning implies reasoning from a set of facts to a general conclusion.
    - Inductive reasoning is the basis of scientific discovery.
    - A *case* is knowledge associated with an operational level.
- Common Sense: This implies a type of knowledge that almost every human being possess in varying forms/amounts.
- We can also classify knowledge on the basis of whether it is *procedural*, *declarative*, *semantic*, or *episodic*.
  - *Procedural knowledge* represents the understanding of how to carry out a specific procedure.
  - *Declarative knowledge* is routine knowledge about which the expert is conscious. It is shallow knowledge that can be readily recalled since it consists of simple and

uncomplicated information. This type of knowledge often resides in short-term memory.

- *Semantic knowledge* is highly organized, ``chunked" knowledge that resides mainly in long-term memory. Semantic knowledge can include major concepts, vocabulary, facts, and relationships.
- *Episodic knowledge* represents the knowledge based on episodes (experimental information). Each episode is usually ``chunked" in long-term memory.
- Another way of classifying knowledge is to find whether it is *tacit* or *explicit*
  - *Tacit knowledge* usually gets embedded in human mind through experience.
  - *Explicit knowledge* is that which is codified and digitized in documents, books, reports, spreadsheets, memos etc.

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# Expert Knowledge

It is the information woven inside the mind of an expert for accurately and quickly solving complex problems.

- Knowledge Chunking
  - Knowledge is usually stored in experts long-range memory as *chunks*.
  - Knowledge chunking helps experts to optimize their memory capacity and enables them to process the information quickly.
  - Chunks are groups of ideas that are stored and recalled together as an unit.
- Knowledge as an Attribute of Expertise
  - In most areas of specialization, insight and knowledge accumulate quickly, and the criteria for expert performance usually undergo continuous change.
  - In order to become an expert in a particular area, one is expected to master the necessary knowledge and make significant contributions to the concerned field.
  - The unique performance of a true expert can be easily noticed in the quality of decision making.
  - The true experts (knowledgeable) are usually found to be more selective about the information they acquire, and also they are better able in acquiring information in a less structured situation.
  - They can quantify soft information, and can categorize problems on the basis of solution procedures that are embedded in the experts long range memory and readily available on recall.
  - Hence, they tend to use knowledge-based decision strategies starting with known quantities to deduce unknowns.
  - If a first-cut solution path fails, then the expert can trace back a few steps and then proceed again.

- Nonexperts use means-end decision strategies to approach the the problem scenario.
- Nonexperts usually focus on goals rather than focusing on essential features of the task which makes the task more time consuming and sometimes unreliable.
- Specific individuals are found to consistently perform at higher levels than others and they are labeled as experts.

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# Thinking and Learning in Humans

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

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# Knowledge Management Systems Life Cycle

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# Challenges in KM Systems Development

- Changing Organizational Culture:
  - Involves changing people's attitudes and behaviours.
- Knowledge Evaluation:
  - Involves assessing the worth of information.
- Knowledge Processing:
  - Involves the identification of techniques to acquire, store, process and distribute information.
  - Sometimes it is necessary to document how certain decisions were reached.
- Knowledge Implementation:
  - An organization should commit to change, learn, and innovate.
  - It is important to extract meaning from information that may have an impact on specific missions.
  - Lessons learned from feedback can be stored for future to help others facing the similar problem(s).

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# Conventional Vs KM Systems Life Cycle (KMSLC)

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## Key Differences

- The systems analyst gathers data and information from the users and the users depend on analysts for the solution.
- The knowledge developer gathers knowledge from people with known knowledge and the developer depends on them for the solution.
- The main interface for the systems analyst is associated with novice users who knows the problem but not the solution.
- The main interface for the knowledge developer is associated with the knowledgeable person who knows the problem and the solution.
- Conventional systems development is primarily sequential, whereas KMSLC is incremental and interactive.
- In case of conventional systems, testing is usually done towards the end of the cycle (after the system has been built), whereas in KMSLC, the evolving system is verified and validated from the beginning of the cycle.
- Systems development and systems management is much more extensive for conventional information systems than it is for KMSLC.
- The conventional systems life cycle is usually process-driven and documentation-oriented whereas KMSLC is result-oriented.
  - The conventional systems development does not support tools such as rapid prototyping since it follows a predefined sequence of steps
  - KMSLC can use rapid prototyping incorporating changes on the spot.

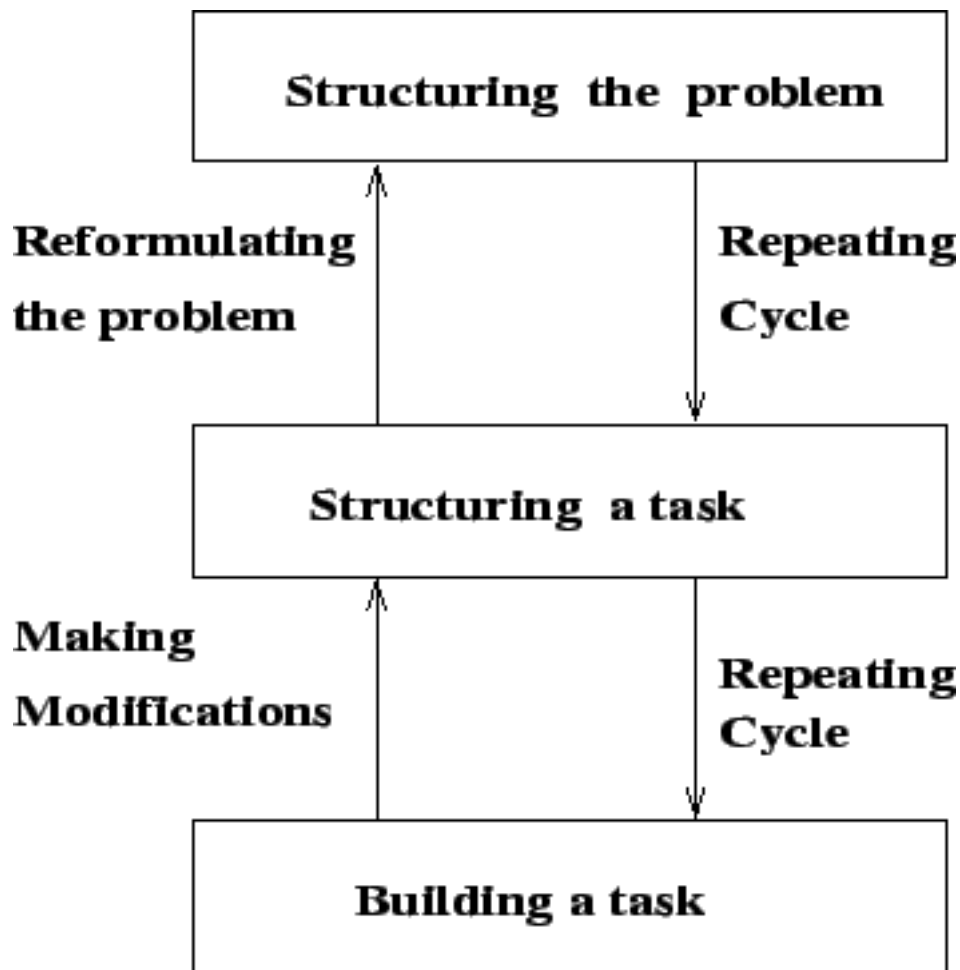


Figure 2.1:Rapid Prototyping

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## Key Similarities

- Both cycles starts with a problem and end with a solution.
- The early phase in case of conventional systems development life cycle starts with information gathering. In KMSLC the early phase needs knowledge capture.
- Verification and validation of a KM system is often very similar to conventional systems testing.
- Both the systems analyst and the knowledge developer needs to choose the appropriate tools for designing their intended systems.

<b>ATTRIBUTES</b>	<b>USER</b>	<b>EXPERT</b>
<b><i>Dependence on System</i></b>	<b>High</b>	<b>Low</b>
<b><i>Ambiguity Tolerance</i></b>	<b>Low</b>	<b>High</b>
<b><i>Co-Operation</i></b>	<b>Required</b>	<b>Not Required</b>
<b><i>Knowledge about the Problem</i></b>	<b>High</b>	<b>Average</b>
<b><i>Uses the System</i></b>	<b>Yes</b>	<b>No</b>
<b><i>Contribution</i></b>	<b>Information</b>	<b>Expertise/Knowledge</b>
<b><i>Availability</i></b>	<b>Yes, Readily available</b>	<b>No, not readily available</b>

**Figure 2.2:**Users and Experts: A Comparison

# KMSLC Approaches

- Primarily due to lack of standardization, a number of approaches have been proposed for KMSLC.
- Refer to Table 3.2 in page 65 of your textbook for a list of representative approaches, and refer to Figure 3.3 in page 66 of your textbook for a proposed hybrid life cycle.
- The conventional systems development approach can still be used for developing KM systems, but it is usually being replaced by iterative design, prototyping etc.

## Evaluating the Existing Infrastructure

KM systems are developed in order to satisfy the need for improving productivity and potential of employees and the company as a whole. The existing knowledge infrastructure is evaluated so that it can give the perception that the present ways of doing things are not just abandoned in preference for a new system.

**System Justification:** It involves answers to the following questions:

- Is existing knowledge going to be lost through retirement, , transfer, or departure to other organizations?
- Is the proposed KM system needed in multiple locations?
- Are experts available and willing to support the building of the proposed KM system?
- Does the concerned problem needs years of proper experience and cognitive reasoning to solve?
- While undergoing knowledge capture, would it be possible for the expert to articulate how the problem will be solved?
- How critical is the knowledge that is to be captured?
- Are the involved tasks nonalgorithmic in nature?
- Would it possible to find a champion within the organization?

**Scoping:** According to the textbook, the term *scoping* means *limiting the breadth and depth of the project within the financial, human resource, and operational constraints.*

**Feasibility:** Feasibility study involves addressing the following questions:

- Is it possible to complete the project within the expected timeframe?
- Is the project affordable?
- Is the project appropriate?
- How frequently the system would be consulted at what will be associated cost?

The traditional approach used to conduct a feasibility study can be used for building a KM system. This involves the following

tasks:

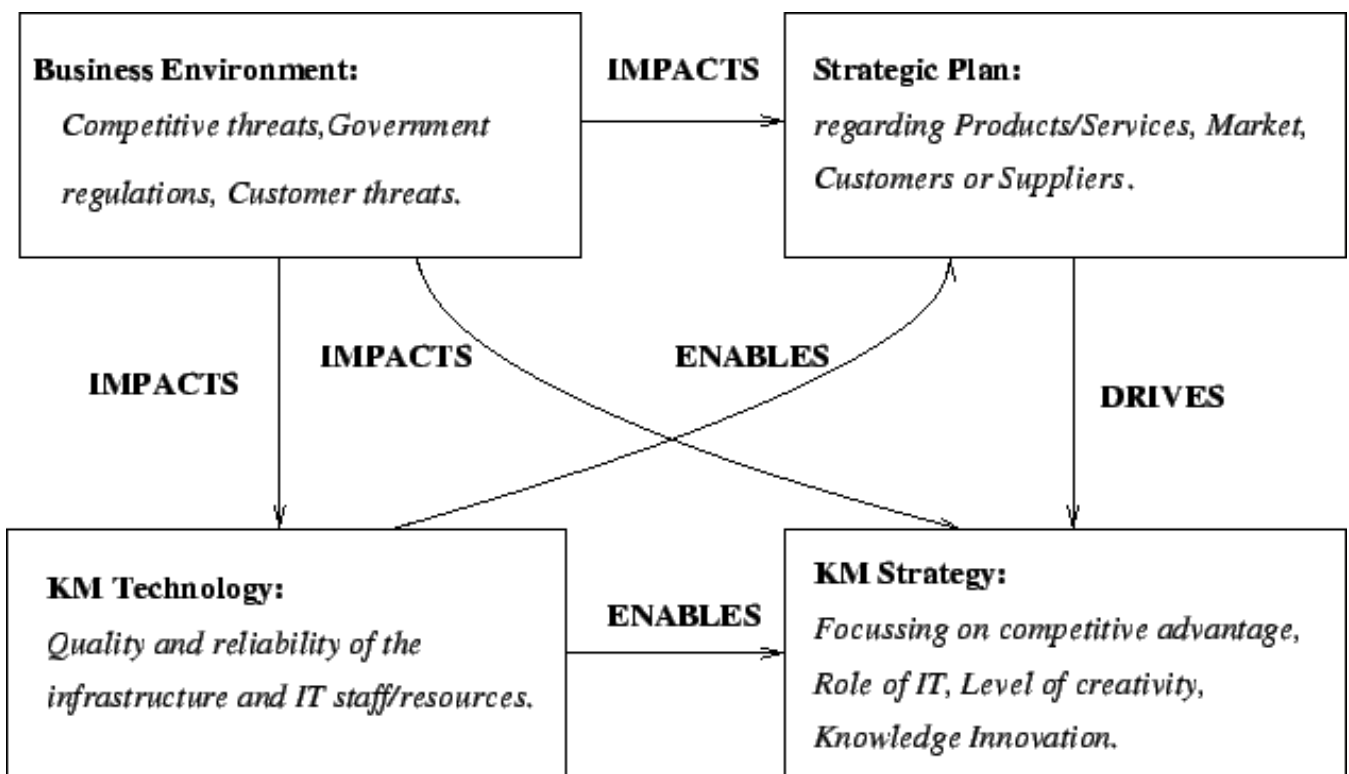
- Forming a knowledge management team.
- Preparing a master plan.
- Performing cost/benefit analysis of the proposed system.
- Quantifying system criteria and costs.

### **User Support**

- Is the proposed user aware of the fact that the new KM system is being developed? How it is perceived?
- How much involvement can be expected from the user while the building process continues?
- What type of users training will needed when the proposed system is up and running?
- What kind of operational support should be provided?

### **Role of Strategic Planning**

- As a consequence of evaluating the existing infrastructure, the concerned organization should develop a strategic plan which should aim at advancing the objectives of the organization with the proposed KM system in mind.
- Areas to be considered:
  - Vision
  - Resources
  - Culture



**Figure 2.3:** Matching business strategies with KM strategies

### Forming a KM team

Forming a KM team usually means

- Identifying the key units, branches, divisions etc. as the key stakeholders in the prospective KM system.
- Strategically, technically, and organizationally balancing the team size and competency.

Factors impacting team success:

- Quality and capability of team members (in terms of personality, experience, and communication skill).
- Size of the team.
- Complexity of the project.
- Team motivation and leadership
- Promising only what that can be actually delivered.

### Capturing Knowledge

- Capturing Knowledge involves extracting, analyzing and interpreting the concerned knowledge that a human expert uses to solve a specific problem.
- Explicit knowledge is usually captured in repositories from appropriate documentation, files etc.
- Tacit knowledge is usually captured from experts, and from organization's stored database(s).

- Interviewing is one of the most popular methods used to capture knowledge.
- Data mining is also useful in terms of using *intelligent agents* that may analyze the data warehouse and come up with new findings.
- In KM systems development, the knowledge developer acquires the necessary heuristic knowledge from the experts for building the appropriate knowledge base.
- Knowledge capture and knowledge transfer are often carried out through teams (refer to Figure 2.4).
- Knowledge capture includes determining feasibility, choosing the appropriate expert, tapping the experts knowledge, retapping knowledge to plug the gaps in the system, and verify/validate the knowledge base (refer to Table 3.4 in page 76 of your textbook).

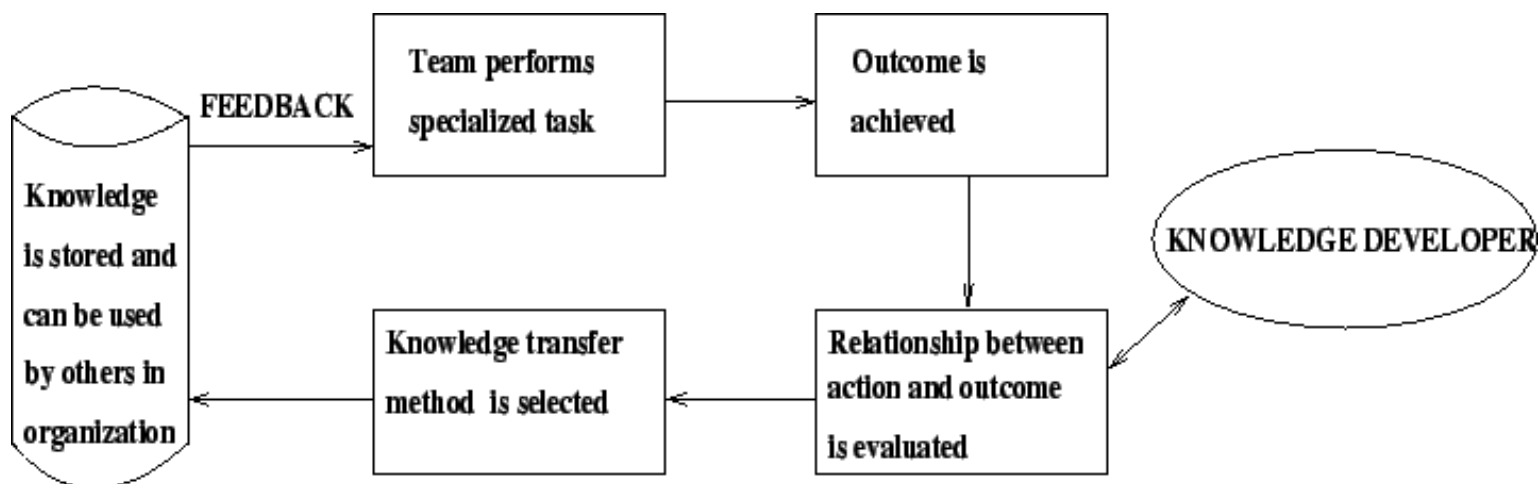


Figure 2.4: Matching business strategies with KM strategies

### The Role of Rapid Prototyping

- In most of the cases, knowledge developers use *iterative* approach for capturing knowledge.
- For example, the knowledge developer may start with a *prototype* (based on the somehow limited knowledge captured from the expert during the first few sessions).
- The following can turn the approach into rapid prototyping:
  - Knowledge developer explains the preliminary/fundamental procedure based on rudimentary knowledge extracted from the expert during the few past sessions.
  - The expert reacts by saying certain remarks.
  - While the expert watches, the knowledge developer enters the additional knowledge into the computer-based system (that represents the prototype).
  - The knowledge developer again runs the modified prototype and continues adding additional knowledge as suggested by the expert till the expert is satisfied.
- The spontaneous, and iterative process of building a knowledge base is referred to as *rapid prototyping*.

