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# Knowledge Management Foundamentals

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# Knowledge Management Fundamentals

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**The ICTP/IAEA Nuclear Energy Management School 2013, Trieste Italy**

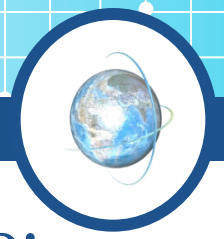
# Objectives of IAEA NKM Programme

- To increase Member States' application of nuclear knowledge management strategies, through:
  - the development and dissemination of methodology, guidance and tools, as well as
  - their implementation in national programmes, and by
  - providing knowledge management services and assistance
- To enhance the synergy and benefit of the Agency's nuclear information and knowledge resources and services

# Key Areas of the NKM Programme


1. Methodology (documents, methods & tools)
2. Services and support (assist visits, missions)
3. Nuclear Education (schools, networks)
4. Technology & Resources (platforms, content)

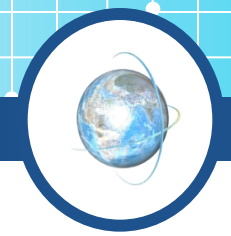
# Lesson objectives



By the end of this lesson the student should be able to:

- To be familiar with the basic principles and important definitions of knowledge management
- To understand the need for and importance of knowledge management in nuclear organizations
- To have a basic familiarity with the key focus areas of nuclear knowledge management
- To confirm this basic understanding (questions to be asked at the end of the presentation)

# KM Topics to be Discussed…

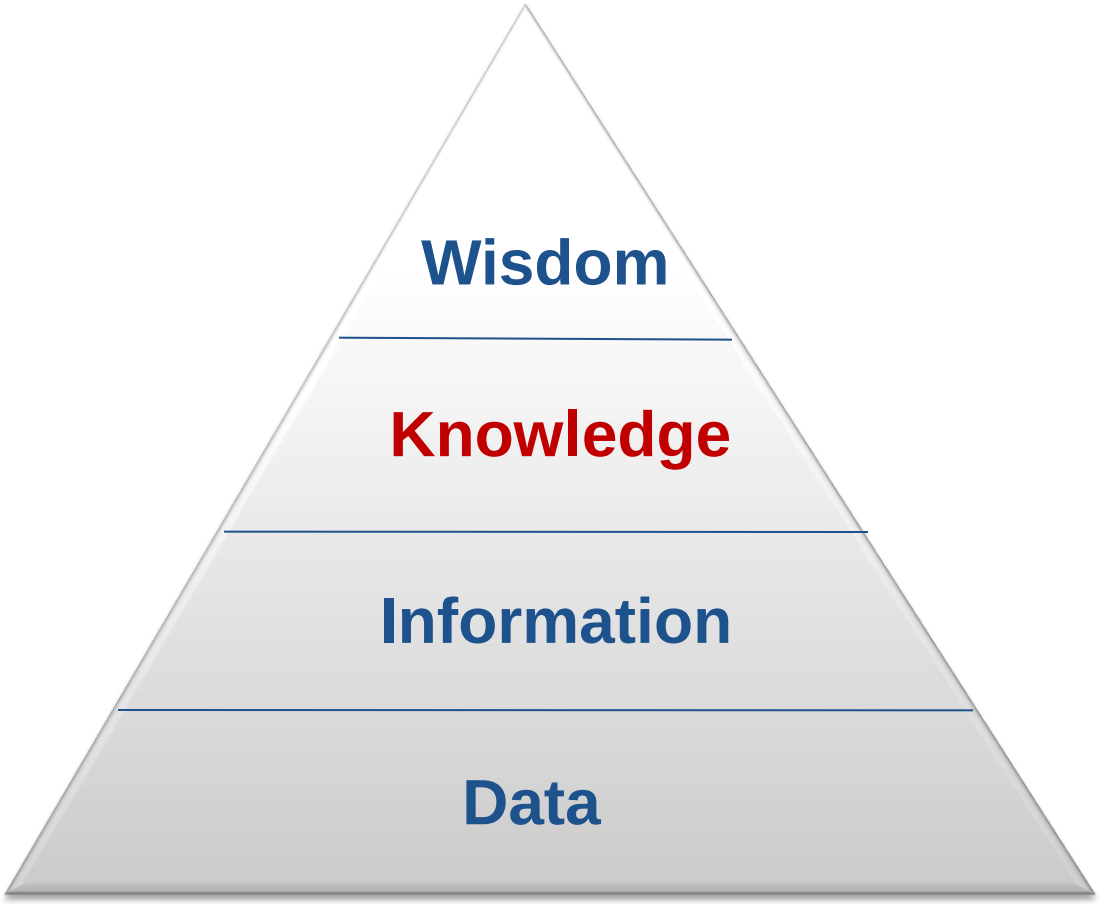


1. *What is Knowledge?*
2. *What is Knowledge Management?*
3. *Why is KM important?*
4. *Why is KM difficult?*
5. *What are KM objectives and benefits?*
6. *Summary (some key points)*

# What is Knowledge?

- The Sum of what is known (OED).
- The State of understanding (OED).
- Both mind and memory (Plotkin, 1994)
- Interpretation and understanding of acquired data and information (IAEA)
- True knowledge is theory wrapped with practical commonsense (James, 1950).
- **“Capacity for effective action”**
- Knowledge is a familiarity with someone or something, that can include facts (data), descriptions, information, and/or skills acquired through experience or education (Wikipedia).

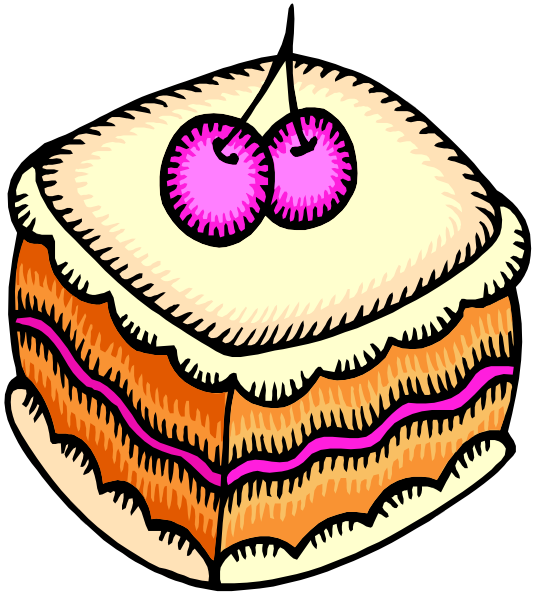
# Knowledge Pyramid




**Jonathan Hey, 2004**

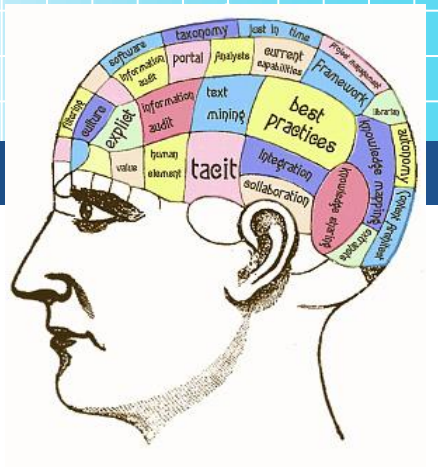
# A simple example…

**The Cake Analogy**



- Data: observed properties (looks nice, tastes great)
- Information: the list of ingredients
- Knowledge: recipe, tools and skill needed to make it right!
- Wisdom:  don't eat it all at once!

# Explicit vs. Tacit Knowledge




## EXPLICIT

- Knowledge that can be captured and codified (e.g., documents, equations, procedures etc.)

