The Abdus Salam
International Centre
for Theoretical Physics

2374-56

Joint ICTP-IAEA School of Nuclear Energy Management

5 - 23 November 2012

COMPETENCE AND KNOWLEDGE MANAGEMENT IN A NUCLEAR ORGANIZATION

YANEV Yanko

Nuclear Knowledge Management Institute
Gersthofer Strasse 162
A-1180 Vienna
AUSTRIA

Yanko Yanev

NEM School, Trieste, 2012

COMPETENCE AND KNOWLEDGE MANAGEMENT IN A NUCLEAR ORGANIZATION

Topics

- Knowledge and Competence
- Managing Knowledge and Maintaining Competence in Nuclear Organizations
- Challenges

Knowledge?

- the acquiring, understanding and interpreting of information.
- Knowledge is often used to refer to a body of facts and principles accumulated over time.
- Knowledge gives information a purpose or a use.
- Data leads to information and information leads to knowledge.
- **Knowledge confers a capacity for effective action**

Many have tried....

Raphael's *School of Athens* and the Wisdom of the Ancients

Knowledge is the mother of all virtue; all vice proceeds from ignorance

Knowledge is power

Learning is a treasure which accompanies its owner everywhere

Knowledge is experience everything else is information

Some major differences between Information & Knowledge

Information & Knowledge

- Visible
- Independent from action and decision
- Format changes after processing
- Physical product
- Independent from existing environment
- Easily transferable
- Can be duplicated

- Can't be duplicated
- Closely related to action and decision
- Thought changes after processing
- Invisible
- Spiritual product
- Identified with existing environment
- Transfer through learning

Competence

- **Competence** (or **competency**) is the ability of an individual to do a job properly.
- Combination of knowledge, skills and behavior used to improve performance;
- The state or quality of being adequately or well qualified, having the ability to perform a specific role.

Competence

- Competency is also used as a more general description of the requirements of human beings in organizations and communities

Competence

- **Competence involves much more than technical training, including attitude and behavior as well as experience and knowledge of the application domain**
- **Competence might be transferable** from one work situation to another, but the extent to which this is possible depends very much on the *context* in which apparently similar competence is required.

General requirements

For a person to be competent, they need qualifications, experience, and qualities appropriate to their duties. These include:

- Appropriate training as would ensure acquisition of the necessary knowledge of the field for the tasks that they are required to perform,
- Adequate knowledge of the hazards and failures of the equipment for which they are responsible,
- Knowledge and understanding of the working practices used in the organization for which they work,
- The ability to communicate effectively with their peers, with any staff working under their supervision, and with their supervisors,
- An appreciation of their own limitations and constraints, whether of knowledge, experience, facilities, resources, etc., and a willingness to point these out.

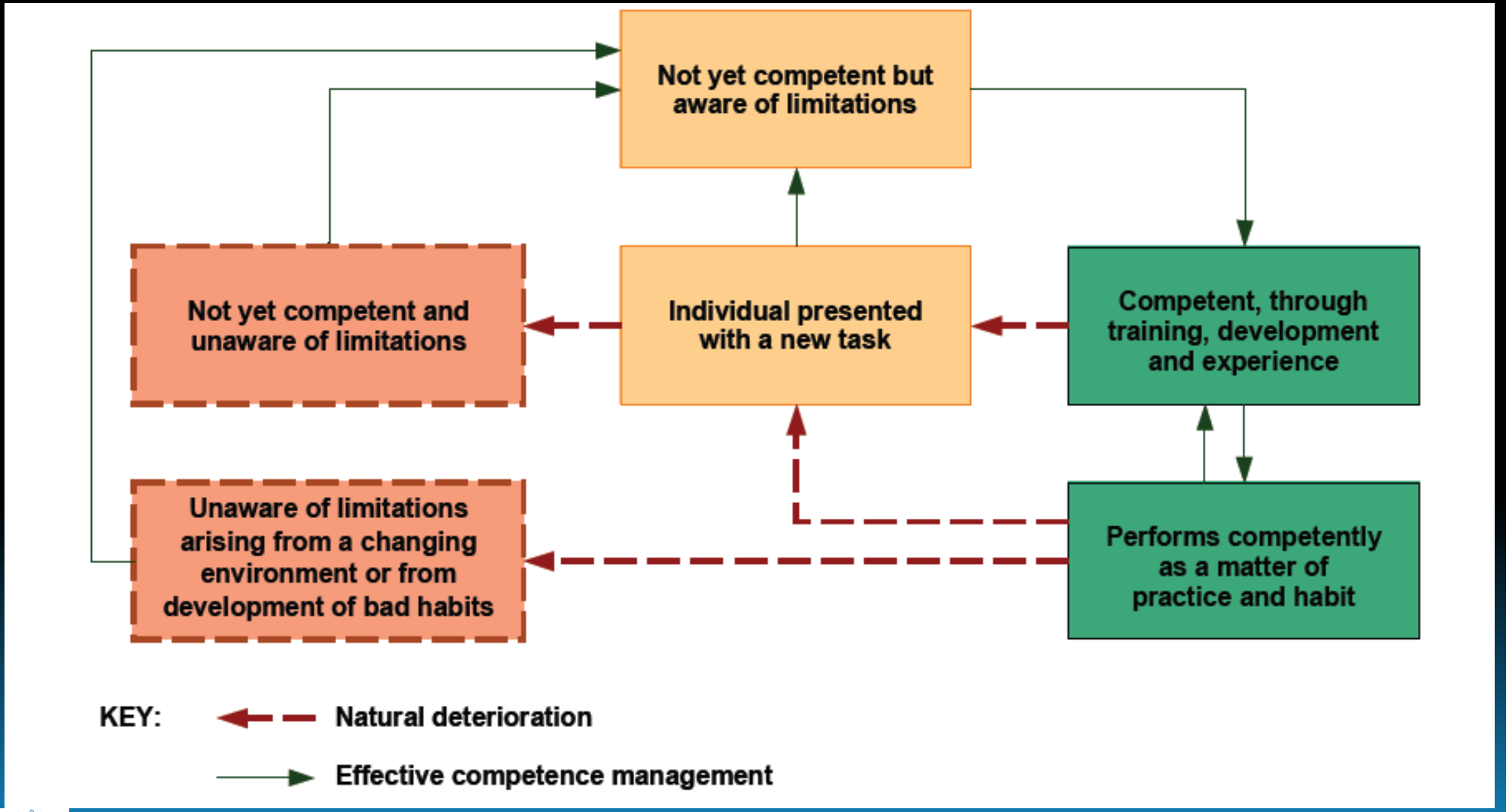
IAEA
International Atomic Energy Agency
Atoms for Peace

Operating organizations

In addition, professional engineers with responsibility for design or for supervision of operators should have:

- a detailed working knowledge of all statutory provisions, approved codes of practice,
- other codes of practice, guidance material and other information relevant to their work,
- awareness of legislation and practices, other than these, which might affect their work;
- general knowledge of working practices in other establishments of a similar type
- an awareness of current developments in the field in which they work.

