La gestion et la création de la connaissance

Mini colloque du 17 juin 1999

Association professionelle des informaticiens et informaticiennes du Québec

Présenté à titre gracieux par
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Partenaire - Yortar Technologies

Content

- Introduction
  - Manual Workers and Knowledge Workers
  - Explicit and Tacit Knowledge
  - Western and Eastern Perspectives
- Four Integrated Dimensions of Knowledge Management
- Eight Building Blocks of Knowledge Management
- Pitfalls
- Knowledge Creation - Case Study

Adapted from: PRISM, Knowledge Management, Arthur D Little, Second Quarter 1998.
“Think of employees as human capital owners and investors... the asset metaphor has become bankrupt.

Thomas Davenport, 1998

Data - Information - Knowledge

• Data
  e.g. “The temperature is 20 C “

• Information
  A context into which data can be put
  “That’s hot for this time of the year”

• Knowledge
  A conclusion drawn from data and information
  Global warming is a bigger problem than we thought
  Two types of knowledge
  Explicit
  Tacit
Manual Workers

- Time and motion studies performed by F. Taylor (1856-1915)
  - Analyze each task, record each motion, eliminate useless motions
  - Each motion is set up to be done the simplest way
  - Optimize for least physical, mental strain and time
  - Motions are put together in a logical sequence into a “job”
  - Tools needed are designed or redesigned
- Manual workers could be made more productive by working harder and longer, no great difference between workers, unless they are lazy.
- Productivity has risen by a factor of 50 since Taylor
- TQM and work from Deming are derivatives of work of Taylor
- Workers are considered as a cost to be minimized (minimal training)
  - e.g. investments are mainly in “production” equipment

Knowledge Workers

- Factors that determine productivity
  - Define “What is the task”, for manual workers the task is obvious
  - Degree of autonomy, teamwork (e.g. minimal direct supervision)
  - Continuous innovation has to be part of the work and responsibilities
  - Continuous learning
- Productivity is not a factor of quantity but quality of the output
  - e.g. nurses in intensive care units, teachers)
- Organizational assets are between the ears of the workers (i.e. does not belong to the organization). Knowledge worker has to be “willing” to share.
- Knowledge workers are very mobile since they own the Knowledge
- Current business practices still see knowledge workers as a cost instead of an asset (i.e. minimize cost, grow asset)
- Management of knowledge workers impacts policies such as recruitment, reward, retention, promotion, management, training.
Explicit Knowledge

- Objective knowledge
- Knowledge that can be captured in words, numbers
- Can be shared in the form of formulas, process and procedure.
- Can be easily transferred between people and organizations
- Dominant form of knowledge in the West
- In the East, explicit knowledge is the tip of the iceberg

Tacit Knowledge

- Subjective knowledge
- “Something” not easily visible and expressible
- Highly personal, deeply rooted in individual’s action and experience, in values, emotions.
- Hard to formalize and communicate or share
- Experience and “tricks of the trade”
- Insights, intuitions and hunches
- Two dimensions of tacit knowledge
  - “Technical”: skills or crafts, “know-how”, e.g. three-star chef
  - “Cognitive”: beliefs, perceptions, ideals, mental models
    - Ingrained, “taken for granted”
## Western Culture

- Separation between the knower and the known, mind and body, mind and matter
- Scientific management: knowledge is managed, controlled.
  - F. Taylor’s time and motion studies
  - Taylor did not recognize experience of workers as source of new knowledge
  - Managers were made responsible for creation of knowledge
- View organization as a machine
- Treating human beings as stimulus-response machines with little capacity for knowledge creation
- Time is sequential (past, present, future)
- Realization of the individual as the goal in life

## Eastern Culture

- Oneness of body and mind of Zen Buddhism
- Samurai education, learning by imitating the moves of the master
  - Development of wisdom through physical training
- Importance of the “whole personality”
- View an organization as a living organism
- Knowledge cannot be managed
- Knowledge is about action, action fuels innovation
- Time is a continuous flow of permanently updated present
- Ideal is to exist among others harmoniously as a collective self
**SYSTEM VIEW OF ORGANIZATIONS**

