



# Introducing Knowledge Management

## Knowledge Modelling and Management

### Part B (1)

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# Relevant Knowledge

- **Knowledge representation and reasoning**
- **Conceptual modelling methods**
- **Modelling experiences**
- **Logic**
- **Logic programming**
- **Prolog**
- **Data mining (optional)**

# What is important?

- **Attend lectures**
- **Read the KM book, lecture notes and relevant recommended papers**
- **Understand the issues and rationale behind the principles, formulates and guidelines**
- **Understand the techniques**
- **Understand the case studies and KM applications**



# Background



# Old World of Business

- **Predictable environment;**
- **Focus on prediction and optimization based efficiencies;**
- **Hold useful information; has pre-defined goals and objectives and best practices;**
- **Following best practices;**
- **Use IT to align information and activities to achieve best practices;**
- **Over time to achieve organisational effectiveness.**

# New World of Business

- **High level of uncertainty and inability to predict the future;**
- **Vast amount of information available;**
- **Sophisticated, global and innovative competitions;**
- **New and innovative practices can make existing practices obsolete;**
- **Use of IT systems to comply with pre-defined goals are no longer sufficient;**
- **Re-thinking, re-engineering, re-everything are required constantly;**
- **Doing the right things; not doing the things right.**

# Question



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  - Changing technologies
  - Changing demands of the market
  - Changing supply of the market
  - Changing laws and regulations
  - Changing political situation
  - Changing economical circumstances
  - Changing business models (e.g. of others)
- **To remain aligned with the dynamically changing needs of the business environment, organisations need to continuously assess their internal theories of business for ongoing effectiveness.**



# Examples of Changing Businesses



- **Camera industry**
- **PC/computing industry**
- **Mobile phone industry**
- **Media industry, inc. music, film, news**
- **Telecom industry**
- **Banking industry**
- **Book/publishing industry**
- **Energy industry**
- **Car industry**
- **Food industry**
- **Retail industry**
- **Manufacturing**
- **Logistics**





# An Introduction to Knowledge Management Concepts and Techniques



# What is KM?

- KM focuses on 'doing the right thing' instead of 'doing things right.'
- KM is a **framework** that examines (business) **processes** from the point of view of **knowledge processes**.
- KM activities are business processes that involve creation, dissemination, renewal, and application of **knowledge** toward achieving organizational sustenance, survival and improvement.

# Knowledge Management Approaches



- **Continuously learning**
  - KM facilitates **continuous and ongoing processes of learning and unlearning** thus ensuring the need for imposing top-down “radical changes” may be minimized.
- **Bottom up approach**
  - It is ingrained in the **day-to-day operations** of the business at the **grassroots level** and driven by the people who interact with the external environment on the frontlines of the business.
- **A synergy of information and innovation**
  - It is to achieve a synergy of data and information processing capabilities, human creativity and innovation of an organisation.
- **In shorts, it emphasises on the below aspects**
  - Data and information processing,
  - Creativity,
  - Innovation of organisations.



# KM Activities

- **Are business activities with two primary aspects:**
  - To identify and treat the **knowledge components** of business activities as an explicit concern of business that are (to be) reflected in the strategies, policies, and practices at all levels of the organization.
  - To make a direct connection between an organization's **intellectual assets** and **positive business outcomes**:
- An organisation's intellectual assets can be **explicit** (expressed and recorded on paper or machines) and **tacit** (personal private know-how) knowledge.

# The Importance of Knowledge



- The traditional “**factors of production**” in business terms are land, labour and capital. Today, these are secondary.
- **Economical facts:**
  - Cost of traditional factors have (comparably) decreased, but
  - **Cost** of obtaining knowledge has increased; and the **value** of having knowledge has increased (65-75%).
  - Knowledge Economy.
- **Knowledge has become one of the most important factors of production.**
- Traditionally, “knowledge” tends to be intangible, implicit and exists mainly in people’s head; however, new thinking are:
  - knowledge is treated explicitly as an **entity/utility** and,
  - may be used as a **means** to obtain social and economic benefits,
  - furthermore, knowledge may be used to **produce** more knowledge.