Stages of competence



Nuclear knowledge

- Involves virtually every area of physical sciences and engineering
- Requires a complex infrastructure
- Must be based on firm technical understanding to manage safety, economics, & innovation
- Takes many years and resources to build up the knowledge base

Nuclear knowledge as Organizational Asset

Asset Classes:

Physical Capital

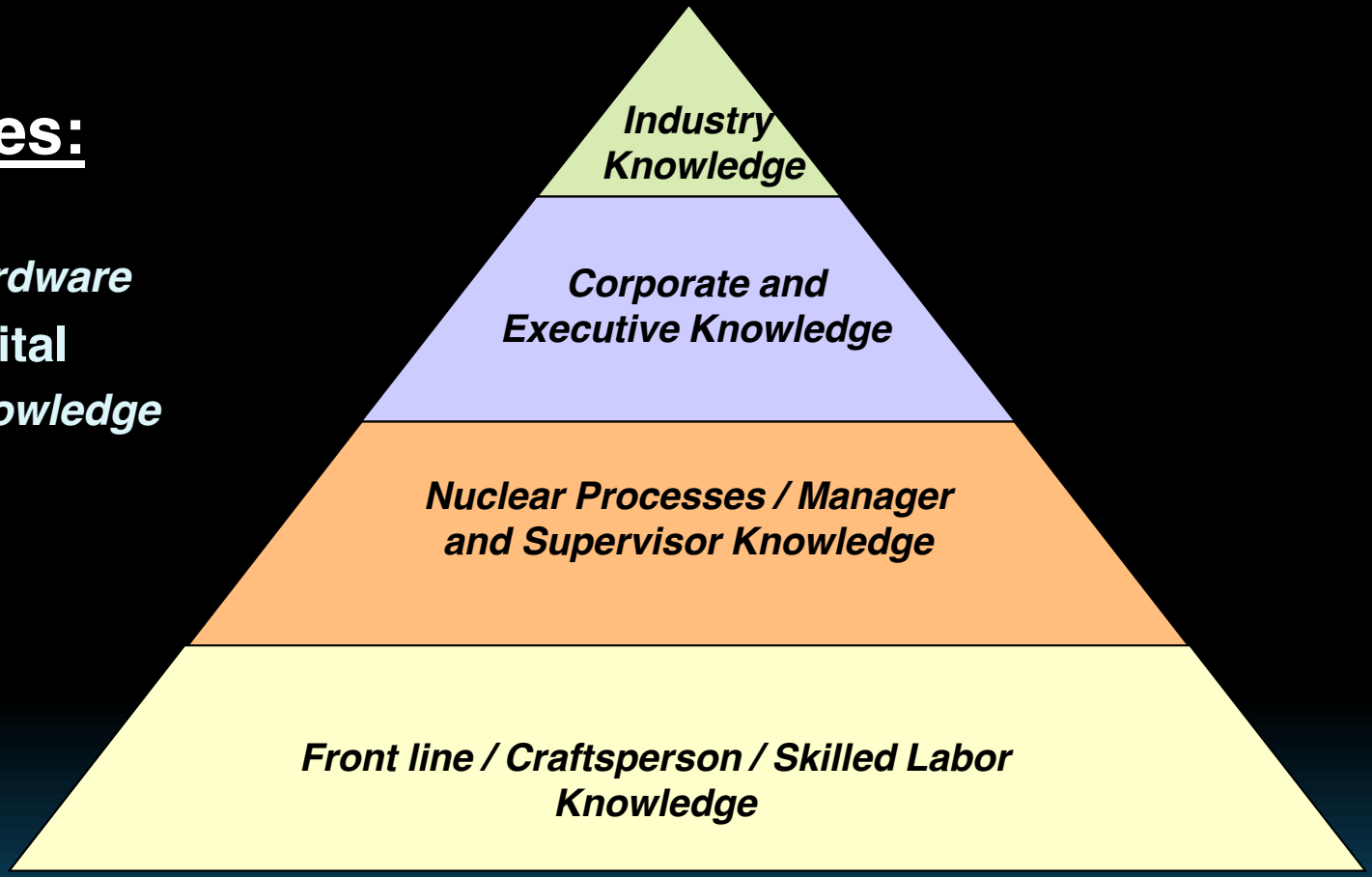
- *Equipment/Hardware*

Technology Capital

- *IT/Process Knowledge*

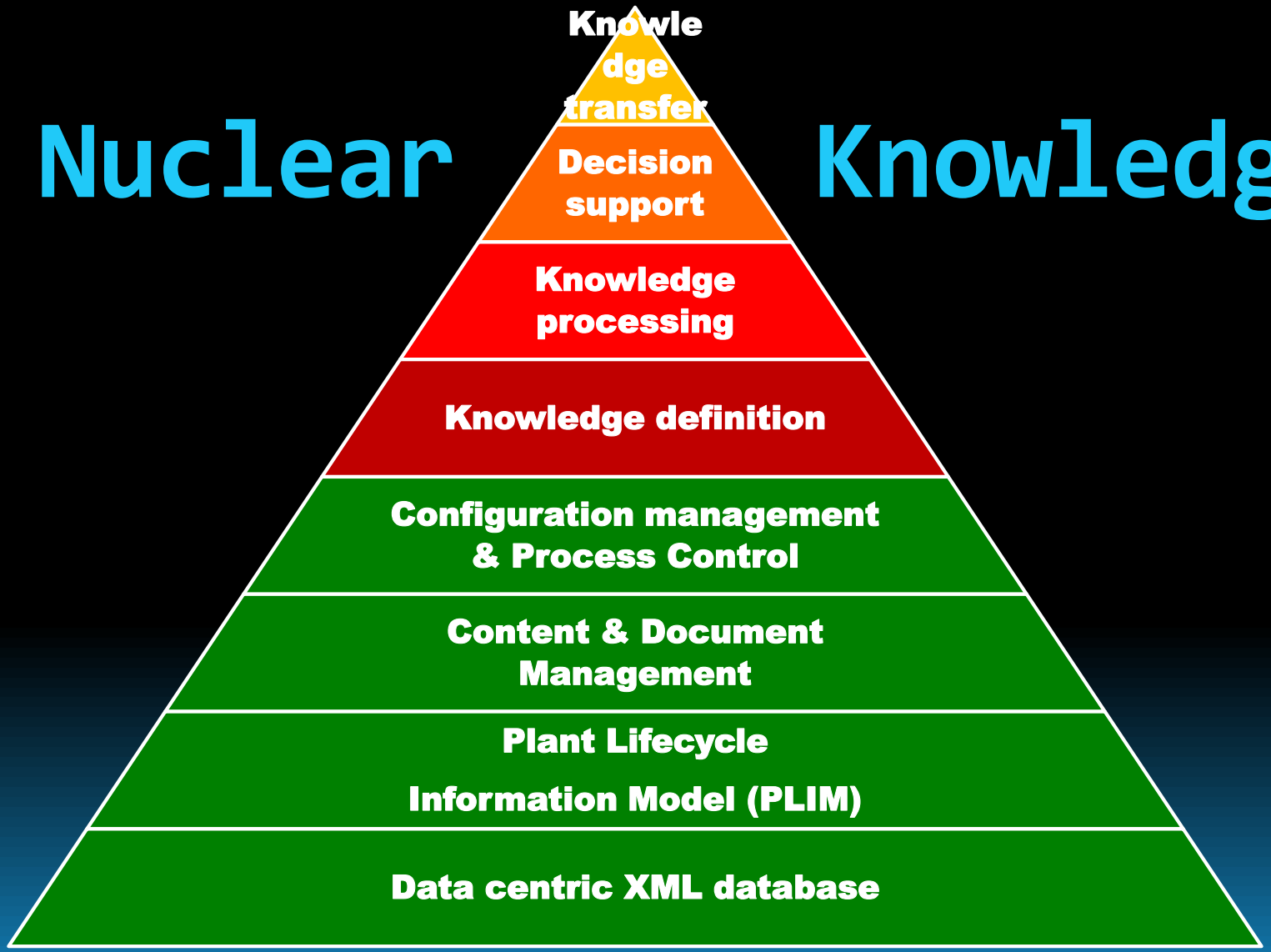
Human Capital

- *People*



A resource which was created by absorbing other resources,
Has its **own *cost*** .Has to be **managed** in an efficient and effective manner to help to reach *organizational or national goals*.

Nuclear Knowledge



IAEA
International Atomic Energy Agency
Atoms for Peace

Who owns Nuclear knowledge?

- Governments, including regulators;
- Designers, vendors, utilities, operators, suppliers, consultants, and support organizations;
- Training and academic institutions;
- Research and Development (R&D) organizations;
- The Public and Non Governmental Organizations (NGOs); and
- International organizations.

Nuclear Knowledge is globally imbalanced

Affected by:

- A combination of governmental budgeting inconsistencies,
- The demographic gaps in the professional workforce,
- The resurging increase in nuclear technology applications worldwide and
- The lack of awareness of the importance of systematically managing nuclear knowledge in the past.

IAEA
International Atomic Energy Agency
Atoms for Peace

Knowledge management:

- **Business activity** **with two primary aspects:**
  - Treating the knowledge component of everyday work as an explicit concern of business, reflected in relevant strategy, policy, and practice at all levels of the organization.
  - Making a direct connection between an organization's intellectual assets (both explicit [recorded] and tacit [personal know-how]) and positive business results.

Knowledge management

- Connected with several well-known management strategies, practices, and business issues, including
  - change management
  - best practices
  - risk management
  - benchmarking
  - may be others.

Knowledge cycle

Nuclear Technology

What?

How?

Data

Skills

Nuclear Information

Knowledge

Nuclear Specialists

Insight

Context

Training

NPP Processes

Why?