### Expert Selection

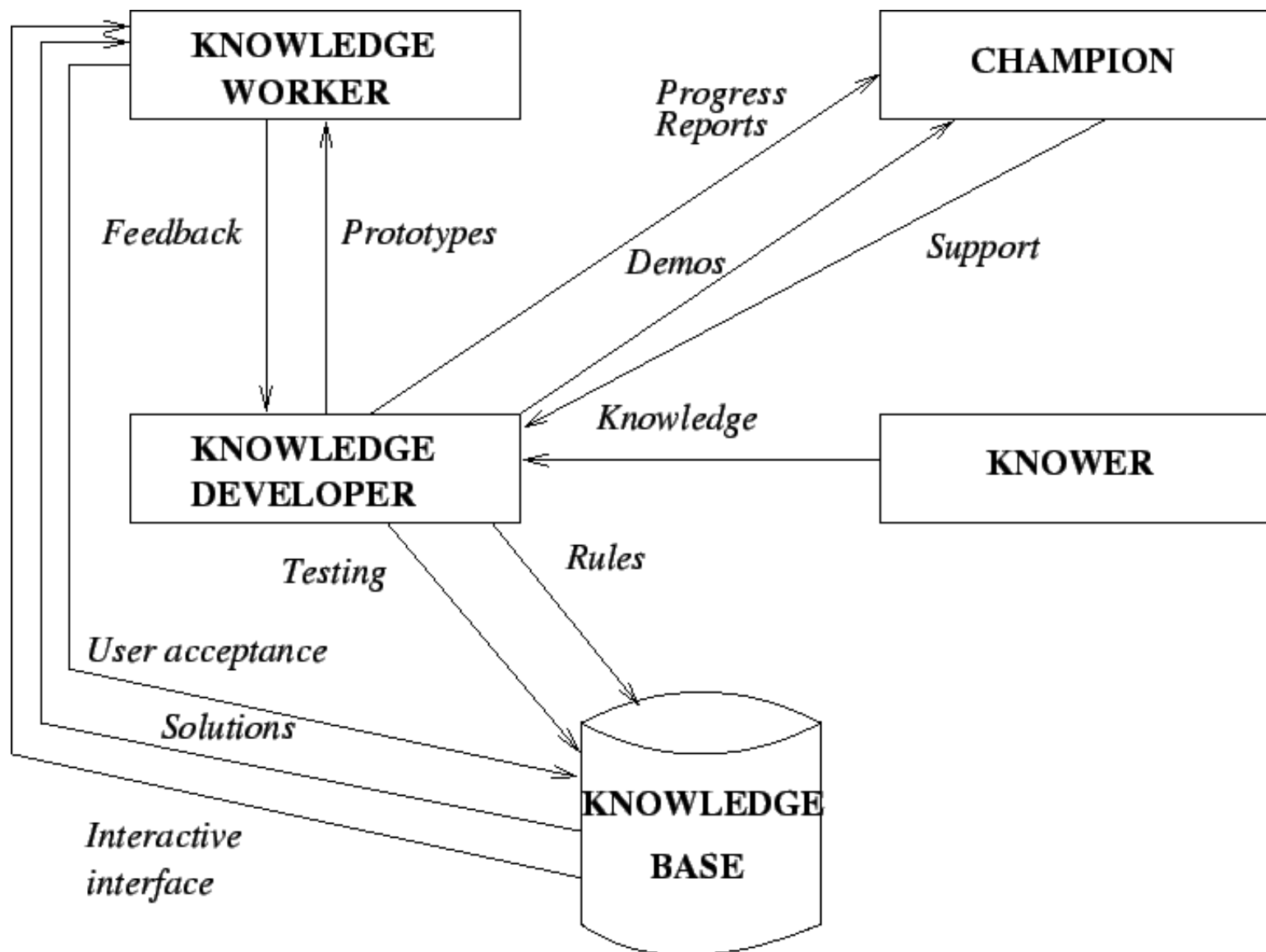
The expert must have excellent communication skill to be able to communicate information understandably and in sufficient detail.

Some common questions that may arise in case of expert selection:

- How to know that the so-called expert is in fact an expert?
- Will he/she stay with the project till its completion?
- What backup would be available in case the expert loses interest or quits?
- How is the knowledge developer going to know what does and what does not lie within the expert's area of expertise?

### **The Role of the Knowledge Developer**

- The knowledge developer can be considered as the architect of the system.
- He/she identifies the problem domain, captures knowledge, writes/tests the heuristics that represent knowledge, and coordinates the entire project.
- Some necessary attributes of knowledge developer:
  - Communication skills.
  - Knowledge of knowledge capture tools/technology.
  - Ability to work in a team with professional/experts.
  - Tolerance for ambiguity.
  - To be able to think conceptually.
  - Ability to frequently interact with the champion, knowledge workers and knowers in the organization.



**Figure 2.5:** Knowledge Developer's Role

## Designing the KM Blueprint

This phase indicates the beginning of designing the IT infrastructure/ Knowledge Management infrastructure. The KM Blueprint (KM system design) addresses a number of issues.

- Aiming for system interoperability/scalability with existing IT infrastructure of the organization.
- Finalizing the scope of the proposed KM system.
- Deciding about the necessary system components.
- Developing the key layers of the KM architecture to meet organization's requirements. These layers are:
  - User interface
  - Authentication/security layer
  - Collaborative agents and filtering
  - Application layer

- Transport internet layer
- Physical layer
- Repositories

## Testing the KM System

This phase involves the following two steps:

- **Verification Procedure:** Ensures that the system is right, i.e., the programs do the task that they are designed to do.
- **Validation Procedure:** Ensures that the system is the right system - it meets the user's expectations, and will be usable on demand.

## Implementing the KM System

- After capturing the appropriate knowledge, encoding in the knowledge base, verifying and validating; the next task of the knowledge developer is to implement the proposed system on a server.
- Implementation means converting the new KM system into actual operation.
- *Conversion* is a major step in case of implementation.
- Some other steps are *postimplementation review* and *system maintenance*.

## Quality Assurance

It indicates the development of controls to ensure a quality KM system. The types of errors to look for:

- Reasoning errors
- Ambiguity
- Incompleteness
- False representation

## Training Users

- The level/duration of training depends on the user's knowledge level and the system's attributes.
- Users can range from *novices* (casual users with very limited knowledge) to *experts* (users with prior IT experience and knowledge of latest technology).
- Users can also be classified as *tutors* (who acquires a working knowledge in order to keep the system current), *pupils* (unskilled worker who tries to gain some understanding of the captured knowledge), or *customers* (who is interested to know how to use the KM system).

- Training should be geared to the specific user based on capabilities, experience and system complexity.
- Training can be supported by user manuals, explanatory facilities, and job aids.

## **Managing Change**

Implementation means change, and organizational members usually resist change. The resistors may include:

- Experts
- Regular employees (users)
- Troublemakers
- Narrow minded people

Resistance can be seen in the form of following personal reactions:

- Projection, i.e., hostility towards peers.
- Avoidance, i.e., withdrawal from the scene.
- Aggression.

## **Postsystem Evaluation**

Key questions to be asked in the postimplementation stage:

- How the new system improved the accuracy/timeliness of concerned decision making tasks?
- Has the new system caused organizational changes? If so, how constructive are the changes?
- Has the new system affected the attitudes of the end users? If so, in what way?
- How the new system changed the cost of business operation? How significant has it been?
- In what ways the new system affected the relationships between end users in the organization?
- Do the benefit obtained from the new system justify the cost of investment?

## **Implications for KM**

The managerial factors to be considered:

- The organization must make a commitment to user training/education prior to building the system.
- Top Management should be informed with cost/benefit analysis of the proposed system.
- The knowledge developers and the people with potential to do knowledge engineering should be properly trained.

- Domain experts must be recognized and rewarded.
- The organization needs to do long-range strategic planning.

Some questions to be addressed by the management regarding systems maintenance:

- Who will be the in charge of maintenance?
- What skills the maintenance specialist needs to have?
- What would be the best way to train the maintenance specialist?
- What incentives should be provided to ensure quality maintenance?
- What types of support/funding will be required?
- What relationship should be established between the maintenance of the KM system and the IT staff of the organization?

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# Knowledge Creation & Knowledge Architecture

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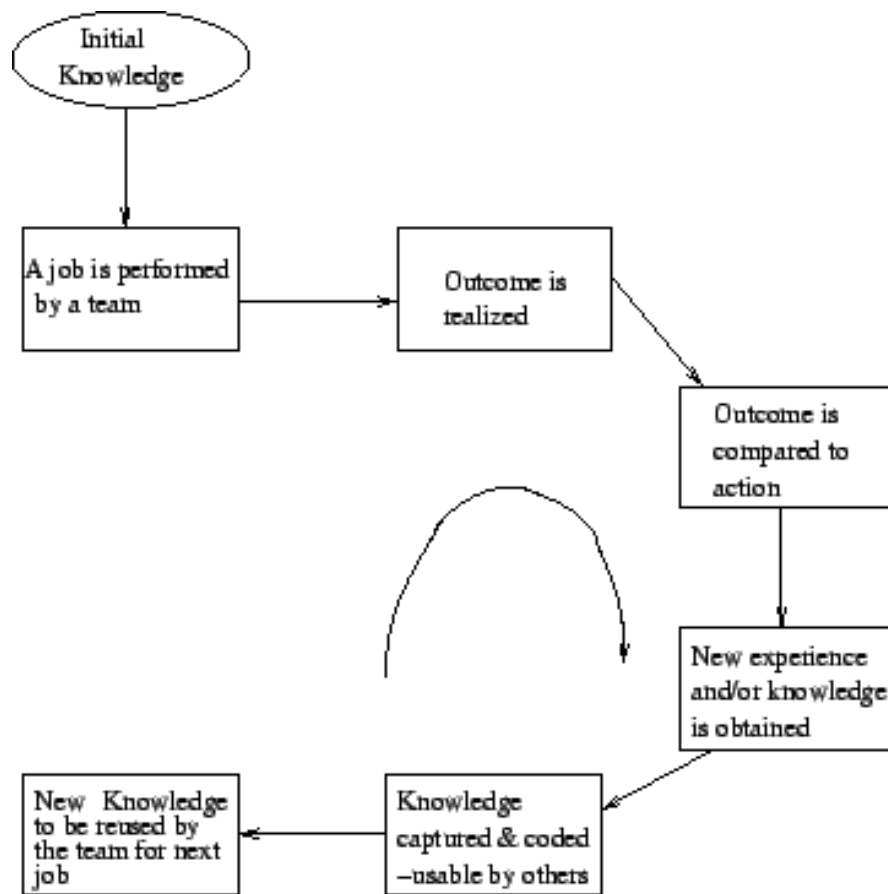
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# Knowledge Creation

- Knowledge update can mean creating new knowledge based on ongoing experience in a specific domain and then using the new knowledge in combination with the existing knowledge to come up with updated knowledge for knowledge sharing.
- Knowledge can be created through teamwork (refer to Figure 3.1)
- A team can commit to perform a job over a specific period of time.
- A job can be regarded as a series of specific tasks carried out in a specific order.
- When the job is completed, then the team compares the experience it had initially (while starting the job) to the outcome (successful/disappointing).
- This comparison translates experience into knowledge.
- While performing the same job in future, the team can take corrective steps and/or modify the actions based on the new knowledge they have acquired.
- Over time, experience usually leads to expertise where one team (or individual) can be known for handling a complex problem very well.
- This knowledge can be transferred to others in a reusable format.



**Figure 3.1:** Knowledge Creation/Knowledge Sharing via Teams

- There exists factors that encourage (or retard) knowledge transfer.
- Personality is one factor in case of knowledge sharing.
- For example, extrovert people usually possess self-confidence, feel secure, and tend to share experiences more readily than the introvert, self-centered, and security-conscious people.
- People with positive attitudes, who usually trust others and who work in environments conducive to knowledge sharing tend to be better in sharing knowledge.
- Vocational reinforcers are the key to knowledge sharing.
- People whose vocational needs are sufficiently met by job reinforcers are usually found to be more likely to favour knowledge sharing than the people who are deprived of one or more reinforcers.

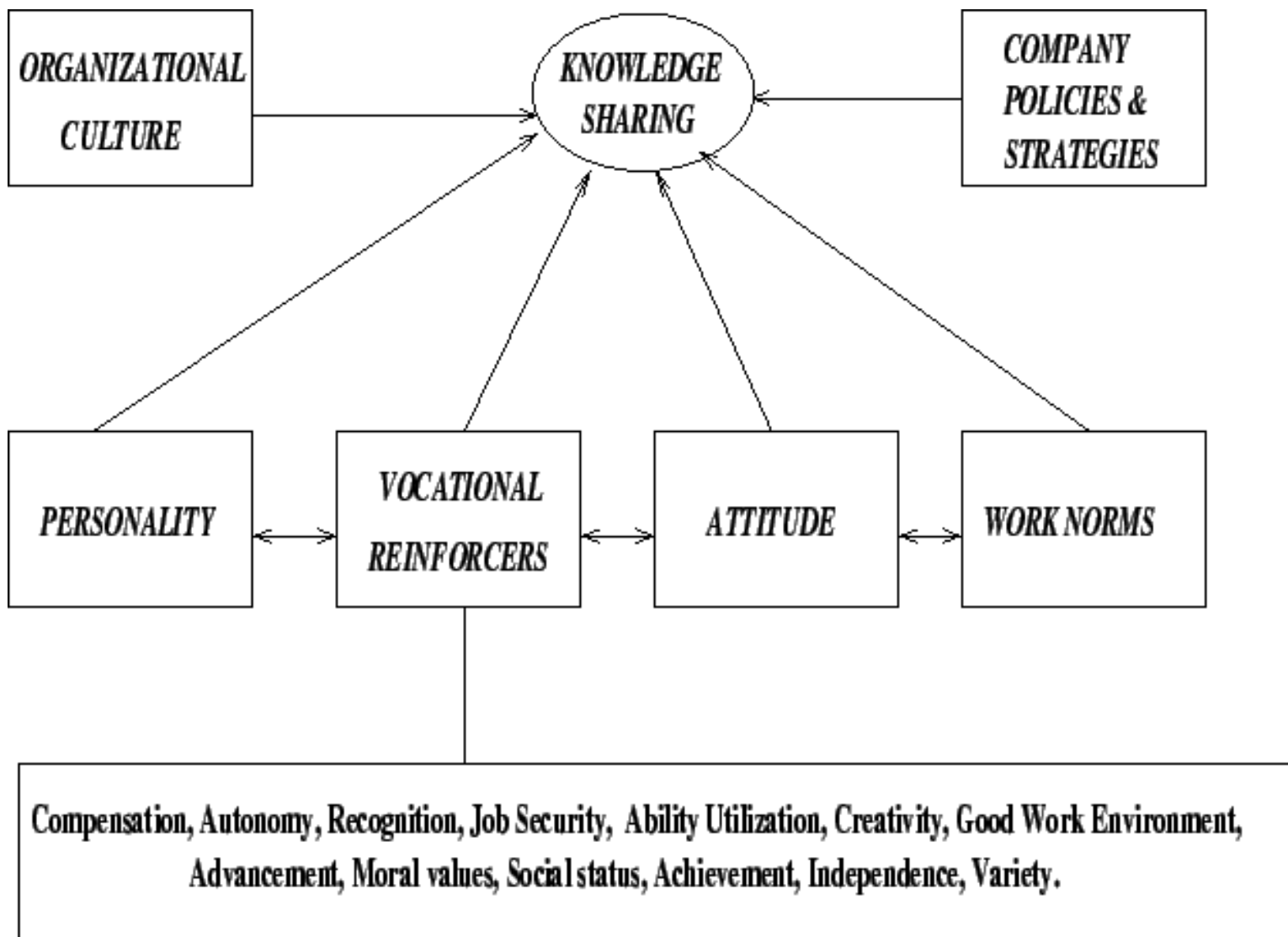


Figure 3.2: Impediments to Knowledge Sharing

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## Nonaka's Model of Knowledge Creation & Transformation

In 1995, Nonaka coined the terms *tacit knowledge* and *explicit knowledge* as the two main types of human knowledge. The key to knowledge creation lies in the way it is mobilized and converted through technology.

