The Abdus Salam International Centre for Theoretical Physics

2473-54

Joint ICTP-IAEA School on Nuclear Energy Management

15 July - 3 August, 2013

Methods and Tools for Knowledge Management in a Nuclear Organization

KARSEKA YANEV Tatiana
IAEA, Vienna
AUSTRIA

Methods and Tools for Knowledge Management in a Nuclear Organization

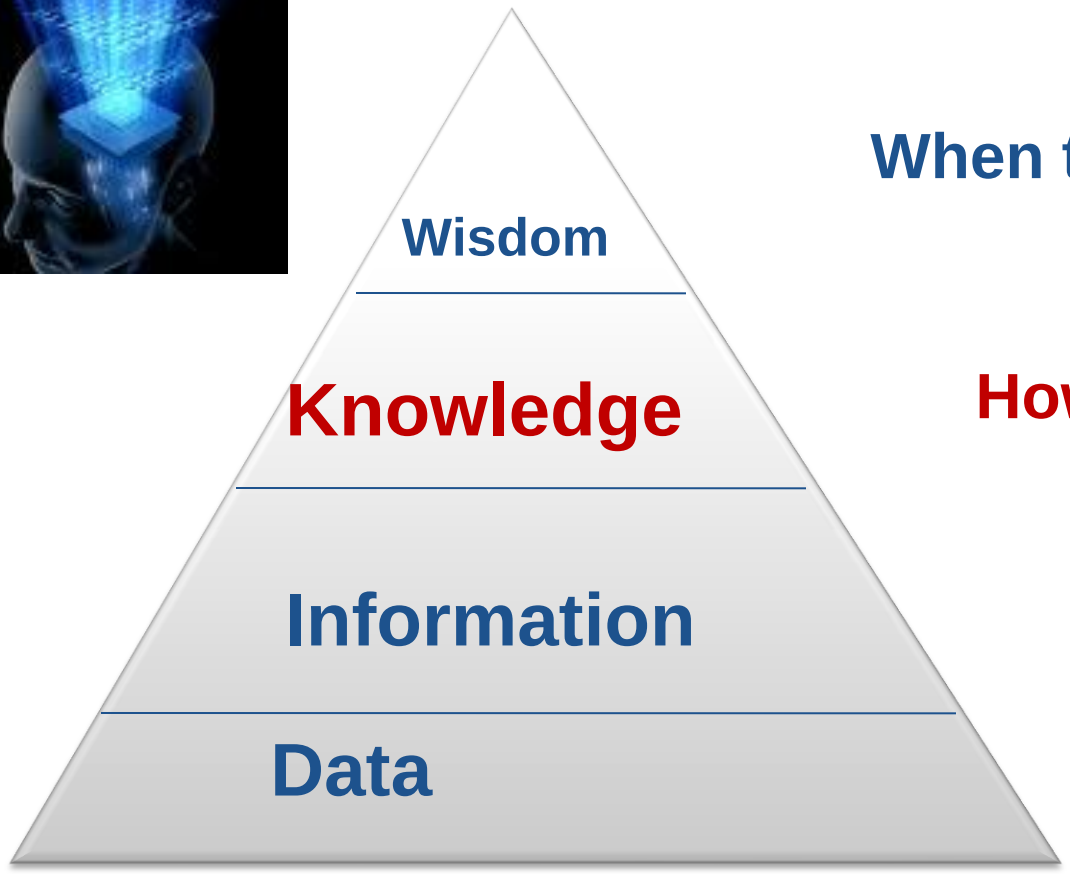
Tatiana Karseka, International Atomic Energy Agency

IAEA/ICTP Nuclear Energy Management School in Trieste
15 July- 2 August 2013

Contents

1. Basic Terminology for Knowledge Management

Knowledge Pyramid



When to use knowledge

How to use information

Adds context

Basic level

Jonathan Hey, 2004

Departure:
16:40 OS 602

Moscow **Austrian Airlines**

17:18

Explicit Vs Tacit Knowledge

EXPLICIT

- Detached knowing
- 'Know-that'
- Knowledge *about* something
- Easy to capture and codify
- E.g. Knowledge of math and science etc.

Manuals

Patents

TACIT

- Attached knowing
- 'Know-how'
- Knowledge of acquaintance (James, 1950)
- Procedural knowledge
- Not easy to capture
- Acquired through experience
- E.g. Playing piano, riding a bicycle etc. (90% of the workplace knowledge)

KNOWLEDGE IS A RESSOURSE

IAEA Definition of Knowledge

1. Knowledge is often used to refer to a body of facts and principles accumulated by humankind over the course of time.

2. Explicit knowledge is knowledge that can be easily expressed in documents.

3. Implicit knowledge and tacit knowledge represent knowledge that people carry in their heads.

The acquiring, understanding and interpreting of information.