## TACIT

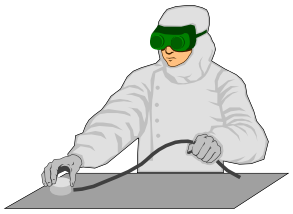
- Knowledge possessed by individuals (personal)
- Experiential knowledge (e.g. “know how”)

**KNOWLEDGE IS A RESOURCE**

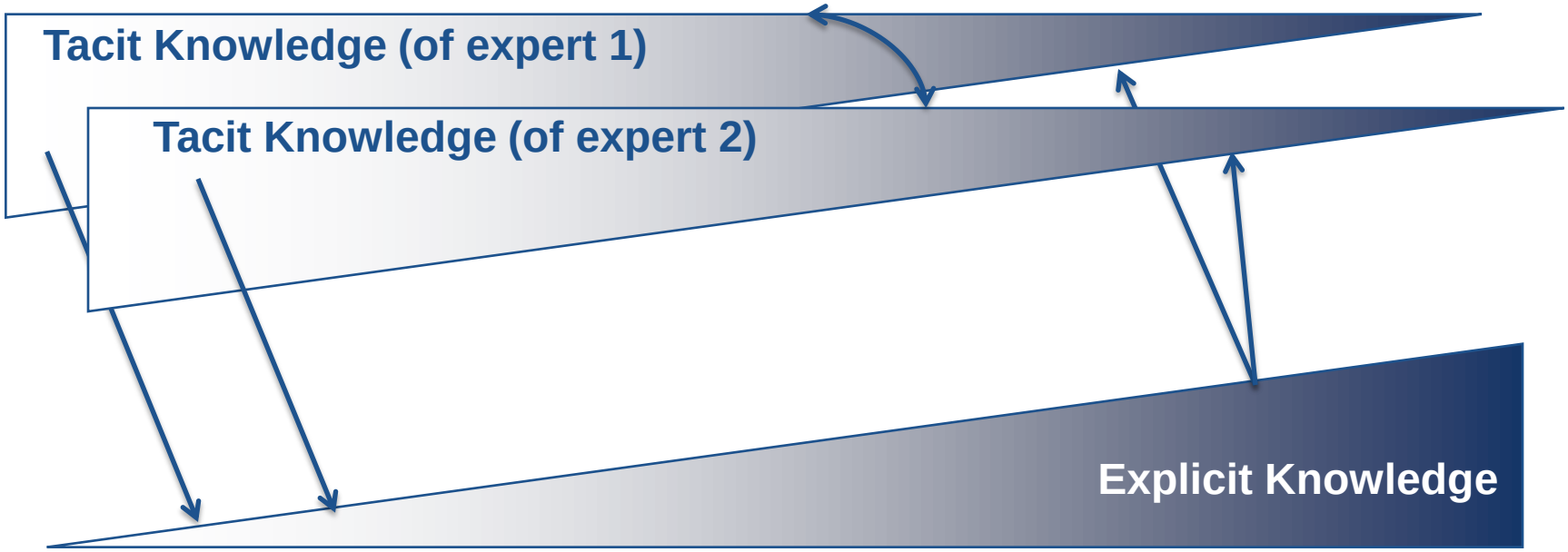
# Knowledge Transfer/Creation
## (Nonaka and Takeuchi Model)

TO

| FROM | Tacit | Explicit |
|---|---|---|
| Tacit | *Socialisation* | *Externalisation* |
| Explicit | *Internalisation* | *Combination* |