IAEA
International Atomic Energy Agency
Atoms for Peace

Knowledge Management involves

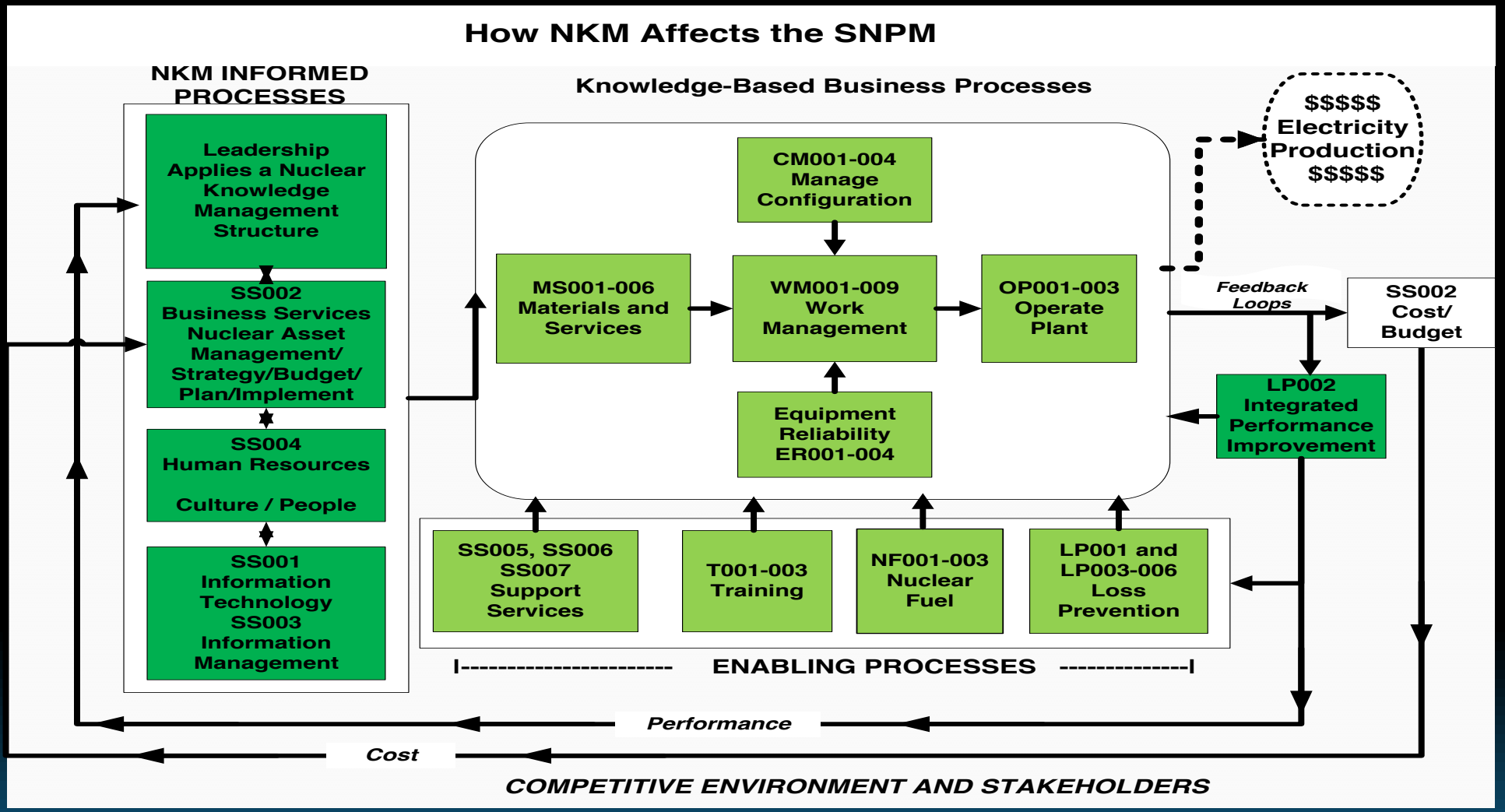
- PEOPLE
- PROCESSES
- TECHNOLOGY

PEOPLE –
not technology –
manage knowledge

Knowledge Organizations develop and implement policies and practices that promote teamwork to help share and manage knowledge – but ultimately people "manage" knowledge

IAEA
International Atomic Energy Agency
Atoms for Peace

PROCESSES


How NKM Affects the SNPM
NKM INFORMED PROCESSES
Leadership Applies a Nuclear Knowledge Management Structure
SS002 Business Services Nuclear Asset Management/ Strategy/Budget/ Plan/Implement
SS004 Human Resources Culture / People
SS001 Information Technology SS003 Information Management
Knowledge-Based Business Processes
CM001-004 Manage Configuration
MS001-006 Materials and Services
WM001-009 Work Management
OP001-003 Operate Plant
Equipment Reliability ER001-004
$$$$$ Electricity Production $$$$$
Feedback Loops
SS002 Cost/ Budget
LP002 Integrated Performance Improvement
SS005, SS006 SS007 Support Services
T001-003 Training
NF001-003 Nuclear Fuel
LP001 and LP003-006 Loss Prevention
ENABLING PROCESSES
Performance
Cost
COMPETITIVE ENVIRONMENT AND STAKEHOLDERS

Technology

Enhances the ability to rapidly disseminate information and develop knowledge bases thereby presenting opportunities to:

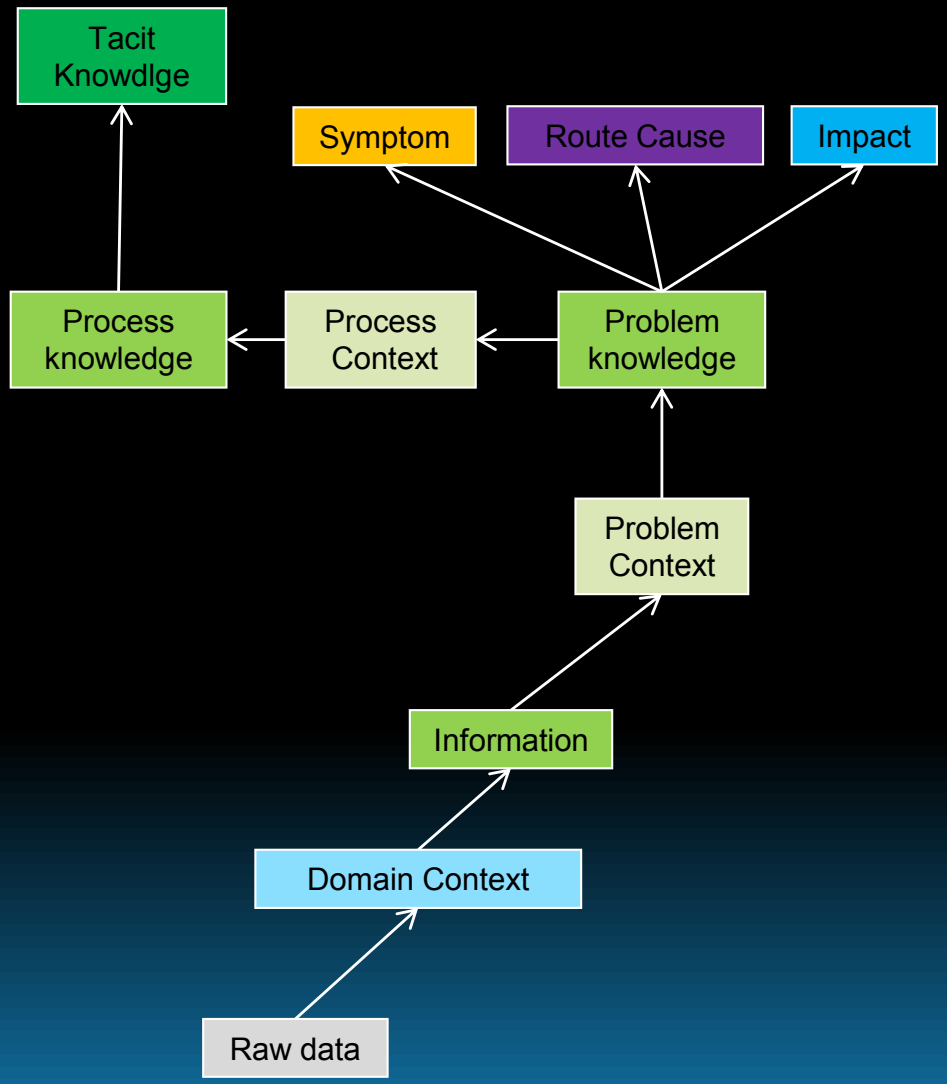
- **Change** traditional organizational structure
- **Inspire** an efficient working style
- **Promote**s networks