# Knowledge

- **What is knowledge ?**
  - Knowledge Era; Knowledge Economy
- **Recognise knowledge as an individual entity**
- **Use structural methods (inc. processes and tools) to assist knowledge management life cycle: (e.g. the KM processes by AKT project)**
  - Acquire knowledge
  - Describe knowledge
  - Formalise knowledge
  - Make use of and extend knowledge
  - Share knowledge

# Data, Information and Knowledge



- **Data:** data are un-interpreted signals; computers are full of data, but it may not necessarily have meanings. (i.e. it is un-interpreted and raw.)
- **Information:** is data with meaning. E.g. a red traffic light indicates drivers to stop. Often this is interpreted within a certain context.
- **Knowledge:** is a combination of data and information, and in addition, the **know-how** for taking actions, given the information. It has two main aspects:
  - It has purposes and goals – that actions are carried out to achieve these goals;
    - » E.g. if you are a driver, then the red light indicates that you need to take actions to stop the car; if you are pedestrian, then the red light indicates that you may proceed;
  - It is generative – knowledge may be used to generate more knowledge.





# Information and Knowledge



- **Information by Nonaka:** Information is a flow of messages.
- **Knowledge by Nonaka:** Knowledge is a meaningful, structured accumulation of information that
  - is created and organized using the flow of the information;
  - is anchored on the commitment and beliefs of its **holders**; and
  - is related to **actions**. [19]
- **Human comprehension:**
  - It may not necessarily be possible to provide a formal and definite definition for knowledge, but it is often comprehensible to an observer when it exists.
  - E.g. via observation of external behaviours, such as examinations, conversations, interviews, demonstration of actions, problem-solving abilities, etc.



# Explicit and Tacit Knowledge



- **Explicit Knowledge:**

- Written in formal, systematic languages;
- Expressed in words, numbers and formulas;
- Easier communicated and shared;
- E.g. hard data, scientific formulae, codified procedures, guidelines or principles.

- **Tacit Knowledge:**

- Personal, private, sometimes hard to communicate;
- Subject to insights, intuitions and hunches;
- Deeply rooted in personal actions, experiences, values, and/or emotions;
- Skills and crafts that are sometimes difficult to formalise using (formal) languages. [19]

# Knowledge Management Techniques and Tools



- **This course introduces KM by using KE techniques, esp. using approaches based conceptual modelling and symbolic based methods.**
- **KM techniques: Symbolic vs. Non-symbolic.**
- **There are many forms and types of technologies and tools that can be used to support the different aspects of KM.**
- **They may be used together to support KM [1, 2]:**
  - Knowledge/conceptual modelling techniques, inc. ontologies;
  - Knowledge based systems;
  - Document management systems – document index and automatic document and information retrieval;
  - Document generation systems – automatic generation of documents (and summary of documents) - based on documents, Ontology and/or domain models;
  - Business process modelling – to describe and understand business processes;



- Discussion forum;
- Capability management systems: to record and derive who knows what and where intellectual assets are stored;
- Match-making, knowledge broker;
- Lessons-learned/experience based knowledge systems;
- Communication, interaction and knowledge visualisation tools – community of practice, social network analysis;
- Centralised vs. distributed systems;
- Internet vs. Intranet based systems;
- Automatic information gathering tools;
- Information retrieval tools;
- Machine learning techniques;
- Data and text mining tools;
- Analysis and information visualisation – dash board presentation;
- User profiling and prediction tools;
- Knowledge resource centre/repository;
- Reusable model/info/software components;
- Quality enhancement tools - speed up design phase and shorten time to market;
- Supply chain management methods.

# Knowledge Management and Engineering



- **Knowledge management:** is a relatively recent topic arise from business management that concerns with ways to leverage knowledge as a key asset and resource in modern organizations. Initially, KM was stemmed from business management that is informal and not always closely related to IT systems or structural methods.
- **Knowledge engineering:** evolves from 1970s and concerns with the development of information systems in which knowledge reasoning plays pivotal roles.
- **The relation** between knowledge engineering and management:
  - Managing knowledge successfully is unconceivable without exploiting the potentials of the information and knowledge systems.
  - Successful knowledge based technical work is only possible if it is properly situated in an **organisational context** within which KM techniques are used.



# Knowledge Engineering as a Discipline



- **What is a discipline - a discipline converts a “craft” into a methodology, such as engineering, scientific methods and quantitative methods; or a methodology for physician’s diagnosis:**
  - A methodology converts “ad hoc” experiences into systems, and anecdote/incident into information;
  - Converts skills into something that can be taught, learned and repeated by others.
- **Knowledge engineering has a long history and has evolved from late 1970s.**
- **Benefits of a knowledge system:**
  - Faster decision-making (by reusing and improving upon previous knowledge and experiences),
  - Increased productivity (by making knowledge explicit and sharable),
  - Increased quality of decision-making (by understanding the causal relations in a decision making process).

# Potential benefits of applying knowledge engineering to knowledge management

- Helps identify **opportunities and bottlenecks** of knowledge resources management by using KM tools.
- Provides developed (automated) **frameworks** to better understand the structures and processes of an organisation.
- Provides **sound methodologies** to build better knowledge systems.