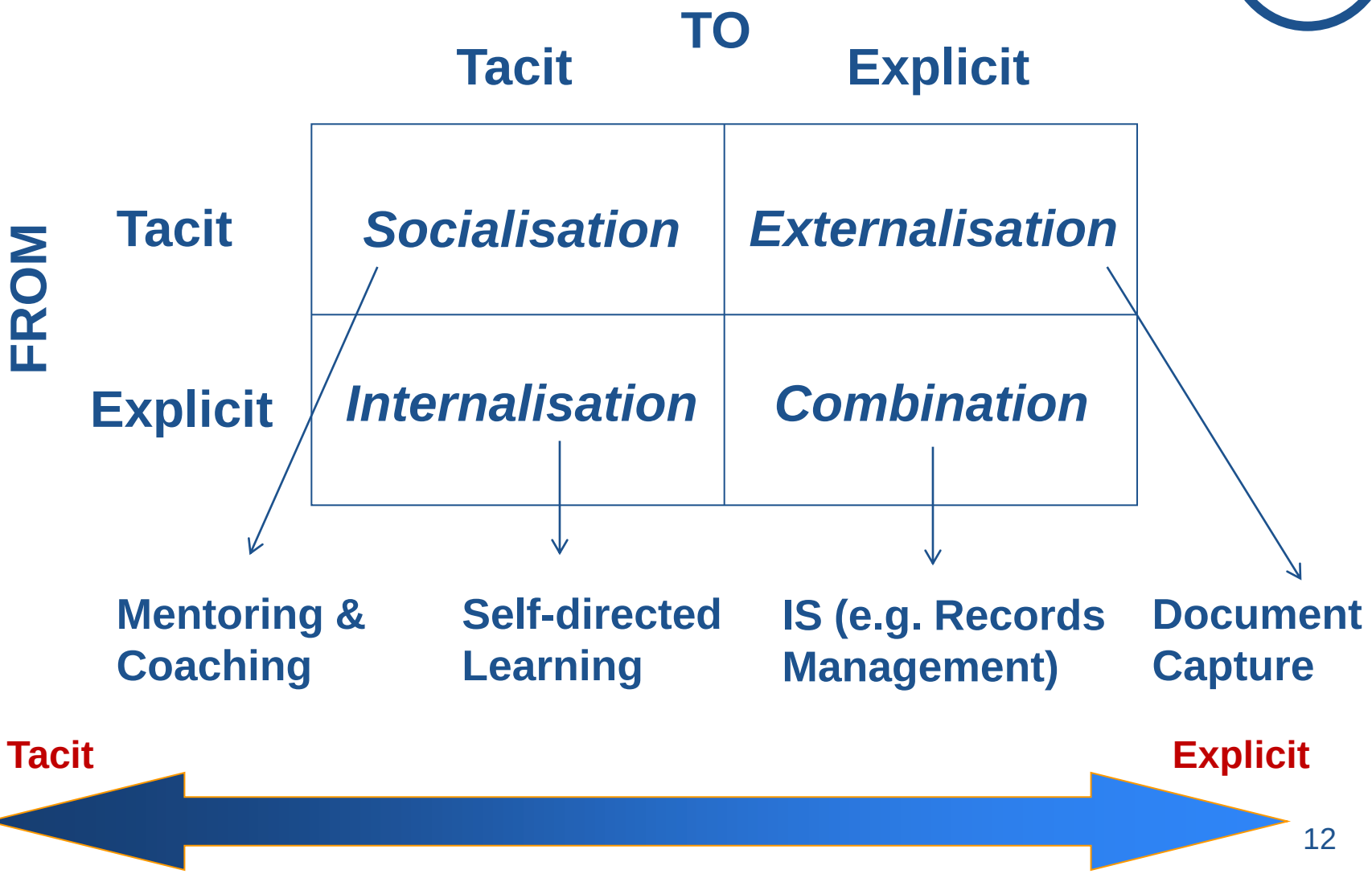
# Knowledge Continuum




Abstract, theoretical intangible

factual, details, tangible, measurable or observable

# Examples – K Transfer & Creation (Nonaka and Takeuchi Model)



# Characteristics of Knowledge

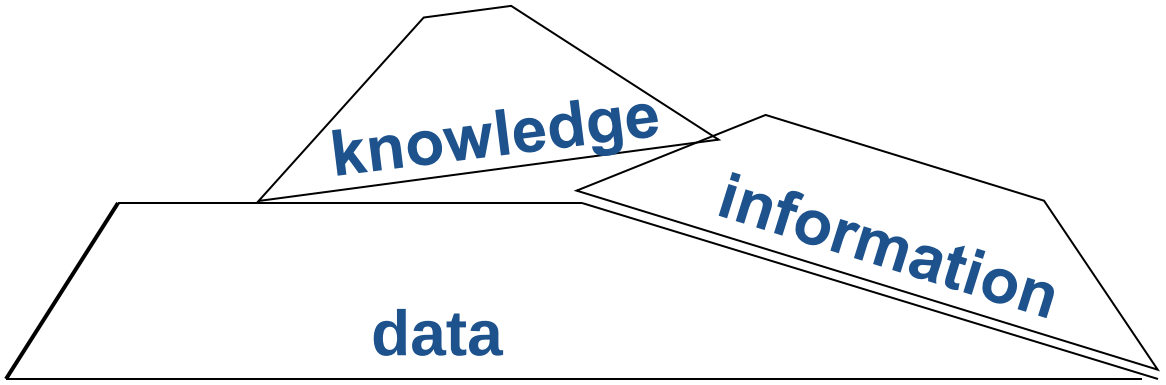
- Knowledge is contextual, can be re-used
- Value of knowledge realized only if it is utilized
- The value of knowledge may change over time
- Knowledge has to be renewed or maintained
- It can be difficult to transfer, capture, distribute
- Developed through learning processes
  - Learning depends on memory, experience, expertise, transfer mechanism, & opportunities
- Facilitates effectiveness and “sense-making”
  - Knowledge enables higher learning
- Creation and utilization enhanced with technology

# In Reality…

**Organizational Knowledge Base (i.e. capacity for effective action)**

←

**Continuous Organizational Learning Processes**



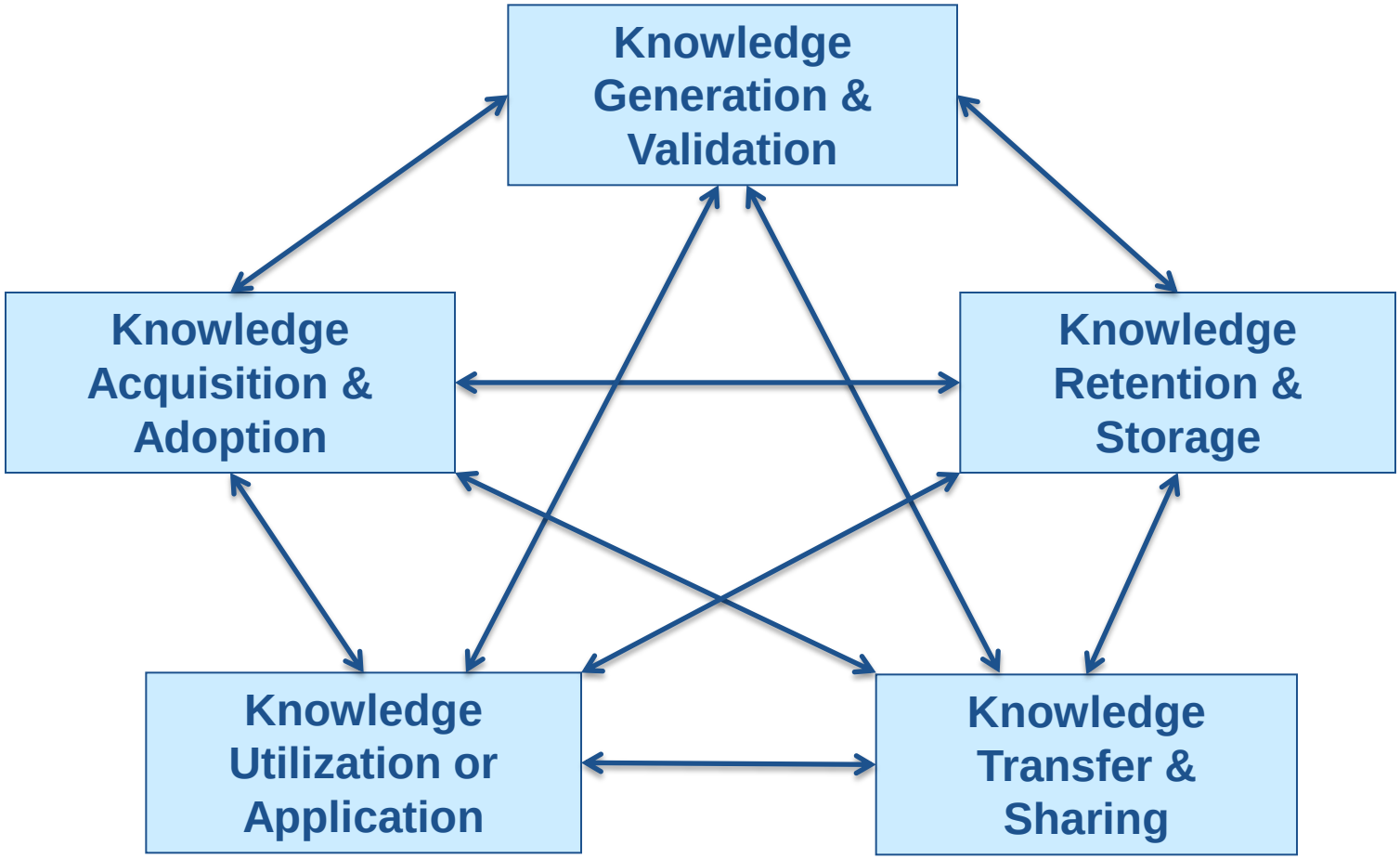
# Knowledge Management

- '…the processes that governs the creation, dissemination, and utilization of knowledge...' (Newman, 1992)
- '...managing the organization's knowledge by creating, structuring, dissemination and applying it to enhance organizational performance...' (O'Leary, 1998)
- '…process to acquire, organize, and communicate knowledge of employees so others may be more effective in their work…' (Alavi and Leidner,1999)
- '…process to acquire, organize, and communicate Knowledge (Andriessen, 2004)

# IAEA definition of Knowledge Management

**KM is an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing, and preserving knowledge, relevant to achieving specified objectives (IAEA)**