Enables organizations and people to organize, preserve and use enormous amount of information efficiently

IAEA
International Atomic Energy Agency
Atoms for Peace

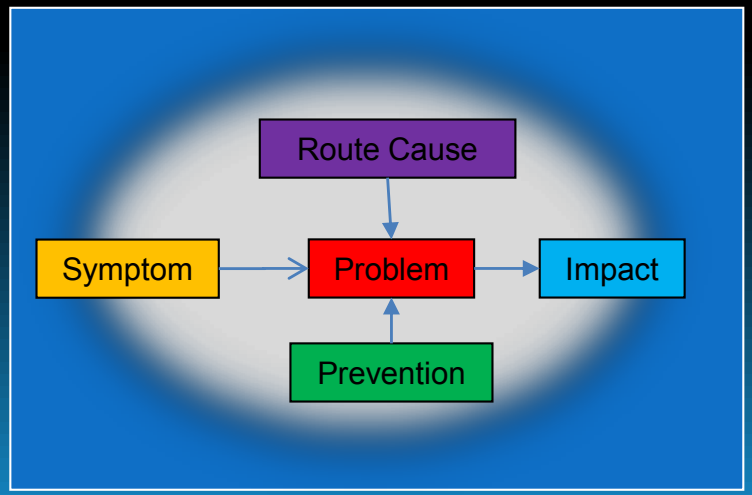
Knowledge capture

- Data to information
- Information to knowledge
- Knowledge to process



Knowledge evolution process

Problem relations cell



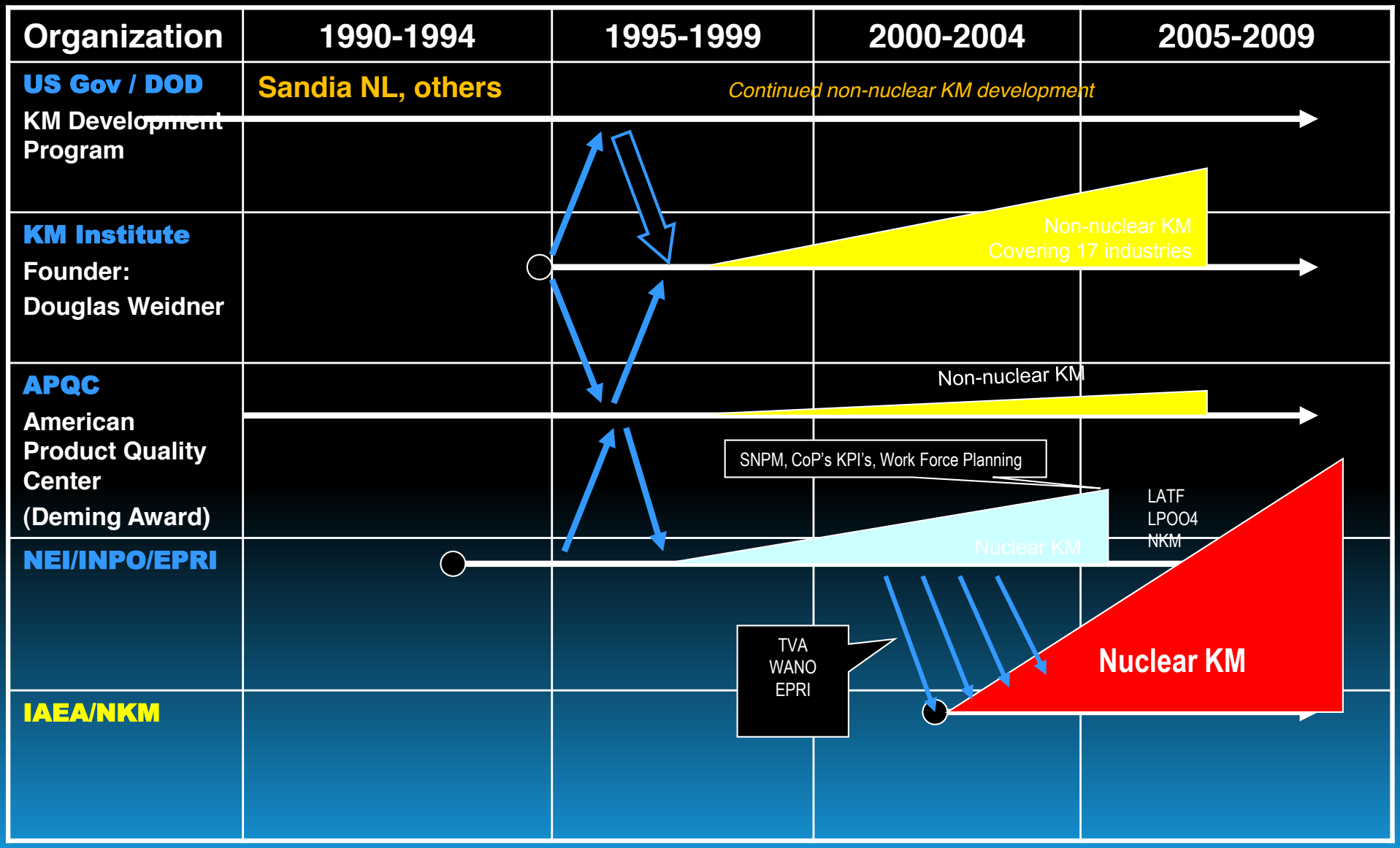
IAEA PROGRAM ON NUCLEAR KNOWLEDGE MANAGEMENT