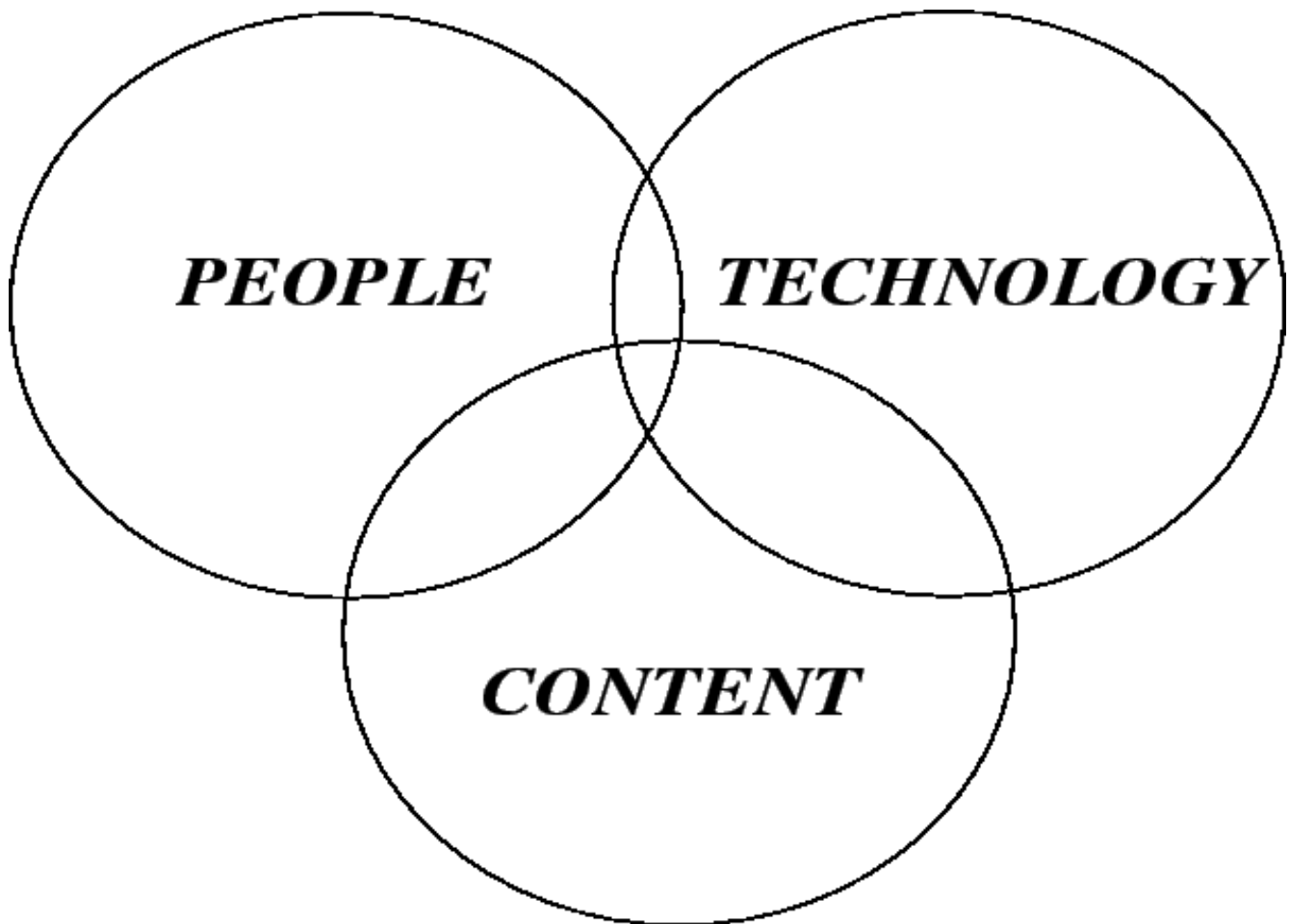
- **Tacit to tacit communication** (Socialization): Takes place between people in meetings or in team discussions.
- **Tacit to explicit communication** (Externalization): Articulation among people through dialog (e.g., brainstorming).
- **Explicit to explicit communication** (Communication): This transformation phase can be best supported by technology. Explicit knowledge can be easily captured and then distributed/transmitted to worldwide audience.
- **Explicit to tacit communication** (Internalization): This implies taking explicit knowledge (e.g., a report) and deducing new ideas or taking constructive action. One significant goal of knowledge management is to create technology to help the users to derive tacit knowledge from explicit knowledge.

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# Knowledge Architecture

- Knowledge architecture can be regarded as a prerequisite to knowledge sharing.
- The infrastructure can be viewed as a combination of people, content, and technology.
- These components are inseparable and interdependent (refer to Figure 3.3).



**Figure 3.3:** Knowledge Management, a conceptual view

## The People Core

- By *people*, here we mean knowledge workers, managers, customers, and suppliers.
- As the first step in knowledge architecture, our goal is to evaluate the existing information/ documents which are used by people, the applications needed by them, the people they usually contact for solutions, the associates they collaborate with, the official emails they send/receive, and the database(s) they usually access.
- All the above stated resources help to create an employee *profile*, which can later be used as the basis for designing a knowledge management system.

- The idea behind assessing the people core is to do a proper job in case of assigning job content to the right person and to make sure that the flow of information that once was obstructed by departments now flows to right people at right time.
- In order to expedite knowledge sharing, a knowledge network has to be designed in such a way as to assign people authority and responsibility for specific kinds of knowledge content, which means:
  - Identifying knowledge centers:
    - After determining the knowledge that people need, the next step is to find out where the required knowledge resides, and the way to capture it successfully.
    - Here, the term *knowledge center* means areas in the organization where knowledge is available for capturing.
    - These centers supports to identify expert(s) or expert teams in each center who can collaborate in the necessary knowledge capture process.
  - Activating knowledge content satellites
    - This step breaks down each knowledge center into some more manageable levels, satellites, or areas.
  - Assigning experts for each knowledge center:
    - After the final framework has been decided, one manager should be assigned for each knowledge satellite who will ensure integrity of information content, access, and update.
    - Ownership is a crucial factor in case of knowledge capture, knowledge transfer, and knowledge implementation.
    - In a typical organization, departments usually tend to be territorial.
    - Often, fight can occur over the budget or over the control of sensitive processes (this includes the kind of knowledge a department owns).
    - These reasons justify the process of assigning department ownership to knowledge content and knowledge process.
    - adjacent/interdependent departments should be cooperative and ready to share knowledge.

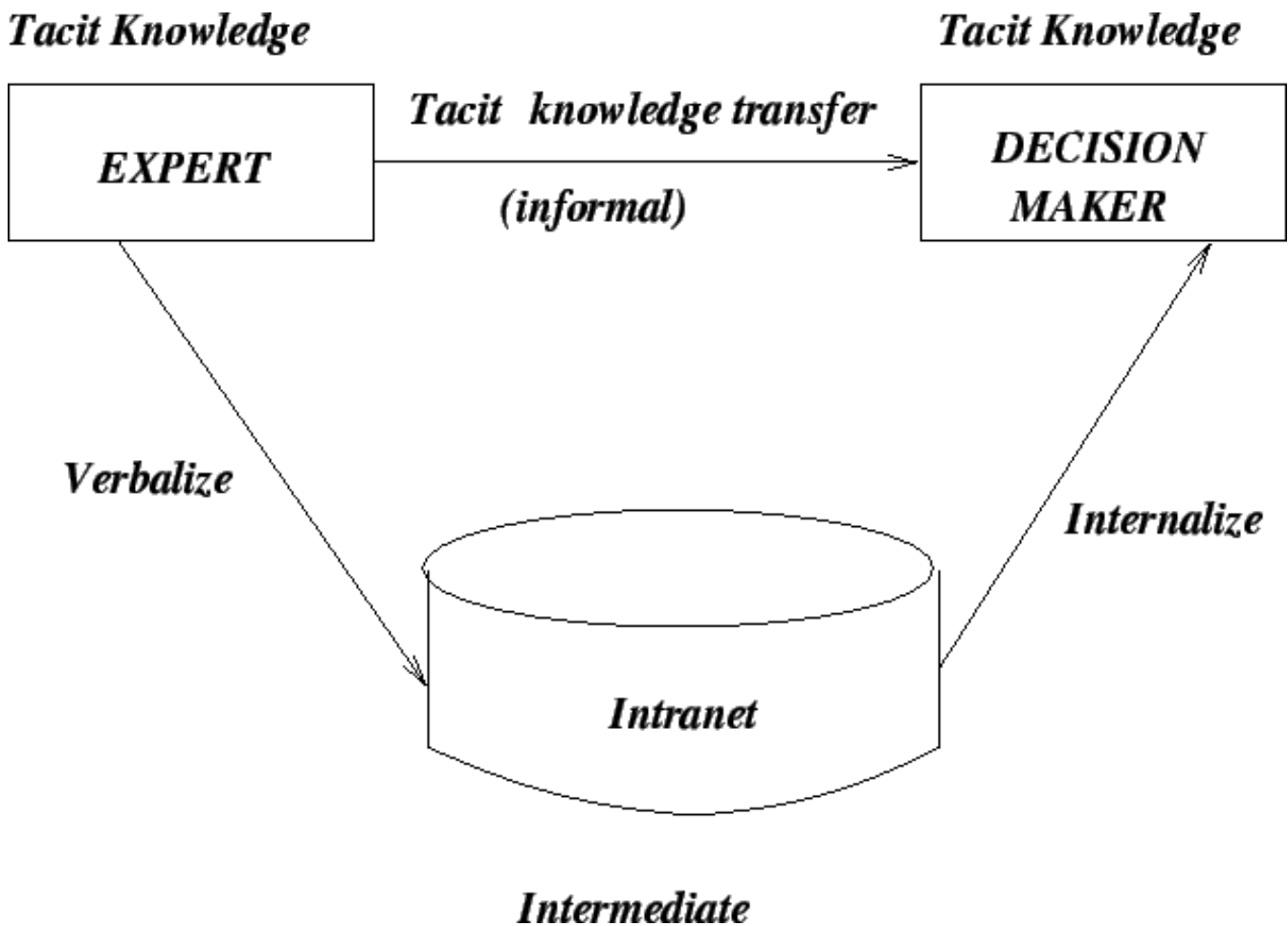
## The Technical Core

- The objective of the technical core is to enhance communication as well as ensure effective knowledge sharing.
- Technology provides a lot of opportunities for managing tacit knowledge in the area of communication.
- Communication networks create links between necessary databases.
- Here the term *technical core* is meant to refer to the totality of the required hardware, software, and the specialized human resources.

- Expected attributes of technology under the technical core: Accuracy, speed, reliability, security, and integrity.
- Since an organization can be thought of as a knowledge network, the goal of knowledge economy is to push employees towards greater efficiency/ productivity by making best possible use of the knowledge they possess.
- A knowledge core usually becomes a network of technologies designed to work on top of the organization's existing network.

## **User Interface Layer**

- Usually a web browser represents the interface between the user and the KM system.
- It is the top layer in the KM system architecture.
- The way the text, graphics, tables etc are displayed on the screen tends to simplify the technology for the user.
- The user interface layer should provide a way for the proper flow of tacit and explicit knowledge.
- The necessary knowledge transfer between people and technology involves capturing tacit knowledge from experts, storing it in knowledge base, and making it available to people for solving complex problems.
- Features to be considered in case of user interface design:
  - Consistency
  - Relevancy
  - Visual clarity
  - Usability
  - Ease of Navigation



**Figure 3.4:**The Transfer of Knowledge

### Authorized Access Layer

- This layer maintains security as well as ensures authorized access to the knowledge captured and stored in the organization's repositories.
- The knowledge is usually captured by using internet, intranet or extranet.
- An organization's intranet represents the internal network of communication systems.
- Extranet is a type of intranet with extensions allowing specified people (customers, suppliers, etc.) to access some organizational information.
- Issues related to the access layer: access privileges, backups.
- The access layer is mostly focused on security, use of protocols (like passwords), and software tools like firewalls.
- Firewalls can protect against:
  - E-mails that can cause problems.
  - Unauthorized access from the outside world.
  - Undesirable material (movies, images, music etc).

- Unauthorized sensitive information leaving the organization.
- Firewalls can not protect against:
  - Attacks not going through the firewall.
  - Viruses on floppy disks.
  - Weak security policies.

## **Collaborative Intelligence and Filtering Layer**

- This layer provides customized views based on stored knowledge.
- Authorized users can find information (through a search mechanism) tailored to their needs.
- Intelligent agents (active objects which can perceive, reason, and act in a situation to help problem solving) are found to be extremely useful in some situations.
- In case of client/server computing, there happens to be frequent and direct interaction between the client and the server.
- In case of mobile agent computing, the interaction happens between the agent and the server.
- A mobile agent roams around the internet across multiple servers looking for the correct information. Some benefits can be found in the areas of:
  - Fault tolerance.
  - Reduced overall network load.
  - Heterogeneous operation.
- Key components of this layer:
  - The registration directory that develops tailored information based on user profile.
  - Membership in specific services, such as sales promotion, news service etc.
  - The search facility such as a search engine.
- In terms of the prerequisites for this layer, the following criteria can be considered:
  - Security.
  - Portability.
  - Flexibility
  - Scalability

- Ease of use.
- Integration.

### **Knowledge-Enabling Application Layer (Value-Added Layer)**

- This creates a competitive edge.
- Most of the applications help users to do their jobs in better ways.
- They include knowledge bases, discussion databases, decision support etc.

### **Transport Layer**

- This is the most technical layer.
- It ensures to make the organization a network of relationships where electronic transfer of knowledge can be considered as routine.
- This layer associates with LAN (Local Area Network), WAN (Wide Area Network), intranets, extranets, and internet.
- In this layer we consider multimedia, URL's, connectivity speeds/bandwidths, search tools, and consider managing of network traffic.

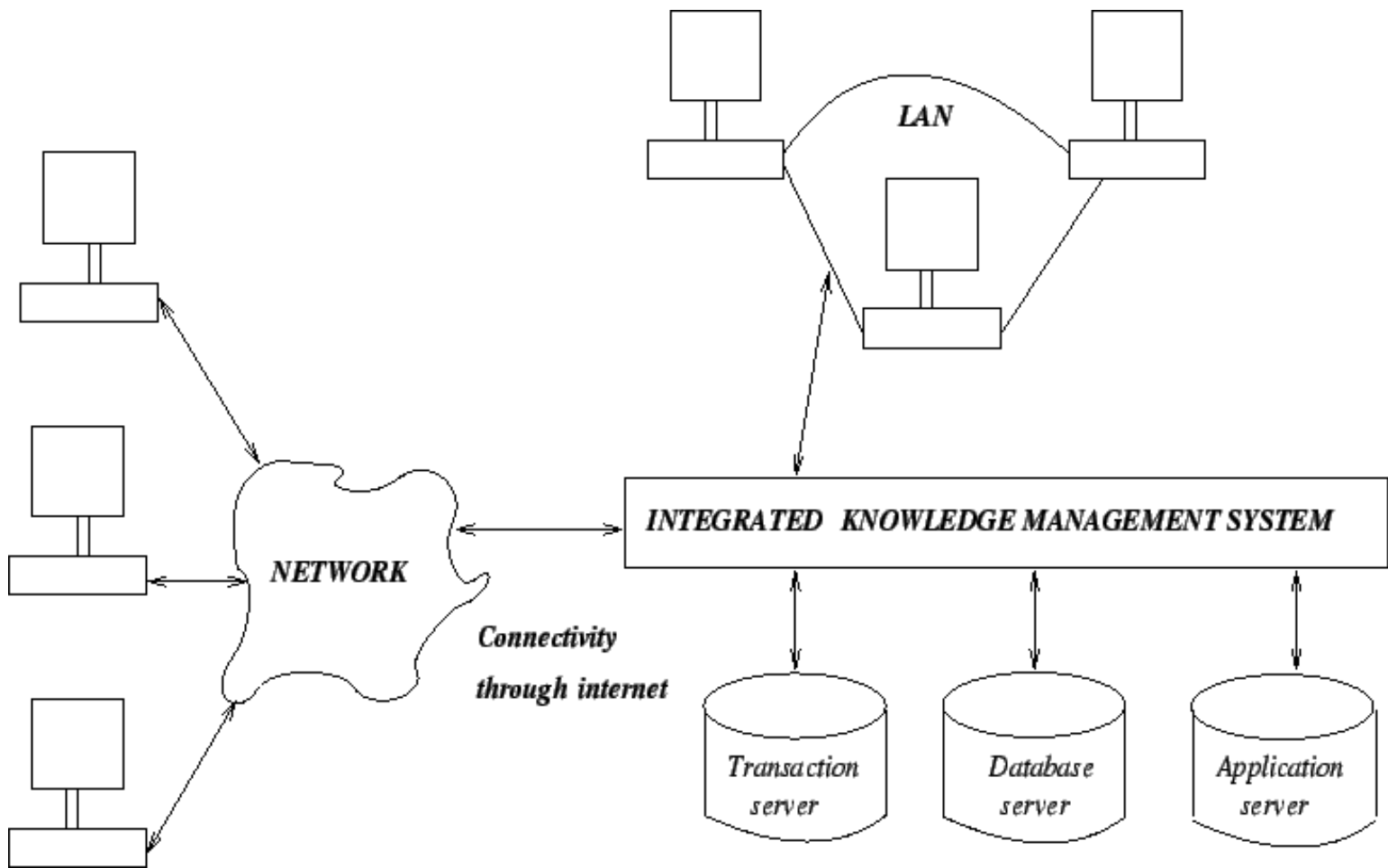
### **Middleware Layer**

- This layer makes it possible to connect between old and new data formats.
- It contains a range of programs to do this job.

### **Repositories Layer**

- It is the bottom layer of the KM architecture which represents the physical layer in which repositories are installed.
- These may include, legacy applications, intelligent data warehouses, operational databases etc.

- After establishing the repositories, they are linked to form an integrated repository.



**Figure 3.5:** Integrated Knowledge Management System

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# Acquiring the KM System

## Building In-house from Scratch

- Requires ready professionals.
- Development cost is high.
- Risk is high.
- Main benefit is the customization.

## Buying

- Quick installation.
- Low cost.
- Customization may not be quite right.

## Outsourcing

- It is a trend that allows organizations to concentrate on their strengths while technological design and other specialized areas are releases to outsiders.