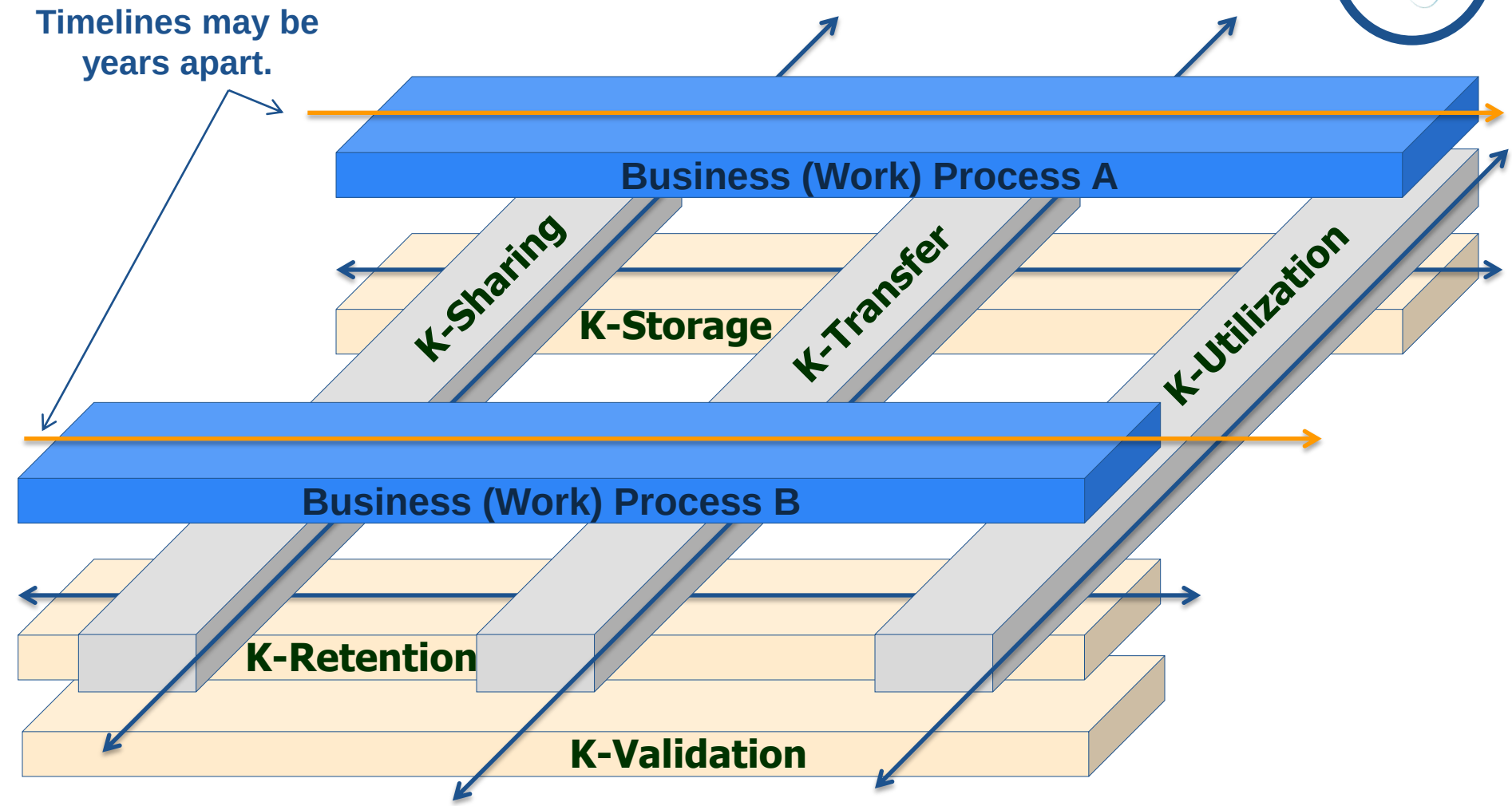
# Knowledge Processes



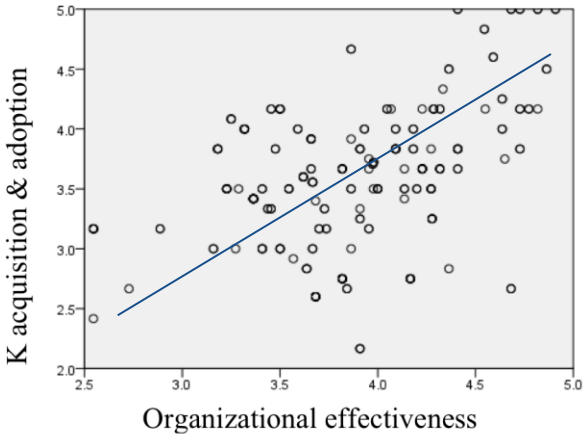
# Knowledge processes embedded in…

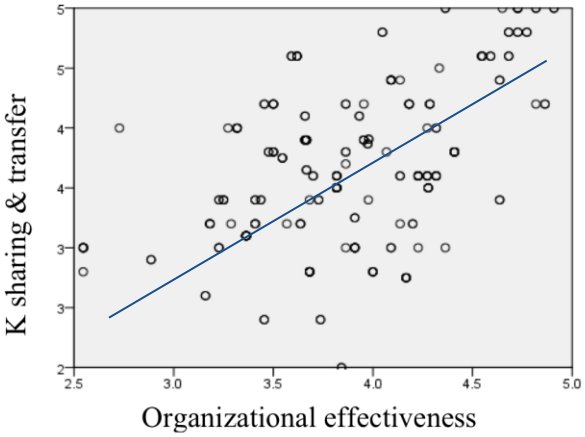
- Equipment reliability programs
- Systematic approach to training
- Plant Configuration management
- Documented operational procedures
- Plant work management systems
- Outage planning systems
- Pre-job briefing
- Document management systems
- Etc.

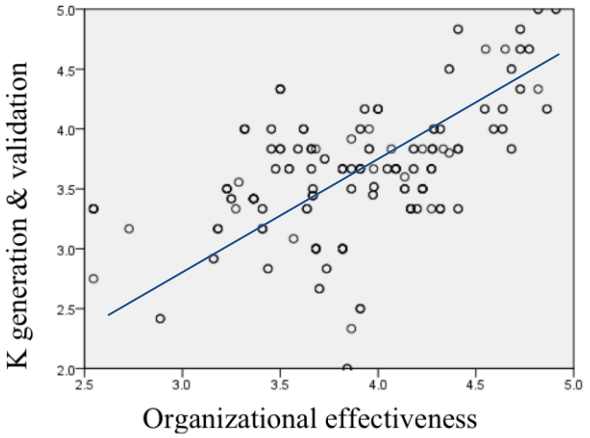
# K-Processes Support Business Processes

