Project Management
Knowledge Management, and
Case Based Reasoning

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Agenda

• Project Management
• Knowledge Management
• Integrating PM, and KM
• Case Based Reasoning
• Role of CBR
• Case Studies
• Conclusions
Project Management

Project

Planning  Organizing  Managing

Limited by time and funding

Knowledge Management

Knowledge

• Formalized knowledge (laws, patents etc.), and intangible know-how
• Ways to communicate, analyze situations, develop new solutions to problems and develop
• Culture, custom, and values. Relationships with suppliers and customers.

Management

• Ways in which an organization’s knowledge assets are handled, including how knowledge is
  • gathered, stored, transmitted, applied, updated, or generated
Defining KM

It involves the acquisition, storage, retrieval, application, generation, and review of the knowledge assets of an organization in a controlled way.

What is Knowledge?

- What is 9?
- We understand it as a number, but what is it representing?
- Only the context will tell us.
- House No=9 will be much more understandable than simply 9.
- What would be knowledge?
- Some thing that would help us in finding a house.

Data

9

Information

H. No=9

Knowledge

Even No. On Right
Odd No. On Left

Understanding

Context dependence

Data

Information

Knowledge

Understanding patterns

Understanding relations

Context dependence
It is harder to justify expenses in areas of an intangible nature such as knowledge sharing, best practices, and knowledge utilization, even though the return on investment in these areas is often much higher.

Organizations need to have a better understanding of knowledge management processes and practices.

ROI is LOW here.
Managing Knowledge in Projects

PMBOK identifies 9 areas of Knowledge

Project integration management.
- Deals with project knowledge concerning choices of where to concentrate resources during the project.
- It includes the knowledge of processes and activities to identify, define, combine, coordinate, and integrate the various activities.

Project Scope management.
- Describes the processes involved in ascertaining the work required to complete the project successfully.
- It includes planning, scope definition, and work breakdown structure. Knowledge boundaries are defined in clear terms.

Project Time management.
- Describes the processes concerning timely completion of the project.
- It includes activity definition, activity sequencing, and activity resource estimation.

Project Cost management.
- Concerns with the process to ensure that the project is completed within the approved budget.
- It includes planning, estimating, budgeting, and controlling costs.

Project Human resource management.

Project Quality management.

Project Communication management.

Project Procurement management.

Project Risk management.

Knowledge is created and flows through all nine areas of project management and in all phases of the project life cycle.
Project managers and staff constantly seek knowledge to address various problems: resources, deadlines, deliverables, goals/objectives, team, planning, communications, and conflicts. The emphasis for project management was on developing tools and techniques such as networks and earned value analysis.

The project management focus has shifted toward managing the knowledge resources in projects including capturing or transferring implicit knowledge. Project teams in organizations need to learn to manage more effectively the knowledge that they acquire and accumulate from their projects so that other projects in organizations can benefit.

Dealing with “gray” situations with greater confidence
Encouraging greater collaboration among employees
Identifying best practices
Improving the capacity for product and processing innovation
Increasing the competencies of existing employees
Minimizing the negative impacts of employee turnover
Responding cost effectively to rapidly changing environments
KM in PM: In Addition

- **Fast Knowledge Access:**
  - Provides faster access to knowledge and/or information to project members, leading to new ideas and creativity.
  - In virtual project management KM becomes essential as it helps in sharing the same knowledge and information easily at all locations. This leads to less confusion among team members at distributed locations.

- **Enhanced Productivity**
  - Helps in improving productivity and providing better customer relations and satisfaction.

- **Improved decision-making**
  - Decision making process improves in terms of quality and time if knowledge is shared efficiently.

- **Quality Training**
  - Helps in improving the quality of training and reducing the training time for trainees in projects.

- **Improved Collaboration and Coordination**
  - as teams look at the same knowledge base.
  - helps in creating a collaborative environment.

- **Collective Wisdom and Experience**
  - Reflects intellectual capital through the collective wisdom and experience of human capital assets.
  - This helps in improving performance in the project and the quality of project work.

- **Risk Identification**
  - Identifies risk by addressing the various risks existing in a project and its related tasks.

- **Risk Mitigation**
  - It improves the flow of knowledge in all directions, integrating processes.

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**KM Cycle**

- Acquire knowledge → Analyze knowledge
- Use knowledge ← Preserve knowledge
Our Focus:

How to use past knowledge?

