Knowledge Management Gains Momentum

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<th>May 1997</th>
<th>April 1998</th>
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<td>72%</td>
<td>19%</td>
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- Knowledge management initiatives in place
- Don't have knowledge management initiatives in place

Base: 500 IT professionals at large U.S. companies

Source: The Delphi Group Inc., Boston
Outline: SE Knowledge Management

- Opportunity Areas
- Some USC-CSE Experiences
- Strategic Issues
Knowledge 'czars' fall from grace

By Barb Cole-Gomolski

Computerworld, 01/04/99

Two years ago, a lot of companies thought that appointing a knowledge management czar - a chief knowledge officer - was the best way to harness corporate know-how.

In reality, the favored strategy has been to take a much more grassroots approach, in which a team of knowledge management experts works closely with - or even is part of - the business units.

CKOs were supposed to straddle business and information technology. Their mandate was to convince workers that it's good to share information and work with IT to build applications to support such sharing. But companies found that putting more control of knowledge management in the hands of end users made it an easier sell.

According to a report from The Delphi Group Inc., a research firm in Boston, about half the companies in the U.S. have some kind of knowledge management effort under way.

Delphi recently completed a study of 25 companies that have knowledge management groups in place and found that the bulk of knowledge sharing happens within business units. "So having a CKO sends out the wrong message," said Delphi President Tom Koulopoulos.

Instead, Koulopoulos said, he sees many companies creating a team that helps each business unit understand the benefits of sharing knowledge. Spreading the responsibility for knowledge management also combats the cultural barriers involved in getting people to share information, he said.

"It's too difficult to start [knowledge management] at the enterprise level," said Jan Scites, vice president for Internet implementation strategy at AT&T Corp. in Bedminster, N.J. The company began its knowledge management efforts in its customer care department and has since rolled out similar applications. "I don't think we'll ever have a CKO," Scites said.

Similarly, The Mutual Group, an insurance holding company in Waterloo, Ontario, has a vice president who oversees the knowledge management team, two knowledge architects and more than 20 team members from IT and the business units.

This organization works because "there is a tendency for the [knowledge management] effort to lose momentum when we get into the trenches," said Betsy Lewis-Chan (betsy.lewis-chan@themutualgroup.com), a Mutual Group knowledge architect.

It's not so much that people don't want to share information, though there is some of that, she said. The resistance comes from the fact that "people are already so busy," she said. Sharing knowledge may mean changing the way they work or adding an extra step to the process to enter some data into a corporate repository or publish it to a Web site.

Because workers are already strapped for time, the knowledge management team at Mutual Group sells them on the idea that the knowledge management effort will save them time. "It may mean that they can spend less time looking for information or read fewer E-mails, but the benefit is efficiency," Lewis-Chan said.

Participants in the Delphi study also said that, for many companies, knowledge management positions were seen as an interim step designed to bring knowledge management to critical mass - essentially a statement of corporate priorities.

Sharon Oriel, director of Intellectual asset management at Dow Chemical Co. in Midland, Mich., said that over time, knowledge management will become part of the corporate culture. "It's kind of like safety was years ago," Oriel said. "It used to be that you had a safety person in every department, but now safety is expected and is a condition of employment."
Opportunity Areas

- Continuing education; distance learning
- SE knowledge repositories
  - Increasingly Web / Intranet-based
  - Share best practices, reusable assets, skill sources, risk sources, and strategies
- Project knowledge capture tools
  - Design rationale, legacy design recovery
- Project decision advisor tools
  - SE Decision Assistant (SEDA)
- Domain knowledge-based application generators

Some USC-CSE Experiences: Continuing Education and Distance Learning

- MS-CS / Software Engineering in place
  - Annual rate: 20 students; growing
  - Core curriculum (4 courses)
    - SE principles and practice (2 semesters)
    - Software architecture
    - Software management and economics
  - Selected options (3 courses)
    - UI design, pP, Languages, Operating systems, Networks, Real-time systems, Computer system architecture
  - General options (2 courses)
- Considering Certificate Program
  - Core curriculum and 1-2 options
  - Lower entry requirements
Continuing Education Issues

- Scaling up
  - Homework and exams vs. projects
  - Instructors, teaching assistants
  - Frequency of offerings
  - Prerequisite makeups
- Distance learning