Present trend exists towards ready-to-use, generalized software packages. Advantages of a reliable KM software package:

- Implementation time is shorter.
- Development cost is comparatively low.
- There exists reduced need of resources.

- Offer greater flexibility.
- Shorter track record.
- Lack of competition.
- Application incompatibility.

Crucial components in case of knowledge management systems development:

- Reliability
- Market pressure.
- Usability.
- Modularity.
- Performance.
- Serviceability.
- Portability.

Buying or outsourcing a KM system raises the important question of *ownership*. The issues to consider in case of ownership:

- What is the user paying for?
- What restrictions exist in case of copying the software for organizational subdivisions?
- Who can modify the software and what are the associated costs?
- How the modifications can be made if at some stage the vendor happens to be out of business?

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# Capturing the Tacit Knowledge

- **Knowledge Capture** can be defined as the *process using which the expert's thoughts and experiences can be captured.*
- In this case, the knowledge developer collaborates with the expert in order to convert the expertise into the necessary program code(s).
- Important steps:
  - Using appropriate tools for eliciting information.
  - Interpreting the elicited information and consequently inferring the experts underlying knowledge/reasoning process.
  - Finally, using the interpretation to construct the the necessary rules which can represent the experts reasoning process.

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# Expert Evaluation

- Indicators of expertise:
  - The expert commands genuine respect.
  - The expert is found to be consulted by people in the organization, when some problem arises.
  - The expert possess self confidence and he/she has a realistic view of the limitations.
  - The expert avoids irrelevant information, uses facts and figures.
  - The expert is able to explain properly and he/she can customize his/her presentation according to the level of the audience.
  - The expert exhibits his/her depth of the detailed knowledge and his/her quality of explanation is exceptional.
  - The expert is not arrogant regarding his/her personal information.
  
- Experts qualifications:
  - The expert should know when to follow hunches, and when to make exceptions.
  - The expert should be able to see the big picture.
  - The expert should posses good communication skills.
  - The expert should be able to tolerate stress.
  - The expert should be able to think creatively.
  - The expert should be able to exhibit self-confidence in his/her thought and actions.
  - The expert should maintain credibility.
  - The expert should operate within a schema-driven/structured orientation.

- The expert should use chunked knowledge.
- The expert should be able to generate enthusiasm as well as motivation.
- The expert should share his/her expertise willingly and without hesitation.
- The expert should emulate an ideal teacher's habits.
- Experts levels of expertise:
  - Highly expert persons.
  - Moderately expert problem solvers.
  - New experts.
- Capturing single vs multiple experts' tacit knowledge:
  - Advantages of working with a single expert:
    - Ideal for building a simple KM system with only few rules.
    - Ideal when the problem lies within a restricted domain.
    - The single expert can facilitate the logistics aspects of coordination arrangements for knowledge capture.
    - Problem related/personal conflicts are easier to resolve.
    - The single expert tends to share more confidentiality.
  - Disadvantages of working with a single expert:
    - Often, the experts knowledge is found to be not easy to capture.
    - The single expert usually provides a single line of reasoning.
    - They are more likely to change meeting schedules.
    - The knowledge is often found to be dispersed.
  - Advantages of working with multiple (team) experts:

- Complex problem domains are usually benefited.
  - Stimulates interaction.
  - Listening to a multitude of views allows the developer to consider alternative ways of representing knowledge.
  - Formal meetings are sometimes better environment for generating thoughtful contributions.
- Disadvantages of working with multiple (team) experts:
- Disagreements can frequently occur.
  - Coordinating meeting schedules are more complicated.
  - Harder to retain confidentiality.
  - Overlapping mental processes of multiple experts can result in a *process loss*.
  - Often requires more than one knowledge developer.

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# Developing Relationship with Experts

- Creating the right impression: The knowledge developer must learn to use psychology, common sense, technical as well as marketing skills to attract the experts respect and attention.
- Understanding of the expert's style of expression:

Experts are usually found to use one of the following styles of expression:

- Procedure type: These type of experts are found to be logical, verbal and always procedural.
- Storyteller type: These type of experts are found to be focused on the content of the domain at the expense of the solution.
- Godfather type: These type of experts are found to be compulsive to take over.
- Salesperson type: These type of experts are found to spend most of the time dancing around the topic, explaining why his/her solution is the best.
- Preparation for the session:
  - Before making the first appointment, the knowledge developer must acquire some knowledge about the problem and the expert.
  - Initial sessions can be most challenging/critical.
  - The knowledge developer must build the trust.
  - The knowledge developer must be familiar with project terminology and he/she must review the existing documents.
  - The knowledge developer should be able to make a quick rapport with the expert.

Deciding the location for the session:

- Protocol calls for the expert to decide the location.

- The expert is usually more comfortable in having his/her necessary tools and information available close to him/her.
- The meeting place should be quiet and free of interruptions.
- Approaching multiple experts:
  - Individual approach: The knowledge developer holds sessions with one expert at a time.
  - Approach using primary and secondary experts:
    - The knowledge developer hold sessions with the senior expert early in the knowledge capture program for the clarification of the plan.
    - For a detailed probing, he/she may ask for other experts' knowledge.
  - Small groups approach:
    - Experts gather together in one place, discuss the problem domain, and usually provide a pool of information.
    - Experts' responses are monitored, and the functionality of each expert is tested against the expertise of the others.
    - This approach requires experience in assessing tapped knowledge, as well as cognition skills.
    - The knowledge developer must deal with the issue of power and its effect on expert's opinion.

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# Fuzzy Reasoning & Quality of Knowledge Capture

- Sometimes, the information gathered from the experts via interviewing is not precise and it involves fuzziness and uncertainty.
- The fuzziness may increase the difficulty of translating the expert's notions into applicable rules.
- Analogies/Uncertainties:
  - In the course of explaining events, experts can use analogies (comparing a problem with a similar problem which has been encountered in possibly different settings, months or years ago).
  - An expert's knowledge or expertise represents the ability to gather uncertain information as input and to use a plausible line of reasoning to clarify the fuzzy details.
  - *Belief*, an aspect of uncertainty, tends to describe the level of credibility.
  - People may use different kinds of words in order to express belief.
  - These words are often paired with qualifiers such as *highly*, *extremely*.
- Understanding experience:
  - Knowledge developers can benefit from their understanding/knowledge of cognitive psychology.
  - When a question is asked, then an expert operates on certain stored information through deductive, inductive, or other kinds of problem-solving methods.
  - The resulting answer is often found to be the culmination of the processing of stored information.
  - The right question usually evokes the memory of experiences that produced good and appropriate solutions in the past.

Sometimes, how quickly an expert responds to a question depends on the clarity of content, whether the content has been recently used, and how well the expert has understood the question.

- Problem with the language: How well the expert can represent internal processes can vary with their command of the language they are using and the knowledge developer's interviewing skills.

The language may be unclear in the following number of ways:

- Comparative words (e.g., *better*, *faster*) are sometimes left hanging.
- Specific words or components may be left out of an explanation.
- Absolute words and phrases may be used loosely.
- Some words always seem to have a built-in ambiguity.

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# Interviewing as a Tacit Knowledge Capture Tool

- Advantages of using interviewing as a tacit knowledge capture tool:
  - It is a flexible tool.
  - It is excellent for evaluating the validity of information.
  - It is very effective in case of eliciting information regarding complex matters.
  - Often people enjoy being interviewed.
- Interviews can range from the highly unstructured type to highly structured type.
  - The unstructured types are difficult to conduct, and they are used in the case when the knowledge developer really needs to explore an issue.
  - The structured types are found to be goal-oriented, and they are used in the case when the knowledge developer needs specific information.
  - Structured questions can be of the following types:
    - Multiple-choice questions.
    - Dichotomous questions.
    - Ranking scale questions.
  - In semistructured types, the knowledge developer asks predefined questions, but he/she allows the expert some freedom in expressing his/her answer.
- Guidelines for successful interviewing:
  - Setting the stage and establishing rapport.
  - Phrasing questions.
  - Listening closely/avoiding arguments.

- Evaluating the session outcomes.
- Reliability of the information gathered from experts:

Some uncontrolled sources of error that can reduce the information's reliability:

- Expert's perceptual slant.
- The failure in expert's part to exactly remember what has happened.
- Fear of unknown in the part of expert.
- Problems with communication.
- Role bias.
- Errors in part of the knowledge developer: validity problems are often caused by the *interviewer effect* (something about the knowledge developer colours the response of the expert). Some of the effects can be as follows:
  - Gender effect
  - Age effect
  - Race effect
- Problems encountered during interviewing
  - Response bias.
  - Inconsistency.
  - Problem with communication.
  - Hostile attitude.
  - Standardizing the questions.
  - Setting the length of the interview.
- Process of ending the interview:
  - The end of the session should be carefully planned.

- One procedure calls for the knowledge developer to halt the questioning a few minutes before the scheduled ending time, and to summarize the key points of the session.
- This allows the expert to comment a schedule a future session.
- Many verbal/nonverbal cues can be used for ending the interview. (refer to Table 5.2, in page 148 of your textbook).
- Issues: Many issues may arise during the interview, and to be prepared for the most important ones, the knowledge developer can consider the following questions:
  - How would it be possible to elicit knowledge from the experts who can not say what they mean or can not mean what they say.
  - How to set up the problem domain.
  - How to deal with uncertain reasoning processes.
  - How to deal with the situation of difficult relationships with expert(s).
  - How to deal with the situation when the expert does not like the knowledge developer for some reason.
- Rapid Prototyping in interviews:
  - Rapid prototyping is an approach to building KM systems, in which knowledge is added with each knowledge capture session.
  - This is an iterative approach which allows the expert to verify the rules as they are built during the session.
  - This approach can open up communication through its demonstration of the KM system.
  - Due to the process of instant feedback and modification, it reduces the risk of failure.
  - It allows the knowledge developer to learn each time a change is incorporated in the prototype.
  - This approach is highly interactive.
  - The prototype can create user expectations which in turn can become obstacles to further development effort.

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# Some Knowledge Capturing Techniques

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## On-Site Observation (Action Protocol)

- It is a process which involves observing, recording, and interpreting the expert's problem-solving process while it takes place.
- The knowledge developer does more listening than talking; avoids giving advice and usually does not pass his/her own judgment on what is being observed, even if it seems incorrect; and most of all, does not argue with the expert while the expert is performing the task.
- Compared to the process of interviewing, on-site observation brings the knowledge developer closer to the actual steps, techniques, and procedures used by the expert.
- One disadvantage is that sometimes some experts do not like the idea of being observed.
- The reaction of other people (in the observation setting) can also be a problem causing distraction.
- Another disadvantage is the accuracy/completeness of the captured knowledge.

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# Brainstorming

- It is an unstructured approach towards generating ideas about creative solution of a problem which involves multiple experts in a session.
- In this case, questions can be raised for clarification, but no evaluations are done at the spot.
- Similarities (that emerge through opinions) are usually grouped together logically and evaluated by asking some questions like:
  - What benefits are to be gained if a particular idea is followed.
  - What specific problems that idea can possibly solve.
  - What new problems can arise through this.

The general procedure for conducting a brainstorming session:

- Introducing the session.
  - Presenting the problem to the experts.
  - Prompting the experts to generate ideas.
  - Looking for signs of possible convergence.
- If the experts are unable to agree on a specific solution, they knowledge developer may call for a vote/consensus.

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# Electronic Brainstorming

- Is a computer-aided approach for dealing with multiple experts.
- It usually begins with a pre-session plan which identifies objectives and structures the agenda, which is then presented to the experts for approval.
- During the session, each expert sits on a PC and get themselves engaged in a predefined approach towards resolving an issue, and then generates ideas.
- This allows experts to present their opinions through their PC's without having to wait for their turn.
- Usually the comments/suggestions are displayed electronically on a large screen without identifying the source.
- This approach protects the introvert experts and prevents tagging comments to individuals.
- The benefit includes improved communication, effective discussion regarding sensitive issues, and closes the meeting with concise recommendations for necessary action (refer to Figure 5.1 for the sequence of steps).
- This eventually leads to convergence of ideas and helps to set final specifications.
- The result is usually the joint ownership of the solution.

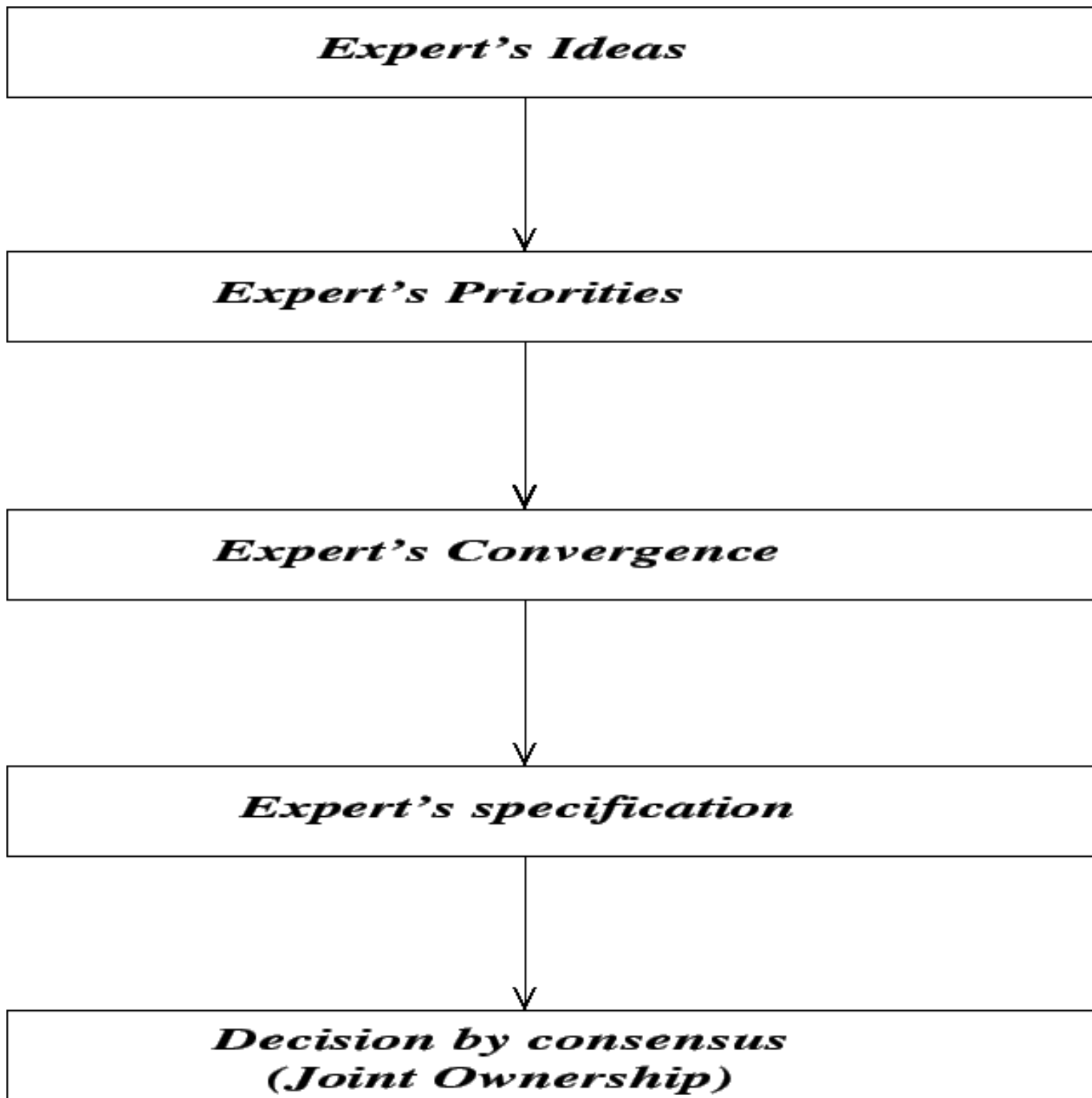


Figure 5.1: The process of brainstorming

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# Protocol Analysis (Think-Aloud Method)

- In this case, protocols (scenarios) are collected by asking experts to solve the specific problem and verbalize their decision process by stating directly what they think.
- Knowledge developers do not interrupt in the interim.
- The elicited information is structured later when the knowledge developer analyzes the protocol.
- Here the term *scenario* refers to a detailed and somehow complex sequence of events or more precisely, an episode.
- A scenario can involve individuals and objects.

A scenario provides a concrete vision of how some specific human activity can be supported by information technology.

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# Consensus Decision Making

- Consensus decision making usually follows brainstorming.
- It is effective if and only if each expert has been provided with equal and adequate opportunity to present their views.
- In order to arrive at a consensus, the knowledge developer conducting the exercise tries to rally the experts towards one or two alternatives.
- The knowledge developer follows a procedure designed to ensure fairness and standardization.
- This method is democratic in nature.
- This method can be sometimes tedious and can take hours.

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# Repertory Grid

- This is a tool used for knowledge capture.
- The domain expert classifies and categorizes a problem domain using his/her own model.
- The grid is used for capturing and evaluating the expert's model.
- Two experts (in the same problem domain) may produce distinct sets of personal and subjective results.
- The grid is a scale (or a bipolar construct) on which elements can be placed within gradations.
- The knowledge developer usually elicits the constructs and then asks the domain expert to provide a set of examples called *elements*.
- Each element is rated according to the constructs which have been provided.

(Refer to page 167 of your textbook for examples).

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# Nominal Group Technique (NGT)

- This provides an interface between consensus and brainstorming.
- Here the panel of experts becomes a *Nominal Group* whose meetings are structured in order to effectively pool individual judgment.
- *Ideawriting* is a structured group approach used for developing ideas as well as exploring their meaning and the net result is usually a written report.
- NGT is an ideawriting technique.