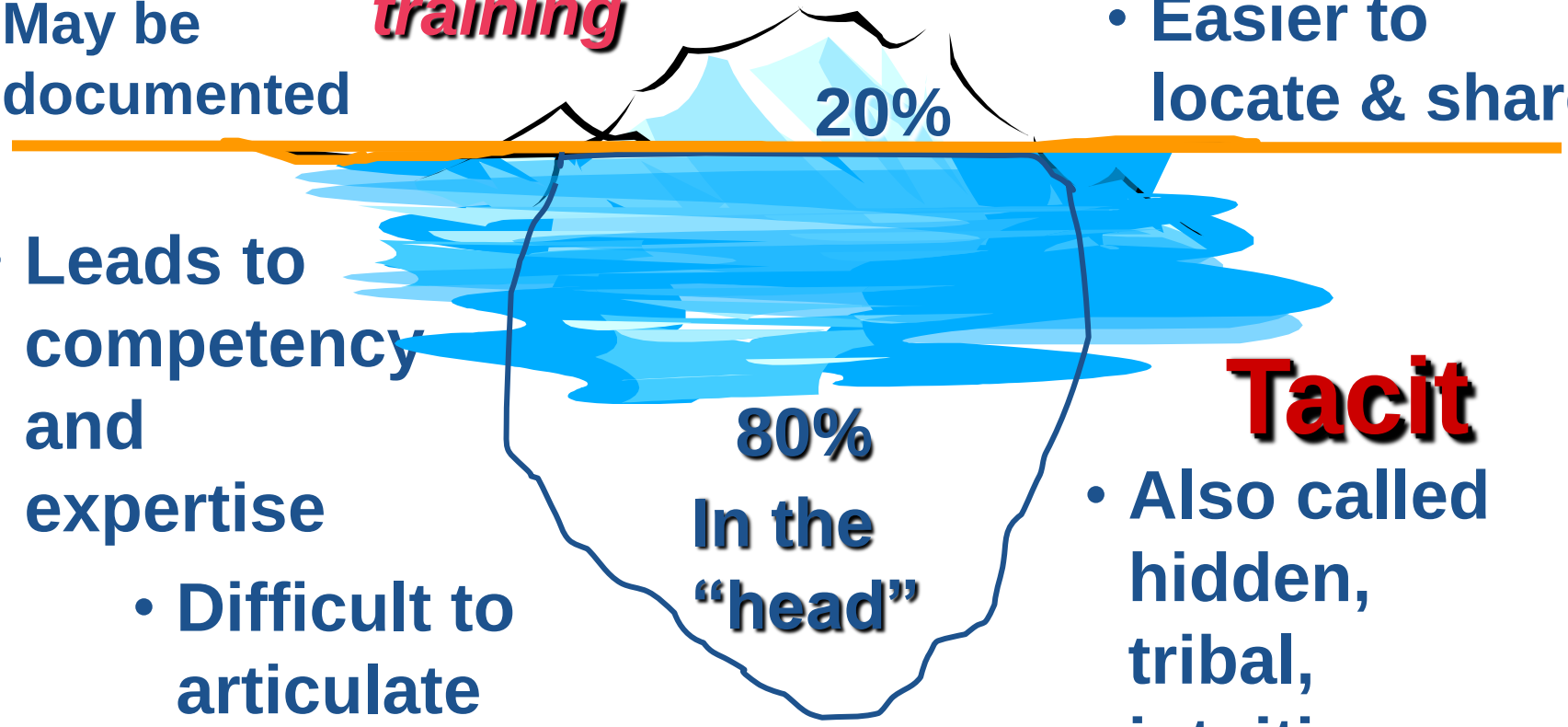
The Nature of Knowledge, and Why Unavailability of Experts is a Problem

- Easier to replicate
- May be documented

May be >20% due to use of procedures & training

Explicit

- Easier to locate & share



- Leads to competency and expertise
  - Difficult to articulate

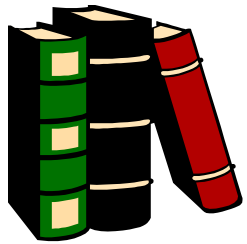
Tacit

- Also called hidden, tribal, intuitive

Organisational Knowledge

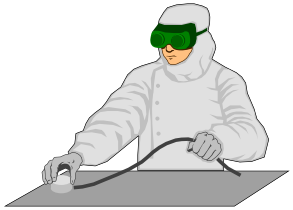
(Spender's Multi-Type Matrix)

	Individual	Group
Tacit	Automatic Knowledge	Collaborative Knowledge
Explicit	Conscious Knowledge	Objectified Knowledge



Knowledge Transfer/Creation
(Nonaka and Takeuchi Model)

FROM \ TO	Tacit	Explicit
Tacit	Socialisation	Externalisation
Explicit	Internalisation	Combination



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
- Knowledge enables higher learning
- Facilitates effectiveness and “sense-making”
- Creation and utilization enhanced with technology

Practical Definitions

Knowledge =
the capacity for effective action.