Distance Learning Issues

- LA-area interactive TV works well
  - Regular students from Aerospace, Boeing, JPL,
    Lockheed Martin, Raytheon, TRW, USAF/SMC,
    Xerox, small companies
- USC and NTU distance learning works well
  for homework and exam courses
  - Reasonable project-course success with
    Qualcomm/San Diego, Raytheon/Tucson
  - Project course scaleup formidable
    - Fallbacks: project kibitzing; project artifacts review
Knowledge Repository Experience: MBASE

- MBASE Laboratory
- MBASE Conceptual Framework
- MBASE Detailed Guidelines
- All guidelines and project materials on Web
  - Archived for analysis and improvement
  - http://sunset.usc.edu/classes

MBASE Laboratory

- 15 software engineering projects/year
  - 5-person USC Digital Library applications
- Rapidly developing successful applications
  - Multimedia, virtual assistants, data acquisition
- Integrating models and tools
  - DARPA-EDCS architecture and WinWin tools
  - Rational Rose, Unified Modeling Language
- Rapidly improving artifact integration
  - 1996 integrated specs, plans: 160 pages
  - 1997 integrated specs, plans: 110 pages
- Results transitioning to early adopters
- Ultimate goal: Model-integrated SW Engr. agents
MBASE Conceptual Framework

**Elements of Critical Front End Milestones**
(Risk-driven level of detail for each element)

<table>
<thead>
<tr>
<th>Milestone Element</th>
<th>Life Cycle Objectives (LCD)</th>
<th>Life Cycle Architecture (LCA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of Operational Concept</td>
<td>- Top-level system objectives and scope of development; environment parameters and assumptions; operational concepts; processes; standard references</td>
<td>- Elaboration of system objectives and scope of development; elaboration of operational concept by increment; elaboration of system architecture by increment</td>
</tr>
<tr>
<td>System Prototype(s)</td>
<td>- Exercise key usage scenarios</td>
<td>- Exercise key usage scenarios</td>
</tr>
<tr>
<td>Definition of System Requirements</td>
<td>- Top-level system requirements; interface, user attributes, and interactions; growth vectors and priorities; prototypes; stakeholders' influence on architecture; choices of architecture options; partitioning and integration of architecture options.</td>
<td>- Elaboration of system requirements; elaboration of system architecture by increment; choices of architecture options; partitioning and integration of architecture options.</td>
</tr>
<tr>
<td>Definition of System and Software Architecture</td>
<td>- Identification of tier-based architecture; physical and logical elements and relationships; choices of COTS and custom software elements; identification of tier-based architecture options.</td>
<td>- Identification of tier-based architecture; physical and logical elements and relationships; choices of COTS and custom software elements; identification of tier-based architecture options.</td>
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<tr>
<td>Definition of Life-Cycle Plan</td>
<td>- Identification of life-cycle stakeholders; analysis, measurement, prototyping, simulation, etc.</td>
<td>- Elaboration of initial operational capability (IOC)</td>
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</table>
Detailed Guidelines

• LCO/LCA Deliverables
  - Operational Concept Description (18 pp.)
  - System and Software Requirements Description (15 pp.)
  - System and Software Architecture Description (16 pp.)
  - Life Cycle Plan (19 pp.)
  - Feasibility Rationale Description (13 pp.)
  - Appendices (12 pp.)

• IOC Deliverables
  - Detailed Construction Plan
  - Iteration Plans, Assessments
  - Test Plans, Procedures, Results
  - Inspection Plans, Reports
  - Detailed Design, Code, Release Notes
  - Transition Plan and Results
  - User's Manual, Training

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Operational Concept
Description (OCD)
1. Introduction

1.1 Purpose of the Operational Concept Description

* This paragraph shall summarize the purpose and contents of this document and identify the project stakeholders
* The specific system whose operational concept is described here is: [name-of-system]
* Its operational stakeholders are: [Describe the stakeholder roles and organizations]
* Use specific names and roles
* Avoid generic introductions as much as possible: for instance, you can show how your particular Operational Concept Description meets the completion criteria for the given phase

Common Pitfalls:
* Simply repeating the purpose of the document from the guidelines

1.2 References

* Provide complete citations to all documents, meetings and external tools referenced or used in the preparation of this document
Outline

