How can we analyze the effectiveness of different knowledge transfer instruments in different situations?

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Overview

Agenda

• An Agent-Oriented Modeling Method to Analyze Knowledge Transfer Effectiveness

• Next week‘s: Final Exam (29.1. 14:00-16:00, HS i12)
  – Register via TUGonline!
  – „Einsichtnahme“: FR 20. Feb. 11:00-12:00, in my office
  – More at the end of this lecture
Overview

Previously:
- Knowledge Organization / Categorization
- Broad Knowledge Bases
- Knowledge Acquisition

- Knowledge Transfer
- Organizational Knowledge Repositories
- (Cognitive Psychology Theories)

Today: Knowledge based Analysis
The „Knowledge Aspect“

- **Knowledge** refers to
  - *Skills, heuristics and experiences* of actors

- **Distinctions**
  - Implicit vs. explicit
  - Pragmatic vs. scientific
  - Inter-subjective vs. objective

- **Knowledge Management** is concerned with the development of *[organizational|technological|cognitive|…]* tools for
  - the **identification, acquisition, generation, transfer, application and storage** of knowledge

**Knowledge Transfer**: Effective sharing of ideas, knowledge, or experience between units of a company or from a company to its customers. The knowledge can be either tangible or intangible. (MIT, Definitions for Inventing the Organization)
Research on Knowledge Transfer focuses on:

- **Theories** [14, 21]
  - Focus on the Nature of Knowledge Transfer
  - Examples
    - Knowledge Flow Theory
    - Knowledge Sharing Dilemma
    - Knowledge Reuse Situations

- **Modeling Languages** [10,11]
  - Identification, Visualization and Analysis of Knowledge Transfer Situations
  - Examples: B-KIDE, KODA, KMDL

- **Instruments** [3,6,17]
  - Improve and Facilitate Knowledge Transfer
  - Examples
    - Wikis
    - Experience Factory
    - Further Technologies
    - etc
The Problems

How can we assess the contribution of different KM instruments to Knowledge Transfer Effectiveness?

Why is Knowledge Transfer Effectiveness difficult to assess?
Questions Related to Knowledge Transfer Effectiveness

– Who depends on knowledge of others?
– How is knowledge transfer executed and facilitated?
– What is the purpose and structure of knowledge transfer instruments?
– Under which conditions can a knowledge transfer instrument fail?
– What are the effects of knowledge transfer failure?
Example: A Knowledge Transfer Instrument

- **Experience Factories (EF)** focus on the facilitation of Knowledge Transfer between Software Developers
- Experience Base
  - “Packages Experiences”
- Goals
  - Knowledge Transfer
  - Knowledge Reuse
Knowledge Transfer in Software Engineering

Knowledge Producer  Knowledge Intermediary  Knowledge Consumer

Software Developer(s)  Knowledge Repositories  Software Developer(s)

Knowledge about …  Knowledge Transfer  Knowledge about …

Shared Work Producers  Barriers  Shared Work Practitioners  Barriers
Barriers to Knowledge Transfer

– **Issues with the Experience Factory** [7]:
  - Lack of awareness, low information quality, low usage, expensive maintenance, context dependent

– **Issues with Knowledge Management in general** [8]:
  - Failure to align KM to org. goals, failure to connect KM to individuals, creation of repositories without defining the goals behind them, etc
Observations

- Knowledge transfer effectiveness is related to the participants of knowledge transfer, and their goals.
- **Knowledge transfer instruments** themselves serve a purpose, and thereby pursue goals as well.
- Therefore analyzing the goals of knowledge transfer participants is critical to KM, but difficult [9].
- However, goal-modeling and analysis has received little attention so far in this context.
The Knowledge Transfer Agent Method

- Proposes a three tiered approach to modeling Knowledge Transfer (KT) Participants and Instruments as Agents
- Based on the intentional modeling framework i* [13]
- Which enables
  - Reasoning and arguing about KT participants’ goals
  - Evaluating different degrees of KT effectiveness
  - Understanding how and why KT instruments fail or succeed
The i* Framework
[Yu 1995]

- An *agent oriented* early requirements modeling approach
  - Strategic Dependency Diagrams (Agents’ Externals)
  - Strategic Rationale Diagrams (Agents’ Internals)

- Beneficial to KM
  - Social actors
  - Implicit knowledge / ability analysis
  - Actor / Role Abstractions

- However, no specific notion of “knowledge”
  - *Extensions necessary*
The i* Framework

– Excerpt of the i* framework meta model

Based on [Den06]
i* Modeling Examples
i* Modeling Examples

i* Modeling Examples: Disaster Mgt.
Proposal

How can we analyze effectiveness of knowledge transfer instruments?
The 3 Levels of Analysis: Extending the i* Framework

**Level 1:**
Identification of Knowledge Dependencies

**Level 2:**
Identification of Supportive Means per Knowledge Dependency

**Level 3:**
Reconceptualizing Supportive Means as Agents

Extension to “standard” i*

Markus Strohmaier
KM Extensions to i* Modeling Notation
(based on [Str04])