**Organizational System**

**Inputs:**
- Human
- Financial
- Technological
- Material

**Outputs:**
- Products
- Services

Legend: → Input-output flow of materials, energy, information

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**West Versus East**

<table>
<thead>
<tr>
<th>West</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on Explicit Knowledge</td>
<td>Focus on Tacit Knowledge</td>
</tr>
<tr>
<td>Knowledge Re Use</td>
<td>Knowledge Creation</td>
</tr>
<tr>
<td>Knowledge Projects</td>
<td>Knowledge Cultures</td>
</tr>
<tr>
<td>Knowledge Markets</td>
<td>Knowledge Communities</td>
</tr>
<tr>
<td>Management and Measurement</td>
<td>Nurturing and Loving</td>
</tr>
<tr>
<td>Individual possesses and processes knowledge</td>
<td>Individual interact with organization through knowledge</td>
</tr>
<tr>
<td>Near-term Gains</td>
<td>Long-term Advantage</td>
</tr>
<tr>
<td>Knowledge is static</td>
<td>Knowledge creation, interaction between tacit &amp; explicit</td>
</tr>
<tr>
<td>Knowledge is taught</td>
<td>Knowledge through experience</td>
</tr>
</tbody>
</table>

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Four Dimensions of Knowledge Management

- **Content**
  - It is essential to strategically define relevant knowledge
    - i.e. knowledge that meets the needs and goals of the organization both now and in the future
    - Specific knowledge needs of organization's stakeholders and main processes
  - Run a knowledge audit to map organization's knowledge base
  - Unproductive approach would be to collect everything known and put it on some network where someone may find it.
    - Abundance of data
    - Redundant information
    - People will have to “dig” from huge amount of information, analyze it and deduce whatever knowledge they can
## Organizational Culture

- Cultural issues are the principal ingredient of success of KM
- Most neglected aspect!
  - Turf battles,
  - Relying on local solutions rather than seeking and emulating best practices (e.g. N.I.H.)
  - Individuals hoarding personal knowledge to justify indispensability
  - Few organizations (e.g. 15%) reward people for sharing knowledge between functions, divisions or sites.
- The choice of knowledge transfer media has to fit local culture
- Modification of reward system (e.g. pay, promotion)
  - e.g. promotions are based on what people know

## Organizational Culture

- Changing behavior demands leadership
  - People being asked to change need clear, recognizable signals from senior management
  - People need to understand the logic behind the changes (e.g. policies) and the consequences of failing to follow them (i.e. carrot and stick)
  - People must understand their mental model that explain the fear of transferring knowledge and the rejection of better ideas
Four Dimensions of Knowledge Management

- **Organizational Culture**
  - KM must be integrated in performance objectives and reviews
  - Need for measurable targets such as:
    - Employee retention
    - Accessibility of Knowledge (e.g. on a server)
    - Percentage of goals met
    - Cycle time
    - Market share
    - Customer satisfaction index

- **Process**
  - Introduction of KM into an organization should follow a natural, logically related sequence of tasks to minimize cost and effort
  - Tasks
    - Identify core knowledge an organization needs to meet its goals
    - Identify available knowledge, i.e. what the organization already knows
    - Create maps of specialists and knowledge creation sources
    - Identify process for knowledge creation
    - Capture and Disseminate Knowledge
      - e.g. teaching, training, coaching
    - Use Knowledge, receive it, accept it and apply it
      - e.g. did we learn to improve quality, did we reduce cost, did we come up with new ideas.
Four Dimensions of Knowledge Management

- **Infrastructure**
  - Infrastructure that supports knowledge management must be adapted to organization’s need
  - Knowledge gets old and decline in values
    - Infrastructure facilitates knowledge capture and application
  - The design of knowledge infrastructure must specify:
    - Updating responsibilities
    - Data structure
    - Help desks
    - Knowledge managers
    - Access rights
    - Data security

BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- **Define Knowledge Goals**
- **Measure Knowledge**
- **Identify Available Knowledge**
- **Use Knowledge**
- **Acquire Knowledge**
- **Develop Knowledge**
- **Distribute Knowledge**
- **Save Knowledge**

Adapted from PRISM, 1998
Define Knowledge Goals
- Goals determine which capabilities should be built
- Normative Knowledge Goals
  - Deal with the creation of a knowledge sensitive corporate culture
  - Sharing and development of know-how create the preconditions for effective knowledge management
- Strategic Knowledge Goals
  - Define organizational core capabilities
  - Describe future knowledge needs
  - Determine desirable competence portfolio for the future
- Operational Knowledge Goals
  - They make sure normative and strategic goals are transformed into action
  - e.g. operational goal could be the accessibility of all internal documents via internet, or definition of English language skills that must be met.