Competence =
Knowledge + Skills + Attitude

Knowledge Management

Knowledge management **is an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing, and preserving knowledge, relevant to achieving specified objectives.**

From IAEA NKM Glossary

Knowledge Management System

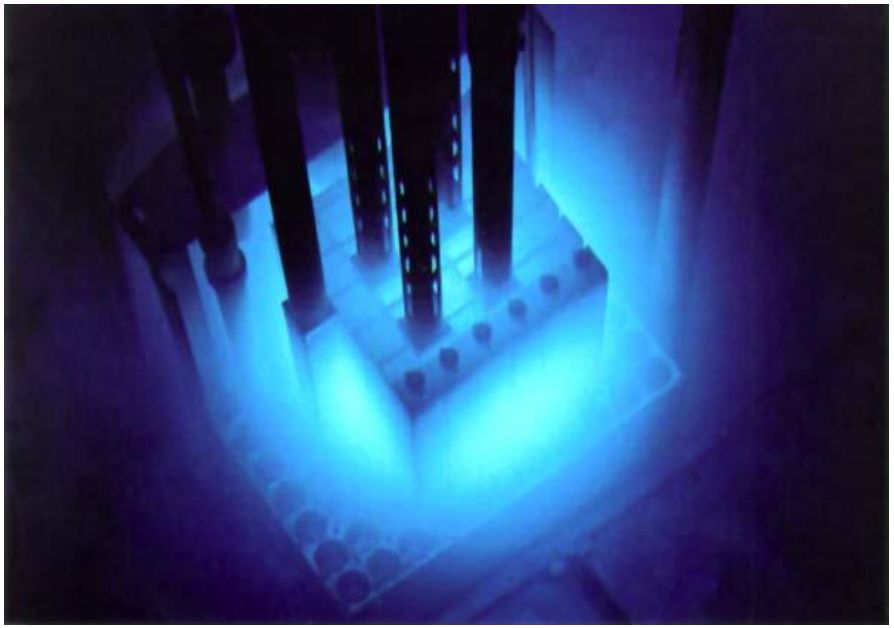
- When managed company-wide, KM can be viewed as a "*knowledge management system*" (KMS)
- Ideally KMS is an integrated and coordinated approach to affect the management of knowledge and is manifested in a variety of implementations including document repositories, expert databases, work processes, etc.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

2. General Methods and Tools for Knowledge Transfer in Organizations

Changes that need to be managed

- Organisational Changes – Business Changes (e.g. Mergers, acquisitions, outsourcing, introduction or discontinuation of a service/product line)
- Loose of competence due to retirement, attrition, reorganization
- Globally – transfer of Nuclear Technology from a vendor to new-comer country

Safety is concerned!



Knowledge Management Objectives

- Promote creating new knowledge and innovation
- Reduce costs of being effective and increase innovation
- Preserve existing knowledge
- Reduce the K-loss from employees who leave
- Increase collaboration and K-sharing to enhance the skills
- Increase productivity by making knowledge accessible
- Enable a “pro-active learning and decision culture”

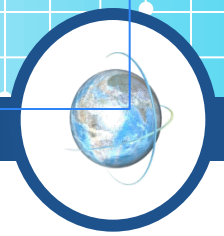
Helps staff do the right things, and do them right!

Corporate Approach to KM

Basic strategy built on four requirements:

- **Processes** need to be in place to correctly identify nuclear knowledge to be preserved, transferred and shared
- **Human resources** must be available and trained in core competencies to support nuclear industry
- **Tools** need to be in place to capture, preserve, retrieve and develop nuclear knowledge
- **Retention and management** of nuclear knowledge essential to support facilities and advance technology