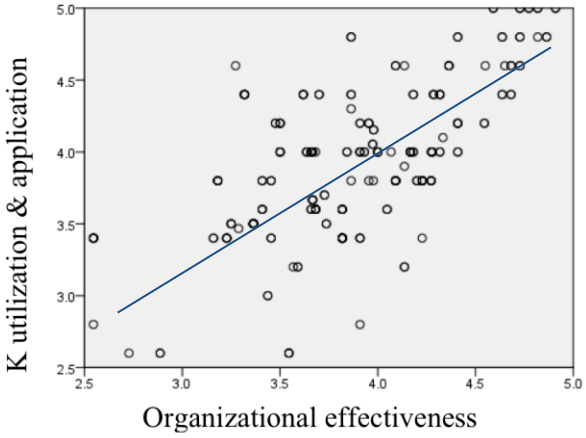


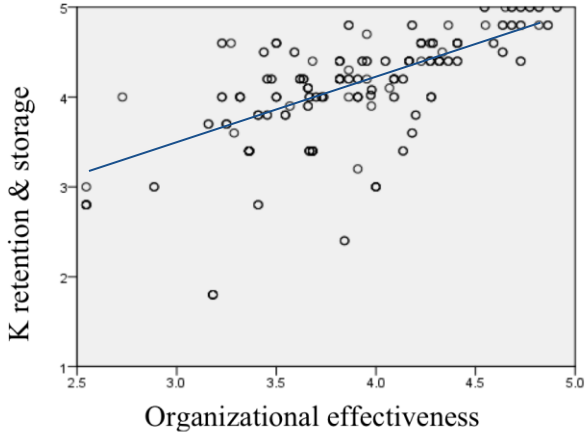
# Results of Global IAEA NPP KM Survey



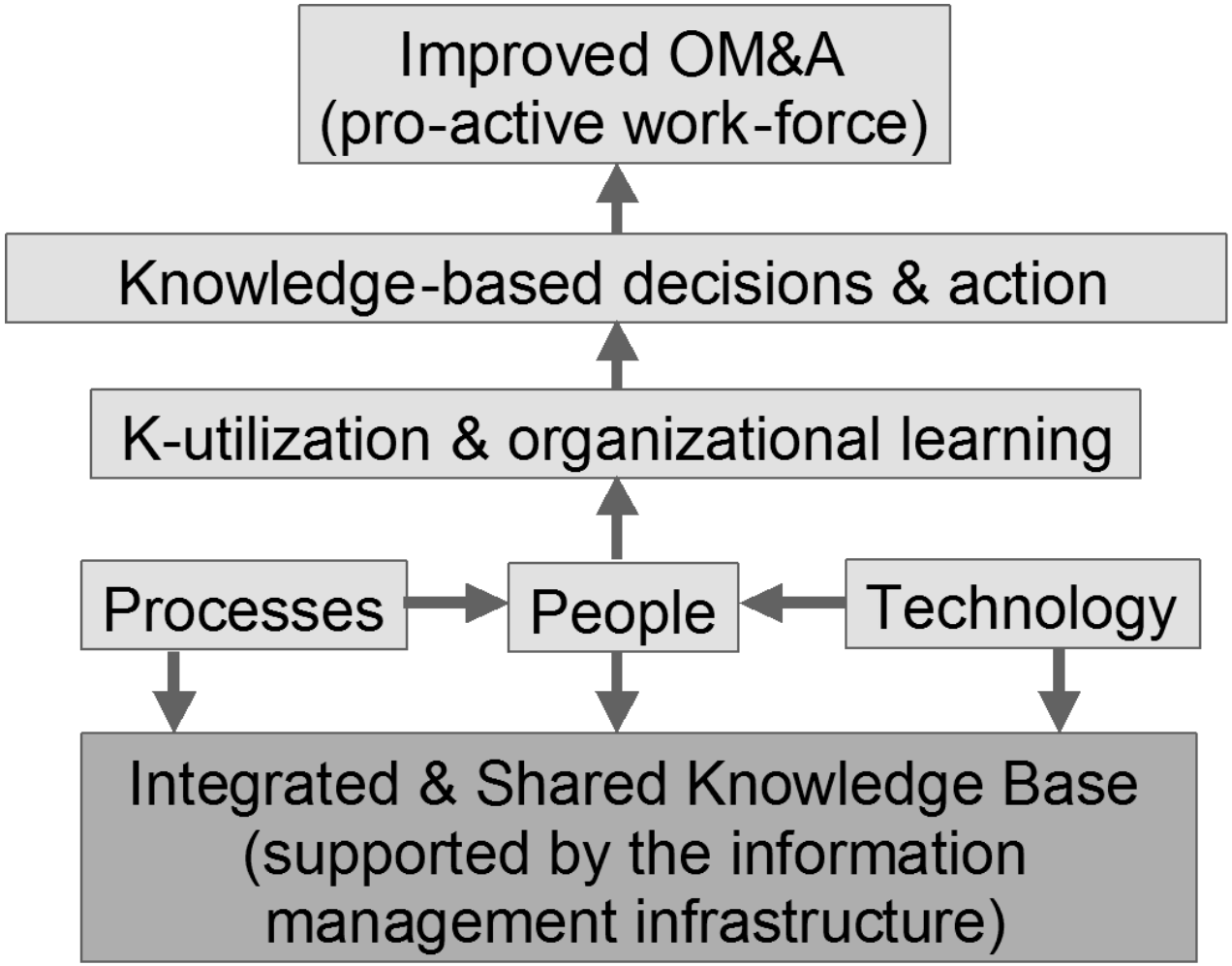

Reference: de Grosbois, 2013 [5]

# *Knowledge Management focuses on…*

**Managing the "Organisational Knowledge Base" (Knowledge Assets or Resources)**

**Influencing Organisational "Routines" (organizational culture, work processes, and learning etc.)**

# Organizational Performance: KM Perspective



# Knowledge Management Objectives

- Promote creating new knowledge and innovation
- Reduce costs of being effective, to innovate
- Preserve existing knowledge
- Reduce the K-loss from employees who leave
- Increase collaboration, K-sharing to enhance skills
- Increase productivity – make knowledge accessible
  - Enable a “pro-active learning and decision culture”
  - Help staff do the right things, and do them right!

# Why KM is a "Priority Issue"

Maturing industry:

- Attrition - vulnerability to loss of tacit knowledge
- Concern over the "pipeline" of new NPP K-workers

Aging fleet of plants and need for refurbishment:

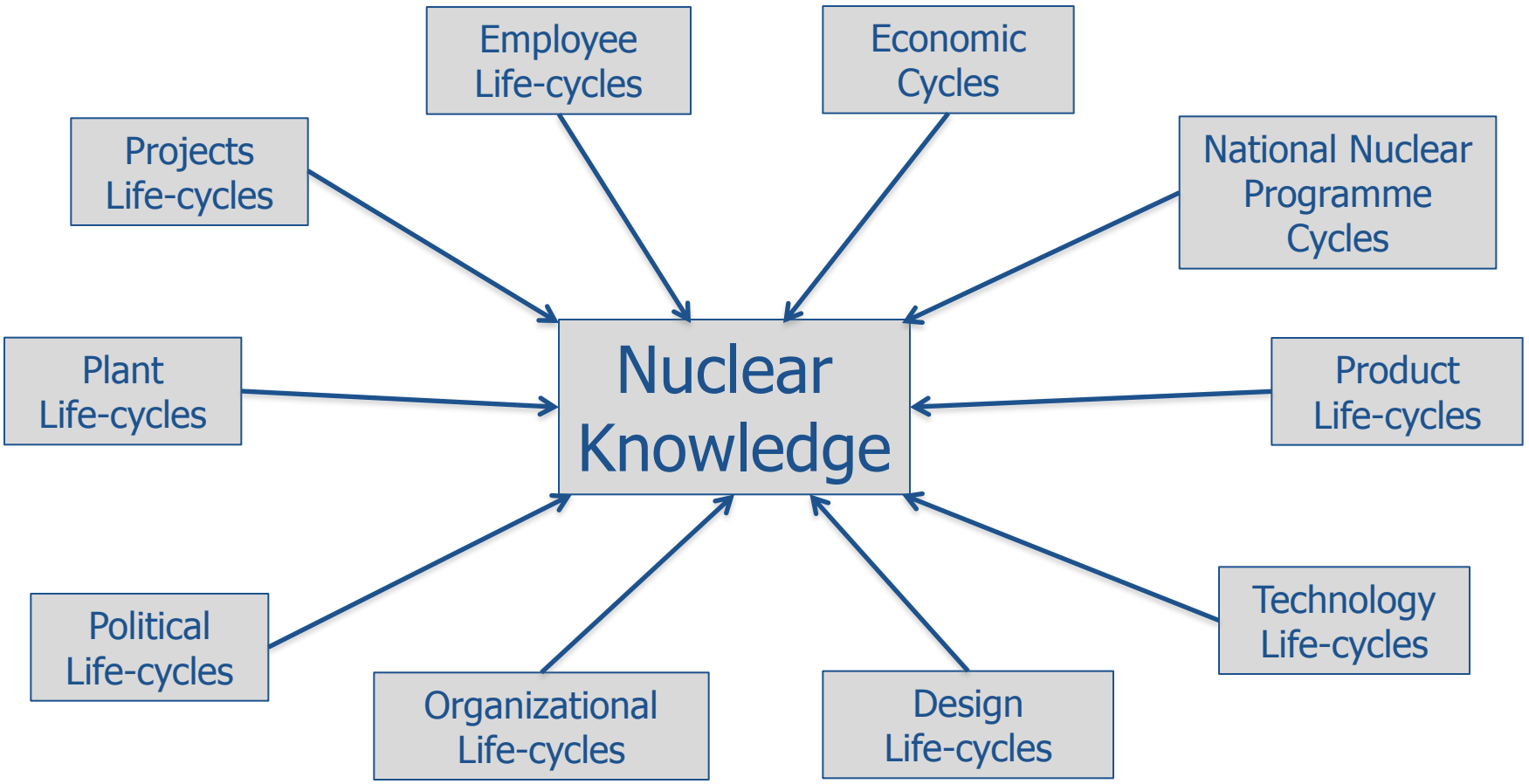
- Design basis information critical (must be up to date)