Dialogue Versus Discussion

<table>
<thead>
<tr>
<th>Dialogue</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeing the whole among the parts</td>
<td>Breaking issues/problems into parts</td>
</tr>
<tr>
<td>Seeing the connections between the parts</td>
<td>Seeing distinctions between the parts</td>
</tr>
<tr>
<td>Inquiring into assumptions</td>
<td>Justifying/defending assumptions</td>
</tr>
<tr>
<td>Learning through inquiry and disclosure</td>
<td>Persuading, selling, telling</td>
</tr>
<tr>
<td>Creating shared meaning among many</td>
<td>Gaining agreement on one meaning</td>
</tr>
</tbody>
</table>

Ellinor, 1998
Dialogue

- Utilization of Dialogue in dealing with organizational problems such as:
  - Creating alignment around vision
  - The alienation of the workforce
    - e.g. lack of meaning, apathy that accompany downsizing, restructuring
  - The integration of diversity
    - Cultural, racial, religious and gender differences
  - The constant running from one fire to another
  - Making sense of increasing levels of complexity and size
  - Moving beyond one right answer
    - How do we hold multiple viewpoints and still move ahead with aligned action

Ellinor, 1998

Dialogue - Principles

- Suspension of Judgement
  - Ability to observe judgements, your own and those of others from a neutral position, remaining detached and unreactive

- Identification and Suspension of Assumptions
  - Assumptions often take on the status of fact and truth
  - Suspension of assumptions means having them in front of you
    - Exercise: left hand column

- Listening
  - The doorway through which we allow the world to enter
  - Listening to others, an act of respect, of valuing
  - Listening to self, internal conversations of doubt, judgements, self defense
  - Listening for collective shared meaning
    - i.e. we all see, ear, and perceive through one window
**Inquiry and Reflection**
- Asking questions and holding an attitude of curiosity, opening the door to new insights
- Taking the time to observe more than one event and wonder about connections between them to formulate a question
- Taking time to listen for the response to emerge

**Identify Available Knowledge**
- Before investing, organizations should know what knowledge and expertise exist both inside and outside their walls
- Many organizations lose track of their data, information, and capabilities
  - Often leads to inefficiency, uninformed decisions, and redundant activities.
- Organizations often “reinvent the wheels”
- Restructuring, downsizing, and reengineering have often destroyed effective informal networks
- One way is to create knowledge maps
  - Support access to organizational knowledge base
Methods and Tools

- Creating Yellow Pages or K-Map for In-House Expertise
  - The people closest to the workflow know the most about it!
  - Points to knowledge, but does not contain it
  - Organization charts are poor substitutes for the map
  - Creating a directory of who-knows-what, a map of expertise
    - Short résumés that highlight knowledge and skills
      - e.g. procurement, contract, welding.
    - Expertise ranked on a three level scale
    - With a thesaurus to help people find what they are looking for even if they are not sure what to call it.
  - Simple technology like Lotus Notes
- Create Blue Pages for Outside Expertise

BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- Acquire Knowledge
  - Because quantity of available knowledge is unlimited, organizations must acquire critical capabilities
  - Four Import Channels
    - Knowledge held by other firms (e.g. take over, joint ventures)
    - Knowledge from key players (e.g. customers and suppliers)
    - Expert (e.g. full time or part time specialists)
    - Knowledge Products (e.g. software, patents, CD-ROMs)
  - Organizations must determine if a knowledge acquisition is for the future (potential knowledge) or the present (i.e. directly usable)
Methods and Tools

- **Body of Knowledge**
  - Software Engineering Body of Knowledge
    - In development
  - Project Management Institute’s Body of Knowledge

- **Best Practices**
  - Software Engineering Institute’s Capability Maturity Models
    - Software engineering, 316 practices are suggested
    - People, Acquisition, Integrated Models
  - EIA (Electronic Industry Association)
    - Systems Engineering Capability Model, EIA 731

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### Capability Maturity Model for Software