- Looking for a method that solves new problems using old problems
- How?
  - By applying the old problem directly, or
  - By Adapting the old problem before applying

Case Based Reasoning

<table>
<thead>
<tr>
<th>Uses</th>
<th>Retrives, and</th>
<th>Reuses it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifies</td>
<td>Revises, and</td>
<td>adapts</td>
</tr>
<tr>
<td>Preserves</td>
<td>Retains,</td>
<td>Reviews,</td>
</tr>
<tr>
<td></td>
<td>Refines</td>
<td></td>
</tr>
</tbody>
</table>

R-Six Model
Basic Assumptions

**Regular Place**
A case-based reasoner assumes the world is regular; it cannot work in an irregular, random, or chaotic environment.

**Repeat Situations**
A case-based reasoner expects situations to repeat. If they do not, there is no point in remembering them.

**Similarities**
Similar problems have similar solutions. If similar problems have very different solutions, a case-based reasoner may give inaccurate advice.

### CBR

- Search Problem
- Store
  - Description – Solution Pair
- Present a new problem
- Retrieve Similar cases
- Adapt the solution and apply

![Diagram](image)
“Last year our customer satisfaction data identified two areas for improvement in the customer care arena,”

“Customers were finding it difficult to contact us and, once contact was made, the experience was inconsistent. In order to address this we put together a strategy that focused on both access and service.”

By Helen Pickup, Director of Microsoft’s Customer Care Centre
Glasgow, Scotland
CBR Strategy Implemented

- Within **nine months** following the implementation of a CBR knowledge management system, Microsoft reported:
  - a **10 percent improvement** in overall customer satisfaction rating;
  - a **28 percent increase** in "first-time-fix" success rate;
  - a **13 percent increase** in the "agent is informed" customer survey score;
  - a **significant reduction in the time** required to train new agents, as well as to elevate existing agent skill sets to the expert level;
  - a **much wider range of customer care** issues handled by individual agents, who also delivered more consistent responses, regardless of the problem.

CBR: Cases

Cases are records of experiences that contain knowledge, which can be both explicit and tacit.

- a description
- the respective outcome or solution
Cases: Storage and Indexing

- An index is a computational data structure that can be held in memory and searched very quickly.
- This means the computer does not have to search each record stored on disk.

Indexing

- Indexed information that is used for retrieval (this will tend to be explicit knowledge), and
- Unindexed information that may provide tacit and contextual knowledge of value to a user but is not used directly in retrieval.
Total Recall @ National Semiconductor

• The company:
  – Established in 1959
  – $2.1 billion in fiscal 2000
  – About 10,500 employees worldwide
  – Fabricating units located in Arlington, Texas; South Portland, Maine; and Greenock, Scotland.
  – Test and assembly sites in Malacca, Malaysia, and Singapore

• The Problem:
  – National ships hundreds of millions of semiconductor components to thousands of customers around the world.
  – Customers returned approximately 4,000 individual parts where verified failures were analyzed.
  – This corresponds to customer report defect rates of approximately **thirty parts per million.**
Expected Benefits

• Being able to depend on deliveries with
  – “zero defects”
• permits manufacturers to achieve
  – lower costs in handling and testing of parts, and helps
  – “just in time” manufacturing schemes.
• The result is a
  – higher overall value
• that provides a competitive advantage to National’s customers

Software Support

• National previously adopted the Eight Discipline (8D) problem-solving methodology, originally defined by Ford Motor Company,

• The software in place had the Failure Analysis (FA) module of
  – Aquaris (Advanced Quality and Reliability Information System)
Problems

• Many users perceived the performance of the system to be **slow**. They would accumulate information over a period of days and only **update the database on a weekly basis**.
• As a result, data was not in synch with the work being done, and status information passed on to customers was **not necessarily current**.