Knowledge
*refers to tacit/implicit knowledge*

Knowledge Dependencies
*refers to situations, where an agent depends on the knowledge of others. It is assumed that the knowledge is provided by the dependee and is applied by the depender*

Communication Channels
*Refers to the way knowledge is transferred between two actors. The receiver is assumed to reliably receive the knowledge*

Knowledge Storage Objects
*refers to the explicated part of a corresponding knowledge domain. Knowledge is assumed to be publicly available*
KM Extensions to i* Modeling Notation
(based on [Str04])

Knowledge resides within Actors

Knowledge dependencies are modeled between actors

Knowledge dependencies are refined through means-ends links

Knowledge domains can be related to softgoals
Knowledge Transfer Agents

– A reconceptualization of Knowledge Transfer Instruments as Agents:

**Definition**: A knowledge transfer agent is an intentional human, organizational or technological actor that focuses on the facilitation of knowledge transfer between two or more other actors.
The Experience Factory Case

- Experience Factories (EF) focus on the facilitation of Knowledge Transfer between Software Developers

  Experience Consumer ↔ Experience Factory ↔ Experience Provider

- EF constitute a **Knowledge Transfer Agent**

<table>
<thead>
<tr>
<th>KTA Concept</th>
<th>Experience Factory Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentional Actor</td>
<td>„Separate Organizational Entity“</td>
</tr>
<tr>
<td>Goal</td>
<td>„Facilitate Knowledge Transfer“</td>
</tr>
<tr>
<td>Participants</td>
<td>„Two or more software developers“</td>
</tr>
</tbody>
</table>
The Experience Factory Case

Questions

− Who depends on knowledge of others?
− How is knowledge transfer executed and facilitated?
− What is the purpose and structure of the experience factory concept?
− Under which conditions can the Experience Factory concept fail?
− What are the effects of failure to providing experiences?

Questions that cannot be answered with traditional approaches
The Experience Factory Case
Level 1 Analysis

- Identification of Knowledge Dependencies

Who depends on the knowledge of others?
The Experience Factory: Level 2 Analysis

- Identification of Supportive Means per Knowledge Dependency

How is knowledge transfer executed and facilitated?

Experience consumer

Develop and maintain software efficiently

Plan project

Knowledge about past projects

Experience base

Knowledge about past projects

Level 1
“Knowledge Dependencies”

Level 2
“Supportive Means”

Experience provider

Develop and maintain software efficiently

Execute project

Help

Develop and maintain software efficiently

Help
What are the effects of failure to providing experiences?

Knowledge Transfer Agent

1st Label Propagation

2nd Label Propagation

nth Label Propagation

Initial Assessment Label

Figure 1
Label values from Lowest (minimum) to highest (maximum)

Satisfied  Weakly satisfied  Conflict  Undecided  Weakly denied  Denied

Highest value: Goal achievable  Lowest value: Goal not achievable
Under which conditions can the Experience Factory concept fail?
The KTA Method
Contributions

Enables Knowledge Analysts to

– Analyze knowledge transfer **effectiveness** in the light of (potentially conflicting) stakeholder goals
– Analyze **how** knowledge transfer instruments work, and why they can succeed or fail
– **Transform** KM problems into requirements engineering problems
Limitations

- Application so far only on a conceptual level
- Conclusions already known about the experience factory concept
- Validity of models
- Scalability
The KTA Method Applications

An Empirical Case Study
- In cooperation with Bell Canada / Kids Help Phone
- Applying the KTA Method to the Kids Help Phone Counseling Centre Toronto (~100 employees)
- Deduction of implications for the design of the Kids Help Phone‘s knowledge infrastructure,
  - incl. organizational and technological aspects
KT Agents are “Intentional actors that focus on the facilitation of knowledge transfer between two or more other actors”.

KT Agents depend on others in order to be successful.
Final Exam

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  – No aids allowed. All you need is a pen. Paper will be provided.
  – Please bring your Student ID.
There are two different ways of obtaining a grade for this course:

1. There will be one written exam at the end of each semester (fall/winter and summer). Examination dates for written exams will be announced via TUGonline. There is no limit on the number of students that can take the written exam.

2. In addition to written exams, oral exams will be offered at the beginning and at the middle of each semester. In case you want to take an oral exam, please contact me at least 4 weeks ahead of time to arrange for a date. Please note that there is limited availability for oral exams, and they are available on a request / first come first serve basis only.

   – To pass either exam (written/oral), you need to have in-depth knowledge about the entire course contents (all lectures including guest lectures, see slides) and the accompanying literature (see papers). Questions will include, but are not limited to, detailed questions on:

   – Criteria for Explicitness, Perspectives on KM, Problems and Principles of Categorization, Principles of Knowledge Organization, the Semiotic Triangle, Broad Knowledge Bases, Knowledge Acquisition Techniques, Knowledge Transfer, Knowledge Flow Theory, the Experience Factory, Discretionary Databases, Knowledge Reuse Situations, Public Good and Knowledge Sharing Dilemmas and corresponding solutions, Metadata, bpoKM and others.
Examination Questions

Examples
Any questions?

- See you next week!

Guest Lecture:
Dr. Mathias Lux, Klagenfurt University
“Multimedia & Semantic Metadata”