Knowledge Modelling and Management

Part A (2)

Yun-Heh Chen-Burger
http://www.aiai.ed.ac.uk/~jessicac/project/KMM
CommonKADS’ Knowledge Management Approach
A Two-Tiered Approach

Knowledge management level
(project management)

Knowledge management actions

Knowledge object level
(create knowledge models and system development)

KM experiences
(reports written at the project management level)

Organizational goals
Knowledge as a resource
Value chain

Project mgmt
Life cycle

Knowledge assets
Organizational roles
Business processes

Annotated business processes,
Knowledge assets and models,
Organisational roles,
Communication models,
Knowledge systems

KM AIM: right time, place, shape,
quality, lowest possible cost.

Source: p76 in [1]
Project Mgmt Life Cycle

- S/W engineering life cycle
  - Strategy phase, Information analysis, System Design, Program and Test, Operation Maintenance

- Rapid, Evolutionary Prototyping approach to Software System Development
  - Gather expert data, implement prototype, validate and get feedback, iterate.

- Spiral model of the software life cycle and CommonKADS activities
  - Review, Risk (Assessment), Plan, Monitor
  - Focuses on products and output, not activities
  - Configurable and adaptive manner driven by goals and risks
  - Quality assurance

Source: Chapter 15 of [1]
Activities in the Knowledge Management Level

Conceptualise
Identify knowledge assets, strength, weakness

Reflect
Identify improvements
Plan changes

Act
Implement changes
Monitor improvements

Starts
Main tasks: capture knowledge assets, strong and weak points:

1. Define scope of the project: bottlenecks, human resources, problems and opportunities;
2. Choose an appropriate level of details;
3. Beware of hidden/informal knowledge;
4. Don’t rely on single source when try to link knowledge – try network analysis, find out how people interact with each other, and how they get information;
5. Evaluate strong and weak points from different angles;
6. Try to quantify the value of knowledge, or at least qualify the value of knowledge, give justification of knowledge, e.g. “this knowledge is indispensable to the organisation”

Results – an overview of domain, inc. a list of knowledge items, bottlenecks, problems and opportunities, weakness and strength.
Guidelines for activity Reflect

**Main tasks:** identify problems/opportunity to be improved upon; set priorities; refine improvement plans.

1. Keep a distance from (S/W) methodologies used – so to prevent bias towards some knowledge system solutions;
2. Avoid choosing software engineering solutions hastily – seek and compare alternative solutions;
3. There are no silver bullets – organisations and knowledge are far more complex than using just one automated system;
4. Murphy’s law – careful in choosing improvements, easier solutions may not be most effective, need risk assessment;
5. Sleep on it – review the reflect process itself.

**Results** – to produce a list of detailed improvement plans with priorities.
Guidelines for activity Act

- **Main tasks:** Initiate agreed improvement plans (e.g. S/W development) and monitor their progress:
  1. Set measurable objectives when monitor progress and evaluate outcome;
  2. Assign responsibilities to stakeholders and give clear instructions - monitor frequently and carefully.

- **Results:** initiate improvement plans, monitor and manage progress.
Main components in Knowledge Object Level

- Organisation model: OM-2
- Agent Model: AM-1 (agent des)

agents

Participate in

have

Business processes

Require

Knowledge assets

- Organisation model: OM-2, OM-3
- Task model: TM-1 (fine task des)

- Organisational model: OM-1, OM-2, OM-4
- Task model: TM-2 (knowledge bottleneck analysis)
- Knowledge model: knowledge specification for KBS
Summary: Three knowledge management processes

1. The knowledge management cycle (process) supports the model of knowledge-value chain, Fig 4.2, p71 [1].
3. Compare CommonKADS’ model with the knowledge management process as described by Preece. For interested readers, see [2] for more details.

- For interested readers, chapter 15 in [1] provides more details on the project management process.
Organisational Context Modelling

CommonKADS’ Approach
What is a model?

