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Evolution of Knowledge Management: From Expert Systems to Innovation 2.0

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universität wien

UNIVERSITY OF VIENNA

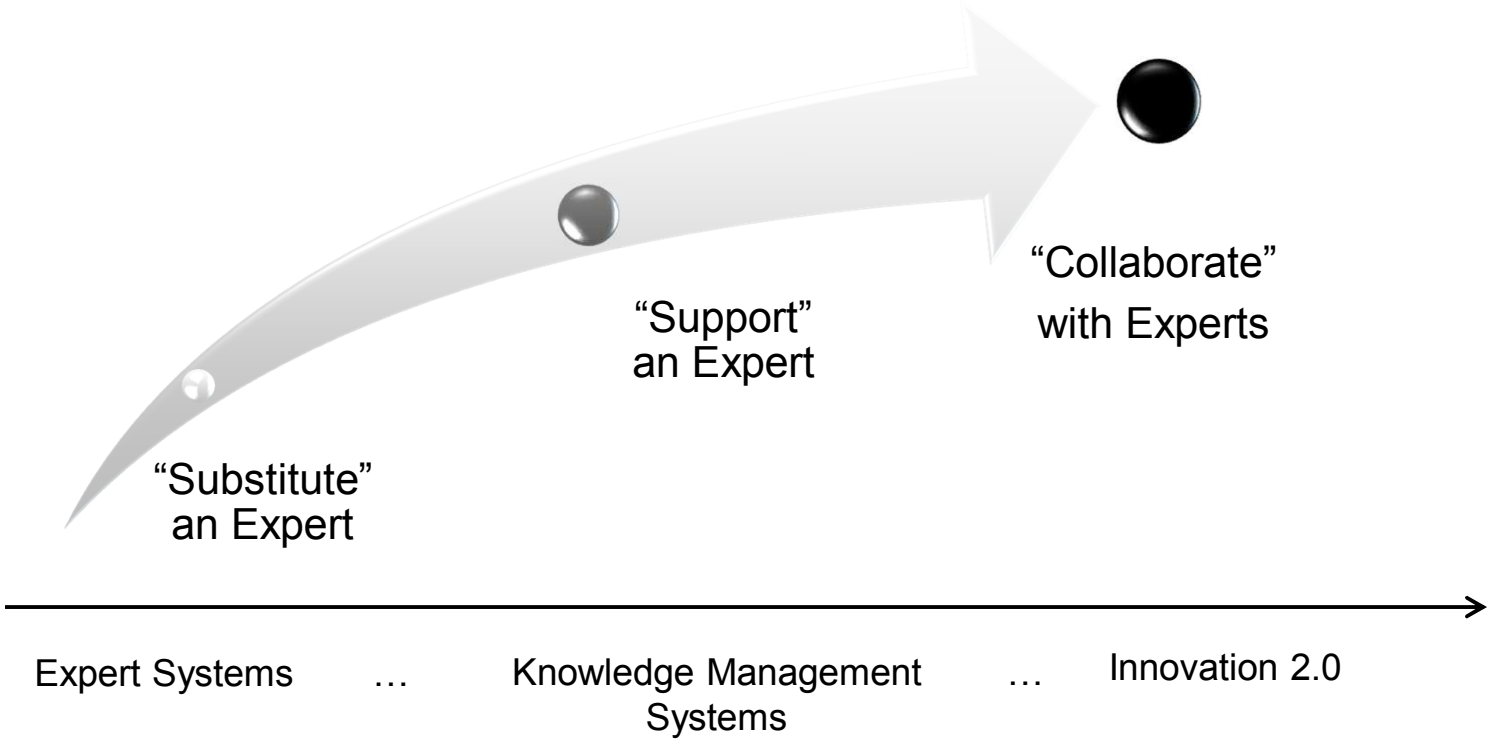
Was founded by Duke Rudolph IV in 1365. It is the oldest University in the German-speaking cultural area and one of the largest in Central Europe.