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# Delphi Method

- It is a survey of experts where a series of questionnaires are used to pool the experts' responses for solving a specific problem.
- Each experts' contributions are shared with the rest of the experts by using the results from each questionnaire to construct the next questionnaire.

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# Concept Mapping

- It is a network of concepts consisting of nodes and links.
- A node represents a concept, and a link represents the relationship between concepts (refer to Figure 6.5 in page 172 of your textbook).
- Concept mapping is designed to transform new concepts/propositions into the existing cognitive structures related to knowledge capture.
- It is a structured conceptualization.
- It is an effective way for a group to function without losing their individuality.
- Concept mapping can be done for several reasons:
  - To design complex structures.
  - To generate ideas.
  - To communicate ideas.
  - To diagnose misunderstanding.
- Six-step procedure for using a concept map as a tool:
  - Preparation.
  - Idea generation.
  - Statement structuring.
  - Representation.
  - Interpretation
  - Utilization.

- Similar to concept mapping, a *semantic net* is a collection of nodes linked together to form a net.
  - A knowledge developer can graphically represent descriptive/declarative knowledge through a net.
  - Each idea of interest is usually represented by a node linked by lines (called *arcs*) which shows relationships between nodes.
  - Fundamentally it is a network of concepts and relationships (refer to page 173 of your textbook for example).

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# Blackboarding

- In this case, the experts work together to solve a specific problem using the blackboard as their workspace.
- Each expert gets equal opportunity to contribute to the solution via the blackboard.
- It is assumed that all participants are experts, but they might have acquired their individual expertise in situations different from those of the other experts in the group.
- The process of blackboarding continues till the solution has been reached.
- Characteristics of blackboard system:
  - Diverse approaches to problem-solving.
  - Common language for interaction.
  - Efficient storage of information
  - Flexible representation of information.
  - Iterative approach to problem-solving.
  - Organized participation.
- Components of blackboard system:
  - The Knowledge Source (KS): Each KS is an independent expert observing the status of the blackboard and trying to contribute a higher level partial solution based on the knowledge it has and how well such knowledge applies to the current blackboard state.
  - The Blackboard : It is a global memory structure, a database, or a repository that can store all partial solutions and other necessary data that are presently in various stages of completion.
  - A Control Mechanism: It coordinates the pattern and flow of the problem solution.

- The inference engine and the knowledge base are part of the blackboard system.
- This approach is useful in case of situations involving multiple expertise, diverse knowledge representations, or situations involving uncertain knowledge representation.

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# Knowledge Codification

- Knowledge codification means converting tacit knowledge to explicit knowledge in a usable form for the organizational members.
- Tacit knowledge (e.g., human expertise) is identified and leveraged through a form that is able to produce highest return for the business.
- Explicit knowledge is organized, categorized, indexed and accessed.
- The organizing often includes decision trees, decision tables etc.
- Codification must be done in a form/structure which will eventually build the knowledge base.
- The resulting knowledge base supports training and decision making.
  - Diagnosis.
  - Training/Instruction.
  - Interpretation.
  - Prediction.
  - Planning/Scheduling.
- The knowledge developer should note the following points before initiating knowledge codification:
  - Recorded knowledge is often difficult to access (because it is either fragmented or poorly organized).
  - Diffusion of new knowledge is too slow.
  - Knowledge is not shared, but hoarded (this can involve political implications).
  - Often knowledge is not found in the proper form.

- Often knowledge is not available at the correct time when it is needed.
- Often knowledge is not present in the proper location where it should be present.
- Often the knowledge is found to be incomplete.

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# Modes of Knowledge Conversion

- Conversion from tacit to tacit knowledge produces socialization where knowledge developer looks for experience in case of knowledge capture.
- Conversion from tacit to explicit knowledge involves externalizing, explaining or clarifying tacit knowledge via analogies, models, or metaphors.
- Conversion from explicit to tacit knowledge involves internalizing (or fitting explicit knowledge to tacit knowledge).
- Conversion from explicit to explicit knowledge involves combining, categorizing, reorganizing or sorting different bodies of explicit knowledge to lead to new knowledge.

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# Codifying Knowledge

- An organization must focus on the following before codification:
  - What organizational goals will the codified knowledge serve?
  - What knowledge exists in the organization that can address these goals?
  - How useful is the existing knowledge for codification?
  - How would someone codify knowledge?
- Codifying tacit knowledge (in its entirety) in a knowledge base or repository is often difficult because it is usually developed and internalized in the minds of the human experts over a long period of time.

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# Codification Tools/Procedures

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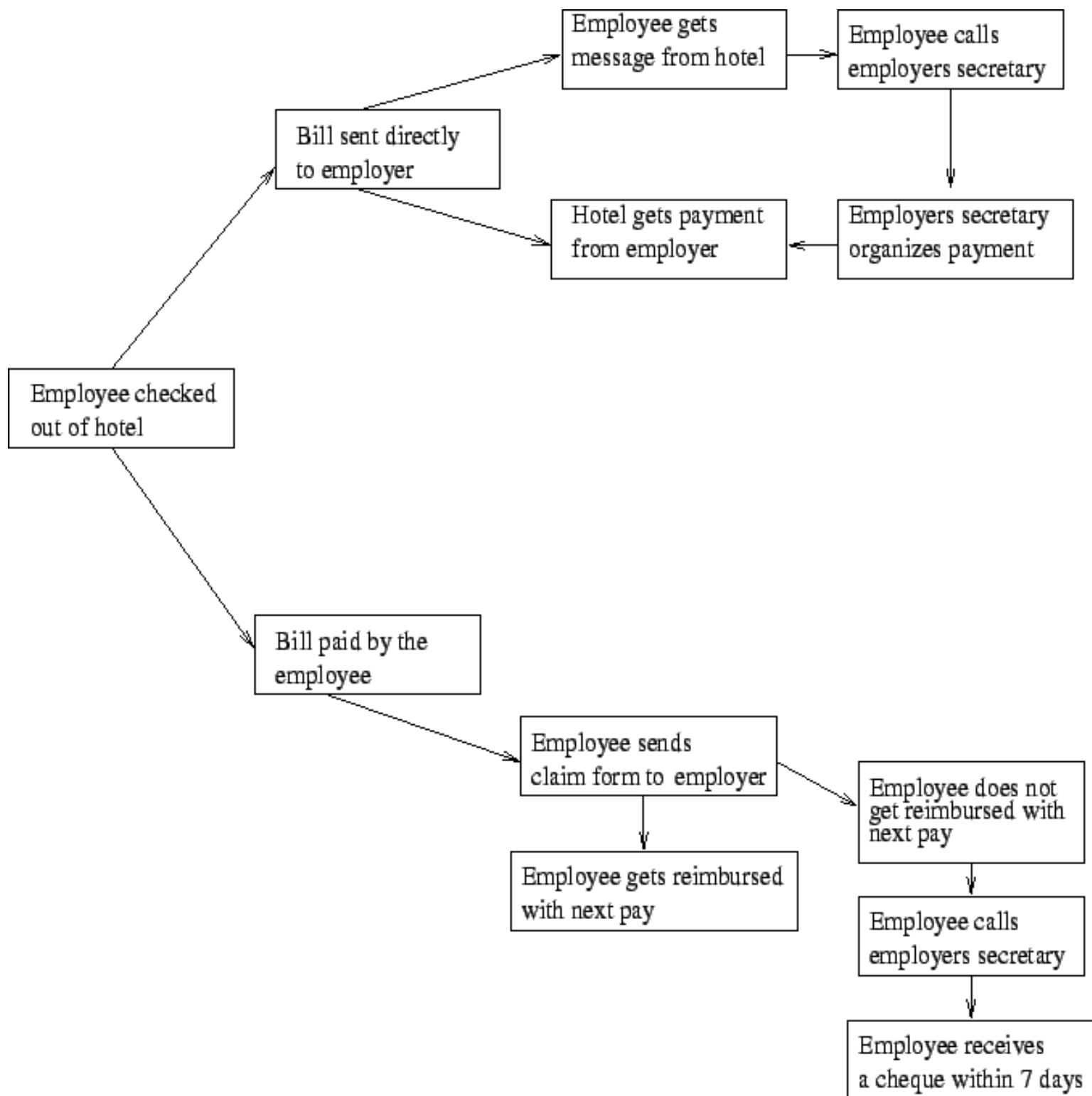
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## Knowledge Maps

- Knowledge maps originated from the belief that people act on things that they understand and accept.
- It indicates that self-determined change is sustainable.
- Knowledge map is a visual representation of knowledge.
- They can represent explicit/tacit, formal/informal, documented/undocumented, internal/external knowledge.
- It is not a knowledge repository.
- It is a sort of directory that points towards people, documents, and repositories.
- It may identify strengths to exploit and missing knowledge gaps to fill.
- Knowledge Mapping is very useful when it is required to visualize and explore complex systems.
- Examples of complex systems are ecosystems, the internet, telecommunications systems, and customer-supplier chains in the stock market.
- Knowledge Mapping is a multi-step process.
- Key can be extracted from database or literature and placed in tabular form as lists of facts.
- These tabled relationships can then be connected in networks to form the required knowledge maps.



**Figure 6.1:**Example: Knowledge Map

A popular knowledge map used in human resources is a skills planner in which employees are matched to jobs. Steps to build the map:

- A structure of the knowledge requirements should be developed.
- Knowledge required of specific jobs must be defined.
- You should rate employee performance by knowledge competency.
- You should link the knowledge map to some training program for career development and job advancement.

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## Decision Table

- It is another technique used for knowledge codification.
- It consists of some conditions, rules, and actions.

A phonecard company sends out monthly invoices to permanent customers and gives them discount if payments are made within two weeks. Their discounting policy is as follows:

*“If the amount of the order of phonecards is greater than \$35, subtract 5% of the order; if the amount is greater than or equal to \$20 and less than or equal to \$35, subtract a 4% discount; if the amount is less than \$20, do not apply any discount.”*

We shall develop a **decision table** for their discounting decisions, where the condition alternatives are ‘Yes’ and ‘No’.

CONDITIONS AND ACTIONS	RULES			
	1	2	3	4
Paid within 2 weeks	Y	Y	Y	N
Order > \$35	Y	N	N	-
$\$20 \leq \text{Order} \leq \$35$	N	Y	N	-
Order < \$20	N	N	Y	-
5% discount	X			
4% discount		X		

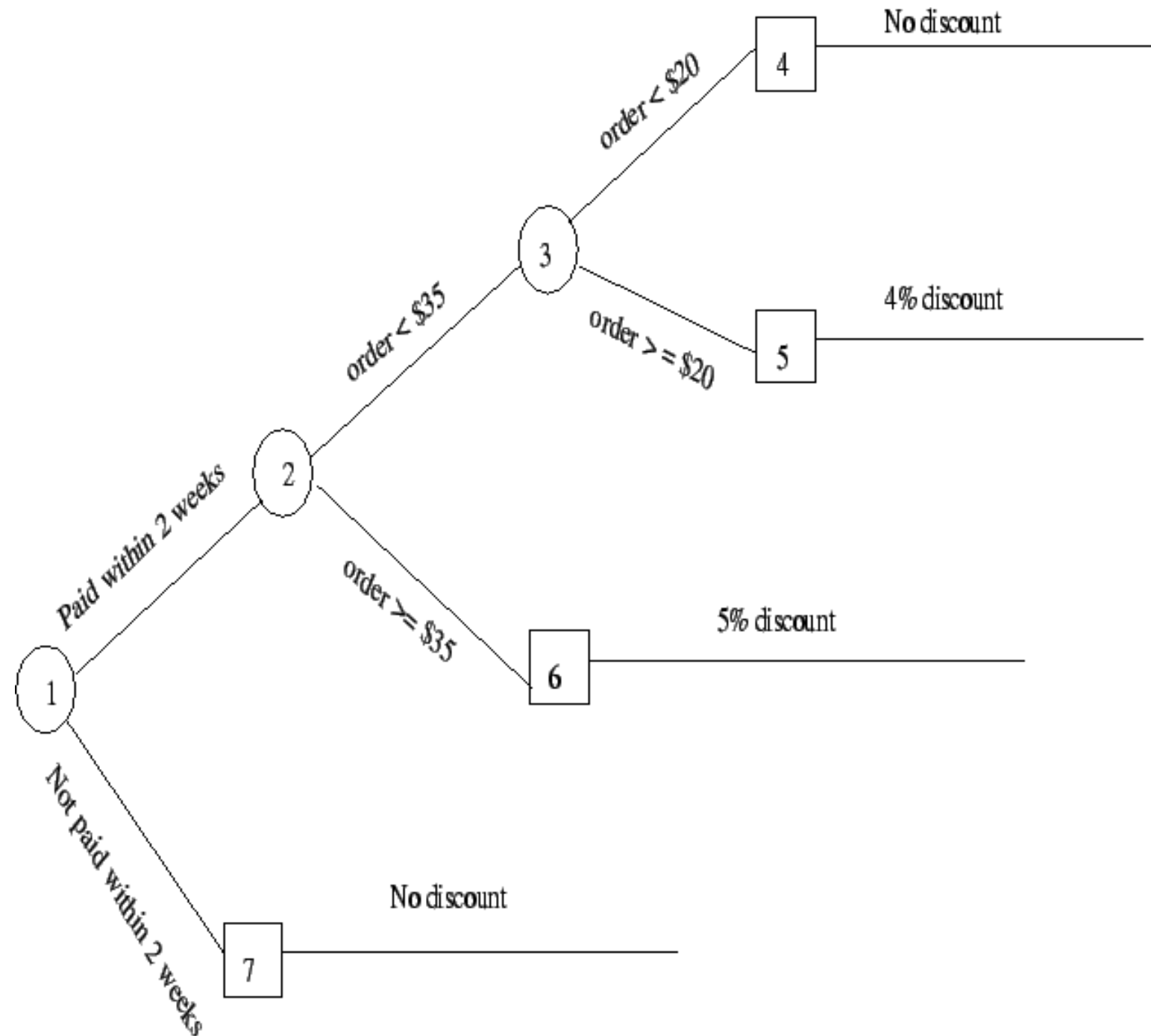
No discount			X	X
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**Figure 6.2:**Example: Decision Table

## Decision Tree

- It is also a knowledge codification technique.
- A decision tree is usually a hierarchically arranged semantic network.

A decision tree for the phonecard company discounting policy (as discussed above) is shown next.



**Figure 6.3:**Example: Decision Tree

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## Frames

- A frame is a codification scheme used for organizing knowledge through previous experience.
- It deals with a combination of declarative and operational knowledge.
- Key elements of frames:
  - Slot: A specific object being described/an attribute of an entity.
  - Facet: The value of an object/slot.

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## Production Rules

- They are conditional statements specifying an action to be taken in case a certain condition is true.
- They codify knowledge in the form of premise-action pairs.
- Syntax: IF (premise) THEN (action)
- Example: IF income is `standard' and payment history is `good', THEN `approve home loan'.
- In case of knowledge-based systems, rules are based on heuristics or experimental reasoning.
- Rules can incorporate certain levels of uncertainty.
- A certainty factor is synonymous with a confidence level , which is a subjective quantification of an expert's judgment.
- The premise is a Boolean expression that should evaluate to be true for the rule to be applied.
- The action part of the rule is separated from the premise by the keyword THEN.
- The action clause consists of a statement or a series of statements separated by AND's or comma's and is executed if the premise is true.

In case of knowledge-based systems, planning involves:

- Breaking the entire system into manageable modules.
- Considering partial solutions and linking them through rules and procedures to arrive at a final solution.
- Deciding on the programming language(s).
- Deciding on the software package(s).
- Testing and validating the system.
- Developing the user interface.

- Promoting clarity, flexibility; making rules clear.
- Reducing unnecessary risk.

### Role of inferencing:

- *Inferencing* implies the process of deriving a conclusion based on statements that only imply that conclusion.
- An *inference engine* is a program that manages the inferencing strategies.
- *Reasoning* is the process of applying knowledge to arrive at the conclusion.
  - Reasoning depends on premise as well as on general knowledge.
  - People usually draw informative conclusions.

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## Case-Based Reasoning

- It is reasoning from relevant past cases in a way similar to human's use of past experiences to arrive at conclusions.
- Case-based reasoning is a technique that records and documents cases and then searches the appropriate cases to determine their usefulness in solving new cases presented to the expert.
- The aim is to bring up the most similar historical case that matches the present case.
- Adding new cases and reclassifying the case library usually expands knowledge.
- A case library may require considerable database storage as well as an efficient retrieval system.

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## Knowledge-Based Agents

- An intelligent agent is a program code which is capable of performing autonomous action in a timely fashion.
- They can exhibit goal directed behaviour by taking initiative.
- they can be programmed to interact with other agents or humans by using some agent communication language.
- In terms of knowledge-based systems, an agent can be programmed to learn from the user behaviour and deduce future behaviour for assisting the user.

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## Knowledge Requirements

- Computing technology and operating systems.
- Knowledge repositories and data mining.
- Domain specific knowledge.
- Cognitive psychology.

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## Skills Requirements

- Interpersonal Communication.
- Ability to articulate the project's rationale.
- Rapid Prototyping skills.
- Attributes related to personality.
- Job roles.

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# Quality Assurance

- The KM system should meet user expectations.
- Performance usually depend on the quality of explicit/tacit knowledge stored in the knowledge base.
- For the expert, quality relates to a reasoning process which produce reliable and accurate solutions within the KM system framework.
- For the user, quality relates to the systems ability to work efficiently.
- For the knowledge developer, quality relates to how well the knowledge source is and how well the user's expectations are codified into the knowledge base.

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# Knowledge Testing

It is required to control performance, efficiency, and quality of the knowledge base.

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## Types of testing

- Logical Testing:

To make sure that the system produces correct results.

- User Acceptance Testing:

It follows logical testing and check the system's behaviour in a realistic environment.

