Guelma University, Algeria
Computer Science Department
2ère Master STIC/ICST – UEF3

Knowledge Engineering Course

Chapter I
Introduction to Knowledge Management

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Outline

1. Data vs. Information vs. Knowledge vs. Wisdom
2. Types of Knowledge: Explicit vs. Tacit
3. Definition of Knowledge Management
4. Importance of Knowledge Management

Data, Information and Knowledge

Data

Raw facts, figures, observations, or values that have no inherent meaning or context. Data is typically unprocessed and lacks relevance until it is organized and interpreted.

Example: A list of temperatures (e.g., 32°C, 24°C, 55°C) is data. It becomes more meaningful when associated with a location and date, indicating daily temperatures in different cities.

- Data can be thought of as a **description of the World**.
- Data are word facts that can be perceived with sensors (Human/Industrial).
- Data is objective and does not carry any specific meaning on its own.
- Data can be in the form of numbers, text, images, or any other format.
- It is usually collected and stored for later use or analysis.
- Data is typically structured, unstructured, or semi-structured.

Information

Is the result of processing and organizing data to provide context, relevance, and meaning. It is data that has been interpreted and is useful for decision-making, understanding, or communication.

Example: A weather report that includes daily temperature forecasts, humidity levels, and weather conditions (e.g., sunny, rainy) for a specific location is information derived from raw data.

- Information allows us to expand our knowledge beyond the range of our senses.
- Information is meaningful and can be used to answer questions, solve problems, or make informed decisions.
- It provides context and clarity to data, making it more understandable and valuable.
- Information is typically organized, categorized, and presented in a structured format.

Knowledge

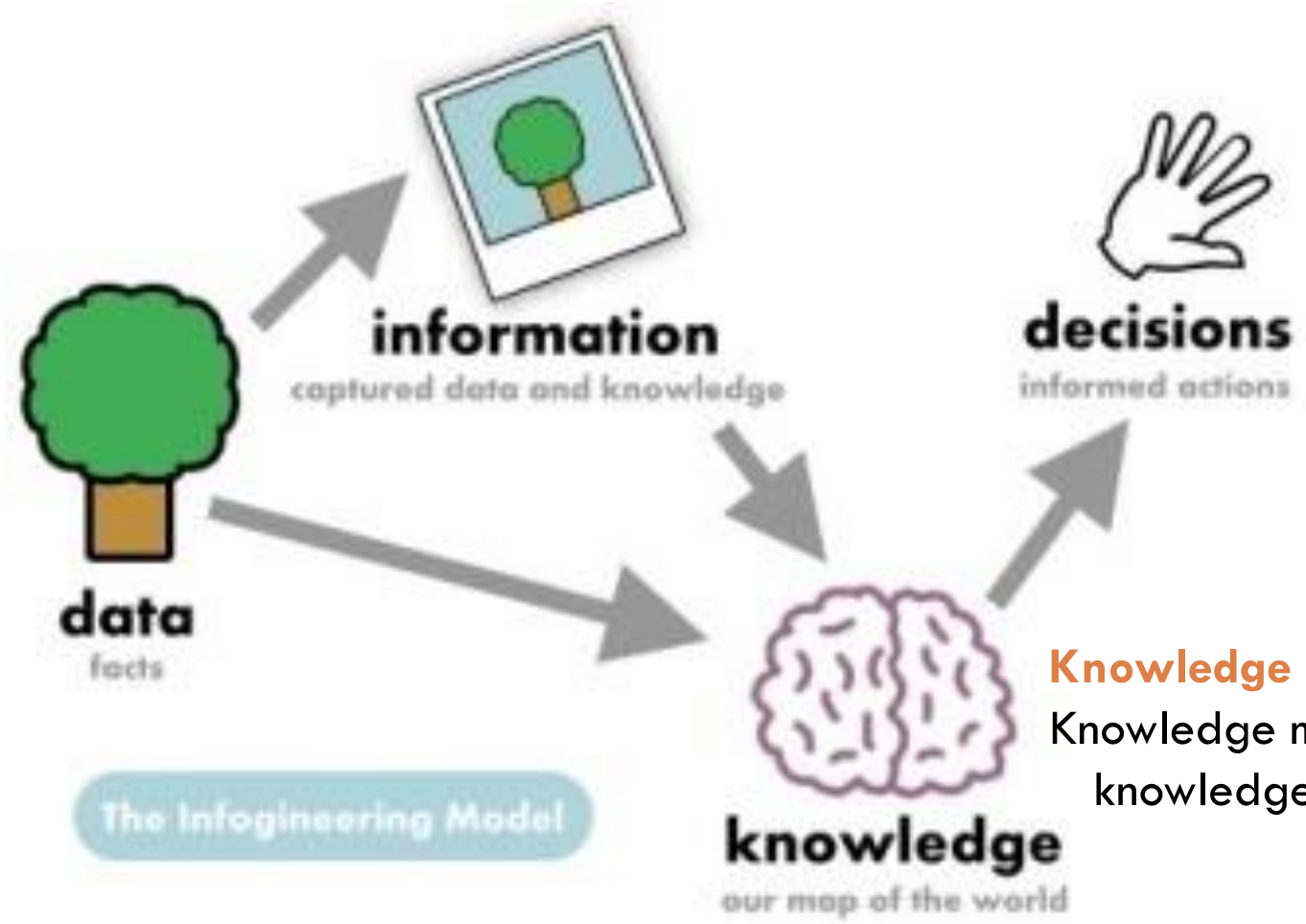
Is a higher-level concept. It involves understanding, insight, and the ability to apply information to specific situations or tasks. It is the result of learning, experience, and expertise.