# Knowledge Creation and Values of Knowledge



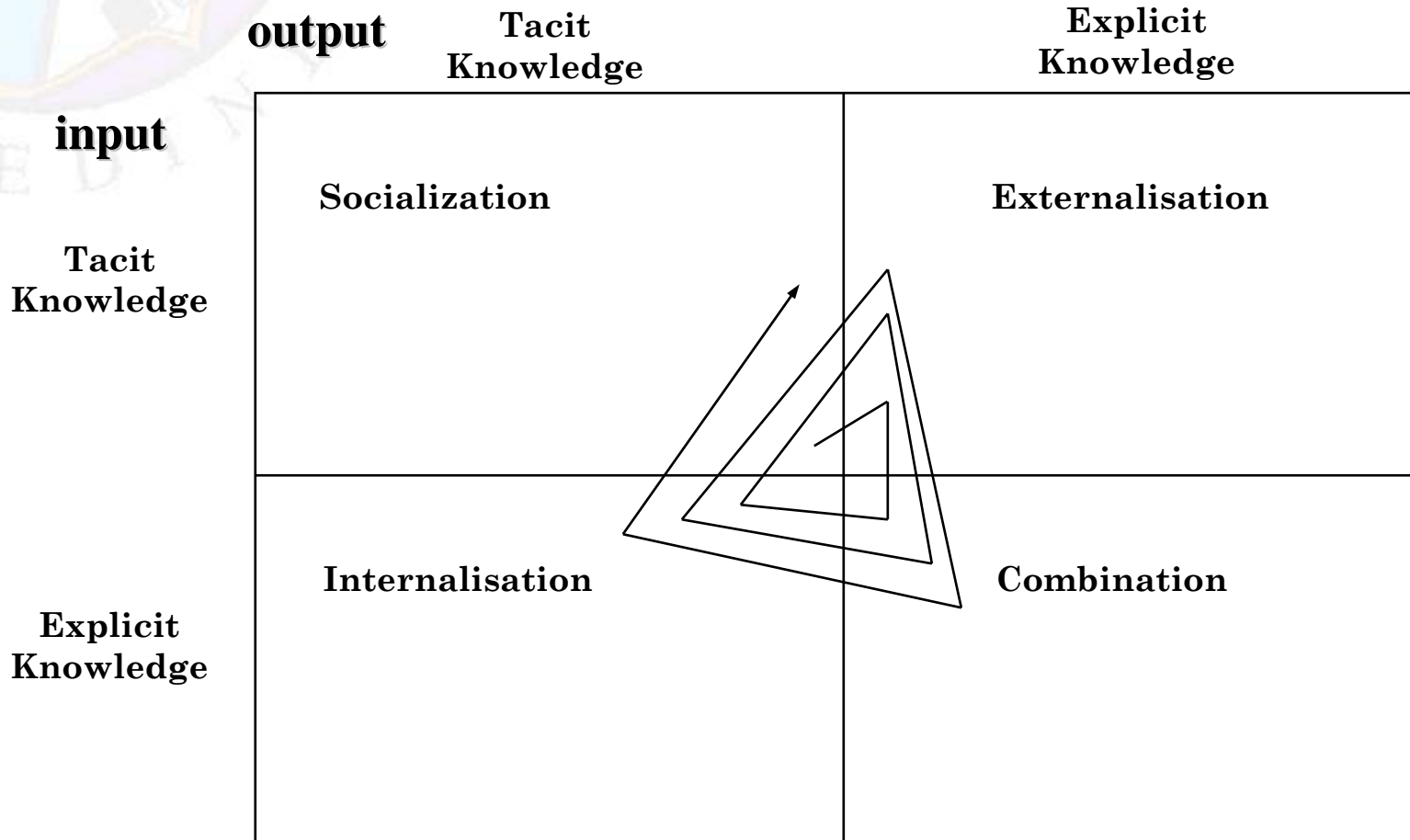


# The Nonaka and Takeuchi's knowledge creation cycle



1. **Socialization:** to transfer knowledge by **showing** rather than **speaking** about the subject matter – the step from tacit to tacit knowledge – e.g. the demonstration of artefacts making.
  2. **Externalisation:** to **write** down the knowledge and know-how in terms of procedures and facts – the process of making knowledge explicit - by converting tacit knowledge to explicit knowledge.
  3. **Combination:** to compare, combine and improve relevant **explicit knowledge** to generate new explicit knowledge – from explicit to explicit knowledge.
  4. **Internalisation:** – to understand the task and internalise the knowledge so that one can **perform a task** successfully without thinking about it.
- **The Knowledge Creation Life Cycle:** Start from socialization through the different phases, repeat the above cycle to form the knowledge creation cycle.