Explicit and Tacit Knowledge



Document

Capture

Teaching

Self-directed learning

What works/best practices

Workshops

Mentoring /coaching

Lessons learned

Sharing experience

Reflection

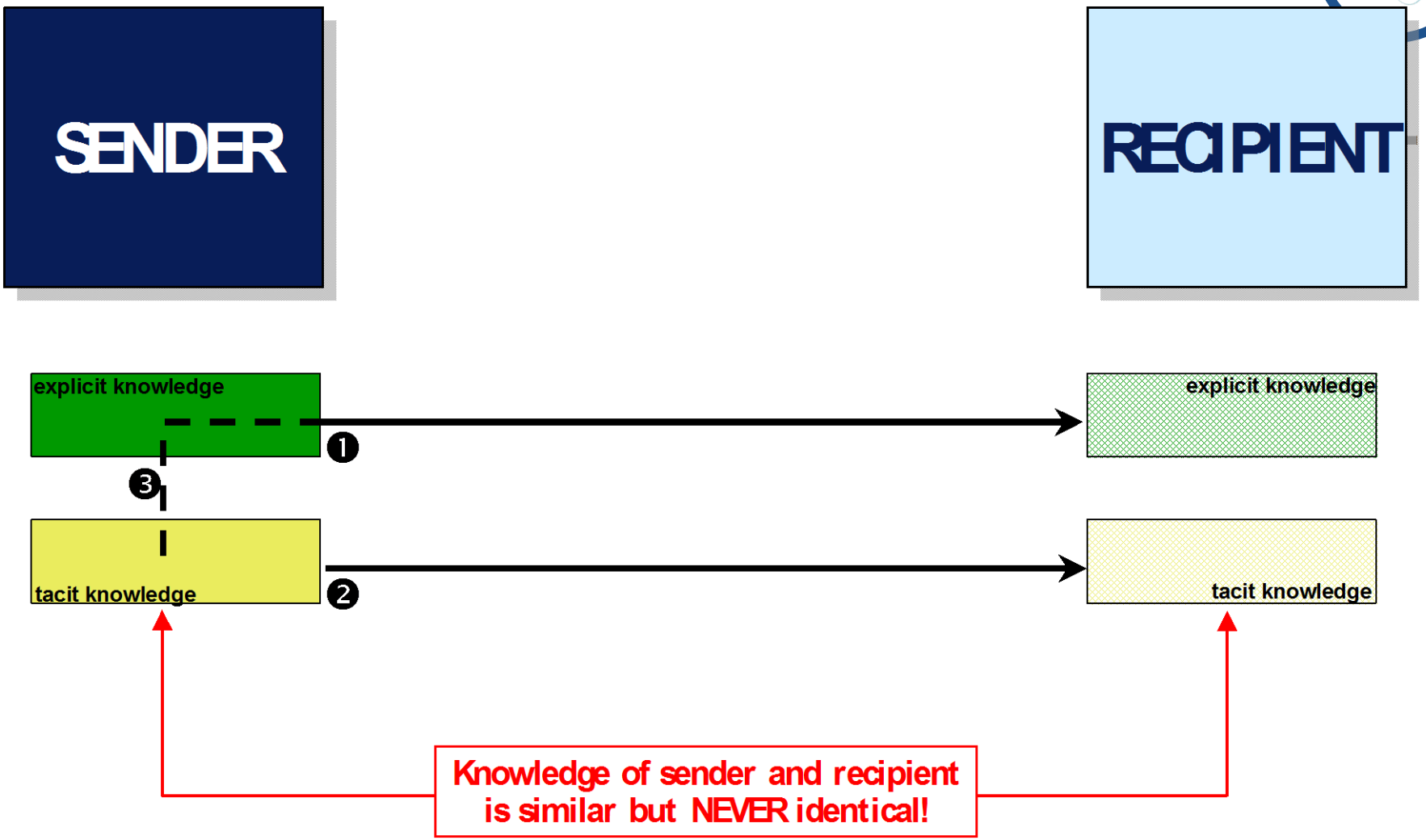
Understanding

Innovation

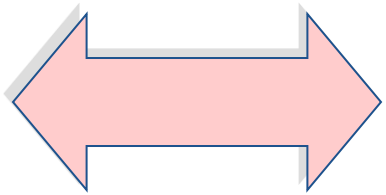
Explicit

Tacit

Three Basic Processes of Knowledge Transfer

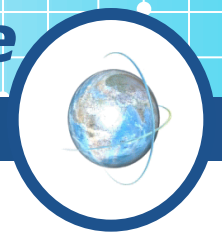


Knowledge Transfer: Explicit to Explicit

Explicit Knowledge in physical form		Explicit Knowledge in physical form

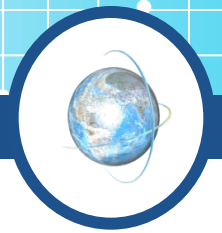
- Transfer of knowledge from one physical form to another.
- Through text search, queries and document categorization.
- Use of technologies like search tools, query languages and databases.

Good practices to capture explicit knowledge

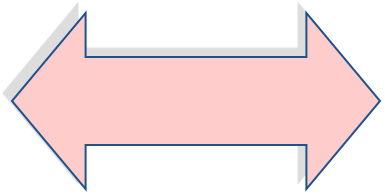


— Digitization of hard copies.
— Use of knowledge bases.
— Use of relational databases.
— Storage of photos and/or sound and/or video files in databases.
— Development of models and simulations running on computers.
— Creation of editable source files available to concerned personnel, like wikis.
— Creation of 3-D models.
— Document management.
— Use of decision support systems as a tool, like data mining.

Knowledge Transfer: Tacit to Tacit



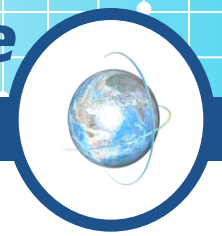
Tacit Knowledge residing in People



Tacit Knowledge residing in People

- **Transfer of knowledge between people**
- **Through meetings and social interactions**
- **Use of technologies like web conferencing and electronic meetings**

Good practices to capture tacit knowledge



— The use of photography and video recording in capturing actual activities conducted by experts, such as in workshops, seminars, lectures, experiments, etc.
— Conduct exit interviews of employees leaving the organization on how they carry out their tasks and duties.
— To conduct mentoring/coaching by experts or senior personnel to younger or new personnel.
— Encourage informal communication between experts and novices in the organization.
— Implement the culture of working in teams inside the organization.
— Conduct self-assessment by each staff's achievements.
— Collaboration with communities of practice.
— Implement online collaborations, where the conduct of researches or projects is done through e-workgroups and where procedures are available online.