1. Introduction
   1.1 Purpose of the Operational Concept Description
   1.2 References

2. Domain Description
   2.1 Organization Background
   2.2 Organization Goals
   2.3 Description of Current System
      2.3.1 Overview of Current System
      2.3.2 Current System Shortfalls
   2.4 Entity Model
   2.5 Organization Activity Model
   2.6 Interaction Matrix

3. System Analysis
   3.1 Statement of Purpose
      3.1.1 Overview of Proposed System
      3.1.2 How the Proposed System Addresses the Current Shortfalls
   3.2 Project Goals
   3.3 System Responsibilities
   3.4 Quality Goals
   3.5 Changes Considered but Not Included

4. Concept of Operation for the Proposed System
   4.1 Operational Overview
      4.1.1 Operational Stakeholders
      4.1.2 Organizational Relationships
      4.1.3 Operational Policies and Constraints
   4.2 Operational Impacts
   4.3 Organizational Impacts

5. Operational Scenarios

6. Analysis Results
   6.1 Summary of advantages
   6.2 Summary of disadvantages/limitations
   6.3. Alternatives and tradeoffs considered

7. Common Definition Language for Domain Description

8. Appendix
Operational Concept Description (OCD)

Purpose
- Describe the overall context of the system to be developed, why it's being built, what exists now, and where the project is starting from
- Describe to the stakeholders of the system to be developed ("developed" is meant to include such terms as "enhanced", "updated", "re-engineered", "automated"), how the system will work in practice once it is deployed
- Enable the operational stakeholders to evolve knowledgeably from their current operational concept to the new operational concept, and to collaboratively adapt the operational concept as developments arise, to make clear the value of developing the new system

Completion Criteria
Below are the completion criteria for the Operational Concept Description for the two phases:
- Life Cycle Objectives (Inception Phase)
- Life Cycle Architecture (Elaboration Phase)

Life Cycle Objectives (LCO)
- Top-level system objectives and scope
  - Organization Context and Goals
  - Current system overview and shortfalls
  - System Boundary: project focus
  - System Environment
  - Evolution Considerations
- Operational concept
  - Operational stakeholders identified
  - Organizational responsibilities determined and coordinated with clients
  - Main operational scenarios coordinated with clients
  - System Concept
- Shared vision and context for stakeholders
  - Common vision and goals for system and its evolution
  - Common language and understanding of system constraints
  - Operational concept satisfiable by at least one system/software architecture
  - Capabilities rationalized by business case analysis in Feasibility Rationale

Life Cycle Architecture (LCA)
- Elaboration of system objectives and scope by system increment
- Elaboration of operational concept by system increment
- All stakeholder-critical nominal and off-nominal scenarios coordinated with clients
- Operational concept satisfiable by the architecture in the SSAD
- Tracing between Project Goals, and Organization Goals and Activities
- Tracing between System Responsibilities and Project Goals and Organization Activities

Intended Audience
- Customer for Domain Description
- Domain Expert for initial System Analysis
- Use language and define CDL appropriate to intended audience

Participants
- Same stakeholders as WinWin negotiation
- Establish a concept of operation that all stakeholders agree upon
General SEDA Concept

- Develop normative software product, process, property, and success models
  - MBASE; initially in digital library domain
- Develop agents to detect, suggest potential model clashes and violations
- Experimentally apply, refine, and generalize agents

Software Status & Plans → SEDA

Model-Based Decision Aids → Decision

Suggestions → Software Decisionmakers

Revised Plans

Software Evolution

Previous SEDA Examples

- Static analyzers
  - specifications, code
  - consistency, traceability, standards compliance
  - constraint satisfaction (set-use analysis)
- Defect-prone module detection
  - complexity; design/code defect correlations
- Test case coverage advisors
- GUI design critics
### USC-CSE SEDA Initiatives

- **Model Clash aide**
  - Process Model Decision Advisor
- **Risk Advisors**
  - Management, technical, COTS integration
- **Specification Critics**
  - Style clashes: Architects' Automated Assistant
- **Cost/Quality conflict detection and advice**
  - QARCC, S-COST

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### Process Model Decision Advisor

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<tr>
<th>Objectives, Constraints</th>
<th>Alternatives</th>
<th>Model Advice</th>
<th>Example</th>
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SE Knowledge Management: Strategic Issues

- Relative costs and benefits among opportunity areas
  - Relative technology maturity
- General vs. Site-specific knowledge management
- What to outsource? From where?
- Knowledge maintenance: Where? How much is enough?
- Knowledge management evaluation and improvement