# Nonaka and Takeuchi's model on dynamics of knowledge creation cycle



# KM, KE and Knowledge Creation



- The aim of KM is to assist this knowledge creation process in **all stages of KM**.
- KM enables and stimulates knowledge creation and more importantly it creates (new) **explicit knowledge**.
- The ability to externalising (general) tacit knowledge is an important and unique characteristic of KE that not many other mature science supports.
- KE assists creating explicit knowledge through a combination of **cyclic activities**; this explicit knowledge is **accumulative** and can be improved over time, because it derives and generates knowledge based on previous knowledge and experiences.

# Knowledge creates values for an organisation

- Michael Porter (1985)'s *value chain model framework* considers an organisation as a collection of activities aiming to create values;
- Each activity adds additional value in the business and production process; these values are embodied in their products and services that are provided for their customers.
- The strategy of KM is therefore to identify where KM may help to add values to those activities.

# A knowledge management activity life cycle

1. **Identify** internal and external knowledge.
2. **Plan** what knowledge is needed in the future and where it is needed.
3. **Acquire** and/or develop knowledge needed.
4. **Distribute** the knowledge to where it is needed.
5. **Foster** the applications of knowledge in the business processes of the organisation.
6. **Control** and maintain the quality of knowledge.
7. **Dispose** knowledge that is no longer needed.

# Definition of KM



- A more practical definition of KM may therefore be provided:
- *KM consists of “A framework and tool set for improving the organization’s knowledge infrastructure aimed at getting the right knowledge to the right people in the right form and at the right time”.*  
*[pp72. 1]*
- KM is not a one-shot or isolated activity but it includes cyclic activities and closely related to and embedded in business processes.



# KM and Value Creation



- In addition, Argyris' model defined a “**double-looped**” organizational learning process:
  - the first loop is the **direct learning** about an application, product or activity;
  - the second loop is the **learning about the knowledge** and the **learning process** itself – these are driven by organisational missions, goals and strategies.
  - KM helps an organisation to obtain **feedback** and learn from **own experiences**, so that it improves its **knowledge infrastructure**.

## Example conceptual models that are used in KM projects

- **Organisation centred models;**
- **Knowledge/data centred models;**
- **Process/task based models;**
- **Agent/Actor based models;**
- **Capability/skill based models;**
- **Communication centred models;**
- **System design and development models:**
  - Inc. inference capabilities for KBS



# Lessons learned from past KM projects



- **People-oriented:** Knowledge is recognised as a key asset for an organisation, but often it is often tacit and private. People are mobile and with own wills. KM projects therefore must be **sensitive** to people's needs, plans, goals and insecurities.
- **Take actions:** KM is not about what one knows, but what one does – the **value of knowledge is only realised when it is used appropriately**. KM is about taking actions given the knowledge and not about having the knowledge as a static asset.
- **Create knowledge pull, not information push** – unselective information storage and exploration creates information bottlenecks:
  - KM needs to be selective and focus.
  - Communication should be **goal-oriented**.
  - KM often needs to be **bottom-up oriented** to be practically successful, so that it can create and sustain knowledge pull to support ongoing projects needs.

- **Communication of knowledge:** Recognise knowledge as a valuable resource, but be careful **not just to simply hand it over like an object** and expect it can be easily transferred, accepted and applied.
- **Knowledge transfer:**
  - Knowledge should be **recreated** by both knowledge provider and receiver – the step of **internalisation**;
  - KM often involves multi-functional and multi-disciplinary teamwork;
  - Knowledge is often created in a virtual organisation that is physically distributed;
  - The purpose of knowledge transfer is to achieve common goals;
  - Not to treat it as an activity of purely mining jewels out of experts' head; but rather, Knowledge Engineering is a **constructive and collaborative activity where modelling of knowledge is central** – often, participants of multiple functions are involved.
- **Lightweight KM approach:**
  - KM approaches are most useful to facilitate knowledge formalisation and sharing among people – i.e. to play a supportive role - to create knowledge pull, and not to impose artificial rigid structures that may interfere with best practices.

# Main References

- [1] (Chapter 1 and 4) in **Knowledge Engineering and Management: The CommonKADS Methodology**. Guus Schreiber, Robert de Hoog, Hans Akkermans, Anjo Anjewierden, Nigel Shadbolt, Walter Van de Velde. (A few copies of the book are available for borrowing from the normal shelf area and the reference shelf in the main library)
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