Example: A meteorologist's ability to predict weather patterns and provide recommendations for upcoming weather events is an application of knowledge derived from years of studying weather information.

- Knowledge is a product of human cognition and learning → **What we know.**
- It is context-specific and often involves a deeper understanding of relationships, patterns, and implications.
- Knowledge can be applied to solve complex problems, make strategic decisions, or create new insights.
- Knowledge is not static but rather is dynamic and grows with new technology, information, learning and experience gathered.

Knowledge

Information = **data** + **meaning**



Knowledge = **information** + **processing**

Knowledge may be created from existing knowledge using logical interference.

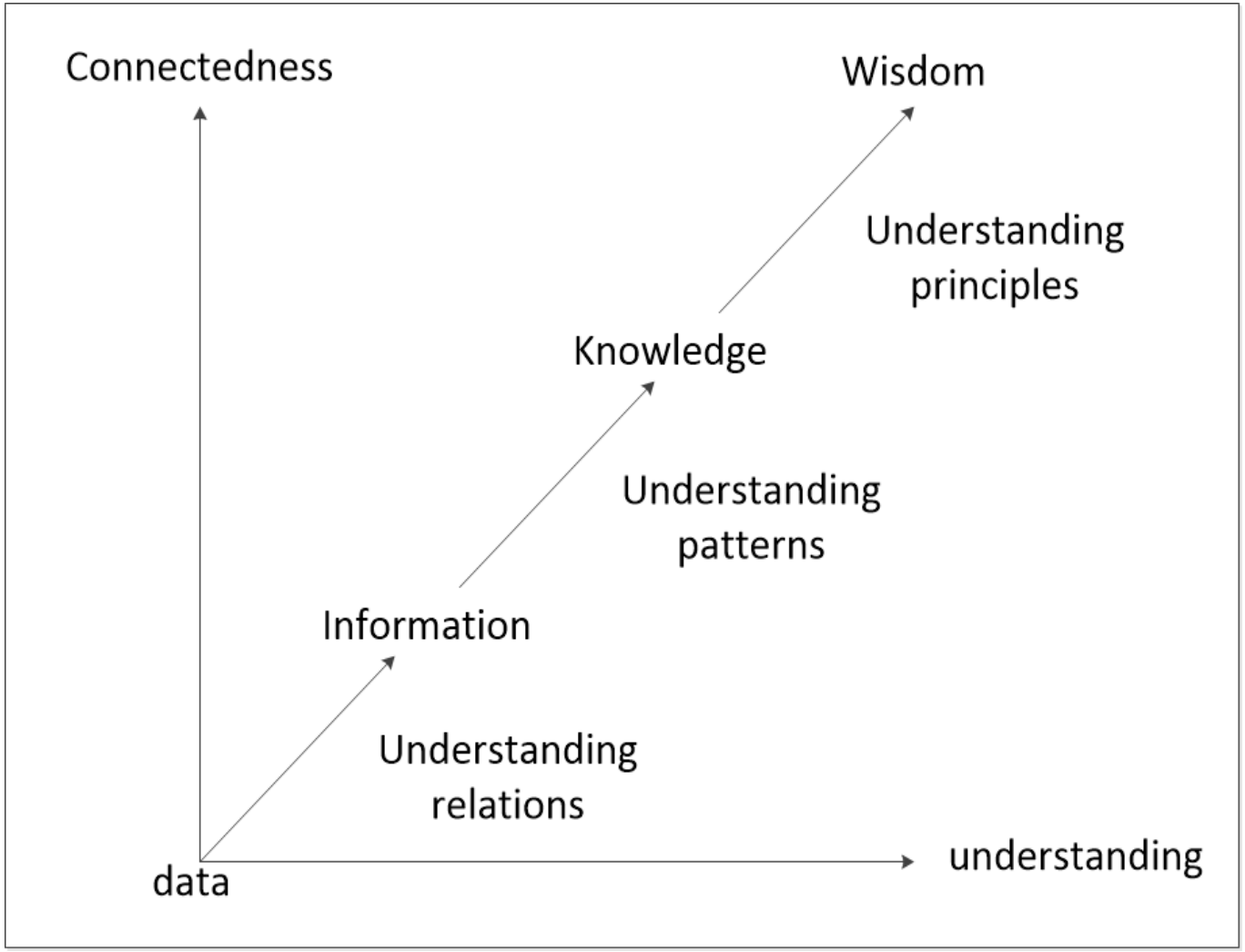
Wisdom

Is is the highest level of understanding and involves making sound judgments and decisions based on a deep understanding of underlying principles, values, and long-term consequences.