<table>
<thead>
<tr>
<th>Level</th>
<th>Characteristics</th>
<th>Key Process Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Optimizing</td>
<td>Process change management, Technology change management, Defect prevention</td>
</tr>
<tr>
<td>4</td>
<td>Managed</td>
<td>Software quality management, Quantitative process management</td>
</tr>
<tr>
<td>3</td>
<td>Defined</td>
<td>Peer reviews, Intergroup coordination, Software product engineering, Integrated software management, Training program, Organization process definition, Organization process focus</td>
</tr>
<tr>
<td>2</td>
<td>Repeatable</td>
<td>Software configuration management, Software quality assurance, Software subcontract management, Software project tracking &amp; oversight, Software project planning, Requirements management</td>
</tr>
<tr>
<td>1</td>
<td>Initial</td>
<td>Heroics</td>
</tr>
</tbody>
</table>
BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- **Develop Knowledge**
  - To produce new knowledge on both individual and collective level
  - Individual knowledge development
    - Relies on creativity
  - Collective Knowledge development
    - Involves the learning dynamics of teams
    - An atmosphere of openness and trust that makes collective learning results superior than individual ones
    - Development of internal think tanks, learning areas, center of competence
    - Identification of lessons learned at the end of projects and transmission of lessons to future teams

**Methods and Tools**

- **Lessons Learned**
  - Assuming that a failure is due to a positive intention
  - Focusing on the reason for failure rather than its gravity
  - A few high tech industries succeed partially because failure is understood to be an integral aspect of the growth process.
  - People could be rewarded for “putting forward” mistakes instead of hiding them
Methods and Tools

- Organizational Alignment
- Managing Change and Transition
- Team Development Workshops
- Root Cause Analysis and Five Why Method
- Six Thinking Hats
- Creative Abrasion
- Study Groups

Organizational Alignment

Employees

Strategy
Policies
Processes
Procedures
Assets

Suppliers

Customers
Management of Change & Transition

Endings Neutral Zone Beginning

Productivity

Time

Team Development Workshop

1. Orientation
Why am I here?

2. Trust Building
WHO are you?

3. Goal/Role Clarification
WHAT are we doing?

4. Commitment
HOW will we do it?

5. Implementation
WHO does WHAT, WHEN, WHERE?

6. High Performance
WOW!

7. Renewal
WHY continue?

Drexler/Sibbet Team Performance Model

Drexler, 1996
**Root Cause Analysis**

- A tool that helps a team to identify, explore, and display in increasing detail, all the possible causes related to a problem or condition in order to discover its root cause(s).
- Also called Fishbone Diagram or Ishikawa Diagram (1960).
### Five Why Method

<table>
<thead>
<tr>
<th>Level of a problem</th>
<th>Corresponding level of improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a puddle of oil on the shop floor.</td>
<td>Clean up the oil.</td>
</tr>
<tr>
<td>Because the machine is leaking oil.</td>
<td></td>
</tr>
<tr>
<td>Because the gasket is deteriorating.</td>
<td>Replace the gasket.</td>
</tr>
<tr>
<td>Because we bought gaskets made of inferior material</td>
<td>Buy better gaskets.</td>
</tr>
<tr>
<td>Because we got a good deal on them.</td>
<td></td>
</tr>
<tr>
<td>Because the purchasing agent gets evaluated on savings over normal price tag</td>
<td>Change the policy</td>
</tr>
</tbody>
</table>

Scholtes, 1998

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### Six Thinking Hats

- Developed by Edward De Bono
  - He separates thinking into six distinct modes, identified with six colored "thinking hats":
    - **White** - facts, figures, and objective information
    - **Red** - emotions and feelings
    - **Black** - logical negative thoughts
    - **Yellow** - positive constructive thoughts
    - **Green** - creativity and new ideas
    - **Blue** - control of the other hats and thinking steps

"Putting on" a hat focuses thinking; "switching" hats redirects thinking. With the different parts of the thinking process thus clearly defined, discussions can be better focused and more productive.