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## Issues

- Subjective nature of knowledge (tacit)
- Lack of reliable specifications
- Verifying correctness/consistency
- Negligence in case of testing
- Time limitations for knowledge developers to test the system
- Complexity in case of user interfaces

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# Logical Testing Approaches

Two approaches:

- Verify the knowledge base formation:
  - The structure of the knowledge as it relates to circular or redundant errors is verified.
  - Consistency, correctness and completeness of knowledge base rules are also verified.
- Verify the knowledge base functionality:

Deals with confidence and reliability of the knowledge base.

## Attributes:

- Circular Errors
- Completeness
- Confidence
- Correctness
- Consistency
- Inconsistency
- Redundancy Errors
- Reliability
- Subsumption error

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# User Acceptance Testing Approaches

Steps:

- Selecting a person/team for testing.
- Deciding on user acceptance test criteria.
- Developing a set of test cases.
- Maintaining a log on different versions of the tests and test results.
- Field-testing the system.

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## Subsections

- [Test Team/Plan](#)

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## Test Team/Plan

A testing plan indicates who is to do the testing. Commitment initiates with management support and a test team with a test plan. The team is expected to

- be independent of the design/codification of the system
- understand systems technology/knowledge base infrastructure
- be well versed in the organization's business
- Deciding on user acceptance test criteria:
  - Accuracy
  - Adaptability
  - Adequacy
  - Appeal
  - Availability
  - Ease of use
  - Performance
  - Face validity
  - Robustness
  - Reliability
  - Operational/Technical Test
- User Acceptance Test Techniques:
  - Face Validation

- Developing a set of test cases
- Subsystem Validation
- Maintaining a log on different versions of the tests/test results
- Field testing the system

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# Managing Test Phase

The following tasks are included:

- Deciding what, when, how, and where to evaluate the knowledge base.
- Deciding who will be doing the logical and user acceptance testing.
- Deciding about a set of evaluation criteria.
- Deciding about what should be recorded during the test.

The following statistics are to be recorded:

- Those rules that always fire and succeed.
- Those rules that always fire and fail.
- Those rules that never fire.
- Those test cases that have failed.
- Reviewing training cases (provided by the knowledge developer, the expert or the user).
- Testing all the rules.

Two types of errors:

- Type-I Error: A rule that fails to fire when it is supposed to fire.
- Type-II Error: A rule that fires when it is not supposed to fire.

# System Deployment

Deployment is affected by the following factors:

- Technical
- Organizational
- Procedural
- Behavioral
- Political
- Economic

The aspects of deployment:

- The transfer of the KM system from the knowledge developer to the organization's operating unit.
- The transfer of the KM system's skills from the knowledge developer to the organization's operators.

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# Issues

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## Subsections

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  - [Ease of Understanding the KM System](#)
  - [Knowledge Transfer](#)
  - [Integration Alternatives:](#)
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## Selection of KB Problem

The KM system can be assured to be successful if:

- The user(s) have prior experience with systems applications.
- The user is actively involved in defining/identifying the specific systems functions.
- The user is actively involved in user acceptance testing and the final system evaluation.
- It is possible to implement the system in the working environment without interrupting the ongoing activities.
- The champion is selling the user's staff on the potential contributions of the system.

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## Ease of Understanding the KM System

Reliable documentation (especially during user training) plays a key role during deployment. Documentation including examples, illustrations, and graphics may reduce training time.

Issues:

- User's level of motivation.
- Technical background of the user.
- Level of trainer's communication skills.
- Time availability/funding for training.
- Location of training.
- Ease and duration of training.
- Accessibility and explanatory facilities of the KM system.
- Ease of maintenance and system update.
- Payoff to the organization.
- Champion's role.

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## Knowledge Transfer

Two Approaches used for transferring KM system technology in implementation:

- The system is actually transferred from the knowledge developer directly to the working unit in the organization.
- Installing the system on the resident hardware.

One way is abrupt, one time transfer resulting in a permanent installation and the other way is a gradual transfer over a given time period (often, through rapid prototyping, a receiving group becomes the part of the developer's team.

Implementation can also be approached as a stand alone installation or as a fully integrated application that can interface with other applications/databases.

KM systems should be designed on platforms which are compatible with other KM systems in the organization.

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## Integration Alternatives:

- **Technical Integration:** Occurs through the organization's LAN environment, the resident mainframe, or existing IS infrastructure.
- **Knowledge Sharing Integration:** Often requires the upgradation of the LAN, the mainframe, or lines.
- **Decision Making Flow Integration:** Suggests that the way the KM system assesses a problem situation should match the user's way of thinking.
- **Workflow Reengineering:** Considered when implementation of the new KM system can propose changes in the workplace.

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## Maintenance

Maintenance implies the way of making the required corrections which can continue to meet user's expectations.

Systems maintenance procedure can be improved if the knowledge base is organized into a set of well-defined modules, so that one can correspond to a specific module and make the necessary changes.

For knowledge based systems deployment to succeed, it must facilitate easy/effective maintenance in the following ways:

- The system includes features to allow changes as needed.
- The system is capable of identifying conflicting, inconsistent and redundant errors.
- The system's help facilities satisfies the user's requirements.
- The availability of the appropriate personnel/team that ensures the fact that the maintenance is carried out effective and on schedule.

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## Organizational factors

- Strong leadership; management provides adequate funding, ensures availability of technology/personnel, allows the champion to function throughout the development process.
- User participation in the process.
- Organizational politics.
- Organizational climate.
- User readiness.

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## More factors

- Return on investment (ROI) factor.
- Quality information.

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## Champion's Role

- Champion is the person who, because of his/her position, influence, power, or control, is capable to acquire and secure organizational support for the new system (from inception to deployment).
- He/she needs to be at the executive level to act as a member of the project's board of directors.
- He/she needs to be aware of the fact that politics, budgetary problems or conflict of interest can stand in the way of deployment.

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# User Training/Deployment

The level of user training depends on:

- The user's knowledge of knowledge-based systems
- The complexity of the KM system and how well it can accommodate user(s)
- The trainer's technical experience/communication skills
- The environment of training venue

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## Subsections

- [Preparing for System Training](#)
- [Overcome Resistance to Change](#)

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## Preparing for System Training

When a system is introduced, then often the initial goal is to educate the users(s) about the new system. A strategic education plan helps the organization to adopt the system as it becomes ready to deploy. Such planning should take place before the development and it can not act as a substitute for training.

Steps to follow in order to promote successful KM system deployment:

- Defining how the KM system agrees with the organizational mission.
- Demonstrating how the system can support to meet organizational goals.
- Allocating adequate resources for the feasible project.
- Advocate positive effects of the system.
- Perform cost-benefit analysis of the KM system technology.

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## Overcome Resistance to Change

The possible resistors:

- Knowledge hoarders.
- Organizational employees.
- Troublemakers.
- Narrow-minded *superstars*.

Psychological reactions implying resistance:

- Projection
- Avoidance
- Aggression

Methods to help:

- User-attitude survey
- Communication training/Training sessions
- Role negotiation

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# Review after Implementation

The questions to consider:

- How the KM system has changed the accuracy/timeliness of decision making?
- How the KM system has affected the attitude of the end users?
- Whether the system has caused organizational changes. If so, then how constructive the changes have been?
- Whether the system has changed the cost of operating the business. If so, in what way?
- How the KM system has affected the relationships among the end users?
- Whether the system has affected the organizational decision making process. What tangible results can be demonstrated in this regard?

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## Subsections

- [Security Issues](#)

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## Security Issues

- The new KM system should provide password/protocol protection.
- Security procedures should be consistently observed.
- Access should be restricted regarding the update of the knowledge-base.

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# Transferring and Sharing Knowledge

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- [Prerequisites for Transfer](#)
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  - [Creating the Culture to Accommodate Change](#)
  - [Reasoning Before Processing](#)
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  - [Knowing how the Organization handles Mistakes](#)
  - [Collaboration/Cooperation are not Rivalry/Competition](#)
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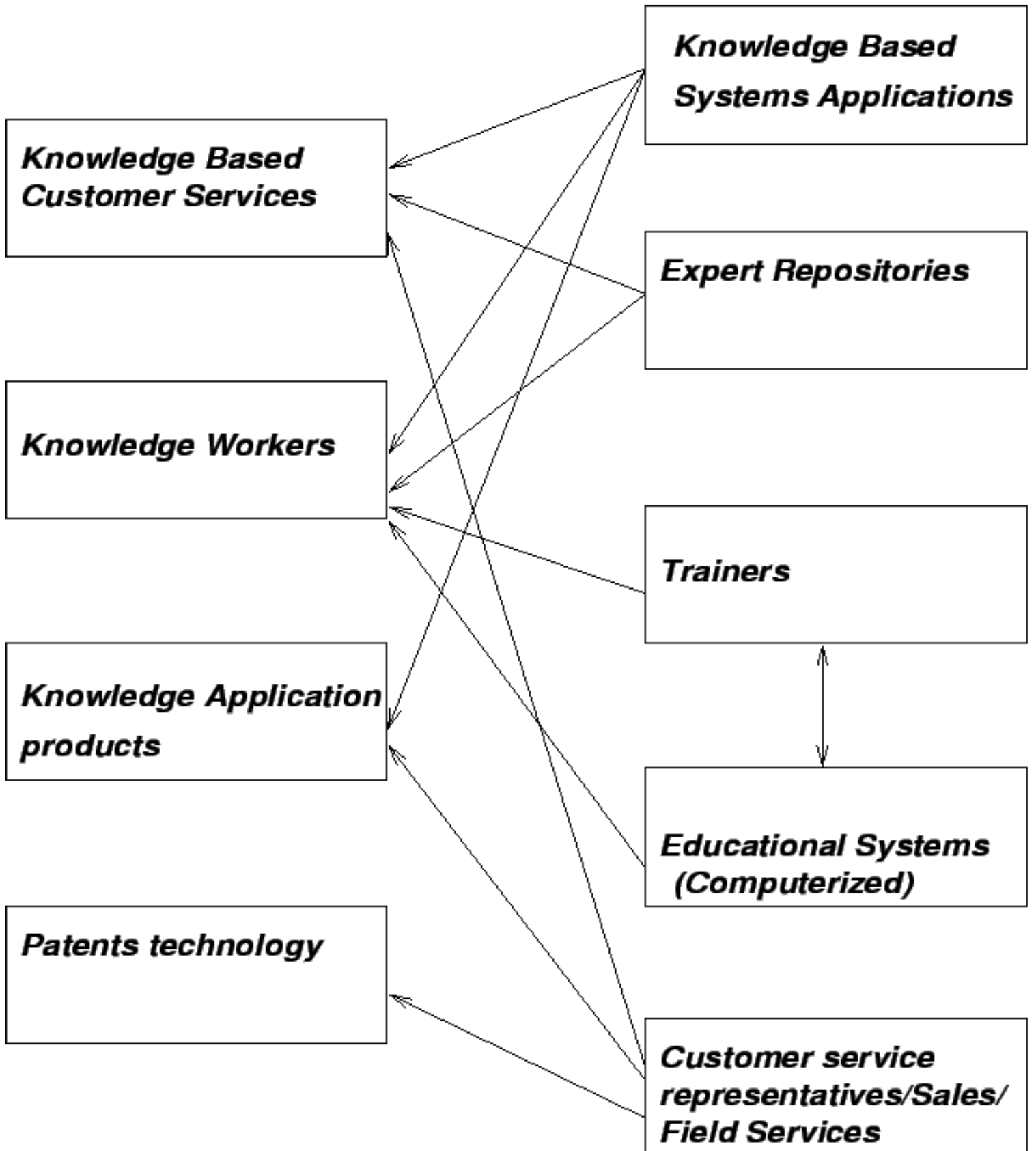
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# Fundamentals

- Knowledge transfer is an integral part of organizational life.
- It represents the transmission of knowledge (conveying the knowledge of one source to another source) and the appropriate use of the transmitted knowledge.
- The goal is to promote/facilitate knowledge sharing, collaboration and networking.
- It can involve accessing valuable/scarce resources, new expertise, new insight, cross fertilization of knowledge and can create an organizational environment of excellence.
- Collaboration implies the ability to connect diverse assets into unique capabilities in pursuit of new opportunities mainly for organizational growth.
- Knowledge transfer can be done by working together, communicating, learning by doing, using face-to-face discussions, or embedding knowledge through procedures, mentoring, or documents exchange.
- Knowledge can be transferred from repositories to people, from team(s) to individual(s), and between individuals.
- Factors:
  - From where the knowledge is transferred: data warehouses, knowledge bases, experts etc.
  - The media used: LAN, wireless transmission, secure/insecure lines, encrypted/plain text etc.
  - To where the knowledge is transferred: Another computer system, a manager, a customer etc.

**KNOWLEDGE APPLICATION****KNOWLEDGE TRANSFER**

**Figure 8.1:**Partial view of a Knowledge Management System for Transferring and Sharing Knowledge Applications

Some organizations know what to do, but for various reasons ignore the available information and perform differently (creating the knowing-doing gap). This problem should be recognized to help organizations making corrections and setting up a knowledge transfer environment for the benefit of all the employees.

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# Prerequisites for Transfer

- *Knowing* can be considered as very personal.
- The terms *knowledge transfer* and *knowledge share* are interrelated.
- Knowledge transfer refers to a mechanistic term meaning providing knowledge for someone else.
- Knowledge sharing refers to exchange of knowledge between individuals, between individuals and knowledge bases etc.
- Knowledge transfer can involve political, interpersonal, leadership and organizational issues to consider.

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## Subsections

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## Building an Atmosphere of Trust in the Organization

Trust is the foundation for knowledge transfer and it can be considered as a psychological state where people feel confident about sharing ideas, experiences, and relationships with others.

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## Creating the Culture to Accommodate Change

Usually *culture* is embedded in the organizations mission, core values, policies, and tradition.

Positive cultural values include:

- Leadership
- Culturally driven forces
- Culturally internalized operational practices.
- Culturally internalized management practices.

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## Reasoning Before Processing

- Sometimes employees undergoing training exhibits greater interest in the process itself (*how to do*) than the reasoning behind the process (*why to do*).
- When new people are hired into an organization, then the first thing the supervisors/managers should do (before the newcomers are shown how to do the job) is to introduce themselves, and present the newcomers with a brief idea about the organizational philosophy, and what the organization expects them to achieve.

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## Doing is Better than Talking

- Actions speak louder than words and are found to be more effective than concepts/theory not tested by experience.
- The philosophy here is *Once you do it, you will know what is involved.*
- Being involved in the actual process is the best way to learn it.

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## Knowing how the Organization handles Mistakes

- Mistakes are bound to be made and there can be cost associated with it.
- Tolerance for mistakes usually allows room for learning to take place.
- Some of the best learnings in business can take place by the method of *trial and error*.
- Organizations that are successful in turning knowledge into action are usually found to inspire respect and admiration, rather than fear or intimidation.

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## Collaboration/Cooperation are not Rivalry/Competition

- Often, as a result of internal rivalry, the employees become knowledge hoarders rather than knowledge sharers.
- In fact, the success of each employee depends on mutual cooperation and knowledge sharing among the group members.
- So, the aim should be to turn away from internal rivalry and move towards collaboration and cooperation which can help to reach the organizational goal.

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## Identifying Key Issues

- Any organization depends on reports/information in order to assess what has been happening over time.
- Usually reports present transaction summaries, historical events, development details etc.
- Often, there can not be found any matter that can analyze the reasoning behind the presented information (why the business turned out the way it did).
- Usually there is no prioritization of what should be acted on or what changes should be made in order to improve the situation.
- Sometimes, organizations spend more resources on outcome than on process itself.
- For successful knowledge management, we should focus on the gathered knowledge, processes and process improvement criteria.

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## How Managers view Knowledge Transfer

- Under the framework of knowledge management practices, the managers are usually expected to create an organizational culture that can set the work norms and can value the transfer of knowledge for giving rise to value-added products and services.
- This represents a successful way of bridging the knowledge-action gap.