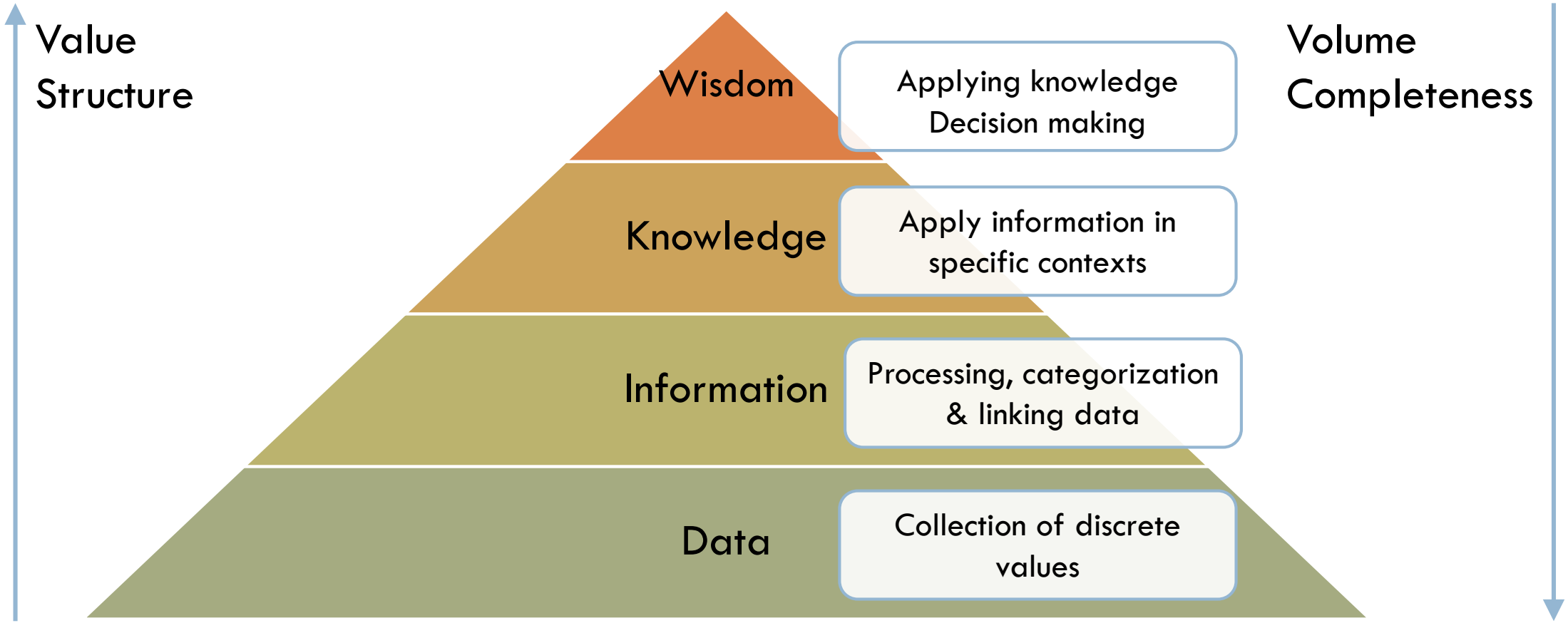
Example: A seasoned environmental scientist's ability to advise policymakers on sustainable resource management, taking into account ecological, economic, and social factors, reflects wisdom gained through extensive experience and ethical considerations.

- Wisdom is the ability to use knowledge and experience to make good decisions.
- Wisdom is not only about knowing what to do but also understanding why it should be done and considering the ethical and moral implications of actions.

From Data to Knowledge (1/3)



From Data to Knowledge (2/3)



From Data to Knowledge (3/3) [Harlan Cleveland, 1982]

Types of Knowledge

Explicit vs. Tacit

Explicit knowledge

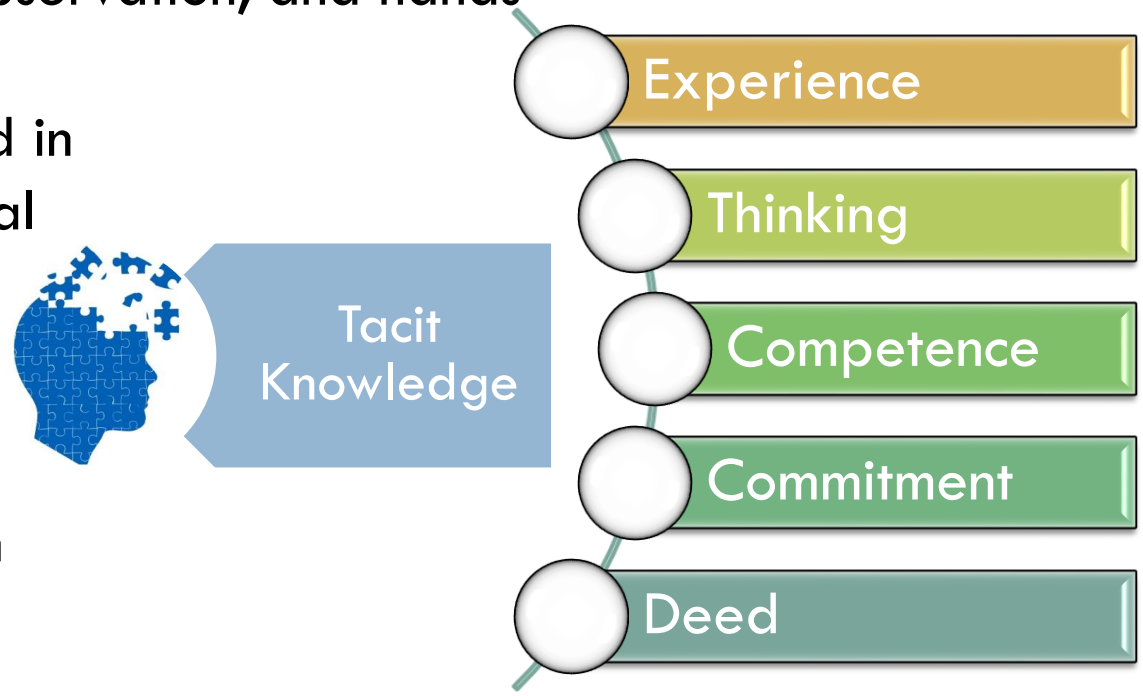
- Formal and codified information that can be easily articulated, documented, and communicated. Tangible and can be expressed in the form of words, numbers, diagrams, documents, or other structured formats.
- Readily accessible and typically easy to transfer from one person to another.
- Can be easily searched for and retrieved when needed.
- Communicated through written or verbal communication and can be shared with others in a structured and systematic manner.
- Well-suited for formal training, documentation, and educational materials.