- An abstract description and/or representation of a part of the world in concerned.
- Often has a perspective, application and goal-driven.
- Captures only important selective features of the part of domain to achieve the goals for having the model.
- Often used to describe a complex or abstract domain.
- Graphs or visualisation methods are often used.
- Often has complimentary textual information.
- Often used to explain, analyse and predict properties and/or behaviours of the world in concerned.
- May be provided in a formal description using specific languages.
Example Models

- Architecture model (3D objects and textual),
- Building plans or blue prints,
- Road map (graphical and textual),
- A set of co-related (mathematical) formulas,
- Business model,
- Organisational model,
- Communication model,
- Process model.
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Aspect: Permit Parking

New College, 1 Mound Place, EH1 2LU (further details)
What is modelling?

- The activities for producing an **abstract description** and/or **representation** of a part of the world in concerned.

- The **activities** of creating, refining and maintaining a model.

- Example modelling tasks:
  - Knowledge acquisition
  - Knowledge capture (e.g. informal)
  - Knowledge representation (e.g. formal)
  - Knowledge analysis
  - Consistency checking
  - Knowledge derivation
Why organisation modelling and context analysis?

- Critical success factor for a KM project is how well the relevant organizational issues have been dealt with.
- Many failures in automated systems are resulted from the lack of concern for social and organizational factors, and not from technical problems.
- Yet, many system development methodologies continue to focus on development problems from technical aspects and do not support appropriate analysis of organizational elements.

- Similar recognition is recorded in Requirement Engineering:
  
  “Requirements engineering is about the satisfaction of goals. But goals by themselves do not make a good starting point for requirements engineering. To see why, consider a project to develop a computer-controlled turnstile guarding the entrance to a zoo ... the real goal is to ensure the profitability of the zoo.” – Zave, Jackson [9a].
CommonKADS’ Organisational Context Analysis
CommonKADS approach
Organisational Context Analysis

- **Organisational Modelling: scoping and feasibility studies:**
  - Identifying **problem/opportunities** areas and potential solutions in an organisational context;
  - **Select focus areas and solutions** based on feasibility evaluations.

- **Task and Agent Modelling: impact of changes and improvement study for selected solutions:**
  - Identify relations between **tasks and agents**, the knowledge involved, possible improvements;
  - **Decide measure and task changes**; ensure organisational acceptance and integration of knowledge system solution.
Worksheets for Organisational Modelling

Organisation Model

OM-1
Scoping
problem, opportunities, org. context, knowledge solutions

OM-2
Organisational focus areas
structure, people, culture + power, resources, processes, knowledge

OM-3
Expand Task description in OM-2
process breakdown

OM-4
Expand Knowledge Asset, in OM-2
knowledge assets – used in task and knowledge model

OM-5
Feasibility Study
test solutions and propose actions
Problems and Opportunities
WS OM-1

- **Problems and opportunities** – give a short list of P&Os through interviews, brainstorm and visioning meetings, discussion with managers:

- **Organisational context**: key features of an organisational context – inc. organizational missions, goals, strategy; external factors; strategies; (knowledge and business) value chain and main value driver;

- **Solutions**: suggest possible solutions for problems and opportunities.
Knowledge Acquisition Approach

• **Identify Key Personnel:**
  • Talk to managers in key business areas, may also include selected customers;
  • Hold KA workshops use models as a way to extract knowledge
  • Identify stakeholders: knowledge providers, knowledge users, knowledge decision-makers;
  • Understand what is at stake for each person/role; identify potential conflicts.

• **Breakdown the organisation into smaller chunks:**
  • Horizontal Division - divide the organisation in different business areas;
  • Vertical Division - Examine the organisation using product and services generation lifecycle – using value-added chain, BPR oriented method.