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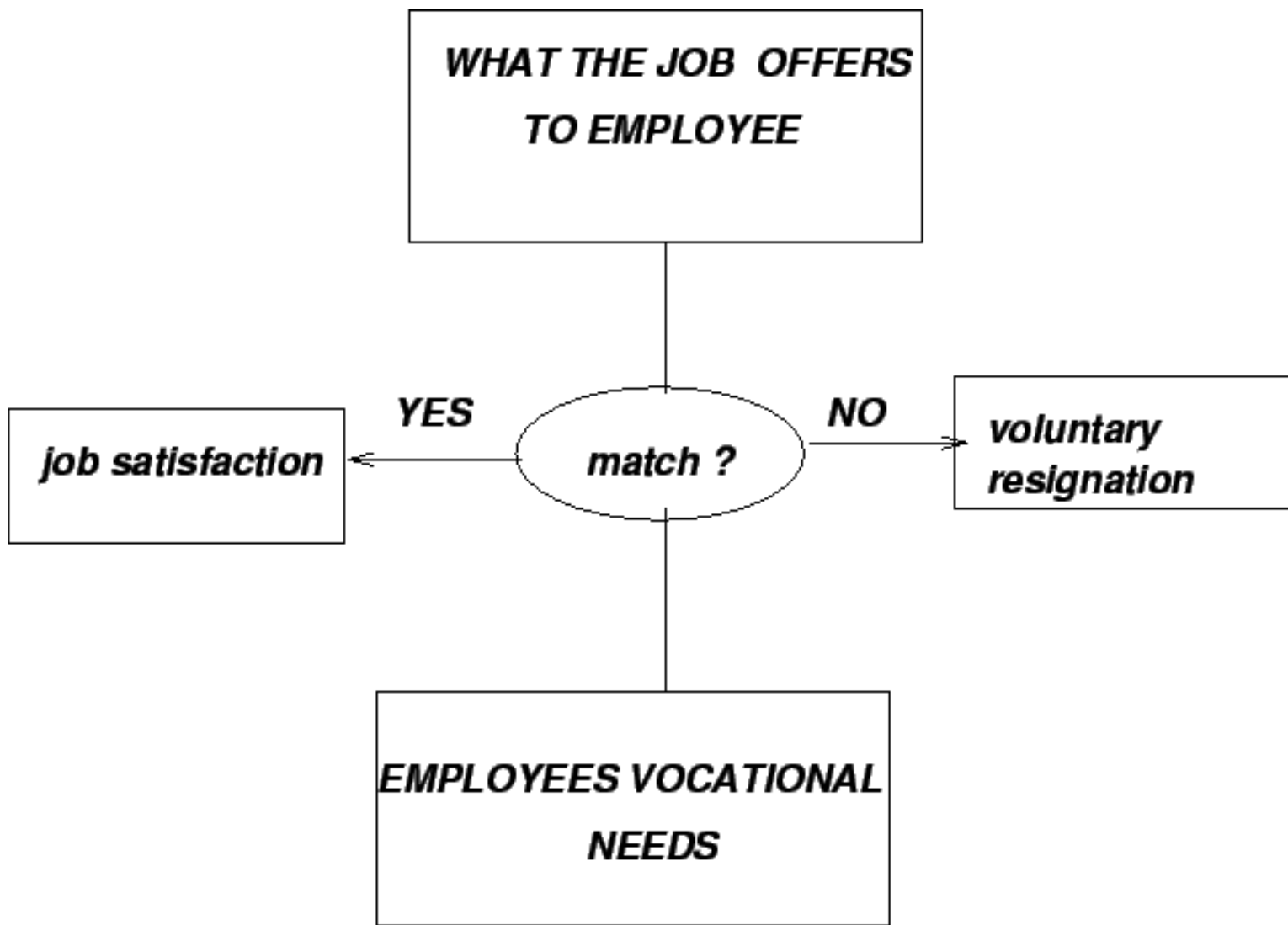
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## Determining Employee Job Satisfaction

The success of knowledge transfer and knowledge sharing relies on employee job satisfaction and the stability of the workplace. Job satisfaction can be derived from the degree of match between an employees vocational needs and the requirements of the job.

Some key vocational needs:

- Level of Achievement
- Ability utilization
- Advancement
- Level of Activity
- Authority
- Level of Creativity
- Compensation
- Independence
- Moral Values
- Level of responsibility
- Recognition
- Status
- Job Security
- Supervision (human relations)
- Supervision (technical)
- Variety
- Conditions of Work



**Figure 8.2:**Employees Job Satisfaction: A Conceptual Model

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# Methods of Knowledge Transfer

- After the knowledge is captured and codified, it has to be transferred so that the organizational members can use it.
- The recipients can be individuals, groups or teams.
- Knowledge transfer makes it possible to convert experience into knowledge.

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## Subsections

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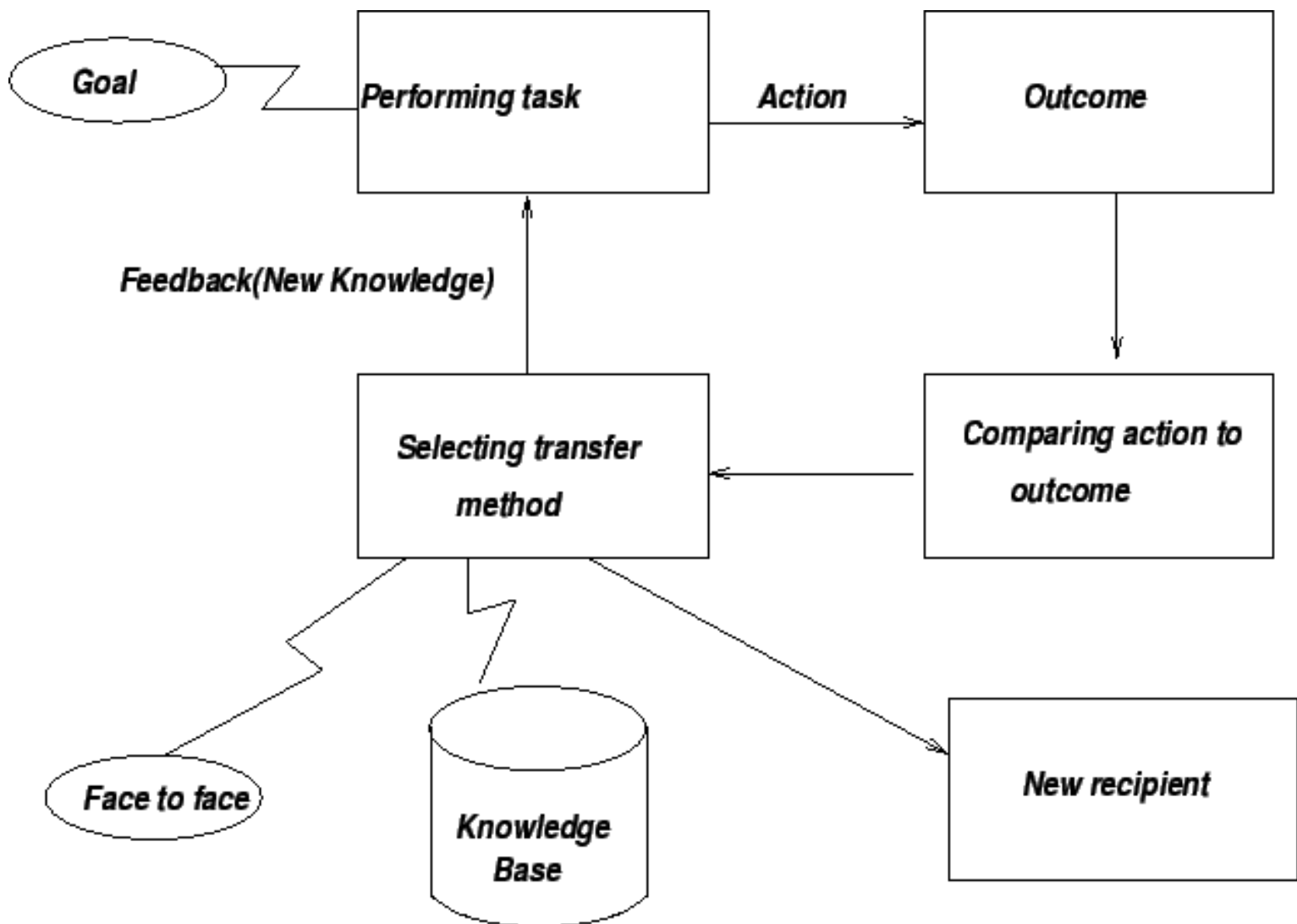
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## Types of Problems

- Routine Problems
- Non-routine Problems
- Complex and critical Problems
- Basic Problems
- Problems with combination of constraints.



**Figure 8.3:** Conversion of experience to knowledge

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## Transfer Strategies

Knowledge can be transferred via:

- documents
- internet/intranet
- groupware
- databases
- knowledge bases
- face to face communication

The best way to absorb tacit knowledge is to be present in the domain where tacit knowledge is practiced. This can be done through job rotation, job training, and on-site learning. This involves on-site decision making, absorbing the mechanics, and the heuristics as they occur, and finally coming up with a new knowledge base that emulates the domain in a unique way. However, the main limitation of such strategy is time.

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## Inhibitors of Knowledge Transfer

There exists a number of organizational and cultural factors that inhibit reliable knowledge transfer.

Key areas where friction may occur:

- Lack of trust
- Lack of time
- Knower's status
- Speed/Quality of transfer

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# Types of Knowledge Transfer

- Collective Sequential Transfer
- Explicit Interteam Knowledge Transfer
- Tacit Knowledge Transfer

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## Subsections

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## Collective Sequential Transfer

- One ongoing team specialized in specific task(s) moves to other locations and performs the same task(s).
- There happens knowledge transfer from one site to another by the same team.
- The focus is on collaboration and is on collective knowledge.

### Issues

- How does one member's task affect others in the team?
- How does one member's way of performing a task contribute to the performance of other team members?
- Which factors affect a member's performance?
- How does one member's task impact the overall performance of the team?

In each team setting, there exists a protocol which specifies how a team should function (known as **Transfer Protocol**).

Features of collective sequential transfer:

- Team meetings (brief) are regularly held.
- Each participant is treated equally in meetings.
- The matter discussed in the meetings is kept within the team.
- It always focuses on the project, not on the individuals.

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## Explicit Interteam Transfer

- Allows a team, which has done a job on a site, to share its experience with another team working on a similar job on another site.
- Most of the knowledge transferred associates to routine work and the procedures are usually precise (explicit knowledge).
- Factors like human relations, organizational subculture (of the receiving team) can make the explicit interteam transfer difficult at times.

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## Tacit Knowledge Transfer

- This kind of knowledge transfer can be found to be unique in case of complex, nonalgorithmic projects.
- The team receiving the tacit knowledge can be different in location, in experience, in technology and in cultural norms.
- Often the knowledge that is to be transferred is required to be modified in language, content etc in order to be usable by the receiving team.
- There can exist difficulty in case of tapping tacit knowledge.

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## Role of Internet

With the use of internet, it is possible to transmit/receive information containing images, graphics, sound and videos. ISP industry can offer services as:

- Linking consumers and businesses via internet.
- Monitoring/maintaining customer's Web sites.
- Network management/systems integration.
- Backbone access services for other ISP's.
- Managing online purchase and payment systems.

The internet is designed to be indefinitely extendible and the reliability of internet primarily depends on the quality of the service providers' equipments.

### Benefits of Internet:

- Doing fast business.
- Trying out new ideas.
- Gathering opinions.
- Allowing the business to appear alongside other established businesses.
- Improving the standards of customer service/support resource.
- Supporting managerial functions.

### Limitations:

- Security
- Privacy

Threats: Hackers, viruses etc.

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# Knowledge Transfer in E-World

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# E-World

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## Subsections

- [Intranet](#)
  - [Extranet](#)
  - [Groupware](#)
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## Intranet

- Serves the internal needs of an organization.
- Links knowledge workers and managers around the clock and automates intraorganizational traffic.
- An organization needs intranet if:
  - A large pool of information is to be shared among large number of employees.
  - Knowledge transfer needs to be done in hurry.

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## Extranet

- Links limited and controlled trading partners and allows them to interact for different kinds of knowledge sharing.
- Intranets, extranets, and e-commerce do share common features.
- Internet protocols are used to connect business users; on the intranet administrators prescribe access and policy for a specific group of users; on a Business-to-Business (B2B) extranet, system designers at each participating company collaborates to make sure there is a common interface with the company they are dealing with.
- Extranets can be considered as the backbone of e-business.
- The benefits are faster time to market, increased partner interaction, customer loyalty, and improved processes.
- Security varies with type of user, the sensitivity type of the transferred knowledge and the type of communication lines used.
- Access control deals with what the users can and what they can not access.
- The issue of the level of authentication for each user should be considered.
- Extranet helps the organization in ensuring accountability in the way it does business and exchanges knowledge with its partners.
- It promotes collaboration with partners and improves the potential for increased revenue.

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## Groupware

- A software helping people to collaborate (especially for geographically distributed organizations).
- Supports to communicate ideas, cooperate in problem solving, coordinate work flow and negotiate solutions.
- Categorized according to:
  - Users working in the same place or in different locations.
  - Users working together at the same time or different times.
- To consider:
  - Group concepts
  - How group members behave in a group setting.

	<b>SAME PLACE</b>	<b>DIFFERENT PLACE</b>
<b>SAME TIME</b>	<b>FACE TO FACE MEETING</b>	<b>VIDEO CONFERENCING</b>
<b>DEFFERENT TIME</b>	<b>PEER-TO-PEER SHARED COMPUTER</b>	<b>E-MAIL</b>

**Figure 9.1:**Groupware Categories

- Reasons for using:
  - Works well with groups having common interests and where it is not possible for the individuals to meet face to face.
  - Some problems are better solved by group than by individuals.
  - Groups bring multitude of opinions/expertise to a work setting.
  - Facilitates telecommuting (time saver)

- Often faster and more effective than face to face meetings.
- Critical prerequisites for system success:
  - Compatibility of software.
  - Perceived benefit to every group member.
- For a face-to face session, the protocol is standard and the communication is highly structured. If the communication structure is known, then a groupware can take advantage of it to speed up the communication and improve the performance of the exchange. This communication environment is called *technologically mediated communication structure*.
- An alternative communication structure is known as a *socially mediated communication structure* where the individuals send a request (e-mail) through technology without any control over how soon or whether the recipient will respond.
- A *session* represents a situation where a group of individuals agrees to get together to conduct a meeting in person, over the telephone, or by videoconferencing etc.
- Groupware systems require that the sessions be conducted within the framework of protocols designed to ensure integrity, privacy and successful completion of each session.
- Session control determines who can enter and exit the session, when they can enter and how. Some rules used in case of session control:
  - Making sure that users do not impose a session on others.
  - Identifying conversational group members before allowing them into a session.
  - Controlling unnecessary interruptions or simultaneous transmissions (that might result in chaos/confusion).
  - Allowing group members to enter and exit at any time.
  - Determining the maximum number of participants and the length of the session(s).
  - Ensuring accountability, anonymity and privacy during the session(s).
- Applications:
  - E-mail/Knowledge transfer
  - Newsgroups/Work-Flow Systems
  - Chat Rooms
  - Video Communication
  - Group Calendaring/Scheduling
  - Knowledge Sharing

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# E-Business

- Brings the worldwide access of the internet to the core business process of exchanging information between businesses, between people within a businesses, and between a business and its clients.
- The focus is on knowledge transfer/sharing.
- It connects critical business systems to critical constituencies (customers, suppliers, vendors etc) via the internet, intranets, and extranets.
- E-Business helps to attain the following goals:
  - Developing new products/services
  - Gaining recent market knowledge
  - Building customer loyalty
  - Enriching human capital by direct and instant knowledge transfer
  - Making use of existing technologies for research and development
  - Gaining competitive edge and market leadership.

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## Subsections

- [Value Chain](#)
- [Supply Chain Management \(SCM\)](#)
- [Customer Relationship Management \(CRM\)](#)

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## Value Chain

- It is a way of organizing the primary and secondary activities of a business in a way that each activity provides productivity to the total business operation.
- Competitive advantage is gained when the organization links the activities in its value chain more cheaply/effectively than its competitors do.
- The knowledge-based value chain provides away of looking at the knowledge activities of the organization and how various knowledge exchange adds value to adjacent activities and to the organization in general.
- Everywhere value is added is where knowledge is created, shared or transferred.
- By the process of examining the elements of the value chain, executives can find the ways to incorporate IT and telecommunications to improve the overall productivity of the firm.
- In case of E-Business, we integrate the KM life cycle from knowledge creation to knowledge distribution via
  - Business to Consumer
  - Business to Business
  - Business within Business

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## Supply Chain Management (SCM)

- Incorporates the idea of having the right product in the right place, at the right time, in the right condition and at the right price.
- This is an integral part of Business to Business framework.
- This employs tools that allows the organization to exchange and update information in order to reduce cycle times, to have quicker delivery of orders, to minimize excess inventory and to improve customer service.

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## Customer Relationship Management (CRM)

- Helps the organization to improve the quality of its relationship management with customers.
- It is a business strategy used to learn more about customer needs and customer behaviour patterns in order to develop better and stronger relationship with them.
- It can improve/change an organization's business processes for supporting new customer focus and apply emerging technologies to automate these new processes.
- The technologies can allow multiple channels of communication with customers (and supply chain partners) and can use customer information stored in corporate databases and knowledge-bases to construct predictive models for customer purchase behaviour.
- Benefits:
  - Increased customer satisfaction.
  - Enhancing efficiency of call centres.
  - Cross selling products efficiently.
  - Simplifying sales processes.
  - Simplifying marketing processes.
  - Helping sales staff to close deals faster.
  - Finding new customers
- Critical elements of CRM software:
  - Operational technology:

Uses portals that facilitate communication between customers, employees, and supply chain partners. Basic features included in portal products:

    - Personalization services
    - Secure services

- Publishing services
- Access services
- Subscription services

- Analytical technology:

Uses data-mining technologies to predict customer purchase patterns.

- Architechtural imperative for CRM is to do:

- Allowing the capture of a very large volume of data and transforming it into analysis formats to support enterprise-wide analytical requirements.
- Deploying knowledge.
- Calculating metrics by the deployed business rules.

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# Learning from Data

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- [The Concept of Learning](#)
- [Data Visualization](#)
- [Neural Network \(Artificial\) as Learning Model](#)
  - [Supervised/Unsupervised Learning](#)
  - [Applications in Business](#)
  - [Relative Fit with KM](#)
- [Association Rules](#)
- [Classification Trees](#)

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# The Concept of Learning

- The collaborative intelligence level of KM infrastructure depends on technologies like:
  - Artificial Intelligence
  - Expert Systems
  - Case-Based Reasoning
  - Data Warehousing
  - Intelligent agents
  - Neural Networks
- Learning technology tools provide a collaborative environment for humans to enhance their ability to understand the important processes that they deal with.
- The goal is to improve the qualities of communication and decision making.
- In the environment of knowledge automation, learning can be regarded as a a process of filtering ideas and transforming them into valid knowledge.
- Knowledge validation is a two-step process:
  - Model Validation:

Involves the testing of the logical structure of a conceptual (or operational) model for internal consistency and testing the results for external consistency (with the observable facts of the real world).
  - Consensual Approval:

Implies approval of a special reference group (or the user) of the results.
- The goals of the learning process:
  - Discover new patterns in data

- Predicting future trends and behaviour
- Verifying hypotheses (formed from the previously accumulated knowledge)
- The two approaches for building the learning model:
  - Top-Down Approach
  - Bottom-Up Approach

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# Data Visualization

- Before starting to build the models, we must become familiar with the stored data structure, relationships etc.
- Exploring the data includes:
  - Identifying key attributes and their distribution.
  - Identifying points which lie significantly outside the expected range of the results.
  - Identifying the initial hypothesis and predictive measures.
  - Extracting the interesting grouping of data subsets for further investigation.