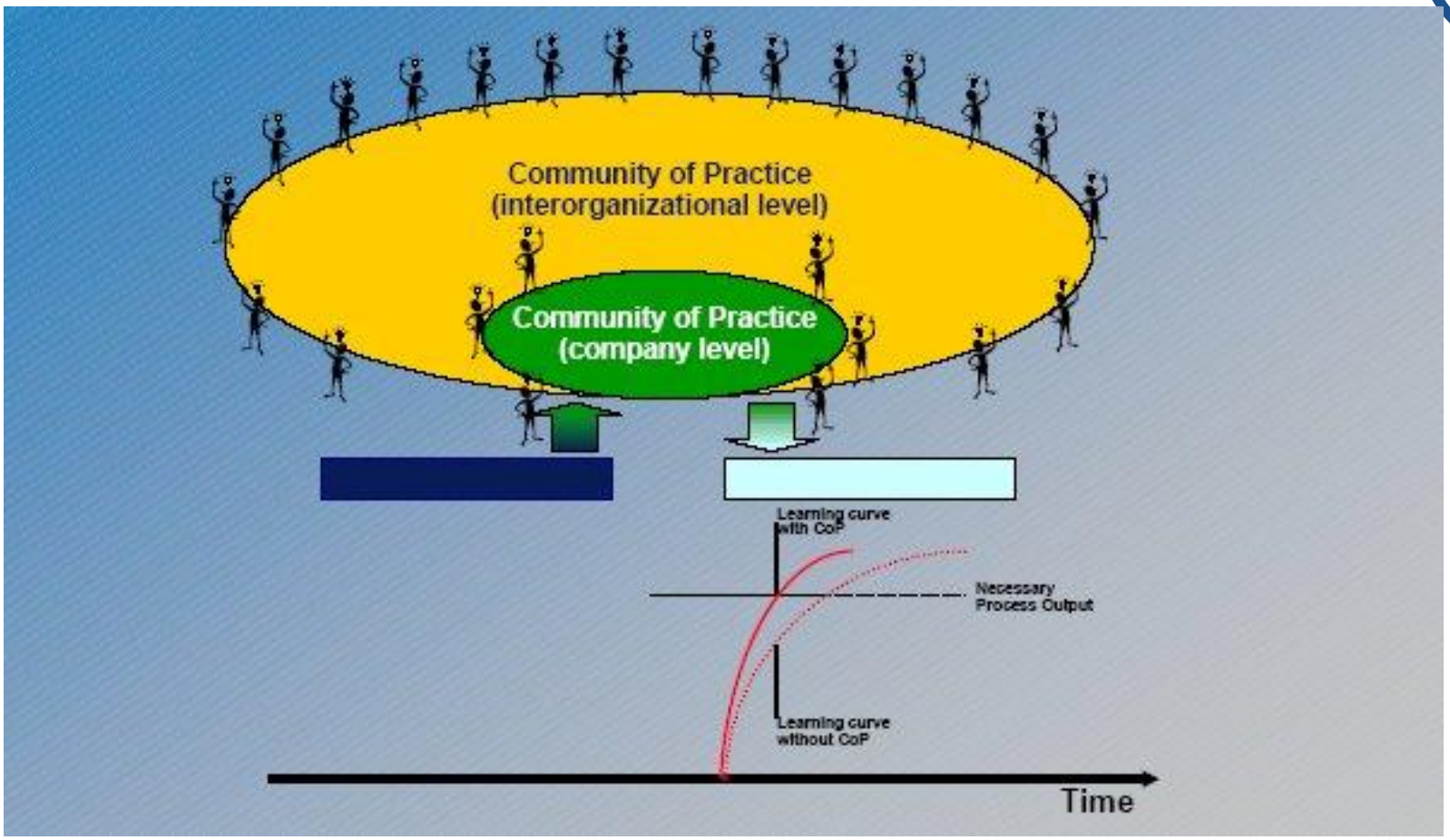
Mentoring and Coaching

Mentoring and Coaching

- Person to person is an effective way to transfer knowledge (especially tacit) to a newcomer
- Select the mentor/coach carefully – not all experts are good at this (mentor training is helpful)
- Use more that one technical expert where appropriate
- Make sure the mentor and learner are a good match
- Allow adequate time (strategic workforce planning is important)
- Monitor progress
- Don’t underestimate the newcomers – Knowledge sharing may go both ways