Explicit knowledge

- Data, information
- Documents
- Records
- Files

Tacit knowledge

- Gained from experience, rather than formal education and training.
- Typically acquired through years of practice, observation, and hands-on experience.
- Informal, highly unstructured, and deeply rooted in an individual's experience, intuition, and personal insights.
- Difficult to articulate and to put into text or drawing.
- It resides in the minds of individuals and is often challenging to externalize or formalize, capture and share.
- Transferred through direct personal interaction, observation, hands-on experience, informal conversations, apprenticeships, etc.



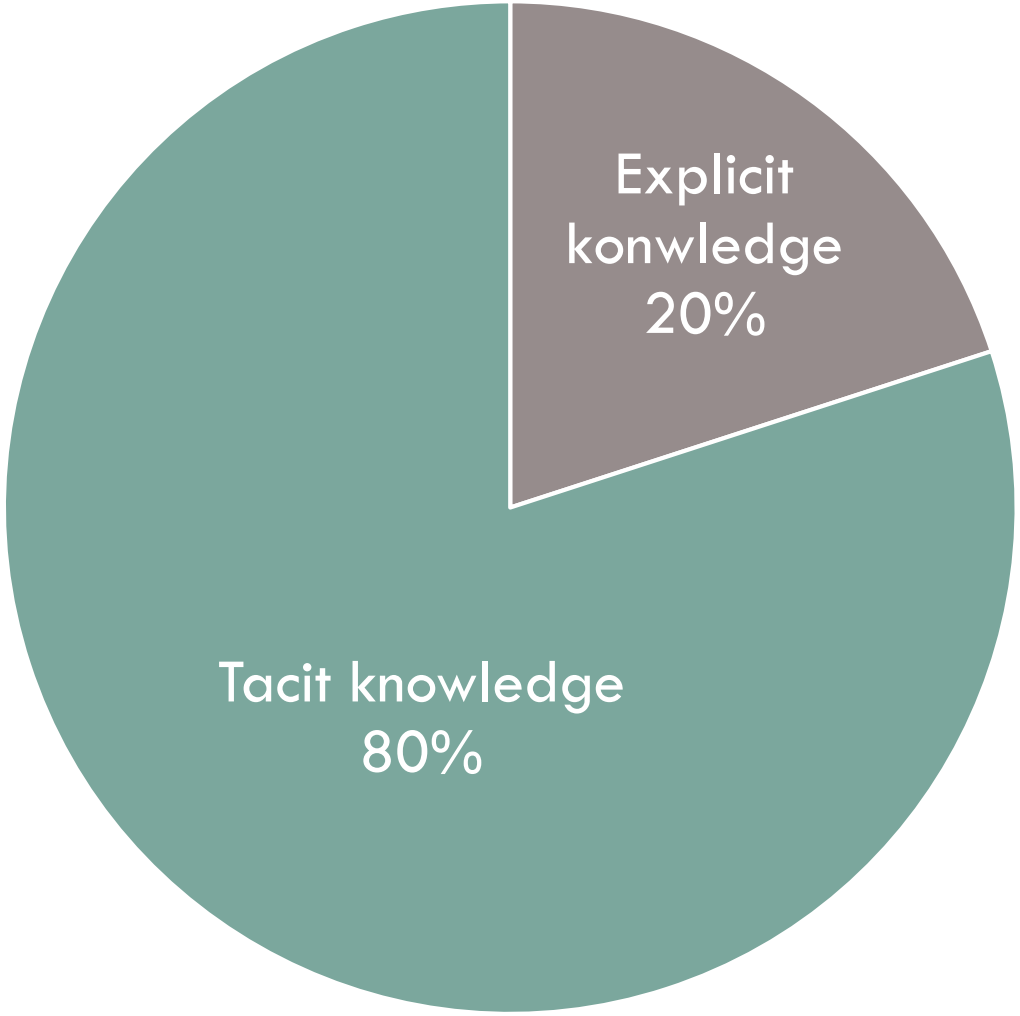
Examples:

- The skill of riding a bicycle.
- An experienced chef's ability to create a perfect dish.
- A master craftsman's intuitive woodworking.