De Bono, 1985
Creative Abrasion

- Intentionally combining people with different skills, ideas and values can generate creative solutions
- Innovation occurs at the boundaries between mindsets, i.e. not on known territories.
- Nissan Design makes hiring decisions specifically to promote cognitive diversity in the firm.
- Bread-making Machine Development at Matsushita
  - Three product divisions with different cultures joined the team
    - Computer controlled expertise of rice cookers
    - Heating expertise from toasters
    - Rotating motor expertise from food processors

Leonard, 1998

Study Groups at Bell Labs

- Employees wishing to improve their knowledge
- Organization provides books and lunches
- Employees, maximum of 8 participants, prepare and meet, during 90 minutes, on their own time at lunch time, during 12 weeks.
- One participant present a book chapter during 30 minutes, then participants discuss and share viewpoints during 30 minutes.
- Each participant presents 2-3 topics during a 12-week session
- Different from classroom training
  - Knowledge transfer is from expert to learner (i.e. download)
  - During typical 3-day training course, learner may suffer from information overload, attention span is limited

Rising, 1998
“For many firms, critical elements of organizational knowledge may hinge on only one or two individuals.”

BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- **Save Knowledge**
  - Knowledge could be lost during reorganization, downsizing and “normal” attrition
    - e.g. destruction of informal networks
  - Storage processes include individual (need incentives), collective and electronic versions (e.g. intranet, internet)
  - Ways of saving valuable knowledge
    - Technical reports, Processes and procedures
    - Guides, templates, checklists and tools
    - Patents, standards
    - Lessons learned
    - Yellow pages and Blue Pages
    - Publications, conference proceedings
  - Knowledge saving is a continual process
BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- **Distribute Knowledge**
  - Who should know what, to what level of detail
  - How can the organization support the process of distribution
    - Infrastructures
  - Often knowledge is not shared because unwritten rules drive people’s behavior in another direction
    - e.g. “They pay us for working not for having ideas”
    - Such rules have to be discovered, made explicit and discussed openly to change the culture.

BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT

- **Use Knowledge**
  - Deployment of organizational knowledge in the production process
  - Without consistent use, there is a high probability that knowledge will decay in quality and investments will be wasted
  - Potential user has to see a real advantage in order to change his behavior and “adopt” the knowledge
    - WII FM, “What’s in it for me”
  - We can claim to use knowledge when we can say “We know how to ….”
**BUILDING BLOCKS OF KNOWLEDGE MANAGEMENT**

- **Measure Knowledge**
  - One of the biggest challenge
  - Example of measurements
    - Capability measures
    - Number of new processes, procedures, patents, etc
    - Product development cycle time
    - Repetition of past “errors” as published in lesson learned repositories
    - Retention of employees
    - Training evaluations
    - Culture changes
    - Market share and stock value

**Methods and Tools**

- **Measures**
  - Assessments
    - SEI assessments
  - Benchmarks
    - SEI Maturity Profiles
    - Qualimètre, Malcolm Baldrige Award

- **Footprint**
  - Kiviat/Radar Graphs, 5-Ups metrics

- **Function Points and Full Function Points (FFP)**
  - FFP for real time systems
    - Developed at Dr. A. Abran’s Laboratory (UQAM)
Knowledge Chart

Radar Graph
Lost Production Caused by a Departure

Productivity

Louise left and Bob arrived

A builder of network protocol analyzer estimates that it takes more than two years to bring a new worker up to speed ($150,000)

DeMarco, 1999

Knowledge Management - Pitfalls

- Not developing an understanding - a definition of Knowledge and Knowledge Management
  - Mixing information with knowledge
  - Too much focus on Knowledge stock instead of Knowledge flow
  - Paying little attention to Tacit knowledge
  - Knowledge workers managed as production workers
- Command and Control Management Style
- Viewing the Organization as a Machine
Knowledge Management - Pitfalls

- Not leaving “slack” time for innovation and creativity
- Not recognizing the importance of experimentation (pilots)
- Substituting Human Contact with Technological Contact
- Focusing on the past instead of the future

THE CONVENTIONAL LEARNING CURVE

I.e. False Learning Curve

A = A slight time loss of productivity while adjusting to the new way
B = Then a rapid increase in effectiveness and efficiency as the new method is mastered
C = Then a plateau at a higher level

Scholtes, 1998
TRANSFORMATION’S LEARNING CURVE

I.e. Real Learning Curve

Effectiveness and Efficiency

A 2 to 3 years B C

Time

A = The illusion of learning
Mastering the rhetoric
Grafting programs onto the old organization