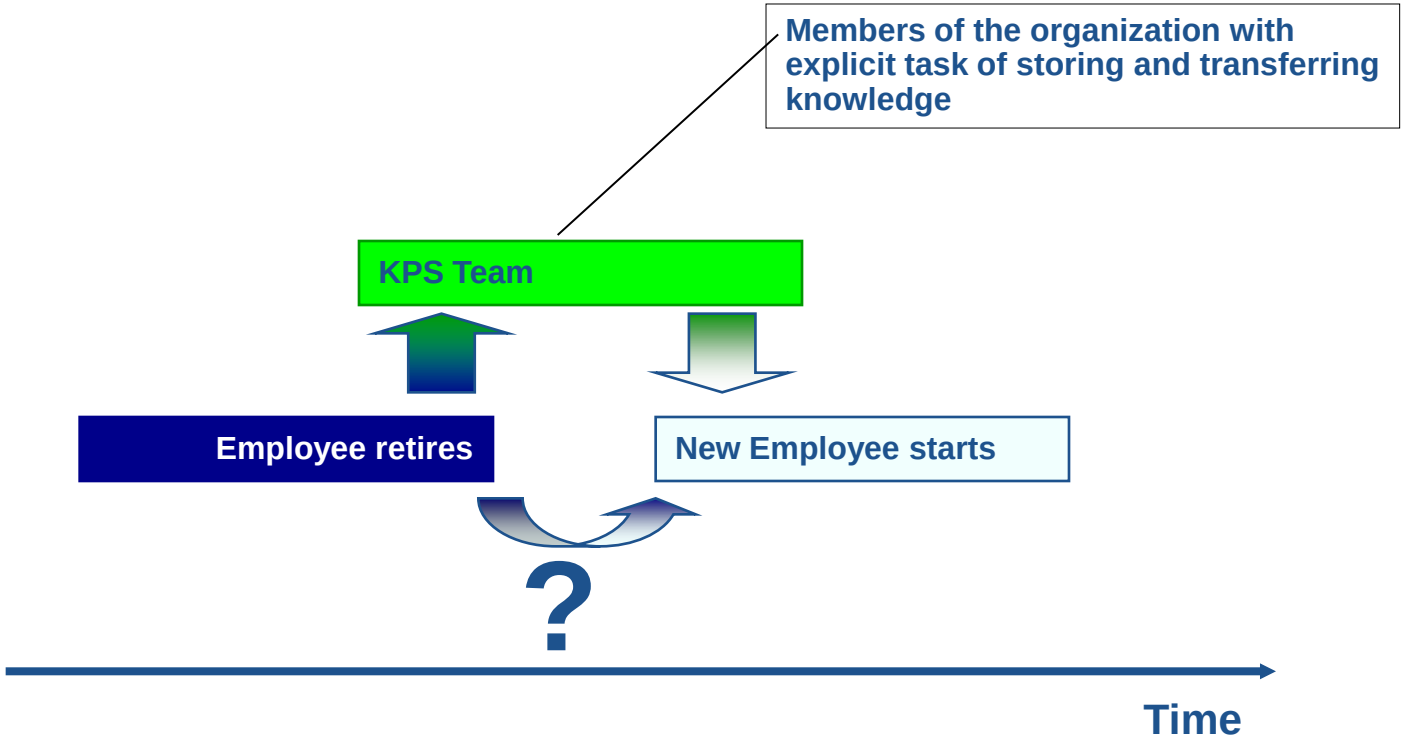
Communities of Practice (CoP)