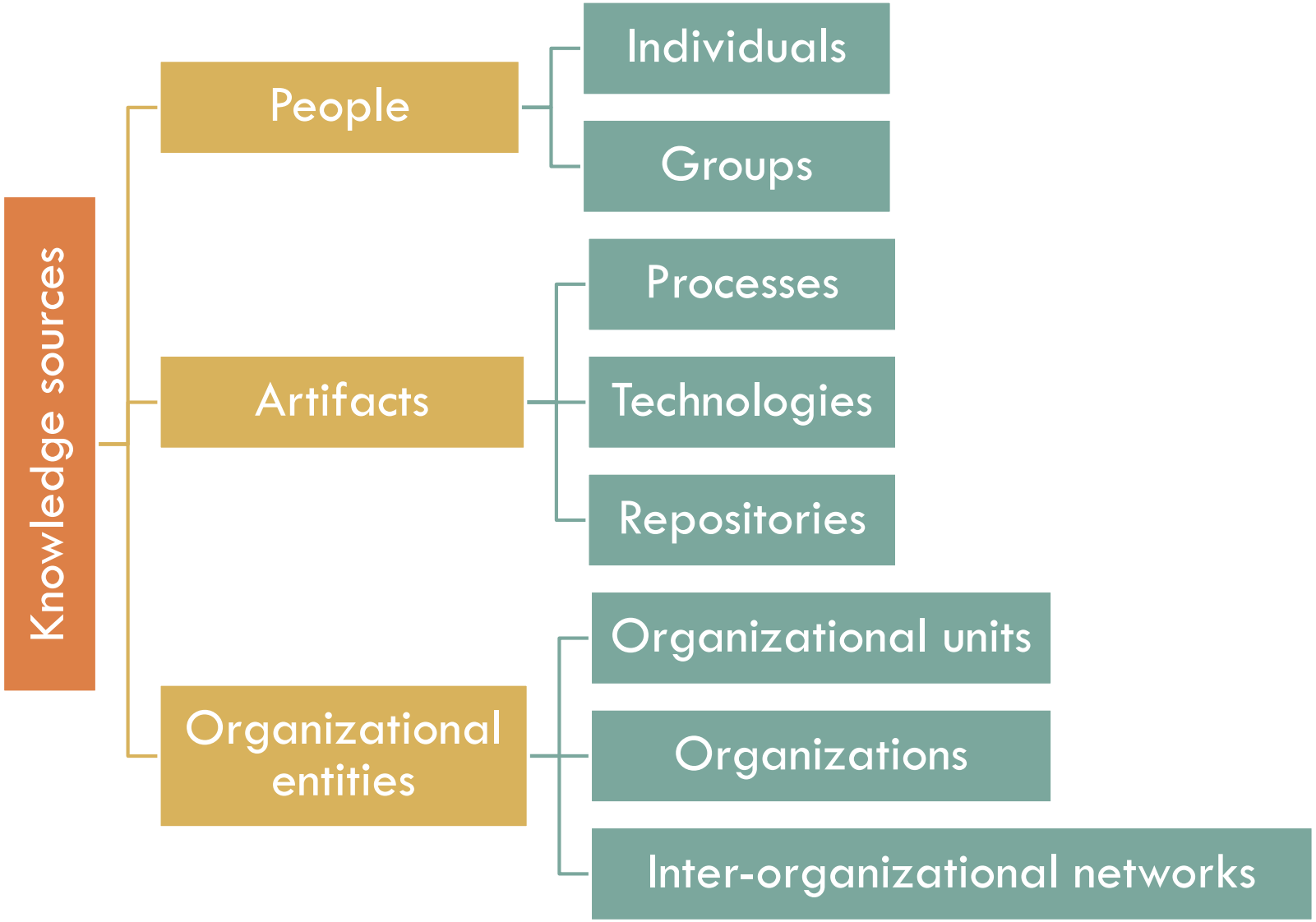
Explicit vs. Tacit knowledge (1/2)

Explicit Knowledge	Tacit Knowledge
Stored in physical objects	Resides in the mind of people
Highly-structured	Highly-unstructured
Easily shared	Sharing requires learning
Reproducible	Not identically replicated

Explicit vs. Tacit knowledge (2/2)



Sources of knowledge



Summary of concepts

- **Knowledge influences success:** to succeed in today's challenging organizational environment, companies need to learn from their past errors and not reinvent the wheel repeatedly. Organizational knowledge is not intended to replace individual knowledge but to complement it by making it stronger, more coherent, and more broadly applied.
- **Knowledge are personal assets:** knowledge often resides in the heads of people.
- **Knowledge has two main types:** two knowledge types are complementary:
  - Codified knowledge (Explicit)
  - Personalized knowledge (Tacit)
- **Knowledge sharing is the key:** knowledge sharing needs to be permanent and systematic process but faces a tremendous challenge = Trust
- **Importance of technology:** technology is the conduit that helps in making knowledge sharing possible.