The University of Vienna is the largest teaching and research institution in Austria, with approx. 6 900 academic staff. It aims to sustain a wide range of studies as well as to promote new and innovative fields of research.

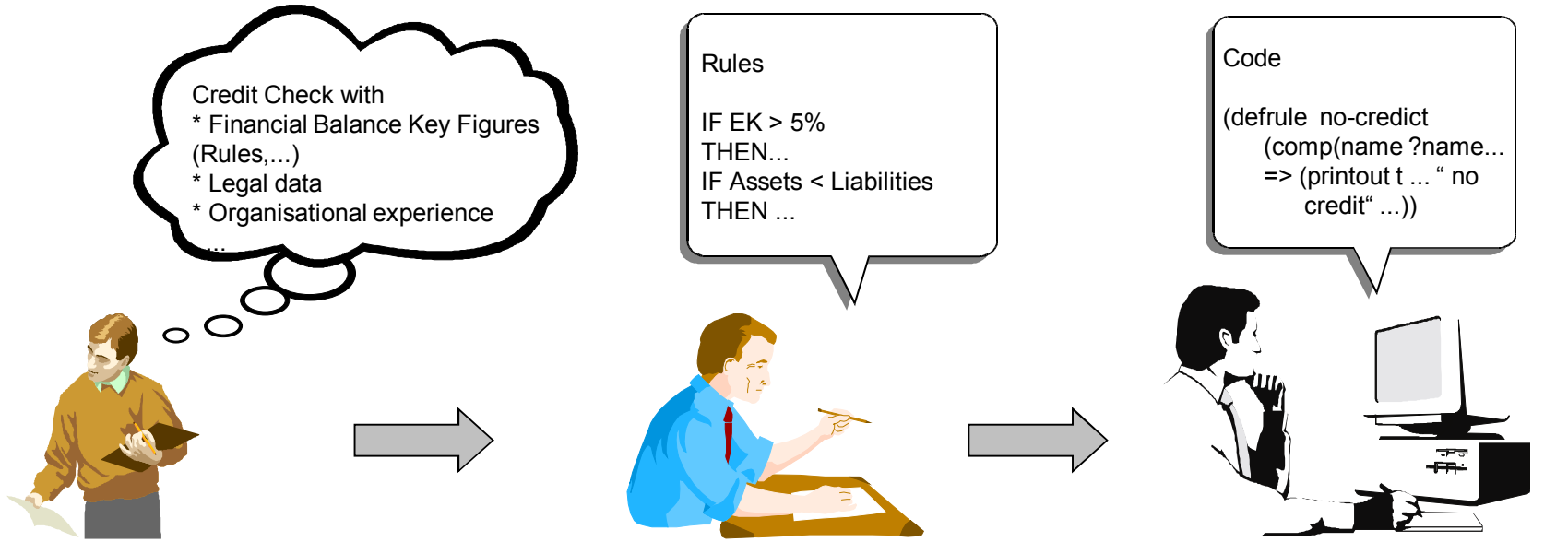
Currently, about 92 000 students are enrolled in more than 187 courses, of which are 55 Bachelor-, 116 Master-, 4 Diploma- and 12 PhD Programmes.

From Expert Systems to Innovation 2.0

The evolution of knowledge processing having its root in information technology and artificial intelligence resulting in today's collaborative Web 2.0 and moving towards Innovation 2.0.



Making Knowledge Machine Interpretable



cognitive Layer

Formulation of toughts

Representation

Selection of appropriate Knowledge representation

Implementationsebene

Selection of software and implementation

KNOWLEDGE MANAGEMENT:

NUCLEAR KNOWLEDGE MANAGEMENT AT IAEA

Overview of the general *Inspection Process*

① The state declares the nuclear material and activities

② Inspectors present at the facilities verify declarations for correctness and completeness (depending on the type of agreement)

③ Inspectors try to detect early misuse of declared nuclear material and technology

④ Additional measures applied to ensure absence of undeclared material and activities

⑤ IAEA provides credible assurances that States are honouring their safeguards obligations.