Problems

• The key concern when a failure occurred was whether or not the failure was indicative of a manufacturing process that might have moved out of control affecting continuing reliability of the parts negatively.
• To address this concern, and maintain confidence in products received from National,
  – customers demand a rapid and complete failure analysis.
  – customers also look for corrective actions to be taken to ensure the root cause of any problem has been identified, and
  – that steps have been taken to guarantee it will not recur
Major Issues

Failure Analysis

Speed

Application Upgrades

• National decided a major software upgrade to have:

  Better knowledge of the workflow

  a Web-based client

  Capturing complete knowledge during failure analysis
CBR Module

CBR was selected to resolve the Problems

Project Plan

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 1999</td>
<td>Initial FQA team formed</td>
</tr>
<tr>
<td>Oct 1999</td>
<td>Interviews of QA and PA engineers</td>
</tr>
<tr>
<td>Oct 1999</td>
<td>Review of CBR vendors</td>
</tr>
<tr>
<td>Nov 1999</td>
<td>Recognition of ad hoc workflow</td>
</tr>
<tr>
<td>Dec 1999</td>
<td>Merge of FQA and CBR teams</td>
</tr>
<tr>
<td>Feb 2000</td>
<td>Completion of first pass spec</td>
</tr>
<tr>
<td>Mar 2000</td>
<td>Extensive CBR training in Paris—divergence of team for Focus</td>
</tr>
<tr>
<td>Apr 2000</td>
<td>Detailed CBR model (case representation) defined</td>
</tr>
<tr>
<td>May 2000</td>
<td>Notes tool for initial case capture</td>
</tr>
<tr>
<td>Aug 2000</td>
<td>Initial case base in place</td>
</tr>
<tr>
<td>Aug 2000</td>
<td>First functional Total Recall modules available</td>
</tr>
<tr>
<td>Sep 2000</td>
<td>Introduction of Total Recall to select users</td>
</tr>
<tr>
<td>Nov 2000</td>
<td>Definition of &quot;don't care&quot; segmentation</td>
</tr>
<tr>
<td>Jan 2001</td>
<td>CBR administrative functions defined for system</td>
</tr>
<tr>
<td>Feb 2001</td>
<td>Training material prepared</td>
</tr>
<tr>
<td>Mar 2001</td>
<td>Beta testing</td>
</tr>
<tr>
<td>Apr 2001</td>
<td>Worldwide rollout</td>
</tr>
</tbody>
</table>
Case Representation

- **Work Flow Model:**
  - Listed all the activities that were needed to conduct the failure analysis
  - These were the **OBSERVATIONS**
- Different sites had different processes therefore domain attributes were added
- These are shown next...

- Initialization
- External visual
- Bench mechanical
- Curve trace
- ATE testing
- Bench testing
- Stress testing
- Stress analysis
- Post-stress curve trace
- Post-stress ATE testing
- Post-stress bench testing
- X-ray
- SAT/SAM
- Decap and inspect
- Deprocess and inspect
- Cross-section and inspect
- Light emission microscopy
- Liquid crystal analysis
- BBIC
- Probing and isolation
- Elemental analysis
Domain Attributes

<table>
<thead>
<tr>
<th>Static Attributes</th>
<th>Dynamic Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer special</td>
<td>Customer claim</td>
</tr>
<tr>
<td>NSID</td>
<td>Failure location</td>
</tr>
<tr>
<td>Parent die</td>
<td>Reported fail temp.</td>
</tr>
<tr>
<td>Family code</td>
<td>Continuity</td>
</tr>
<tr>
<td>Technology</td>
<td>Parametric</td>
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<tr>
<td>Fab process</td>
<td>Functionality</td>
</tr>
<tr>
<td>Package</td>
<td>Failure condition</td>
</tr>
<tr>
<td>Leads</td>
<td>Post-stress continuity</td>
</tr>
<tr>
<td>Date code</td>
<td>Post-stress parametric</td>
</tr>
<tr>
<td>Fab location</td>
<td>Post-stress functionality</td>
</tr>
<tr>
<td>Assembly location</td>
<td>Post-stress failure condition</td>
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<tr>
<td>Die rev</td>
<td>Stress analysis</td>
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<tr>
<td>Customer name</td>
<td>Package integrity</td>
</tr>
<tr>
<td>Customer location</td>
<td>Exposing</td>
</tr>
<tr>
<td>Device type</td>
<td>Fault isolation</td>
</tr>
<tr>
<td></td>
<td>Detecting</td>
</tr>
<tr>
<td></td>
<td>Case type</td>
</tr>
</tbody>
</table>

Mapping between workflow model and domain attributes
Resources

• Four main servers were deployed
• Approximately 1000 man hrs were required to get the first draft specification report.
• National had about 150 personnel in their IS division, a product quality assurance group was engaged for CBR implementation.
• Traditionally National Instruments spent 10 million dollars in software support

Benefits achieved

The first version of the Total RECALL system saved approximately 1 million dollars in a year.
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