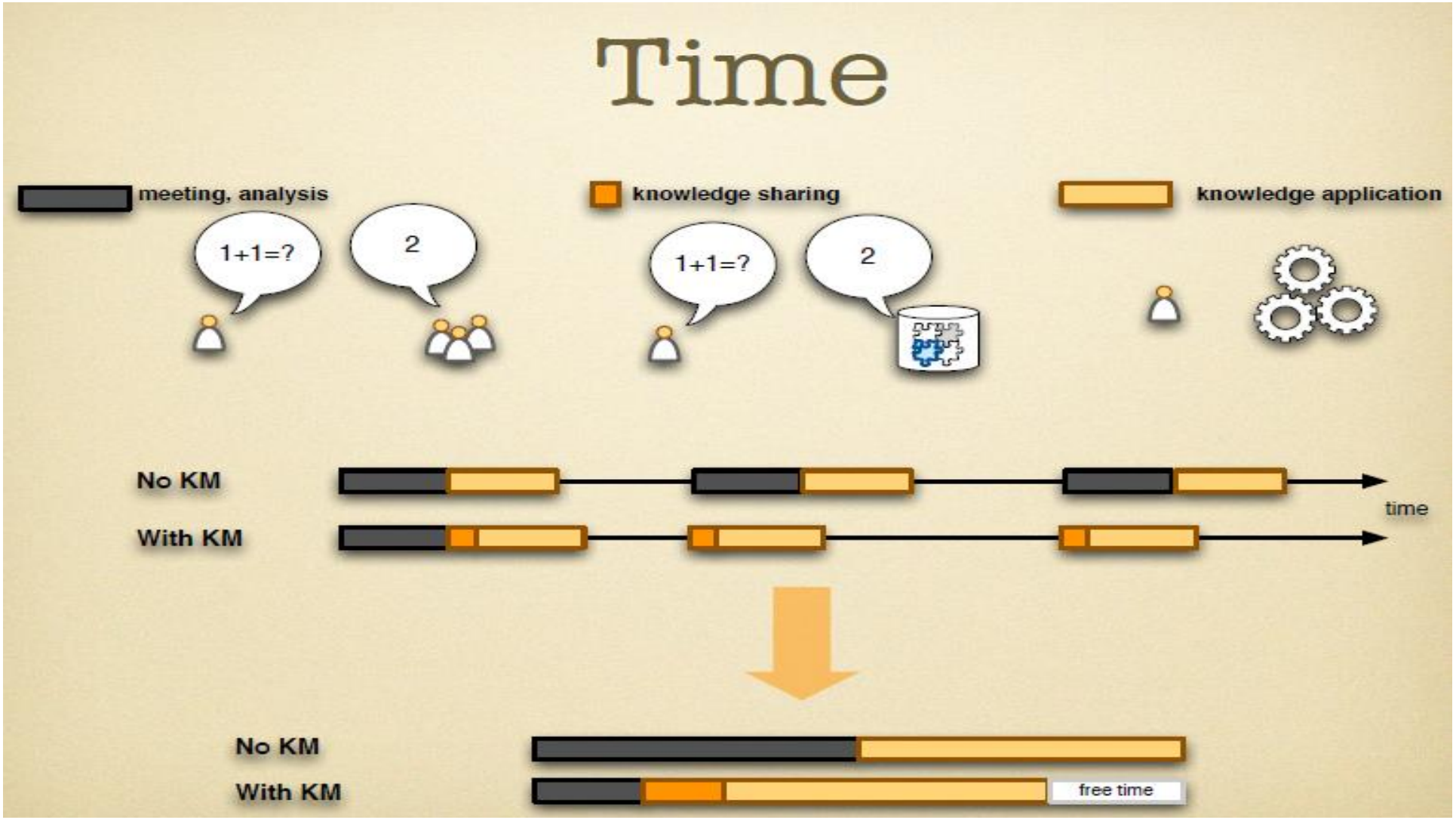
Knowledge Management (KM)

Factors motivating the need for Knowledge Management (1/3)

- **Increasing internal/external domains complexity:** As industries and business environments become more complex, there is a greater need for organizations to manage and leverage specialized knowledge.
- **Accelerating market volatility:** Markets are becoming increasingly volatile due to factors like rapid technological advancements, and changing customer preferences.
- **Intensified speed of responsiveness:** In today's fast-paced world, the ability to respond quickly to customer inquiries, emerging trends, or competitive threats is crucial.
- **Diminishing individual experience:** Organizations are experiencing a loss of institutional memory as experienced employees retire or leave the workforce.
- **Globalization and distributed workforces:** Many organizations operate on a global scale or have geographically dispersed teams. This geographical diversity presents challenges in terms of communication, collaboration, and knowledge sharing.

Factors motivating the need for Knowledge Management (2/3)

Factors motivating the need for Knowledge Management (3/3)



Knowledge Management (KM) (1/3)

Knowledge management (KM) is a multidisciplinary process that involves applying a systematic approach to the creation/capture, organization, dissemination, and application of knowledge within an organization. It aims to capture, store, and leverage both explicit (documented) and tacit (unspoken) knowledge to enhance decision-making, innovation, and overall organizational efficiency.

- **Knowledge Capture:** involves identifying, capturing, and documenting valuable knowledge assets, which can include data, information, best practices, expertise, and lessons learned.
- **Knowledge Organization:** organizing and categorizing knowledge to make it easily accessible and searchable for employees and stakeholders.
- **Knowledge Sharing:** encouraging the sharing of knowledge among employees, departments, and teams, fostering collaboration and the exchange of expertise. Everyone can benefit from best practices and avoid repeating things that failed.