Need for the next level of productivity gains:

- deregulation and competition
- rising operating costs
- move towards "lean" operations and maintenance
- opportunities arising from new technology

Awareness that other industries doing more and benefiting

# Threats to Nuclear Knowledge



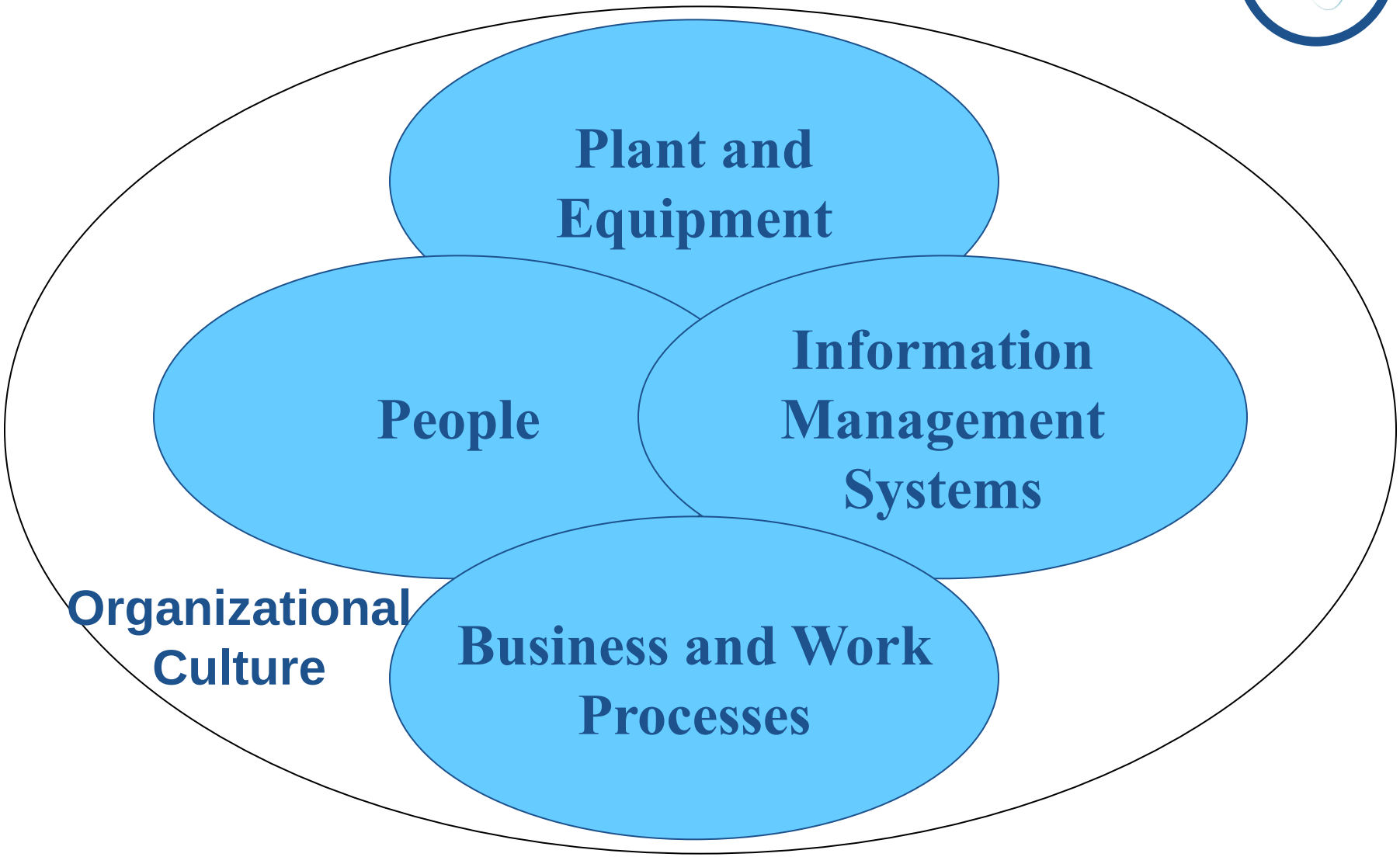
# Barriers to Mitigating K-loss Threats

- Ownership (responsibility)
- Commercial interests (e.g. intellectual property)
- Financial and resource limitations
- Awareness (importance)
- Management support (perceived priority)
- Time needed and available (urgency)
- Manageability

# Why KM in Nuclear Challenging

- a complex technology base (design and OM&A)
- long technology & plant life cycles, high capital intensiveness
- a need for life-cycle asset management strategies that are knowledge-driven (i.e. economic and risk informed decisions)
- dependence on multi-disciplinary technologies, expertise
- competing operational objectives (safety, production, cost)
- need for simultaneous integrated coordination of complex physical and human (socio-technical) systems
- a regulated industry environment (safety, EQ, & NQA)
- Individual understanding of KM often narrow

# KM in NPP Organizational Context



# KM Performance Model

(adapted from ref.[1])

**KM Practices**

- **Transfer**
- **Sharing**
- **Generation**
- **Utilization**

**KM Processes**

- **Identification**
- **Acquisition**
- **Storage**
- **Retention**
- **Preservation**

