Wissensdatenbanken für den Help Desk

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1. Knowledge Management
2. Help desk specificities
3. Usability
4. Organizational Memory & Information Retrieal
5. Case-based Reasoning
6. Ontology-based Knowledge Management
7. Outlook: From Help Desk to Self Help

Motivation

...hey, you’ve heard that before!
1 Knowledge Management

Knowledge Management Process

[Probst et al. 1999]

Knowledge Goals: Determine Goals for KM Activities

Knowledge Identification: Create Overview about available Knowledge

Knowledge Structuring: Structuring and Integration of Knowledge

Knowledge Capturing: Acquisition of Knowledge

Knowledge Dissemination: Goal-oriented dissemination of Knowledge

Knowledge Usage: Productive Usage of Knowledge for the Company

Knowledge Preservation: Storage and Maintenance of Knowledge

Knowledge Assessment: Assessment of current Knowledge and compliance with goals

1 Knowledge Management

Tacit vs. explicit

- Tacit Knowledge
  - Personal, Created by Experience
  - Intuition, Mental Models, not documented

- Explicit Knowledge
  - Documented
  - Reconstructable

=> Only in back office!

=> Help desk!

Juggling tacit and explicit knowledge is key concern for KM and Help Desk

Side 5

Side 6
1 Introduction to Knowledge Management

Informal vs. formal knowledge

informal:
- E.g. ASCII-Text, Word-Document, PowerPoint-Presentation

semi-structured:
- Informal representation is enriched with attributes
- Examples: XML, SGML, HTML, email

structured:
- Structured according to fixed set of attributes
- Example: (Text-)Database

formal:
- Examples: Frames, Production Rules, relational Database, Program Code

Organizational Memory

- Knowledge Dissemination, Knowledge Preservation
- Usual Motivation:
  - Document writing is (relatively) easy.
  - Knowledge often available in documents (manual, internal memos etc.)

- Principle:
  - Instead of formalization of knowledge, administer Organizational Memories
    - Documents containing Knowledge in a human readable and understandable form.
    - Knowledge Maps (Skills etc.)
  - Structuring of Knowledge simplifies search and usage, e.g. by
    - Classification of Documents/Indexing, Case Based Reasoning
Help desk specificities

2 Help desk specificities

A Call

1. Routing (don't lose calls)
2. Response by help desk agent
   a. Identification of user / product type
   b. Recall problem history
   c. Identification of problem
   d. Suggestion for recovery from problem
   e. 2a. OR 3. OR 4.
3. Escalation to back office
   1. Identify expert in back office
   2. Relay to expert
4. Close connection

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General Context

General Data Processing
- Capture Data
- Maintain Data
- Process Data
- Integrate Data
- Search for Data
- Use Data

Organization
- less skilled people
- little training
- often short engagement
- separation between help desk and back office

Overall situation makes KM difficult!
2 Help desk specificities

Customer Requirements
- "one face to the customer"
- consistent response (customer history)
- satisficing response (problem tracking)
- high quality response
- proper escalation

Ill-suited help desk is expensive, because:
Customers call more often - you pay for each call!
You lose customers!

System Requirements
- fast response time
- access to relevant operative data
- good usability

Don't forget the feedback loop into the back office!
(frequent problems, wrong delegation, ...)
Balance efforts

Costs for coding knowledge  Costs for response to call

Depth of coding knowledge

Overall costs

Weighted sum

Depth of coding knowledge

Identifying problems & finding solutions

- Database queries  
  - Information retrieval  \{ Conventional
- Case-based reasoning  
  - Ontology-based KM  \{ Innovative
Why Usability?

• Well, it’s required by federal law

• Costs:
  – Unnecessary search on the help desk may be avoided.
  – Assume 50 agents handling 5000 calls per day, and 150 000 DM costs for each agent per year
  – Assume 1% time reduction by better usable software ->
    1.500 DM * 50 = 75.000 DM
    (more with total cost calculation)

• Better motivation of help-desk agents
Usability – what?  ISO 9241

Basic considerations
1. Suitability for the task
   • supports the user in the effective and efficient completion of the task
2. Self-descriptiveness (Selbsterklärungsfähigkeit)
3. Controllability (Steuerbarkeit)
   • user is able to maintain direction over the whole course of the interaction
4. Conformity with user expectations (Erwartungskonformität)
   • e.g. common hot keys
5. Error tolerance (Fehlerrobustheit)
6. Suitability for individualization (Individualisierbarkeit)
7. Suitability for learning (Lernunterstützung)
Scenario - Xerox

- Photocopier repairmen
- Working in distributed setting
- Sharing best practices over lunch
- Widely diverging practices (depending on climate, altitude, ...)

Tips and Tricks Database

- Everyone may contribute best practices
- 6% of people provide more than 90% of knowledge
- Simple manual check sorts out a few percent of apparently bad ideas
- „Best practices“ may be redundant
- Everyone may search the database with search engine

-> some 30,000 entries (summer 2000)
Evaluation

Evaluating Xerox France against the rest of the world

Result

- Service time about 10% decreased while rest of the world stayed on the same level
- Especially the difficult cases tend to be solved faster

Pitfalls

- Wrong entries
- Obsolete entries
- No mechanism/process for removing bad entries / maintenance of cases
5 Case-based Reasoning

Importance of Lessons Learned

"Human experts are not systems of rules, they are libraries of experiences."