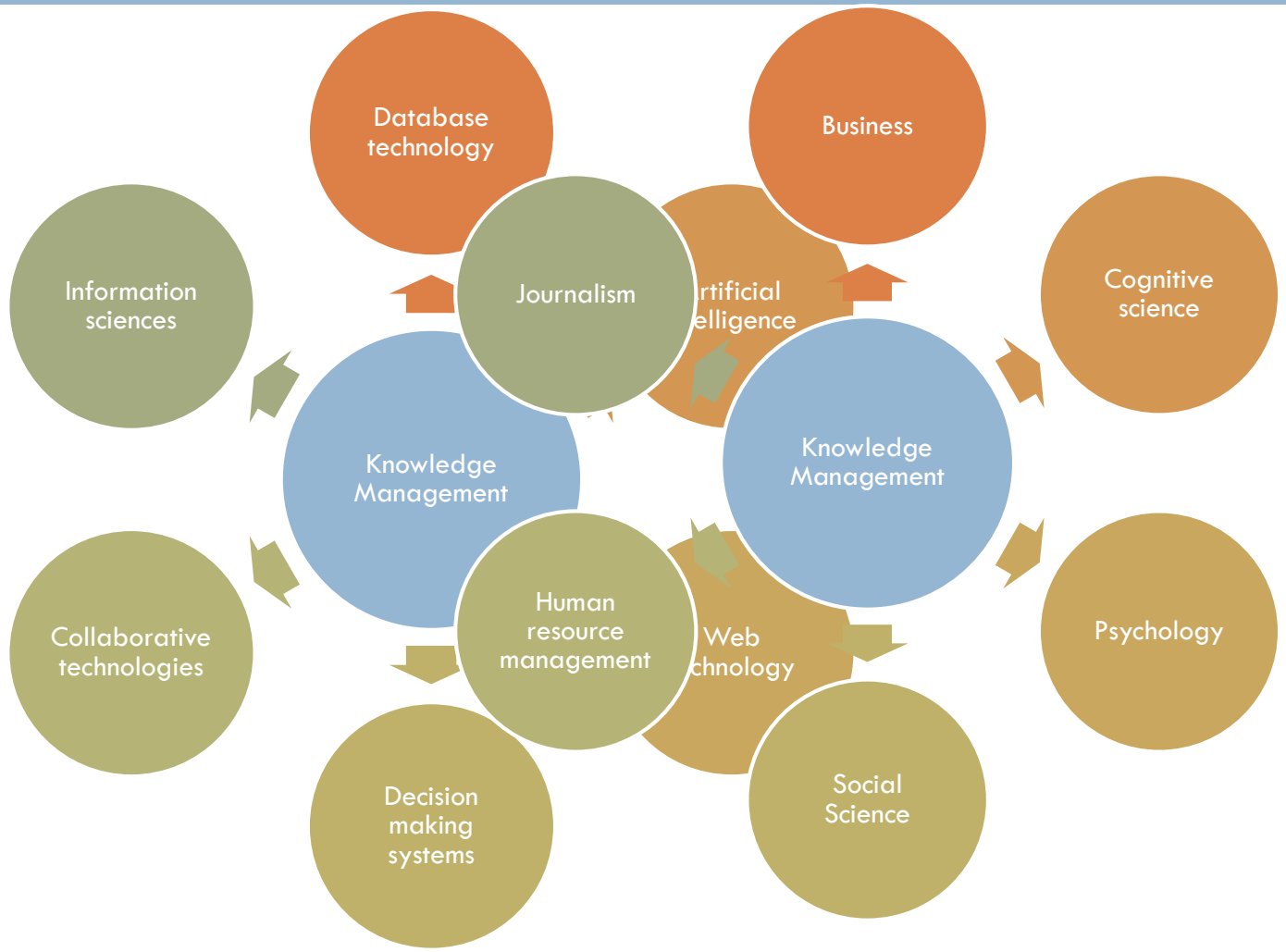
Knowledge Management (KM) (2/3)

- **Knowledge Application:** apply knowledge effectively to solve problems, make informed decisions, innovate, and achieve organizational objectives.
- **Technology and Tools:** information technologies and software tools are useful to support knowledge storage, retrieval, and dissemination.
- **Continuous Learning:** promotes a culture of continuous learning and improvement, where employees are encouraged to contribute to and learn from the organization's knowledge resources.
- **Competitive Advantage:** enabling organizations to adapt to change, respond to challenges, and capitalize on opportunities more efficiently.
- **Ethical Considerations:** safeguarding sensitive information, respecting intellectual property rights, and ensuring data privacy and security.

Knowledge Management (KM) (3/3)

- **Measurement and Evaluation:** measuring the impact of knowledge management efforts through key performance indicators to assess their effectiveness and return on investment.
- **Leadership and Culture:** strong leadership support and the cultivation of a knowledge-sharing culture where employees are encouraged to contribute and collaborate.

Multidisciplinary nature of Knowledge Management



Knowledge Management System (KMS) (1/2)

A knowledge management system (KMS) is a structured framework or software solution designed to facilitate the capture, organization, storage, retrieval, and dissemination of knowledge within an organization.