Community of Practice

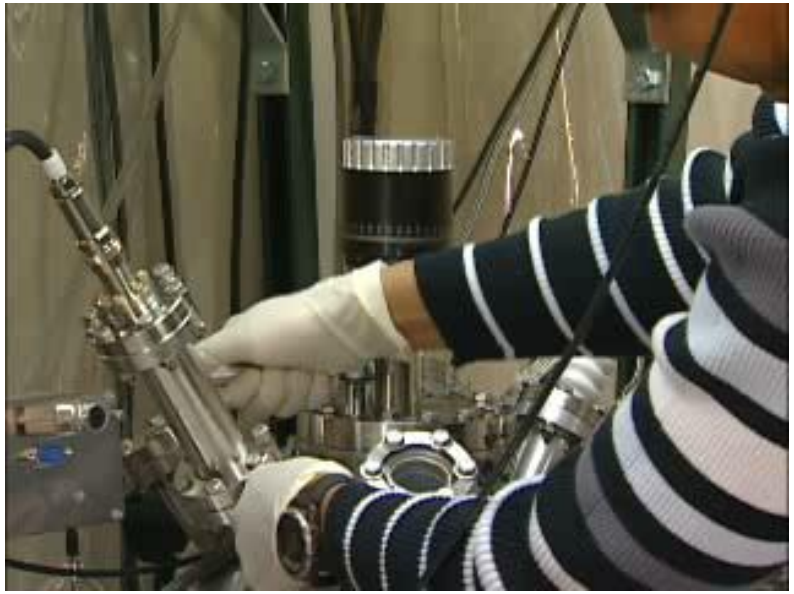


Low cost and good effectiveness

KPS(torage) Teams



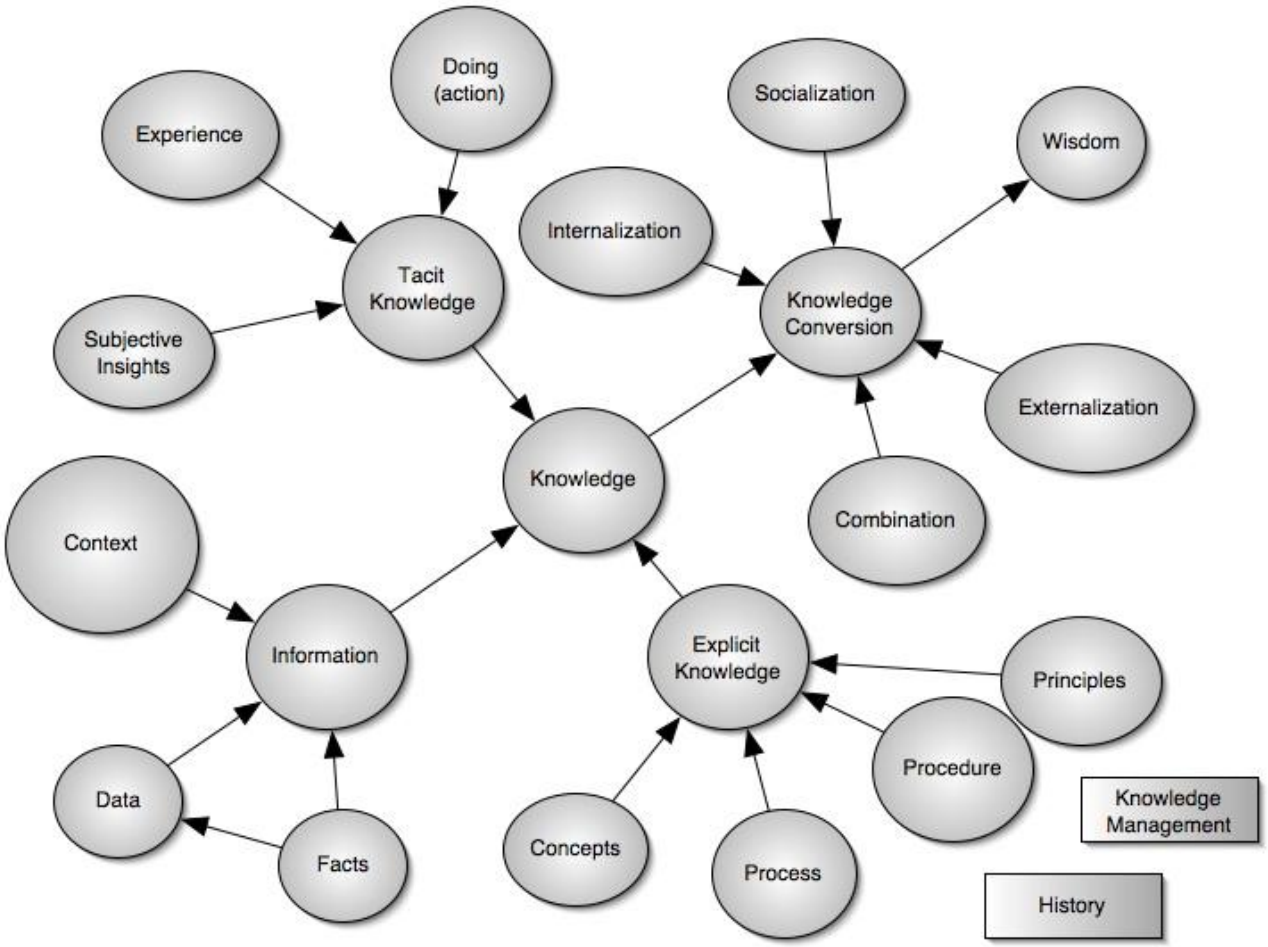
OVERVIEW VIDEOS



High Level Overview of Entire Program

Overview of a Process Step

Knowledge Map



Clark, D. R. (2004), **Knowledge Typology Map**
Retrieved July 26, 2010 from http://nwlink.com/~donclark/hrd/ahold/isd.html

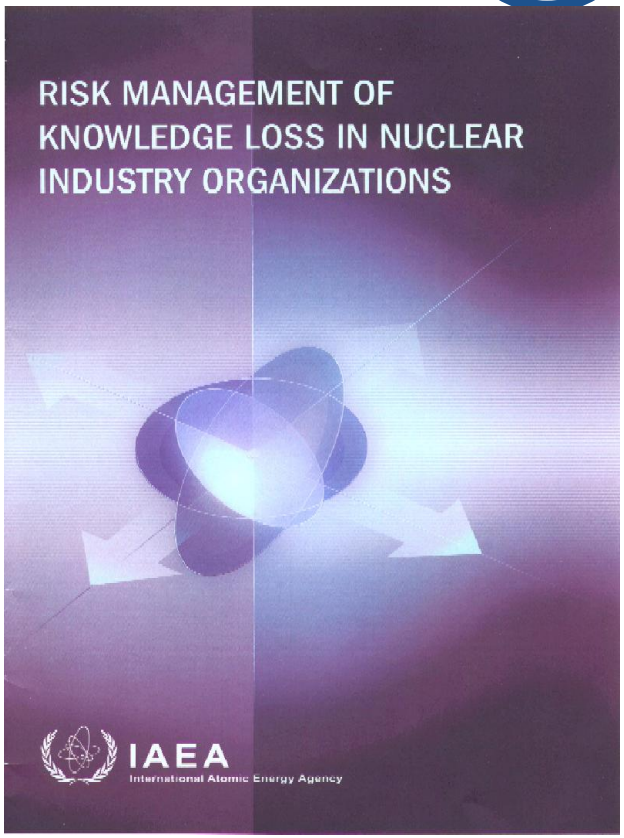
3.1 Knowledge Loss Risk Assessment example of a Methodology

