Global Knowledge Management

Knowledge Representation

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Collaborative Course Development!

Thanks to my colleagues Prof. Dr. Markus Bick and Prof. Dr. Franz Lehner who have developed parts of the Knowledge Management Course which we taught together during the Jyväskylä Summer School Course 2011.

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The challenges

- How to codify knowledge?
- How to find, retrieve and utilize knowledge?
- How to represent knowledge?
- How to deal with differences regarding common knowledge?
- How to deal with cultural aspects of knowledge processes?
- How to make knowledge accessible?
- And many more…
Remember?
Definition – Knowledge

“Knowledge comprises all cognitive expectancies – observations that have been meaningfully organized, accumulated and embedded in a context through experience, communication, or inference – that an individual or organizational actor uses to interpret situations and to generate activities, behavior and solutions no matter whether these expectancies are rational or used intentionally.” (Maier 2002)

“A set of data and information (when seen from an Information Technology point of view), and a combination of, for example know-how, experience, emotion, believes, values, ideas, intuition, curiosity, motivation, learning styles, attitude, ability to trust, ability to deal with complexity, ability to synthesize, openness, networking skills, communication skills, attitude to risk and entrepreneurial spirit to result in a valuable asset which can be used to improve the capacity to act and support decision making.” (CEN 2004)
Types and Classes of Knowledge

Knowledge

"high flyer"

Information

stock price: 81,60 €

Data

81,60

Characters

“1“, "6", “8" and “,”

interpretation/cross-Linking

context

syntax

character set
Types and Classes of Knowledge

Declarative Knowledge:
• knowing that

Procedural Knowledge:
• knowing how

Position, room
Lecture time
Traffic rules

Navigation
Lecture behavior
Traffic behavior

[Source: http://kartta.jkl.fi]
Types and Classes of Knowledge

Organizational Knowledge:
• consists of the critical intellectual assets within an organization

Individual Knowledge:
• knowledge of each person (employee)

Building cars….

Steering / using production facilities

[Picture Source: http://commons.wikimedia.org]
Types and Classes of Knowledge

Explicit Knowledge:
• codified knowledge that can be easily shared and understood

- Traffic rules
- Driving instructions
- ...

Implicit / Tacit Knowledge:
• knowledge that people carry in their minds and is, therefore, difficult to access

- Traffic customs
- Interpretations
- ...

Global / cultural differences

[Picture Source: http://commons.wikimedia.org]
SECI Model (Nonaka & Takeuchi, 1996)

- Socialization
- Externalization
- Combination
- Internationalization
Key questions

- Which knowledge does an organization have?
  - Outcome (e.g. how to build a car)
  - Process (e.g. which steps are necessary to build a car)
  - Competences (e.g. how to design an engine fulfilling certain constraints)

- Which knowledge is critical (e.g. how to combine fuel technologies)?

- Which knowledge needs to be shared?
  - Between people, groups, departments, organizations

- How to represent this knowledge?
  - Making knowledge and relations explicit
  - Providing opportunities for knowledge identification and creation (searching, inference mechanisms / data mining)
Knowledge Entities

- How to organize knowledge
  - By topic, by process, by problem etc
- Represented through
  - Individuals and competences
  - Documents of any format
- Defining relations and interdependencies
Knowledge Types (Holsapple & Joshi, 2007)

Additional attributes

- **Nature** (Dixon, 2000)
  - Frequent vs non-frequent
  - Routine vs non-routine

- **Complexity**
  - Expert … common

- **Importance**
  - Critical
  - Important
  - Routine
Some solutions

- Conceptual approaches
  - Natural language
  - Formal representation such as predicate logic
  - Data model
  - Semantic networks
  - (Concept) Graphs
  - Ontologies, taxonomies, folksonomies
  - Data models
  - Social tagging
  - ...

- Representation formats
  - XML
  - RDF
  - OWL
  - But also: doc, html, avi, gif, ...

- Remember the goals: identifying knowledge, creating new knowledge, relating (multi-lingual, multi-perspective) knowledge
Basic concepts

- **Ontology** (an IS perspective): An ontology defines the terms used to describe and represent an area of knowledge (W3C). Ontologies include computer-usable definitions of basic concepts in the domain and the relationships among them.
  - Specialization: Folksonomy as an aggregation of concepts created by stakeholders
- **Taxonomy**: A hierarchical organizational structure for the classification of concepts
- **Vocabulary**: Set of concepts and terms to describe a domain
Basic concepts in the global context

- **Ontology**
  - Relating multiple languages
  - Relating concepts
  - Creating multiple meaning of concepts (e.g. what does the concept “sauna” mean)

- **Taxonomy**
  - Limited for multi-perspective representations and complex relations
  - Easier to handle in multiple languages / cultures / organizations

- **Vocabulary**
  - Controlled vocabularies to create shared understanding of a domain
  - Rather simple to translate
Topic Maps

The scream painted by

Madonna painted by Edvard Munch

Norway located in OSLO

Knowledge layer

Information layer

Occurrence

Occurrence

Occurrence

Occurrence

Occurrence
Example: Protege
Ontology Example: RDF
Ontology Example: RDF
Ontology Use

- Creating models for domains
- Knowledge Management
  - Processes
  - Problems
  - Topics / Subjects
  - People
- Usage
  - Describe / relate
  - Query
  - Tag
  - Publish
  - Share
  - Create
  - ...
- Assessment
  - Usage analysis
  - Updating frequency
  - ...
Global Aspects

- Multilingual aspects
  - Translated ontology
  - Metamodel
  - Mappings (e.g. synonyms)
  - Conceptual differences

- Cultural aspects
  - Process and procedure mappings and comparisons
  - Conceptual differences

- Maintenance
  - How updates ontologies?
  - Who incorporates changes?

- Time
  - How long are concepts valid?
  - How to model those?
Multilingual Models (Montiel-Pensoda, 2008): Combined Meta-Model
Multilingual Models (Montiel-Pensoda, 2008): Mapping / Multilingual Vocabulary
Multilingual Models (Montiel-Pensoda, 2008): Mapping / Multilingual Vocabulary

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<th>Language</th>
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<tr>
<td>LexicalEntry-2</td>
<td>English</td>
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<tr>
<td>LexicalEntry-3</td>
<td>Spanish</td>
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</tbody>
</table>

Lexical Entry Relationships

- Synonyms: LexicalEntry-2
- Translations: LexicalEntry-3

Lexicalizations

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<tr>
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<th>Dialect</th>
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<th>G. Number</th>
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<tbody>
<tr>
<td>FAO</td>
<td>Feminini</td>
<td></td>
<td>English</td>
<td>Singular</td>
</tr>
<tr>
<td>Food and Agricultural Organization</td>
<td>Feminini</td>
<td></td>
<td>English</td>
<td>Singular</td>
</tr>
</tbody>
</table>
Knowledge Search: Ontology Browsing
Summary

Key steps
- Knowledge identification
- Knowledge representation
  - Multilingual, multi-perspective
  - Consider collaborative practices
- Knowledge prioritization and characterizing
- Knowledge organization

Match knowledge with business processes and KM activities

Next step (and lecture): Tool support
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