Nuclear Knowledge Management

- The first issues (Sandia National Lab. ; Minatom -Russia,
- TVA and the attrition issues,
- No Next Nuclear Generation (NNNG),
- The IAEA initiative,
- The NKM program

GOOGLE: 7 600 000 hits

NKM BIG PICTURE



Nuclear Knowledge

Type of Knowledge	Typically Required by
Know-What (Understanding what is needed for effective decisions)	Managers, Plant Owners, Policy-makers
Know-How (Application of knowledge)	Operators, Regulators, Suppliers, Constructors
Know-Why (Generation of knowledge)	Designers, Developers, National Laboratories, Universities, Vendors, Regulators

IAEA
International Atomic Energy Agency
Atoms for Peace

NKM Objectives

- Safety objective - Achieve *safe* operation and maintenance of all nuclear facilities by sharing of operational experience;
- Economic objective - Achieve *gains in economics and operational performance* through effective management of the resource knowledge;
- Security objective - Achieve *responsible use* by properly identifying and protecting nuclear knowledge from improper use.
- Innovation objective - Facilitate *innovation* to achieve significant improvements in the safe, economical operation of all new nuclear projects;
- Sustainability objective - Maximize *the flow of nuclear knowledge from one generation to the next*

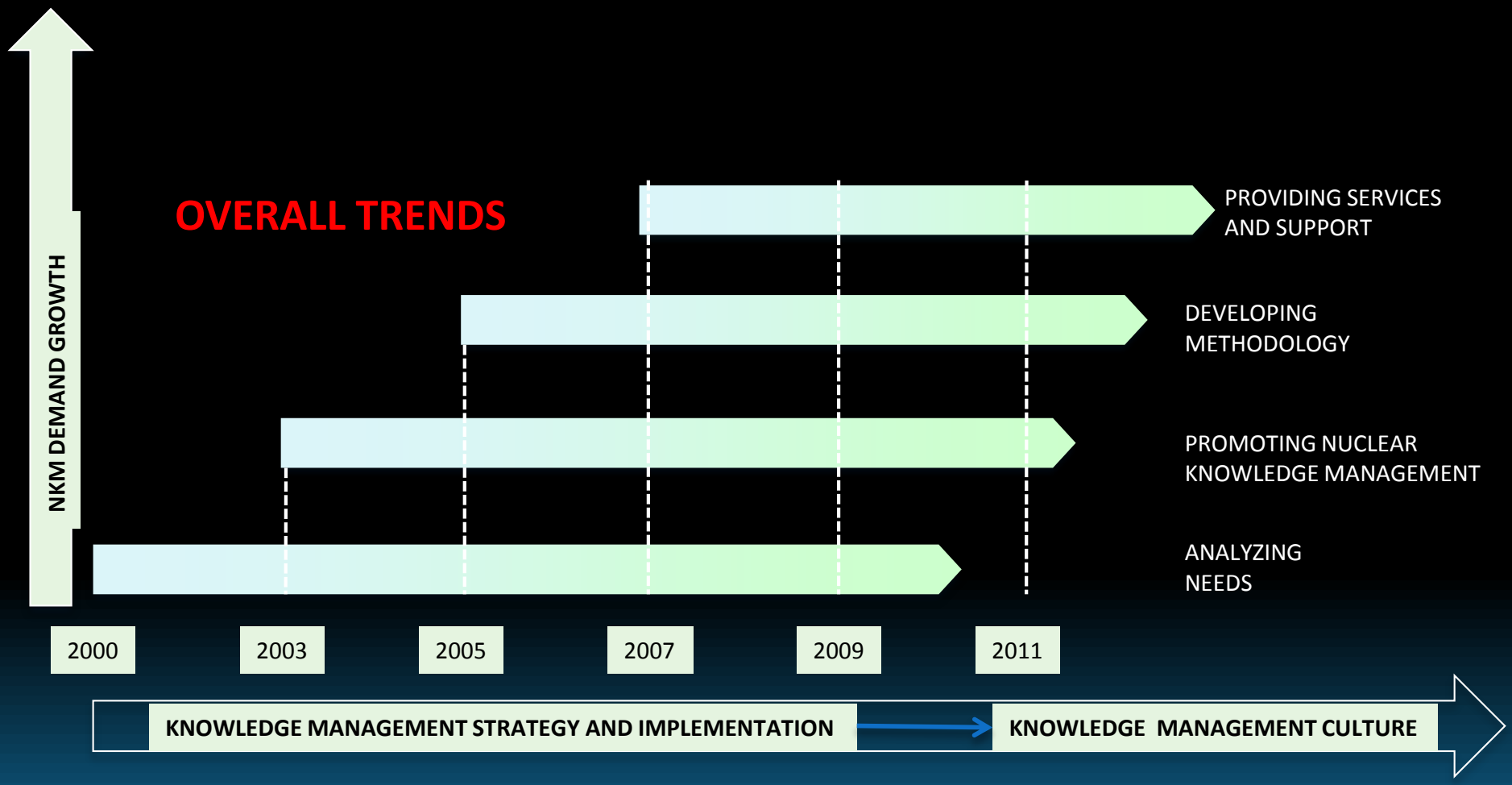
IAEA
International Atomic Energy Agency
Atoms for Peace

Definition of NKM

- **Nuclear Knowledge Management** at the project, organizational and national levels is an **integrated and systematic** approach applied to all stages of the knowledge cycle, including its identification, sharing, protection, dissemination, preservation and transfer.
- **NKM** affects and relates to human resource management, information and communication technology, process and management approaches, document management systems, and corporate and national strategies.