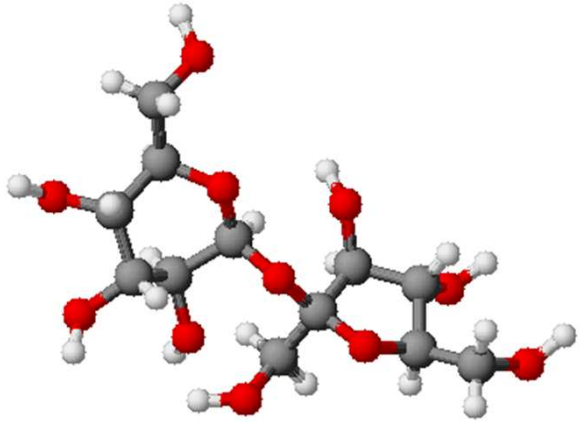
Supporting the Process?

Why formalize NFCM Model?

- Great number of potential acquisition paths may exist in a state.
- Both Plutonium (Pu) and Highly Enriched Uranium (HEU) can be used in Weaponization.
- From a number of declared activities there may be only a few that are undeclared.
- For some States number of acquisition paths may be in the hundreds.
- Acquisition paths do not have to only exist within one State. Global acquisition paths may exist.

Formalization with Pattern Theory

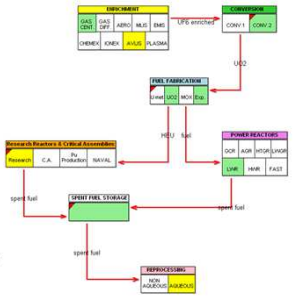
- PT can be used as an intermediate language for transformation.
- Close to graph theory and diagrammatic language availability.
- Not only analysis formalism but construction formalism.
- Easy translation to O-O data structures
- It allows unified representation of various algorithms for calculation and simulation.

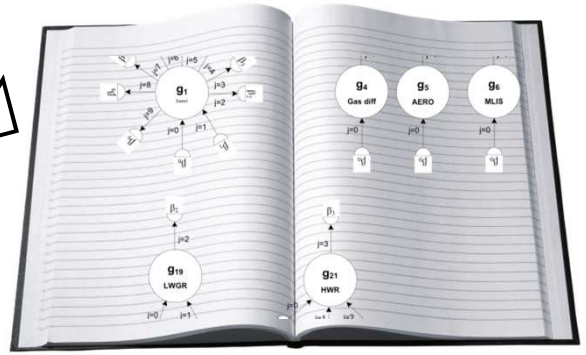


Transforming Nuclear Processes to Generators

1. Conversion I.
2. Enrichment of Uranium
3. Conversion II
4. Fuel Fabrication
5. Nuclear Reactors
6. Deuterium and Heavy Water Production
7. Reprocessing of Irradiated Fuel
8. Spent Fuel Management

documents describing all nuclear technologies, nuclear materials and processes used in each





Bonding rules buried in documents were used to formalize all modeling elements of NFCM and their relations to allow for *regular* acquisition path configurations

Application Scenario #1

Query 1: ***{****Find all potential acquisition paths for country* ***X}****.*

Step 1 *– Identify all elements in a model representing nuclear activities*

Step 2 *– Map elements found in Step 1 to generators (g1, g2, g3….)*

Step 3 *– Identify all generators that have a bond to the generators* ***gPu*** *and* ***gHEU****.*

Step 4 *- For each generator identified in step 3 find bonds to all other generators. Iterate until no new bonds are discovered.*

Application Scenario #2

Query Scenario 2: *{Find the most plausible (probable) acquisition path for country **X**}.*

Step 1 - get results from *Query 1*

Step 2 – Attach weights to bonding between generators based on the findings of inspectors.

Step 3 – calculate conditional probabilities of events making up a regular acquisition path structure.