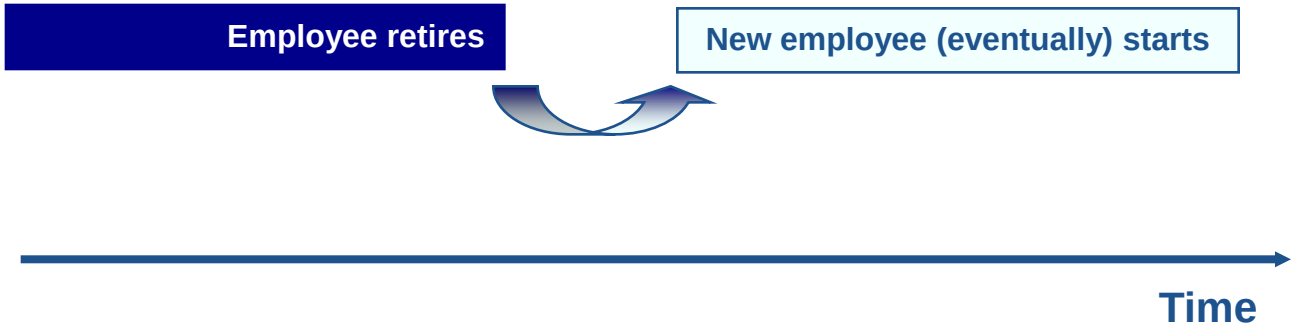
**Organizational Effectiveness**

- **Strong Knowledge Base**
- **Proactive Organization**

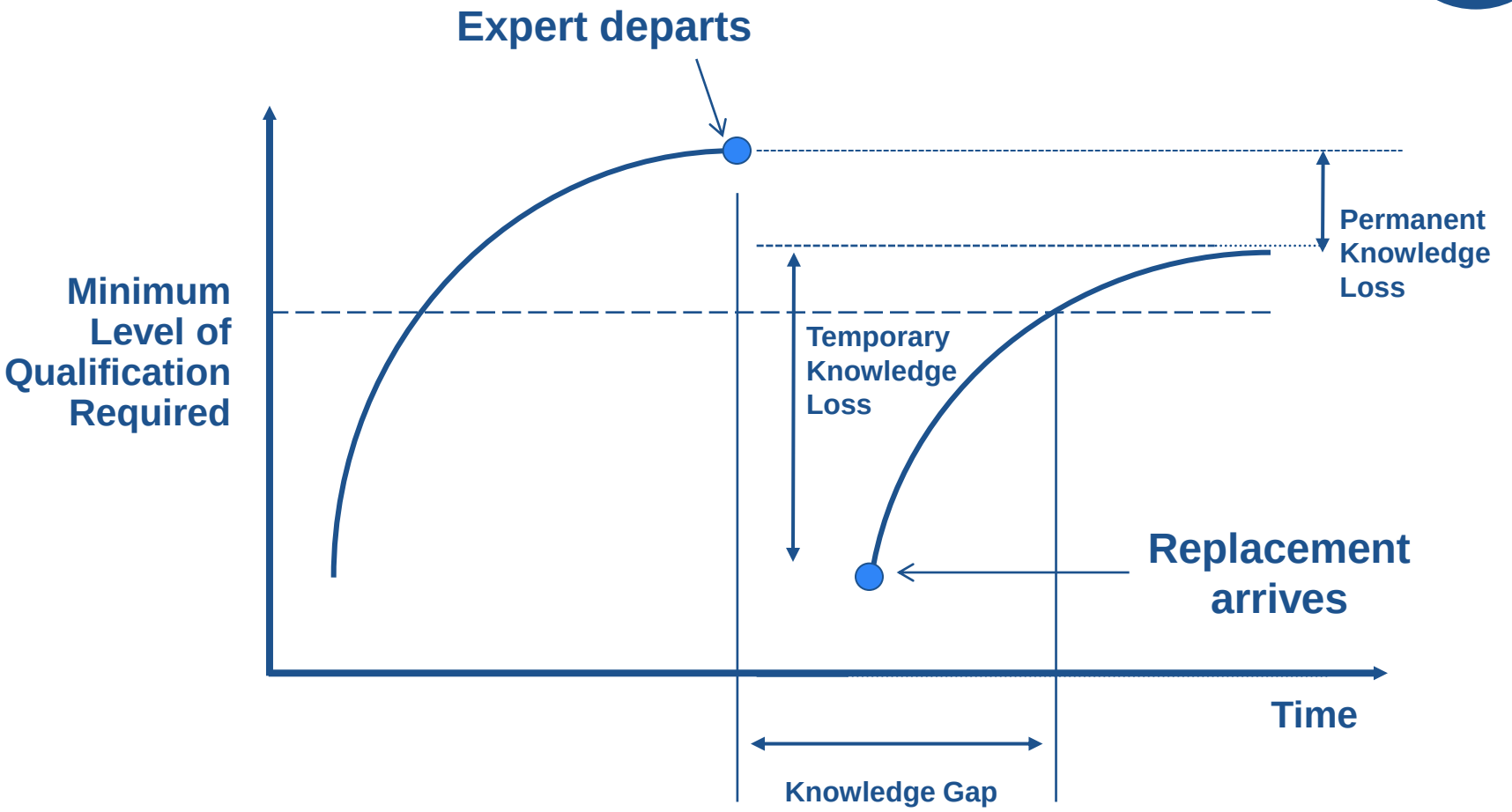
**Organizational Performance**

# Attrition-related knowledge loss:

**Loss due to insufficient knowledge transfer**



# Attrition-related knowledge loss:



# Consequence of knowledge loss

- inability to make decisions effectively
- higher risk of making incorrect decisions
- when the decisions are important:
  - potential adverse impact on production
  - potential adverse impact on safety

# Not all nuclear facilities practicing KM

**Some typical reasons:**

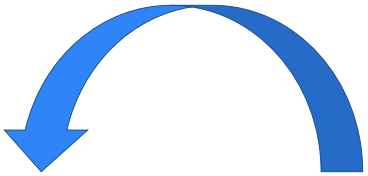
- **Not realizing the importance or need**
- **Lack Costly**
- **Employees overwhelmed with info/data**
- **No knowledge sharing culture (“hoarding”)**
- **Lack of leadership and example**

# Learning organization

**An organization whose key personnel view its future success as being based on continuous learning and adaptive behavior.**

**The organization, therefore, becomes renowned for creating, acquiring, interpreting and retaining knowledge and then modifying its behavior to reflect new knowledge and insights.**

# Organizational Learning & Knowledge



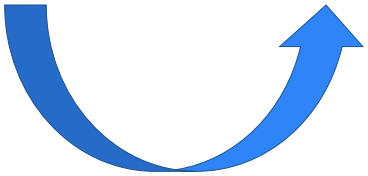
Organizational Learning
(via knowledge processes)

"Building" and "Maintaining" the organizational knowledge base

Organizational Knowledge Base
(knowledge assets)

Tacit Knowledge (people "know how and why")

Codified Knowledge
(info, process, technology)