IAEA
International Atomic Energy Agency
Atoms for Peace

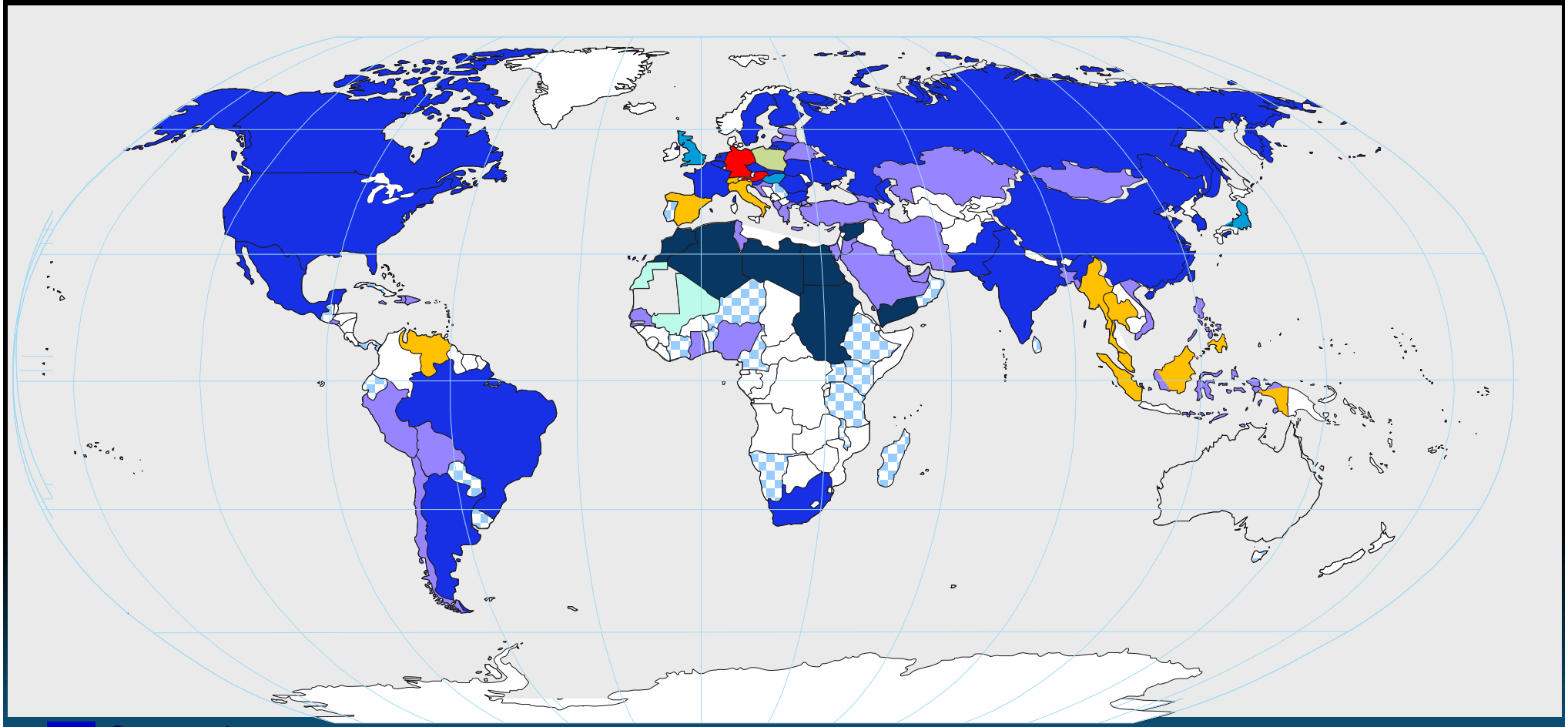
EVOLUTION OF NKM



Or what to remember…

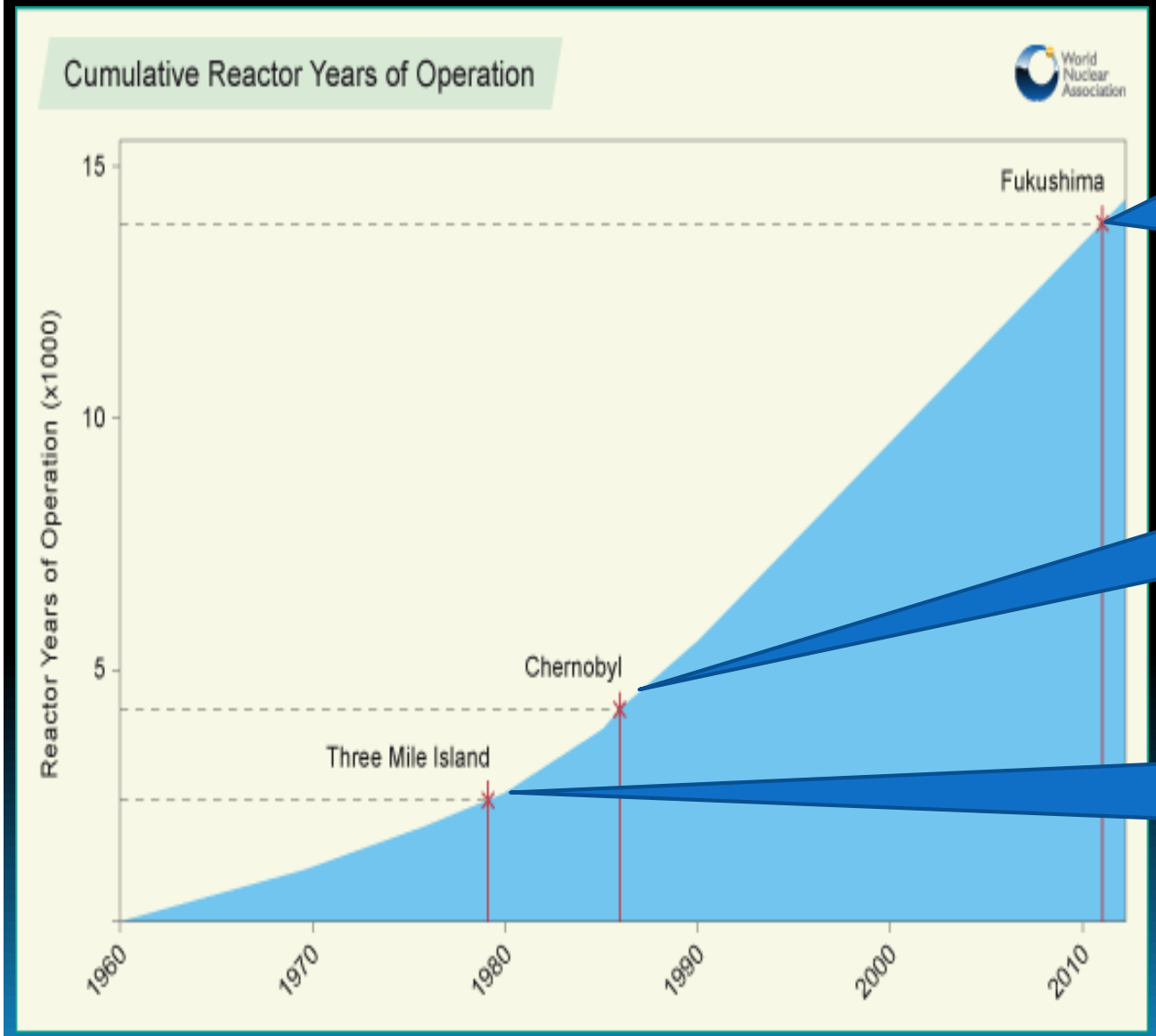
THE FUTURE CHALLENGES TO NUCLEAR KNOWLEDGE AND COMPETENCY MANAGEMENT

Growing Demand for Nuclear Knowledge



IAEA
International Atomic Energy Agency
Atoms for Peace

Critical Moments

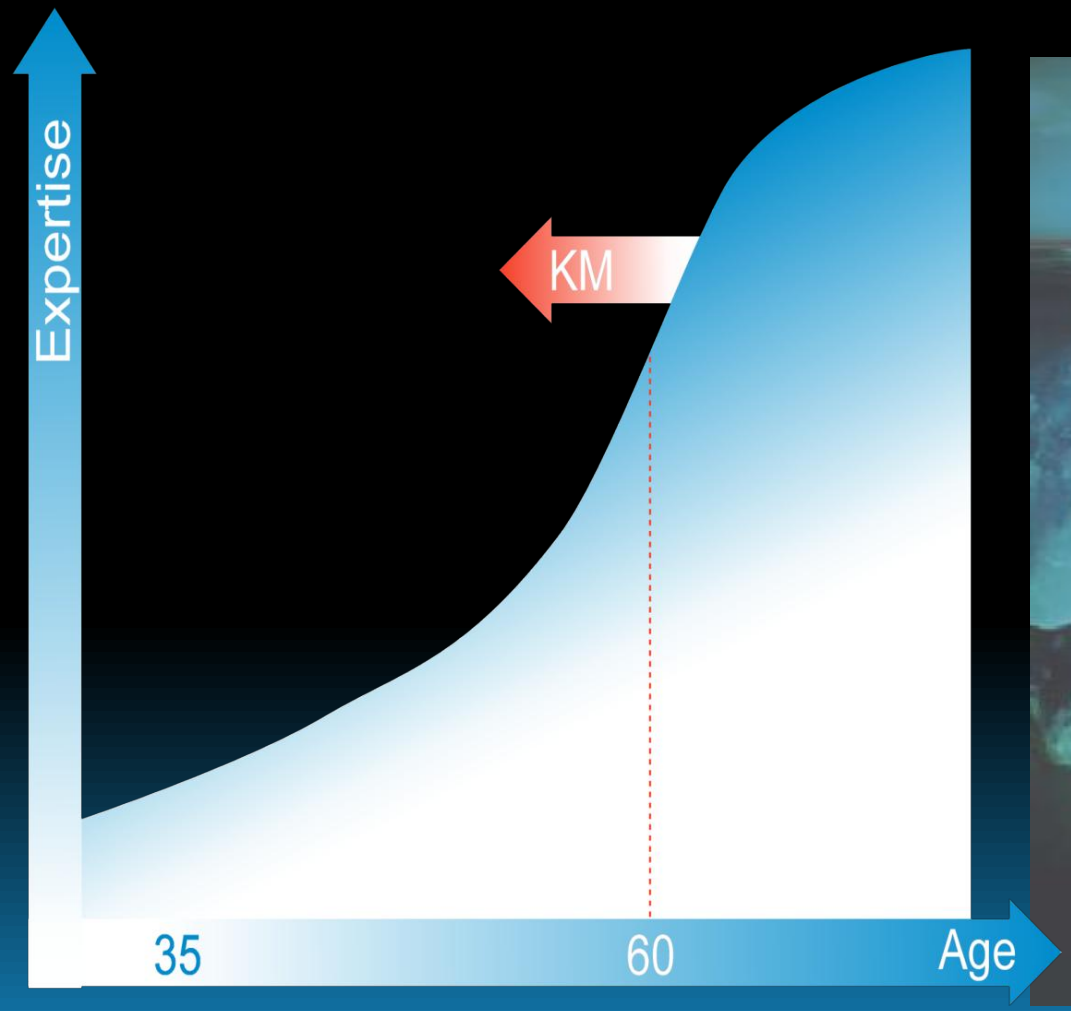


CATASTROPHIC EXTERNAL EVENTS
Design deficiency?
Knowledge Management?
Safety Culture?

SAFETY CULTURE

DEFENCE IN DEPTH/SAT /DESIGN DEVELOPMENT

Knowledge Preservation



Explicit knowledge: data, facts, documents

Implicit (tacit) knowledge: experience, communications, culture

IAEA
International Atomic Energy Agency

4 things to keep in mind…

1. **Operating facilities**:
   - operation of these facilities and the associated activities could be affected adversely by **knowledge deficient decision-making,** lacking the sufficient level and quality of knowledge and competence at any future stage of the facility's life-cycle.
2. New Projects:
   - The increasing number of new-build projects especially in developing countries will require the same on-going diligence and oversight in design, delivery, and supply as we have today. Vendors may be involved with several projects, which will require **careful allocation of experienced human resources**.

IAEA
International Atomic Energy Agency
Atoms for Peace

4 things to keep in mind…

3. New comers:
   - While most new plants will be built initially in established nuclear power countries, there will also be plants built in countries without nuclear power experience. These new entrants will require **international human resource commitments over an indeterminate time to assist with the establishment of the robust nuclear infrastructure** that established countries have developed over several decades.
4. Education and training:
   - The number of skilled people at all levels has to expand substantially, which means **increased requirements for education and training**. This involves more than courses from educational institutions.

IAEA
International Atomic Energy Agency
Atoms for Peace

Lao Tzu

- In the pursuit of knowledge: everyday something is added.
  In the pursuit of enlightenment: everyday something is dropped."

Your best resource on Managing Nuclear Knowledge :
http://www.iaea.org/nkm