First Evaluation of the Approach

- Considered Graphs, Graph Grammars and Petri-nets
- An important property of a generator is that it can carry attributes. It allows unified representation of various algorithms for calculation and simulation.
- From the structure of a single generator we already know which other element(s) it can bond to. This is not obvious from a single node in a Petri net (place or transition).
- A generator configuration (unobservable image) is much more closely related to actual model (observable image) we are formalizing that would be the case for instance with a Petri net.
- Between purely graph representations and graph grammars which are rule intensive and formalisms such as Petri nets that are unique in studying behavioral properties, pattern theory finds its place as a mixture that strikes the optimal balance of all these properties.

KNOWLEDGE EVALUATION:

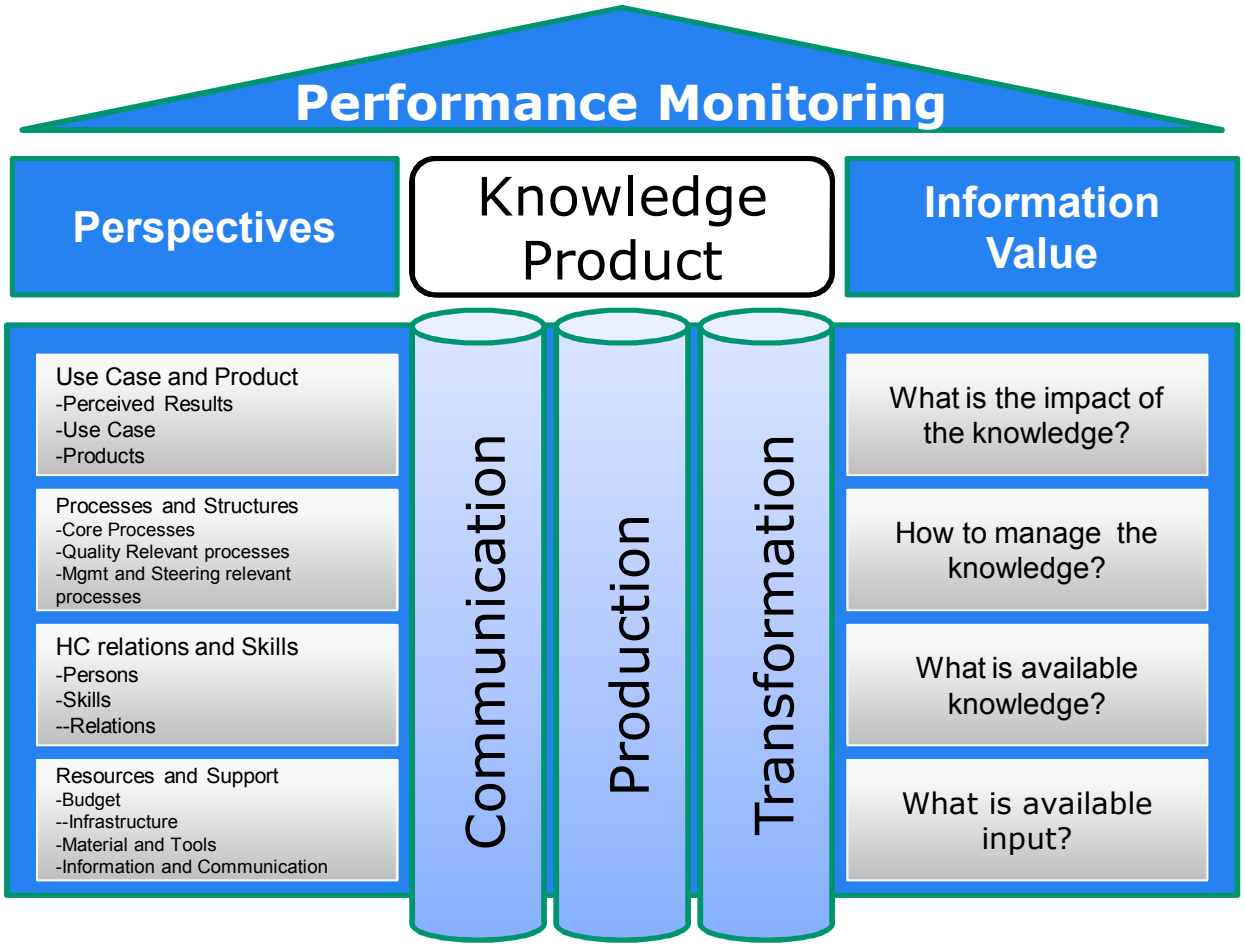
KNOWLEDGE BALANCE AT NBC-DEFENCE SCHOOL

Overview of NBC-Defence School

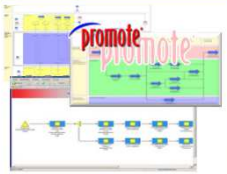
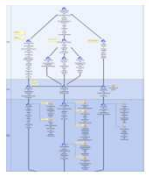
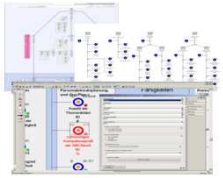
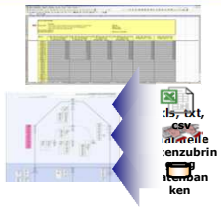
- Use Case for Knowledge Balances in Austrian Military:
  - Exemplified organisation representing Operation, Teaching and Research in one use case.
  - Transformation towards “New Public Management” through introduction of organisational management tools.
  - Learning organisation in high complex application area for a 24/7 operation support unit.
  - Experienced Decision Maker is retiring and externalises “best practice” of heading this unit.

Knowledge Balance Framework

Proposed knowledge perspectives and main pillars for best performance of knowledge products. A holistic consideration of Balance Scorecards and Intellectual Capital Measurements.



Knowledge Balance - Roadmap

Phase	Definition of Initial Situation	Specification of Goals	Identification of Cause-And-Effect Relations	Quantification of Goals	Operational Data Coupling	Communication Knowledge Scorecard	Steering and Management
Instruments	 **Knowledge Relevant Models**	 **Success Factors and Knowledge Goals**	 **Cause and Effects Relations**	 **Indicators**	 **Operational Data**	 **Reports**	 **Knowledge Performance Cockpit**