B = Sufficient understanding to see that “we don’t know much”
The beginning of the integration of the knowledge and know-how

C = Real learning begins

Scholtes, 1998

21 August 2006

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Ladder of Inference

I take Actions based on my beliefs

I adopt Beliefs about the world

I draw Conclusions

I make Assumptions based on the meanings I added

I add Meanings (cultural and personal)

I select “Data” from what I observe

The reflexive loop (our beliefs affect what data we select next time)

Observable “data” and experiences as a videotape recorder might capture it

Senge, 1994

21 August 2006

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I adopt **Beliefs**

We can’t count on John. He is unreliable

I draw **Conclusions**

John always comes in late

I add **Meanings**

John knew when the meeting was to start. He deliberately came in late

**Observable**

The meeting was called for 9 AM and John came in at 9:30. He did not say why he was late

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**The Reinforcing Cycles of Blame**

Errors → Blame → Fear → “Cover-Ups” → Risk Taking → Information Flow → Ability to Solve Problems Effectively → Knowledge of Current Reality → Ability to Innovate

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Senge, 1994

Paul, 1997
SINGLE AND DOUBLE LOOP LEARNING

Single Loop Learning: We identify a gap/problem and solve it.
Double Loop Learning: Identification of gap/problem depends on new ways of thinking perceiving the problem.

Danger in the White Space

Organizational learning is happening at the middle management level and between middle managers.

If the white space, between managers, is empty of communication, of teamwork, full of turf battle, stress, overload, then learning is minimal if not totally absent.
Symptoms of Bad Brainpower Management

- You repeat mistakes
- Work gets duplicated
- Customer relations are strained
- Good ideas don’t get shared
- You have to compete on price
- You can’t keep up with market leaders
- You are dependent on key individuals
- You are slow to launch new products
- You don’t know how to price for service

Stewart, 1997a

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Barriers to Change

- **Machine Age Organizations are Robust**
  - Organizational structure come from military models
  - Command and control style
    - “Obey the rules, don’t screw up or else”
    - Check your brains at the door
    - Career advancement if you don’t rock the boat
    - Obedience and CYA (Cover Your Anatomy) is valued more than innovation, creativity and leadership

Ungson, 1999
Barriers to Change

- **Common Accounting Practices**
  - Accounting systems were designed for paying taxes and counting industrial age assets
    - i.e. bricks and plumbing
  - “It is very difficult to discern (from looking at their financial reports) well-run companies from profitably going out of business companies”
  - Financial reports have become rigid prisons for executives

Ungson, 1999

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What is our knowledge worth individually?

1. **Calculation of knowledge value per employee**

<table>
<thead>
<tr>
<th>Experience</th>
<th>Number of shares (financial statement)</th>
<th>Value of shares</th>
<th>Total assets (Balance sheet)</th>
<th>Value of intangibles (intellectual capital = shareholder value - assets)</th>
<th>Number of employees</th>
<th>Percentage of employees possessing share of intellectual capital</th>
<th>Number of employees possessing share of intellectual capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 months</td>
<td>80,000,000</td>
<td>20.00</td>
<td>$700,000,000</td>
<td>$900,000,000</td>
<td>3,700</td>
<td>90.00%</td>
<td>3,330</td>
</tr>
<tr>
<td>6-12 months</td>
<td>80,000,000</td>
<td>20.00</td>
<td>$700,000,000</td>
<td>$900,000,000</td>
<td>3,700</td>
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<td>3,330</td>
</tr>
<tr>
<td>12-24 months</td>
<td>80,000,000</td>
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<td>$700,000,000</td>
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<td>3,700</td>
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<td>24-36 months</td>
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</tr>
<tr>
<td>Over 36 months</td>
<td>80,000,000</td>
<td>20.00</td>
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<td>$900,000,000</td>
<td>3,700</td>
<td>90.00%</td>
<td>3,330</td>
</tr>
</tbody>
</table>

**The K-Factor** (knowledge factor) estimates each employee’s contribution to the corporate knowledge according to their level of experience.

**Per employee share of intellectual capital** is divided up based on number of employees and K-Factor.

Shostak, 1999
## What do these Numbers Represent?