- **Knowledge Repository:** serves as a centralized repository where organizations can store various forms of knowledge, including documents, data, reports, best practices, lessons learned, and expertise from employees. This repository makes it easier to access and share knowledge across the organization.
- **Knowledge Capture and Creation:** allows for the systematic capture and creation of knowledge. This involves documenting processes, recording expert insights, and collecting data/information to create and update the knowledge repository.
- **Knowledge Organization and Retrieval:** categorization, indexing, and search capabilities to organize knowledge effectively. Users can search for and retrieve relevant knowledge quickly, improving decision-making and problem-solving.

Knowledge Management System (KMS) (2/2)

A knowledge management system (KMS) is a structured framework or software solution designed to facilitate the capture, organization, storage, retrieval, and dissemination of knowledge within an organization:

- **Collaboration and Sharing:** promote collaboration by enabling users to share their knowledge, expertise, and experiences with others. They often include features such as discussion forums, wikis, and social networking tools to facilitate communication and knowledge exchange among employees.
- **Continuous Improvement:** support of ongoing learning and improvement. They enable organizations to identify areas where knowledge gaps exist and to implement strategies for knowledge creation, capture, and dissemination to address those gaps. This helps organizations adapt to changing circumstances and stay competitive.

Elements of KMS

- **Knowledge teams:** multi-disciplinary and cross-functional persons to create, acquire, organize, codify and disseminate knowledge.
- **Knowledge repository:** the content of KMS that includes documented processes, best practices associated with products and sub-systems, aimed at enabling users to derive tangible benefits.
- **Learning organization:** a continuous process to improve the quality and enrich the content of the knowledge repository.
- **Technology infrastructure:** enable effective tools to store, share, communicate knowledge among peoples of the same organization. This includes Internet, hubs, social media, etc.
- **Corporate initiatives:** top managers of organizations should put much importance to manage the KMS of their organizations and promote knowledge sharing.

Knowledge resources (1/2)

- **Knowledge in Employees:** expertise and experience that individuals bring to an organization. It encompasses the tacit knowledge, skills, and insights possessed by employees, which are often critical for problem-solving, innovation, and decision-making ➔ Employees can leave.
- **Customer Knowledge:** understanding customers' preferences, behaviors, needs, and feedback help in tailoring products and services to meet customer expectations and improve customer satisfaction ➔ the most vital knowledge source.
- **Knowledge in Products:** expertise and information embedded within a company's products or services. This can include technical specifications, features, usage instructions, and maintenance guidelines. Effective knowledge management ensures that this information is accessible to employees and customers ➔ Smarts add value to the product.

Knowledge resources (2/2)

- **Knowledge in Processes:** documented and tacit knowledge associated with organizational workflows, procedures, and operations. Effective knowledge management optimizes processes, making them more efficient and ensuring that process-related knowledge is shared and updated.
- **Organizational Memory:** a collective knowledge and experience that an organization accumulates over time. It includes historical data, lessons learned, past successes, and failures. Knowledge management ensures that this memory is preserved and accessible to support future decision-making and learning.
- **Knowledge in Relationships:** pertains to the insights and information related to an organization's interactions with external entities such as customers, partners, suppliers, and stakeholders. Effective relationship management leverages this knowledge to build stronger connections and collaborations.

Importance of Knowledge Management (1/3)

- **Enhanced Decision-Making:** ensures that relevant and up-to-date knowledge is readily available to decision-makers. This, leads to more informed and data-driven decision-making processes, reducing uncertainty and improving the quality of decisions.
- **Innovation and Problem-Solving:** fosters a culture of learning and innovation by encouraging the sharing of insights, best practices, and lessons learned. This environment stimulates creativity, problem-solving, and the generation of new ideas, which are essential for staying competitive.
- **Efficiency and Productivity:** streamlined access to knowledge and information helps organizations operate more efficiently. Employees spend less time searching for information, leading to increased productivity and cost savings.
- **Continuous Improvement:** facilitates the identification of areas for improvement. By analyzing historical data, organizations can pinpoint weaknesses, optimize processes, and implement changes for ongoing enhancement.

Importance of Knowledge Management (2/3)

- **Risk Management:** allows organizations to anticipate, identify, and mitigate risks more effectively. By drawing on past experiences and expertise, organizations can make proactive decisions to minimize potential negative impacts.
- **Competitive Advantage:** in a rapidly changing business environment, having access to knowledge and the ability to apply it strategically can provide a significant competitive advantage. Organizations that adapt quickly and effectively to new circumstances often outperform their competitors.
- **Customer Satisfaction:** leads to better customer service and satisfaction. When employees have access to a wealth of knowledge, they can address customer inquiries more effectively, leading to improved customer experiences.
- **Institutional Memory:** helps preserve institutional memory by capturing and storing knowledge, even when employees leave the organization. This ensures that critical information and expertise are retained and can be passed on to new employees.

Importance of Knowledge Management (3/3)

- **For individuals:**
  - Helps in doing jobs and save time.
  - Builds a sense of community bonds within the organization.
  - Helps people to keep up to date.
  - Provides challenges and opportunities to contribute.
- **For communities :**
  - Develops professional skills.
  - Promotes peer-to-peer mentoring.
  - Facilitates more effective networking and collaboration.
  - Develops a common language.
- **For organizations:**
  - Solves problems quickly.
  - Diffuses best practices.
  - Improves knowledge embedded in products and services.
  - Increases opportunities for innovation.
  - Enables organizations to stay ahead of the competition better.
  - Builds organizational memory