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# Neural Network (Artificial) as Learning Model

- Neural networks (NN) are modelled after the human brain's network.
- This technology tries to simulate biological information processing via networks of *neurons* (electronically interconnected basic processing elements).
- Neural networks are analog and parallel.
- They learn by example.
- They help decision making in case of knowledge automation systems.
- They can be viewed as self-programming systems based on their inputs/outputs.
- Each neuron has got a transfer function that computes the output signal from the input signal.
- The neuron evaluates the inputs, determine their weights (strengths), *sums*, the combined inputs, and compares the total to a threshold (transfer function) level.
- If the sum is greater than the threshold, the neuron *fires* (sends outputs). Otherwise it does not generate a signal.
- Interconnecting neurons with each other forms a layer of nodes (or a neural network).

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## Subsections

- [Supervised/Unsupervised Learning](#)
- [Applications in Business](#)
- [Relative Fit with KM](#)

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## Supervised/Unsupervised Learning

- The learning of the NN can be
  - Supervised:
    - The NN needs a teacher with a training set of examples of input and output.
    - Usually each element in a training set is paired with an acceptable response.
    - The network makes successive passes through the examples, and the weights adjust toward the goal state.
    - When the weights represent the passes without error, then it means that the network has learned to associate a set of input patterns with a particular output.
  - Unsupervised (Self-Supervised):
    - No external factors can influence the adjustment of the input's weights.
    - The NN does not happen to have advanced indication of correct or incorrect answers.
    - It adjusts through direct confrontation with new experiences. This process is called *self organization*.

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## Applications in Business

- Risk Management
- Fidelity Investment
- Mortgage Appraisals

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## Relative Fit with KM

Some characteristics of NN that fits in KM system framework:

- Neural networks exhibit high accuracy and speed in response.
- A lot of input preprocessed data is usually required to build a neural network.
- A neural network starts all over with every new application.

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# Association Rules

It is a knowledge-based tool which generates a set of rules to help understanding the relationships that might exist in data.

## Types:

- Boolean rule:

Examines the presence or absence of items.

- Quantitative rule:

The quantitative measures (values) are considered.

- Multi-dimensional rule:

Refers to a multitude of dimensions.

- Multilevel association rule:

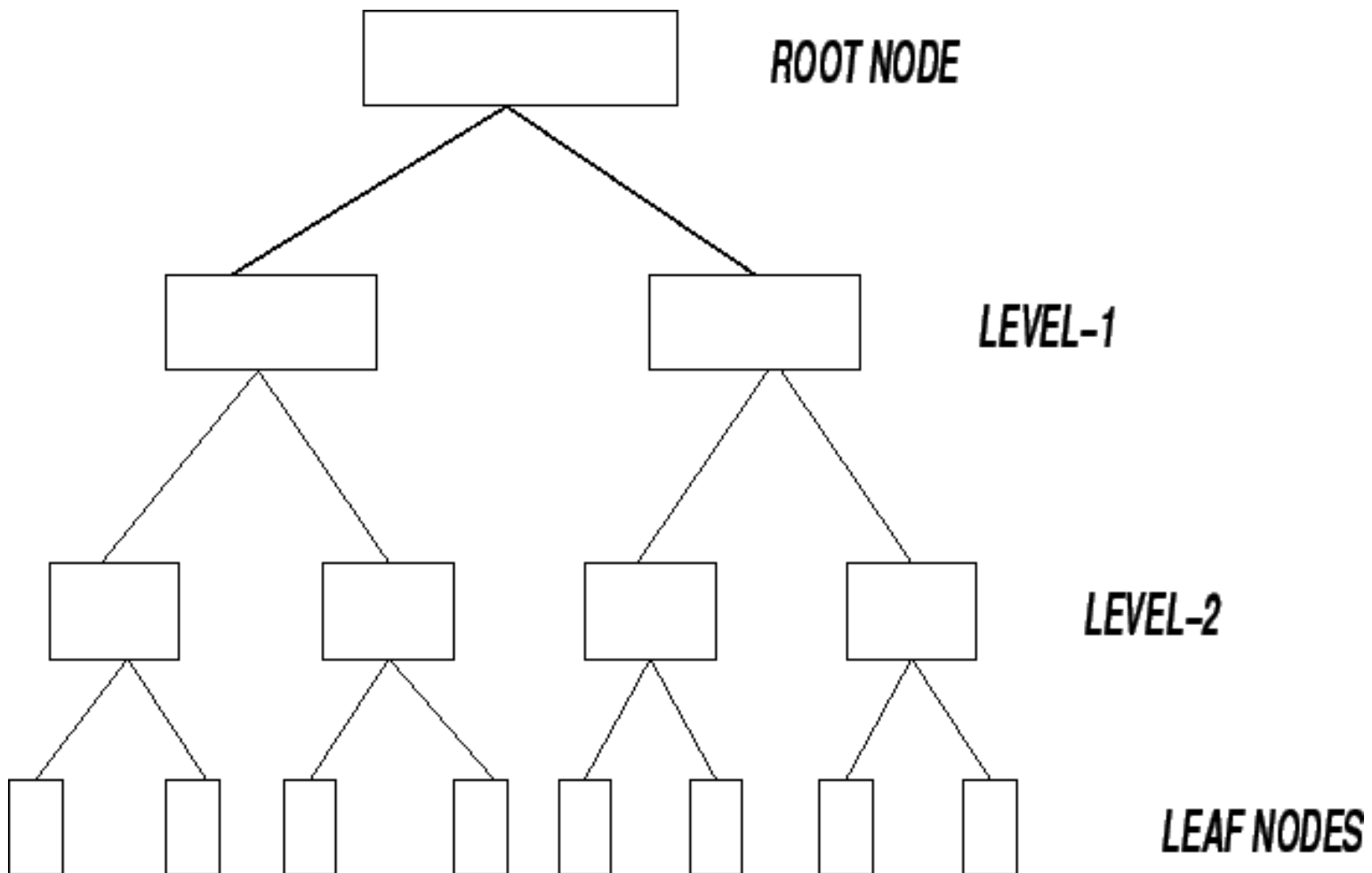
A transaction can refer to items with different levels of abstraction.

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# Classification Trees

- These are popular tools used for classification.
- A *tree* represents a network of nodes.
- There exists a *root node* which represents the starting node of the tree.
- The ending nodes are called *leaf nodes*.
- The root node and the leaf nodes are usually separated by a number of intermediate node organizations in layers (called *levels*).
- At each level, nodes split data into groups until they reach the leaf node.



**Figure 10.1:**A Binary Tree

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# KM Tools and Knowledge Portals

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  - [Portals and Business Transformation](#)
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# Portals

*Portals* are Web-based applications which provide a single point of access to online information. These can be regarded as virtual workplaces which

- promotes knowledge sharing among end-users (e.g., customers, employees etc).
- provides access to data (structured) stored in databases, data warehouses etc.
- helps to organize unstructured data.

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## Subsections

- [Evolution](#)

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## Evolution

- Initially portals were merely search engines.
- In the next phase they were transformed to *navigation sites*.
- In order to facilitate access to large amount of information, portals have evolved to include advanced search capabilities and taxonomies.
- They are also called *Information portals* because they deal with information.
- Organizations are becoming increasingly aware of the opportunities obtained by using and adding value to the information lying dormant in scattered information systems.
- Portals can integrate applications by the way of combining, analyzing, and standardizing relevant information.
- *Knowledge portals* provides information about all business activities and they are capable of supplying metadata to support decision making.
- In case of knowledge portal, we do not focus on the content of the information, but we focus on how it will be used by the knowledge workers.
- Knowledge portals have two kinds of interface:
  - Knowledge consumer interface
  - Knowledge producer interface
- *Enterprise Knowledge Portals* (EKP) can distinguish knowledge from information and can produce knowledge from raw data and information.

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# Business Challenge

- In case of most of the businesses, usually there exists an inherent pressure to optimize the performance of operational processes in order to reduce cost and enhance quality.
- Customer-oriented systems allow organizations to understand the customer behaviour pattern (s) and helps them to offer the right product at the right time.
- Often, organizations need to commercialize their products at the lowest possible price.

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## Portals and Business Transformation

- Usually problems arise from the following two fundamental aspects underlying the present computing technology:
  - The explosion in the quantity of business information already captured in electronic documents leads many organizations to lose their grip on the information as they upgrade their processes and transform to new systems.
  - The fast speed with which the quantity (and kinds) of information content is growing, indicates that what is needed to meet the challenges is a strict internal discipline which can help to expose and integrate the sources of enterprise knowledge.
- Types of pressures faced by most organizations:
  - Shorter time to market
  - More demanding investors/customers
  - Knowledge worker turnover

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## Market Potential

- Knowledge portals are emerging as key tools for supporting the knowledge workplace.
- The infrastructure components of the Enterprise Information Portal (EIP) market:
  - Business intelligence
  - Content management
  - Data management
  - Data warehouses/data marts

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# Knowledge Portal Technologies

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## Functionality

- Gathering
- Categorization
- Collaboration
- Distribution
- Personalization
- Publishing
- Searching/Navigation

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## Collaboration

- The aim for using the collaboration tools is to create a collaborative KM system which supports sharing and reusing information.
- In the context of KM, collaboration implies the ability for more than one people to work together in a coordinated fashion over time (and space) using electronic devices.
- Types of collaboration:
  - Asynchronous collaboration: Human-to-human interactions via computer systems having no time/space constraints.
  - Synchronous collaboration: Human-to-human interactions (via computer systems) that occurs instantly.
- Push Technology:

Places information in a place where is it easily visible.
- Pull Technology:

Requires to take specific actions in order to retrieve information.

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## Content Management

- Requires directory/indexing capabilities to automatically manage the ever growing warehouses of enterprise data.
- Addresses the problem of searching for knowledge in all information sources of the enterprise. This knowledge can include structured as well as unstructured internal information objects like office documents, collaborative data, MIS, experts, and also external information.
- *Metadata* is required to define the types of information.
- Content management component needs to publish information in the knowledge-base.
- Content management can handle the way the documents are analyzed, categorized, and stored.
- *Categorizing:* As the volume of documents (under management) grows, it becomes rather important to organize similar documents into smaller groups and to name the groups.
- Since document collections are not static, hence portals must provide some form of taxonomy maintenance. As new documents are added, they must be added to the taxonomy at proper places (using a classification technology). As the clusters grow and as the conceptual content of the new documents change over time, it can become necessary to subdivide clusters or to move documents from one cluster to another.

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## Intelligent Agents

- *Agents* are softwares which are able to execute a wide range of functional tasks (e.g, comparing, learning, searching etc).
- *Intelligent agents* are tools that can be applied in the context of EKP's.
- They are still in their infancy, most applications are yet experimental and have not reached the actual commercial stage.
- As the relationships between the organizations and their customers become more complex, the organization needs more information regarding what these relationships mean and the way to exploit them. Intelligent agent technology can help to address these needs.
- Customers usually set certain priorities while purchasing products (or using services). Intelligent agents can master the individual customers' demand priorities by learning from experience with them, and most of all they can qualitatively and quantitatively analyze these priorities.
- Some of the customer services that can be benefitted by intelligent agents:
  - Customer assistance (customized) with online services.
  - Customer profiling and integrating profiles of customers into a group of marketing activities.
  - Forecasting customer requirements.
  - Executing transactions (financial) on the behalf of customers.
  - Negotiating prices/payment schedules.

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# Managing Knowledge Workers

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# Knowledge Workers

- A knowledge worker is a person who transforms business and personal experience into knowledge.
- Usually a knowledge worker is found to be innovative, creative and he/she is fully aware of the organizational culture.
- A knowledge worker can be thought of as a product of values, experiences, processes, education, and training.

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## Subsections

- [Personality/Professional Attributes](#)

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## Personality/Professional Attributes

- Understands and adopts the organizational culture.
- Aligns personal/professional growth with corporate vision.
- Possesses the attitude of collaboration/sharing.
- Possesses innovative capacity/creative mind.
- Has got the clear understanding of the business (in which he/she is involved).
- Always willing to learn, and willing to adopt new methodologies.
- Possesses self-control and can learn by himself/herself.
- Willing to accomodate uncertainties
- Core competencies:
  - Thinking skills
  - Innovative teams/teamwork
  - Continuous learning
  - Innovation/Creativity
  - Risk taking/Potential success
  - A culture of responsibility towards knowledge
  - Decisive action taking

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# Business Roles in Learning Organization

- A *Learning organization* is an organization of people with total commitment to improve their capacity, to create and to produce. It can respond to uncertainty, to challenges, and to the change in general.
- The rate of learning of an organization can turn out to be the most critical source of competitive advantage.

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## Subsections

- [Management and Leadership](#)
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## Management and Leadership

- In KM, we distinguish between *managers* and *leaders*.
- Traditional managers usually focus on the present. They are usually action-oriented and spends most of the time supervising, delegating, controlling, and ensuring compliance with set procedures.
- Traditional managers were once workers and were promoted to managers. When they manage subordinates, they are aware of each aspect of the business since they were once there.
- Smart managers usually focus on organizational learning in order to ensure operational excellence.
- Smart managers can not be expected to have mastered the work of the subordinates. They can take on the role of leaders where change is the primary goal.
- The challenge is to get the organization moving towards achieving goals (in line with the rate of change).
- The leader's role in a learning organization is more of a facilitator than a supervisor.
- He acts more like a teacher than like an order giver.
- In case of teaching, the focus is on the transfer of knowledge from the instructor to the learner. The instructor is supposed to be the expert and his/her role is to deliver quality content and to communicate the content with potential.
- Learning should essentially promote a way of thinking, not just convey facts.
- In a learning organization, the smart manager can play the role of the instructor, and the knowledge workers can play the role of learners.
- The smart manager provides opportunities for knowledge workers to brainstorm ideas, exchange knowledge, and come up with new and better ways of doing business.

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## Work Management Tasks

Work management tasks include the following:

- Retrieving, creating, sharing, and using knowledge in everyday activities.
- Managing knowledge workers and nurturing their knowledge-oriented activities.
- Ensuring readiness to work.
- Maintaining work motivation among knowledge workers.
- Allocating effort and switching control among tasks.
- Managing collaboration and concurrent activities among knowledge workers.
- Sharing information and integrating work among knowledge workers.
- Recruiting knowledge-seeking and bright individuals.

factors to be considered by the managers:

- Time constraint.
- Knowledge workers doing work that the organization did not hire them to do.
- Working smarter/harder.
- Work Schedule.
- Knowledge worker productivity.

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# Work adjustment

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## Introduction

- Smart managers should ensure the right match between the vocational needs of their knowledge workers and the requirements of their jobs.
- The aim is to assure the stability of the workforce and continuity on the job.
- Achieving and maintaining correspondence with the work environment can be viewed as basic motives of human work behaviour.
- Correspondence starts when an individual brings certain skills that enables him/her to respond to the requirements of the job or the work environment.
- On the other hand, the work environment provides certain rewards in response to the individual's requirements.
- When both the individual's and the work environment's minimal requirements are mutually fulfilled, the correspondence exists.
- When an individual achieves minimal correspondence, he/she is allowed to stay on the job and have an opportunity to work toward a more optimal correspondence.

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## Smart Leadership Requirements

The knowledge chain represents a series of steps which determines the potential of a learning organization. One approach involves the following steps:

- Assessment of the core competency of the organization.
- Response to organization's shortcomings (internal).
- Excellent knowledge of the external market and the nature of competition in the market.
- Online response to company's external environment.
- Measuring the return on time.

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# Technology and Knowledge Worker

- The primary activities of knowledge work:
  - Assessment
  - Decision Making
  - Monitoring
  - Scheduling
- A knowledge worker can act as a manager, a supervisor, or a clerk who is actively engaged in thinking, information processing, analyzing, creating, or recommending procedures based on experience and cumulative knowledge.
- IT plays a key role in the learning organization in the following processes:
  - Knowledge capture
  - Information distribution
  - Information interpretation
- There exists a multitude of equipment and software supporting knowledge worker's tasks. They include:
  - E-mail
  - LAN
  - Intelligent Workstations
- Intelligent workstations automates repetitive, and tedious tasks. They should perform the following functions:
  - Administrative support functions

- Personal computing functions
- Managing intelligent databases

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# Ergonomics

List of factors affecting the ergonomics of knowledge workers:

- Environmental issues: proper lighting, layout etc.
- Hardware issues: furnitures, workstations etc.
- Knowledge worker-system interface: software, user training etc.

Knowledge worker-system interface emphasizes features like:

- Minimum worker effort and memory.
- Best and effective use of human patterns.
- Prompt problem notification.
- Maximum task support.

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# Managerial Considerations

Considerations for a change leader:

- Focusing less on problems, and more on opportunities and successes.
- Adopting an attitude which views challenges as opportunities.
- Working on future business rather than considering past problems.

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# Managing Knowledge Projects

A knowledge manager is expected to possess psychological, technical and business skills. Managerial functions include:

- Drafting knowledge teams
- Deciding on customer requirements
- Identifying project problems
- Ensuring successful results

The knowledge manager is expected to focus on:

- Encouraging team members to create new knowledge.
- Helping knowledge workers do their jobs.
- Allowing knowledge workers to participate in major organizational decisions.
- Encouraging knowledge workers and employees to learn as they earn a living on a day-to-day basis.

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