- Dollar values ($334,448 for an experienced employee) represent the cost of:
  - recruiting
  - orienting to company, product, process
  - mentoring and coaching
  - formal training in company, product, process
  - additional management time
  - impact to project of using inexperienced versus experienced employees
    - higher error rates, lower productivity
  - impact to schedules of missing milestones
  - replacing an employee by a new one who does not work out
  - rebuilding sources of lost knowledge

   Shostak, 1999

## Bread-Making Case Study

- 1970’s - Matsushita’s profit were diminishing
  - 1973 - Attempt to make a bread machine failed
  - 1980 - Idea of bread making is suspended
    - technical difficulties, small anticipated demand
- 1983 - Corporate program was launched to improve competitiveness and to enter new markets
- 1984 - Three divisions were integrated
  - Rice-cooking,
  - Heating appliance, e.g. coffee making,
  - Rotation, e.g. food processor
  - A team is sent to America to find suggestions for new products
    - Their observations
      - More working women, Simplified home cooking, Poorer diet
      - Developed a concept “Easy and Rich”
        - Produce delicious, nutritious food, easily prepared

   Nonaka, 1995
Bread-Making Case Study

1984 - Pilot Team is Formed (multidisciplinary)
- Product concept
  - Machine should knead, ferment, and bake bread automatically once the ingredients are in the machine
  - Should not need special ingredients
  - Built-in timer to prepare bread at night
  - Bread making must not be affected by room temperature
  - Bread should have a good shape (e.g. square for English bread)
  - Should be better than mass-produced bread
  - Retail price within a specified range
- Many new “things” had to be developed at the same time
  - Learning bread making and baking skills
  - Developing taste measurement tools
  - Developing recipes
  - Developing machinery, heating, casing and control system
- First prototype
  - Overcooked crust, raw inside!

Nonaka, 1995

Bread-Making Case Study

1984 - Software developer proposed to learn bread-making skills from head baker of Osaka Hotel (best bread in town)
- Learned through observation, imitation and practice
- Many failures that could not be explained by the novice and the head baker
- Other members of the team were brought in to learn also
- “Twisting-Stretch” image was suggested and used to explain the “requirements” to the designers of the machine

1985 - Successful prototype
- Tacit knowledge of people were used during design (i.e. trade off analysis) to preserve quality of the bread

1987 - Product introduced to the market
- Record selling product - 536,000 units during the first year

Nonaka, 1995
Benefits to the Organization due to Successful Product
- Increased confidence and desire to develop other innovative products
- Rigid barriers were dissolved
- Development learned to listen to the voice of the customers
- Products could be created through cooperation instead of competition

“Things and Heart” Concept
- Things such as sound, taste, smell, look, feeling
- Heart such as health, easy, pride, joy of possession, pride of giving gift.
- New products: large screen TV, integrated coffee brewer and grinder

1991 - New Corporate Vision
- “A Possibility-Searching Company”

Knowledge Creation Process
1. Tacit Knowledge to Tacit Knowledge
2. Tacit Knowledge to Explicit Knowledge
3. Explicit Knowledge to Explicit Knowledge
4. Explicit Knowledge to Tacit Knowledge

Nonaka, 1995
Knowledge Creation

- **Metaphor**
  - Is not just a grammatical structure but a distinctive method of perception
  - Is a way to intuitively understand through imagination, symbols without the need to analyze
  - Is a way to establish a connection between things that seem to be distant
  - Often metaphoric images can have multiple meanings
  - Example
    - Honda’s Theory of Automobile Evolution
    - Two distant ideas - a theory of evolution for organisms and a machine

- **Analogies**
  - A vehicle for reconciling contradictions and making distinctions
  - Intermediate step between pure imagination and logical thinking
  - Example of Canon’s analogy between a beer can and the design of a low cost disposable mini-copier drum

Knowledge Creation

- **Models**
  - A vehicle to resolve contradictions
  - Concepts become transferable through consistent and systematic logic
  - Example: Honda’s New Car Project
    - Man maximum- machine minimum
    - Sphere, instead of the standard American design of a long rectangle

- **Tacit Knowledge to Explicit Knowledge Conversion**
  - Using metaphor to link contradictory ideas
  - Using analogies to resolve contradictions
  - Using models to crystallize a concept, making the knowledge available to the rest of the organization