• **Question:** how do you identify a knowledge decision-maker?
### Organisational Model OM-1

**Organisation Model: Problems and Opportunities Worksheet OM-1**  
Initial assessment on context and problem analysis  
Example Worksheet for Housing Application

| Problems and Opportunities | *Assessment of individual applications takes too much time, creating back log to be processed.*  
<table>
<thead>
<tr>
<th></th>
<th><em>There is not sufficient staff for handling urgent cases.</em></th>
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</table>
| Organizational Context    | *Mission: Enable people to take responsibility to find a proper home.*  
|                           | *External factors: National regulations.*  
|                           | *Strategy: Provide high quality housing at a reasonable price.* |
| Solutions                 | Solution 1: Develop an automated system to speed up application assessment.  
|                           | Solution 2: Set up a training program for application assessment. |

[Table taken from Chapter 10, p241.]
Variant Aspects WS OM-2

- For each identified problems/opportunities in OM-1, OM-2 describe important focus areas below:
  - Organisational structure;
  - Processes – aided using an UML activity diagram, or other business process models (used by OM-3);
  - People and their roles;
  - Resources – e.g. information systems, equipment and materials, technology/patents and rights;
  - Knowledge – exploited in processes (used by OM-4);
  - Culture and power – organisational practice; social and interpersonal skills; influence, relationships and networks.

- The process aspect is emphasised.
Example Organisational Structure to Use with OM-2
Organisational Structure

- Composition, hierarchy, structure of the company;
  - E.g. rigid hierarchical or flat management style
- Size of company;
- Who is responsible for which areas of business and tasks;
- Who is responsible/report to whom;
- Who to talk to when problems or queries arise;
- Functions of a company;
- Missions of a company.
THE IND BOARD

SDM TEAM
- Simon Hayes: Chief of Staff

HOME OFFICE BOARD
- Data: Home Office-wide strategy, leading cultural change by promoting values and diversity, building an effective organisation
- David Norgaard: Permanent Secretary
- Lin Homer: Director General, ND

HOME OFFICE VALUES
- We deliver for the public
- We are professional and innovative
- We work openly and collaboratively
- We treat everyone with respect

Non-Executive Directors
- Chris Luitse
- Tim Gbede

REGENCY DIRECTORS
- Regional Directors will manage a model of regional integrated working. They are collectively responsible to the Board, but will be line managed by individual Board members.
- Phil Taylor (Interim): Regional Director, Scotland
- Chris Hudson (Interim): Regional Director, North East, Yorkshire and the Humber

David Stephens: Resource Management
- Richard Westlake: Policy - Head of Profession
- Tom Dado: International Delivery
- Vacant: European Policy
- John Welsh: Arab and Apears Policy
- James Quintal: Managed Migration Strategy and Review
- Alec Thompson: Special Cenomwok Directorate
- Gary Raw: Research and Statistics
- Mark Lowe: HRM UK
- Kim Allin: Communications
- J.J. Buckingham: Information Management
- ND Review
- Jeremy Oppenheim: Director of Social Policy
- Jonathan Dufty: Social Policy
- Brian Murgatroyd: WESC Reform
- Tony Smith: Border Control
- Angela Perdew: Border Control
- Simon: Border Control
- Peter Graham: Special Projects
- Wendy James: Performance Management and Assurance Unit
- Dave Robins: Enforcement and Removals
- Claire Fothergill: Enforcement and Removals
- Michael Campbell: Criminal Cases
- Chris Pock: Asylum Case Load
- Keith Liddiard: Asylum Appeals
- Fredic Shearer: Asylum Model
- Paul Dunlop: Asylum Resources
- Bob Fyle: Asylum Case Load
- Keith Liddiard: Asylum Appeals
- Fredric Shearer: Asylum Model
- Paul Dunlop: Asylum Resources
- Tony Mitter: Network Operations and Performance
- Glynn Williams: Business Development
- Emma Doherty: Corporate Services
- Fiona Screven: Strategic Programme Director
- Tony Alder: Finance and Planning
- Robert Scantlebury: Commercial and Programme
- Services Development
- Fiona Webster: Corporate Services
- Transformation Programme
- Chris Fellow: Performance and Management
- Consultancy Services
- Tim Barber: Corporate Services Group
- Ror We Cob: Human Resources
- Jonathan Piets: IMD College
- Andrew Pinn: Security and Anti-Corruption
- Unit
- Gillian Smith: Workforce Planning and Other
- Projects
- Marie Kondoglu: Enablers Management Support
- Unit
- Stephen Kondoglu (acting): Human Rights
Organisational structure