Results	Identified: • Knowledge Products • Knowledge Processes • Knowledge Workers	Specified: • Knowledge Strategy • Knowledge Goals • Knowledge Success Factors	Transparent: • Cause and Effects • Relation between Goals and Indicators	Defined: • Key Performance Indicators Composition • Measure Calculations	Collection: • Considering existing data • Importing and accessing operative data.	Communicating: • Generated Reports • Comparing Results	Monitoring: • Steering through Knowledge Monitoring

First Evaluation of the Approach

First Findings in this pilot:

- Documentation, Communication, Transparency has been efficiently established
- Enhancement of the Management and Planning Quality
- Method- and Tools Competence had been gained to better assess cost and benefit of this approach
- Enhancement of the compliances
- Cost-Benefit ratio for Follow-up Projects

⇨ Two follow-up projects have been realised:

1.In the research and development department to assess the innovation within the military

2.In one technical high-end operative unit to monitor the performance of a highly skilled team

Outlook: Innovation 2.0

Open Innovation 2.0 takes full advantage of cross-fertilisation of ideas and drives for experimentation and prototyping in real world, to speed up and increase the potential for innovation. It is a catalytic, positive approach for innovation which helps solving key European challenges by embracing change, not resisting it! We drive the Open Innovation 2.0 paradigm towards recognition and adoption in Europe, in all sectors.

The **Open Innovation Strategy and Policy Group (OISPG)** works on increasing knowledge and ICT intense sectors to respond to highly open and competitive ecosystems needed to create new markets and ICT and knowledge based products and services.

There are **5 key elements** in the new innovation process:

1. **Networking**
2. **Collaboration** involving partners, competitors, universities, and users;
3. **Corporate Entrepreneurship**, enhancing corporate venturing, start-ups and spin-offs;
4. **Proactive Intellectual Property Management**: to create markets for technology;
5. **Research and Development** (R&D): to achieve competitive advantages in the market.

http://ec.europa.eu/digital-agenda/en/open-innovation-20

Thank you for your attention!