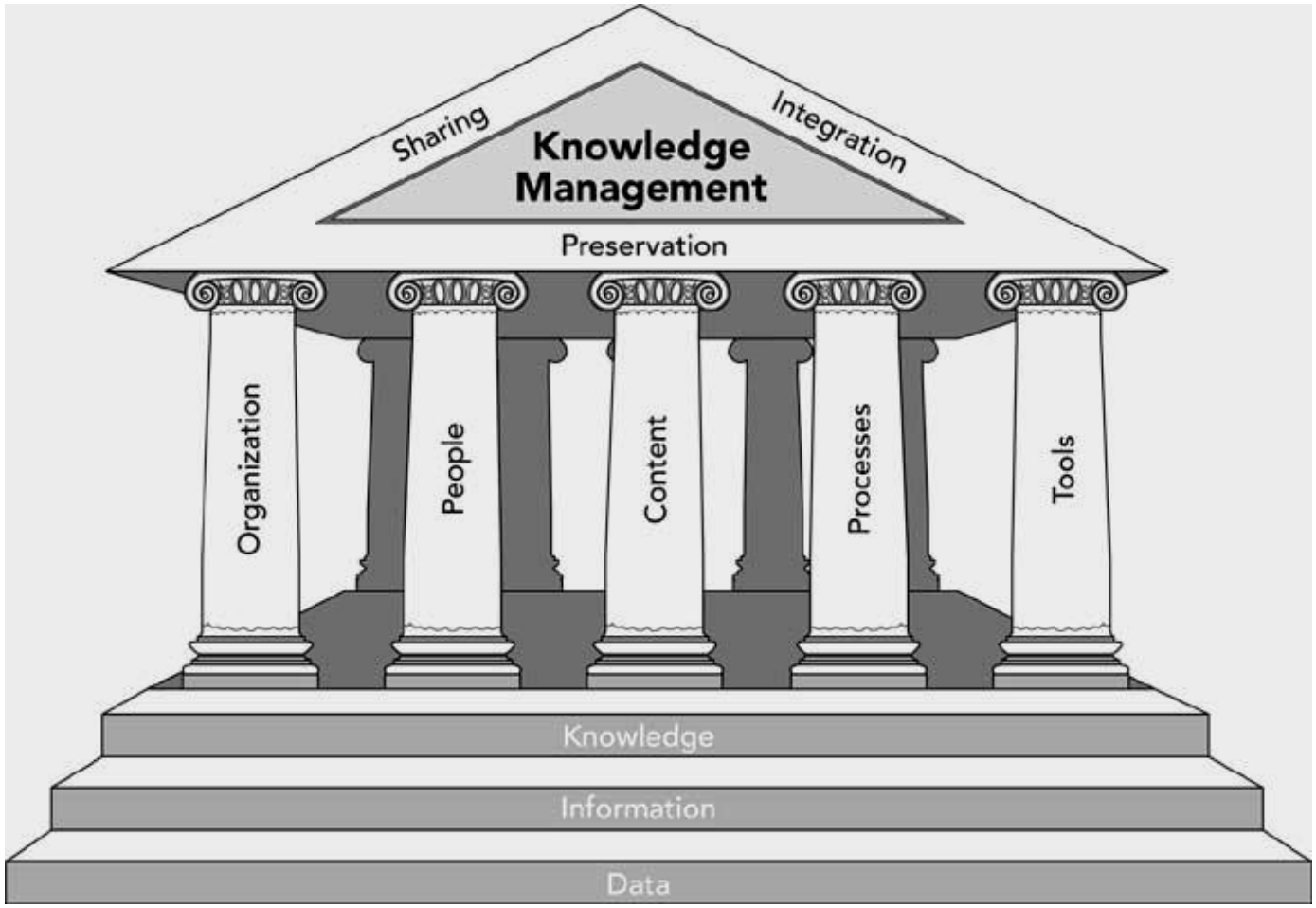
# Steps to Creating Effective KM

- Awareness and Acceptance Of Strategic Importance of KM
- Top Management Commitment and Development of Common Vision of Role/Benefit of KM in NPP
- Wider Management Team Acceptance of Need for and Desirability of Improved KM and Organizational Learning
- Local Ownership, Resources, and Action on Specific KM Initiatives
- Workforce Commitment and Engagement: Developing the KM and OL Culture

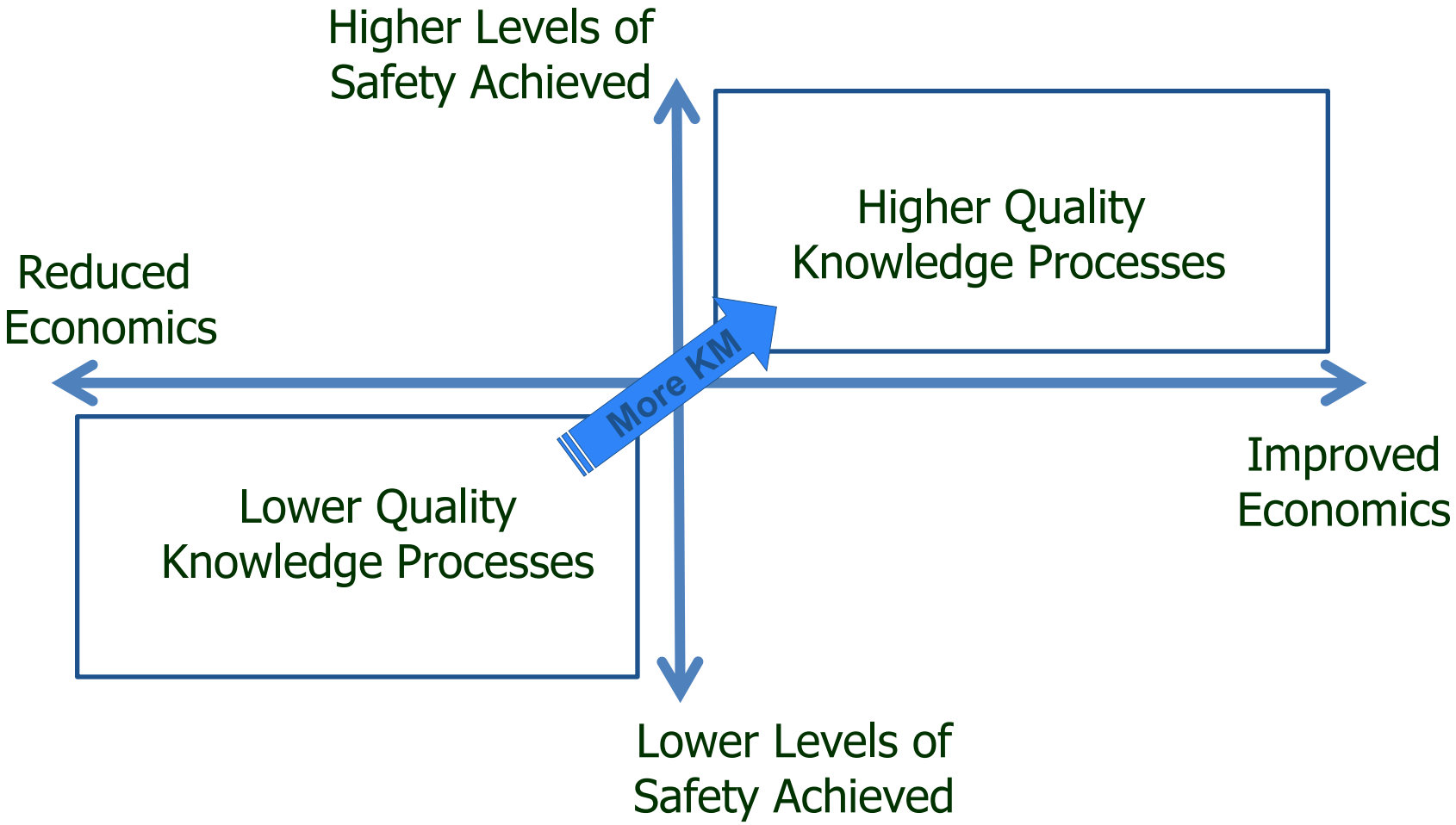
# Knowledge Management System

- When managed company-wide, KM can be viewed as a "*knowledge management system*" (KMS)
- Ideally KMS is an integrated and coordinated approach to affect the management of knowledge and is manifested in a variety of implementations including document repositories, expert databases, work processes, etc.
- Supported by organizational memory and an organizational memory system.
- One of the aspects of the overall management system.

# Why Integrated and Systematic?



# Expected Impact of KM on Nuclear Facilities



# Summary – Key Points

- KM is difficult and challenging
- KM is an important strategic issue for NPPs
- KM recognized as an important driver of organizational performance
- KM initiatives need to be aligned to support the "best practices" already being performed
- An integrated approach to KM is needed
- Information management tools and infrastructure are important
- Leadership and culture are important factors

IAEA
International Atomic Energy Agency

http://www.iaea.org/NuclearKnowledge/

# Thank You !


**References:**

- [1] de Grosbois, J. (2011). Ph.D. Thesis: "The Impact of Knowledge Management Practices on Nuclear Power Plant Organizational Performance". Carleton University, Ottawa.
- [2] de Grosbois, J and Kumar, V. (2009). The role of knowledge management in NPP organizational performance. International Journal of Nuclear Knowledge Management (IJNKM). Volume 3 - Issue 2, pp 137–156.
- [3] de Grosbois, J. "The Impact of Knowledge Management Practices on NPP Organizational Performance – Results of a Global Survey". IAEA TECDOC 1711 Publication, 2013.

# Question

1. Give 5 examples of a threat to organizational knowledge that you can think of.
2. Name 5 reasons why KM is difficult.