CEO/Chairman

The CEO is responsible for the overall strategic direction and management of EPA, and is supported by the Executive, the Office of the Chairman and the EPA Solicitor, who all report to directly to the CEO. The statutory role of Chairman is responsible for administering the relevant provisions of the Environment Protection Act 1970 and is advised by the members of the Environment Protection Board (Advisory).

Sustainable Development Directorate

Sustainable Development works with partners, including business, other government organisations and the broader Victorian community, to facilitate progress towards developing a sustainable Victorian environment.

Water and National Program Directorate

Water and National Program includes EPA’s water programs including stormwater and ballast water policy. The Directorate is responsible for EPA agreements, partnerships and relations with national, interstate and local governments.

Environmental Science Directorate

Environmental Science provides strategic direction and corporate management of the environmental science functions of EPA including air quality studies, fresh and marine water studies and environmental chemistry. In addition, the role provides overall direction to the air quality and environmental audit programs.

Regional Services Directorate

Another Example Organisational Structure (Unilever)

- General Director
  - Technical Director
    - Logistics Management
    - Technical Dept. Management
  - Personnel Director
  - Marketing & Sales Director
  - Finance Director
    - Coldstore & Warehouse Management
    - Information & IT Management
  - Development Dept. Management
    - Ice-cream development
    - Quality assurance
    - Packaging design
  - Manufacturing management

Traditional organisation diagram
**Analyse an Organisational Chart**

- What is the name of the (sub-)organisation? Is it clearly shown in the structure?
- Is the organisational structure clear and logical?
- Is it clear who is responsible for what role?
- Is it clear what is involved in each role, what are the people’s duties?
- Is it clear how people interact with each other?
- Are the actual people (at least higher level posts) involved in the organisations clearly identified?
- What is the knowledge based network between personnel?
- What are the informal influence links? (see case study in slides 3 later on)
Example Visual Process Model to Use with OM-2
Example UML Activity Diagram for Submitting a Tender for an Elevator

Business and process areas, roles, activities, objects and interactions between them.
UML Activity Diagram Notations

- Initial activity
- Final activity
- Activity State
- Object (:class-name)
- Control flow (directional arcs)
- Object flow (dashed directional arcs)
- Swim Lanes: divide business/process areas
- Decision (diamond)
- Concurrency (splitting and joining control threads)
- Signals: sending and receiving signals

Sec. 14.2, p348, p438 [1].
Good naming style for a process

- Start with a **verb** that indicates the action to be carried out,
- Followed by a **noun (phrase)** that indicates the main type of data that the process operates upon
  - This data type is often included in a class in a class diagram, an entity in a relational diagram, or a class in an ontology,
  - data types may be highlighted using **all capital letters**
- Keep it **meaningful**,
- Keep it **short**,
- Keep it **unique** within the model.

- Process name may also be used together with
  - an unique (shorter) ID, a position ID in the process hierarchy, reference ID (when reuse of processes) to provide a more comprehensive ID schema
  - see IDEF3 process description schema for more info on this [5].
Process Breakdown WS OM-3

- Provides more details for each process
- For each process in OM-2, gives:
  - Task ID;
  - Task Name (as in the process model and OM-2);
  - Agent (performed by person/software);
  - Position – where is this task carried out in the organisational structure;
  - Knowledge asset used;
  - Is it knowledge intensive? (true/false)
  - Determine the significance of the process:
    » 1-5 points (5 = most significant)
    » in terms of its frequency, cost (vs. efforts required), resources used and mission criticality.
Based on Knowledge identified in OM-2, specify them in more detail and identify where they may be improved.