Riesbeck & Schank 1989

Motivation & Process

Motivation:
• Knowledge Documents (e.g. Product Manual)

General CBR Process:
• RETRIEVE cases similar to current problem
• REUSE retrieved cases
• REVISION proposed solution (improve/correct)
• RETAIN new knowledge

Knowledge Containers
• Case base (collection)
• Vocabulary used to describe cases
• Similarity measure
• Adaptation model for revision

(Kolodner 1993),
(Lenz et al. 1998)
5 Case-based Reasoning

Thesaurus (Foskett 1980) - „A treasury“ of words

• Improve effectiveness of communication between people
• Constantly developing / Permanent revisioning

• Contents
  – Guidelines for form of terms (e.g. singular/plural)
  – Guidelines for relationships (BT, NT, RT)

• Administration:
  – Check consistency (dangling links?)
  – Maintain statistics (keep it as small as possible!!)
  – Acceptability of terms
  – Maintain records of term history

5 Case-based Reasoning

Textual Case-based Reasoning

“Know How Documents”

• FAQ Finder: Burke et al. 1997

Success Stories

• Automatic hotline for Siemens technicians
  (Lenz et al., PAKM 98, CEUR Aachen)
  (human hotline as backup)

• In-house configuration management of LHS AG (Lenz 1998)

• Aircraft maintenance at British Airways (Magaldi 1999)
5 Case-based Reasoning

FAQFINDER

Please Enter a natural language question to be answered.
(for example, "Who is Lin Peng?")
FAQfinder is not a search engine do not enter keywords

Is downshifting a good way to slow down my car?

Find Answer
Clear Question

Quick Match
Merge Related FAQs

(© Burke et al. 1997)
5 Case-based Reasoning

FAQFINDER

Question: Is downshifting a good way to slow down my car?
File: autos_consumer_FAQ

- They tell me I should downshift when braking to slow my car down. Is this really a good idea?
  It used to be a very good idea, back in the days of mediocre, fade prone drum brakes. In modern disc brake equipped cars, use of downshifting to slow the car is not really necessary, except in cases of long, steep downhill runs. Otherwise, modern disc brakes are more than adequate to stop a passenger car in all circumstances, and they are much cheaper to repair than clutch linings.

- What about DOT-5 brake fluids?
  This breaks down in to two parts. The DOT-5 specification...

- How often should I replace my brake fluid?
  Probably more often than you do. Traditional brake fluid...

- Can I rotate radials from side to side, or rotate them only on one side of my car?
  Car and tire manufacturers have differing views on this...

- How many snow tires should I buy, and if I buy 2, which end of the car should I put them on?
  In short, 4, and both ends. To explain, many drivers in...

(© Burke et al. 1997)
5 Case-based Reasoning

FAQ Finder Techniques

Matching User Query with QA pairs in FAQ file:

- Statistics model
  - Vector space model: term vectors with \( \text{tfidf} \) values
  - \( \text{tfidf} = n \times \log(M/m) \)
    (term frequency inverse document frequency)

- Semantic model
  - Word by word comparison of user question and FAQ questions
  - using marker passing in WordNet
  - punish for words that are not matched

- No syntactic model

5 Case-based Reasoning

Experience Factory (Basili et al. 1992)

[Diagram of Experience Factory]

Experience Engineer

Experience Base

Project Organization

- Planning
  1. Characterize
  2. Set goals
  3. Choose models
- Performing
  4. Perform project

Software knowledge derived from past projects

Feedback, Lessons learned, Deliverables

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© Althoff et al. 1998
5 Case-based Reasoning

Experience Factory

Case := Problem (characterization)/solution (artifact) pair

Query: Query at hand defines new case (problem without solution)

Retrieve: New case is used to find most similar case among the known (previous) cases

Reuse: New and retrieved case are combined to a proposed case including the suggested artifact

Revise: Suggested artifact is applied and evaluated

Retain: Useful experiences from applying the artifact are retained by adapting the case base and the conceptual knowledge

(© Althoff et al. 1998)

Conclusion on CBR

- Domain modeling important, but also expensive
- Commercially successful
- Claim

Calculate costs needed per case, number of cases and re-use

5 Case-based Reasoning

Quality

Calculate costs needed per case, number of cases and re-use

Investment
Plan

- The Shape: Motivation
- The Skeleton: Framework
- The Meat: Ontology-based Tools for KM
Factors of Production

- Capital
- Labour
- Land
- Knowledge

Effective and Efficient Use!

Knowledge
6 Ontology-based Knowledge Management

Eff-Use of Knowledge

Knowledge

Improve Knowledge Life Cycle

Knowledge
Subtasks of Knowledge Processes

- Use
- Create
- Import / Link
- Capture
- Organize
- Find
- Document Management
- E-Mail
- Search Machines

Don't forget the overall process!