Knowledge Retention Principles

- Focusing on the critical positions where knowledge loss is the greatest threat (critical knowledge focus)
- Identifying and prioritizing the specific knowledge and skills at risk
- Developing concrete, actionable responses to mitigate this loss
- Use of a formalized risk assessment process for potential knowledge loss

Relevant documents and sources

"Risk Management of Knowledge Loss in Nuclear Industry Organizations" – Published July 2006



STI/PUB/1248

Knowledge Retention Process

Three main sub-processes/activities

- **Step 1. Conduct a Knowledge Loss Risk Assessment**
- **Step 2. Determine Approach to Capture Critical Knowledge**
- **Step 3. Monitor and Evaluate**

Basic Risk Assessment Principles

Step 1 Step 2 Step 3

- A “Knowledge Loss Risk Assessment” is designed to identify positions/people where the potential knowledge loss is greatest and most imminent
- Includes ratings based on two factors:
  - Time until retirement
  - Position criticality
- Provides focus - Identifies positions where steps to mitigate knowledge loss may be needed

Attrition Risk Factor

Step 1 Step 2 Step 3

Attrition Risk Factor	X	Position Risk Factor	=	Total Risk Factor

Attrition Risk Factor = Projected attrition dates (retirements and other termination) will be assigned a retirement factor as follows:

5 - Within current or next fiscal year

4 - Within 3rd fiscal year

3 - Within 4th fiscal year

2 - Within 5th fiscal year

1 - Within or greater than 6th fiscal year

Position Risk Factor

Step 1 Step 2 Step 3

Attrition Risk Factor	X	Position Risk Factor	=	Total Risk Factor

Position Risk Factor -- An estimate of the difficulty or level of effort required to replace the position based upon the following criteria:

5 - Mission-critical knowledge/skills.

4 - Critical knowledge and skills.

3 - Important, systematized knowledge and skills..

2 - Proceduralized or non-mission critical knowledge and skills.

1 - Common knowledge and skills.

Total Risk Factor

Step 1 Step 2 Step 3

Risk Factor -- An estimate of the effort and urgency necessary to effectively manage the attrition.

20-25 High Priority - Immediate action needed.

16-19 Priority - Staffing plans should be established to address method and timing of replacement.

10-15 High Importance- Look ahead on how the position will be filled/ work be accomplished.

1-9 Important - Recognize the functions of the position and determine the replacement need.

Risk Assessment Matrix

Position Risk Factor

Attrition Factor

	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Determine Approach to Capture Critical Knowledge

Step 1 | Step 2 | Step 3

- Conduct Interview to identify potential knowledge loss areas
- Assess consequences of loss using interview results and organization specific critical skills inventories
- Prioritize and identify options to retain or mitigate
- Develop and implement action plans

Options to Retain/Mitigate Knowledge Loss

Step 1 | Step 2 | Step 3

1 Codification

- Documentation & Procedures
- Checklists, Inventories, etc.
- Performance Support Systems
- Concept Mapping

2 Education & Training

- Classroom and Simulator Training
- CBT, Video-based, and alternative delivery
- Coaching and Mentoring
- OJT and Targeted Work Assignments
- Coaching, Shadowing & Mentoring
- Apprenticeship Programs

3 Alternative Resources

- Agency/site/department expert
- Rotational or “Visiting” Staff
- Multi-skilling or Cross-training
- Contractors, part-timers, retirees

4 Engineer It Out

- Process Improvement
- Update Equipment
- “Smart” tools and technology
- Eliminate task, product or service

Monitor and Evaluate Knowledge Retention Plans

Step 1 | Step 2 | Step 3

- Review updated Work Force Planning Attrition Data
- Monitor previous Knowledge Retention Plans
- Identify areas that need to be reassessed
- Coordinate and replicate

4. Conclusions

Conclusions

- ✓ **The way you define knowledge defines your Knowledge Management.**
- ✓ **Knowledge is the key resource of most nuclear organizations in today's world.**
- ✓ **KM is a tangible help to overcome organizational change.**
- ✓ **Identifying critical knowledge, assessing risk of its loss, selecting methods and tools for its preservation and development is a must to keep safety on the top level.**
- ✓ **Because critical knowledge is often tacit, Leadership and culture are important catalysts.**

IAEA
International Atomic Energy Agency

Thank You !