This is to be used for the task and knowledge models later on:

- Name (of knowledge asset),
- Possessed by which agent – relate to OM-3,
- Used in which task – relate to OM-3,
- Is it provided in the right form (yes/no),
- Is it provided in the right place (yes/no),
- Is it provided at the right time (yes/no),
- Is it provided with the right quality (yes/no).
Feasibility Study
Organisational Modelling: OM-5

• **Purpose:** to select feasible solutions
• **Activities** focuses on knowledge.
• **Main components** include:
  – Organisational structure
  – Processes
  – Staff
  – Resources
• **These components are filled in the as-is and to-be models for comparison**
  – assess the value, feasibility and acceptance of knowledge-oriented solutions.

**For each potential solution,** 3 types of feasibility tests are carried out, w.r.t. business, technical and project aspects.
Business Feasibility testing:

1. What are the expected *business benefits* for the organisation?
   - inc. tangible and intangible, short and long-short term business benefits
2. How large is the expected *added value*?
3. What are the expected *costs* for solution? (*Cost-effectiveness analysis*)
4. How does it compare with alternative solutions?
5. Are organizational changes required?
6. What are the economic and business risks?
Given a Business Process Model for Submitting a Tender for an Elevator

Business and process areas, roles, activities, objects and interactions between them.
Analyse Knowledge Intensivity and Cost-effectiveness

**Customer**
- :customer Information

**Sales Department**
- Process CUSTOMER INFORMATION
- Calculate Cost
- Write TENDER
- **Knowledge Intensive**
  - Starting point of a process
  - ending point of a process
  - Activity
  - Class/Object

**Design Department**
- Decide Design style
- :elevator design

5% time **
20% time
25% time **
50% time **
Technical feasibility testing:

1. How complex is the solution, is it readily available?
2. Any critical aspects required?
   - Timing, quality, resources?
   - How to achieve goals or go about limitations?
3. Are success measures clear?
   - What are the tests for validity, quality and satisfactory performance?
4. How complex are the interactions with users?
5. How complex are the interactions with other software?
6. Any technological risk?
   - Limitations, fading out of technologies, etc…
Feasibility Decision Document
WS OM-5

- **Project feasibility testing**: based on OM-3 and OM-4, given each problem and solution pair:

1. Are there adequate **commitments** from actors, stakeholders?
2. Are the needed **resources** available? (time, budget, equipments, staffing)
3. Are **knowledge** and required **competence** available? (If lacking, can a knowledge system provide similar competence?)
4. Are the **expectations** realistic?
5. Are project **organization** and (internal/external) **communication** adequate?
6. Any other (foreseeable) project risks? E.g. change of personnel, organisational strategies, technical or business environment?
Proposed actions:

1. **Focus:**
   - What is the recommended focus in the identified problem-opportunity area?

2. Identify **Target solution.**

3. Identify expected **results, costs and benefits.**

4. What are the **project actions?**

5. **Risks:** if internal/external conditions are changed, when does one need to re-consider and alter the project?
Learning Objectives and Exercises

- Gain an overview of the different types of knowledge modelling methods and how they may be used together;
- Understand the relationships between the different models/worksheets: e.g. what worksheets are used to produce worksheets of next stages? What models are used to support each worksheet?
- Understand what is the overall process of the CommonKADS Organisational Context Analysis, i.e. one that involves all worksheets?
- Able to select the appropriate modelling method(s) given a problem; can construct correct models given a domain; can carry out reasoning on models based on lightweight logical methods;
- Can independently review relevant literature and extend one's knowledge.
Main References

http://www.amazon.co.uk/exec/obidos/ASIN/0262193000/qid=1091803195/sr=1-1/ref=sr_1_2_1/026-4023131-7023627.

[2] Alun Preece, Alan Flett, Derek Sleeman, David Curry, Nigel Meany and Phil Perry. Better knowledge management through knowledge engineering:


[source: http://www.aiai.ed.ac.uk/~jessicac/project/KMM]
Other references (not examable)