Management of Knowledge Containers

Document Management
Search Machines
E-Mail
"Content" Management
Content Management
6 Ontology-based Knowledge Management

Management of Knowledge Contents

Document Management

E-Mail

Search Machines

Management of Knowledge Containers

containers may change - contents remain important!

6 Ontology-based Knowledge Management

Let's talk about facts

Use

Create

Import / Link

Find

Capture

Organize

Eff-use through knowledge network!
Ontology

+ Axioms
+ Other Relations
+ Taxonomy
+ Concepts

An ontology (in our sense) is ...

...a formal specification \(\Rightarrow\) executable

...of a shared conceptualization \(\Rightarrow\) group of people

...of some part of the world that is of interest \(\Rightarrow\) application

An Ontology-based Organizational Memory

Applications
Search Tools
Agents

Use
Create
Import / Link

Find
Analyze
Derive Views
Infer Knowledge
Summarize

Organize
Extract
Annotate

Structure Knowledge Base

Facts
Documents
Metadata are data about data:
- data schemata
- summarization of document content
- excerpts of document content

Ontology-based OM
(or „meat to the skeleton“)
6 Ontology-based Knowledge Management

Structure - Ontology Engineering

- Meta descr.
- Concepts
- Relations
- Axioms
- Composition
- Partition
- Reasoning
- Exception

New Ontology

6 Ontology-based Knowledge Management

Structure - OntoEdit

- Meta descr.
- Concepts
- Relations
- Axioms
- Composition
- Partition
- Reasoning
- Exception

New Ontology
6 Ontology-based Knowledge Management

Structure - Ontology Learning

- Discovering Algorithms
- OntoEdit
- Evaluation
- Proposes new conceptual structures
- Uses models
- Ontology
- Domain lexicon
- Uses references
- Text Processing Server
  - Selected text & preprocessing method
  - XML tagged text
  - Stemming
  - POS tagging
  - Chunk parsing
  - Lexical DB

- Text & Processing Management
  - (XML tagged) text & selected algorithms
  - Uses

- Ontology-based OM

- Facts
- Documents
- Create
6 Ontology-based Knowledge Management

Create - Using Templates

```xml
<project>
  <author>Jill Dole</author>
  <plandate>October 18th, 1999</plandate>
  <participants>
    <member>Jill Dole</member>
    <member>Hans-Peter Schnurr</member>
    <member>Steffen Staab</member>
  </participants>
  <Ganttchart>here goes the table</Ganttchart>
  <tasks>
    <task>Analysis of Nordic Life Business Processes</task>
    <task>Analysis of Nordic Life IT environment</task>
  </tasks>
</project>
```
Ontology-based OM

Create

Import / Link

Facts

Documents

6 Ontology-based Knowledge Management

Import / Link – XML & RDF(S)

 Ontology-bas ed Knowledge Management

Import / Link – XML & RDF(S)
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Ontology-based OM

Create

Import / Link

Capture

Gather

Annotate

Capture - Manual Annotation

Headline news alert - receive headline stories by email every time a press release is issued

Jun 20, 2000
M.A. Hanna, Geon To Unite As PolyOne Corporation

Jun 5, 2000
Geon and M.A. Hanna Announce Top Management Team to Lead Combined Polymer Services Company

May 11, 2000
M.A. Hanna Agrees to Sell Shapes Distribution Business to GE Plastics
6 Ontology-based Knowledge Management

Annotation Cycle

- Collect experiences
- Repackage
- Capture
- Organize
- Structure Knowledge Base

Ontology-based OM

- Create
- Import/Link
- Capture
- Gather
- Annotate

Facts
Documents
6 Ontology-based Knowledge Management

Organize - Process Support (...)

- Database
- Documents (Metadata)
- Terminology
- Axioms
- Task in Process

> Compile plan
> Collect participant agreement
> Deliver plan

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Organize - Process Support

Data capture by help desk agent

<employee>
<name>Rudi Studer</name>
<position>Professor</position>
<email>???????????</email>

....

</employee>
6 Ontology-based Knowledge Management

Ontology-based OM

Structure Knowledge Base

Find / Access

Organize

Capture

Create

Import / Link

Gather

Analyze

Derive Views

Infer Knowledge

Summarize

Capture

Gather

Annotate

Ontology-based OM

Find - Semantic Search
Decentral Contribution
Multiple Views
Derived Views
Strategic Questions

Experience Base
Rule Base
- positive Rules
- negative Rules
Success story

Help desk at Boeing

- Over 50000 concepts
- Long time support for repair
  (over 50 years for some products!)
- Daily active widespread usage

From Help Desk to Self Help
Internet Help-Desk

Success story:
• Microsoft Developers Network

Criteria:
• Target group
• Size of target group

Intelligent combination of multiple techniques!

http://wm2001.aifb.uni-karlsruhe.de

14-16 März 2001
Wm2001.aifb.uni-karlsruhe.de
Thank You!