Nonaka, 1995
Knowledge Creation

• Continuous and dynamic interactions between tacit and implicit knowledge through four types of knowledge conversion

• 1 - From Tacit Knowledge to Tacit Knowledge Conversion
  ◦ Sharing experiences, e.g. craftsmanship, O.J.T.(On Job Training)
  ◦ Honda Brainstorming Camps
    ◦ To solve difficult problems
    ◦ Informal meetings at a resort area, e.g. sake, hot spring.
    ◦ Enhances mutual trust
    ◦ Taboo: criticisms without constructive suggestions
  ◦ Matsushita Home Bread Making Machine Project
    ◦ Difficulties in automating the kneading process
    ◦ Breads were even X-rayed to analyze cause of difficulties
    ◦ Learned bread making from Osaka hotel’s head baker
    ◦ Observed that head baker had a special way of stretching and twisting the dough (tacit)
    ◦ This observation was converted to a specification (explicit)

Nonaka, 1995

Knowledge Creation

• 2 - From Tacit Knowledge to Explicit Knowledge Conversion
  ◦ Language is not adequate for this type of knowledge conversion
  ◦ Tacit knowledge is articulated using metaphors, analogies, models
  ◦ Dialogue and reflection are then used to share metaphors, analogies
  ◦ Honda’s New Car Project
    ◦ Metaphor - Automobile Evolution
    ◦ If the automobile were an organism, how should it evolve?
    ◦ Resulting analogy - Sphere
      ◦ Man maximum, machine minimum
  ◦ Canon Mini Copier Project
    ◦ Had to design a new drum system for mini-copier
    ◦ Analogy: Are there similarities between beer can and drum manufacture?

Nonaka, 1995
Knowledge Creation

3 - From Explicit Knowledge to Explicit Knowledge Conversion
- Combining bodies of knowledge
- Training and education
- Examples
  - Combining different data to produce a financial report
  - Canon used knowledge from camera sector to create mini-copiers

4 - From Explicit Knowledge to Tacit Knowledge Conversion
- Learning by doing
- Knowledge can be gained when re-experiencing what others have lived
- Knowledge developed in one project is used when developing a new project
- Mutsushita's pilot project to reduce work time
  - Employees experimented a 150 hour-month schedule
  - This “bodily experience” was a pilot to reduce to 1800 hours of work per year

Knowledge Creation Spiral- Bread making Machine Project
- Software developers learned kneading secret (tacit) from head baker
- Tacit knowledge was translated to specifications (explicit)
- Pieces of knowledge were captured in a workbook (explicit)
- Knowledge was enriched when developing the project
- This knowledge of knowledge creation process was transferred to other parts of the organization in order to “create” new products

Nonaka, 1995
Knowledge Creation

1. From Tacit to Tacit Conversion
   Learning bread making skill
   imitating the head baker

2. From Tacit to Explicit Conversion
   Knowledge externalized by the
   “twisting stretch” concept

3. From Explicit to Explicit Conversion
   Concept and technology combined to
   produce a prototype

4. From Explicit to Tacit Conversion
   Other people internalize knowledge and
   use it to broaden, extend and reframe
   their own knowledge

Knowledge Creation

- Three Work Flows
  - Relay Race Model - Stove pipe culture - Throw over the wall
    Marketing | R & D | Production

  - Sashimi Model - Overlying of functions occurs only at border of phases

  - Rugby Model - Constant interactions of multi discipline team from start to end

Nonaka, 1995
Knowledge Creation

- Interactions Between Three Roles
  - Senior Management who set the vision, direction
  - Front-line workers who are domain experts, focused on day-to-day
  - Middle-managers who make links between vision/direction and expertise from front-line employees
  - Example - Kao’s “Surface active science” vision/direction is used to produce coatings such as soap, cosmetics, floppy disks

- Learning Organization Versus Knowledge Creation
  - In learning organization true knowledge can be obtained only by the mind while in eastern model most powerful learning comes from bodily experience
  - In learning organization, double loop learning does not happen often, while in eastern model it is a continuous double loop learning

Nonaka, 1995

A Little Experiment in Tacit Knowledge

- Become a Nose Finder by K-E Sveiby
  - Shut your eyes, extend your arm then touch the tip of your nose with your finger index
  - At the same time, concentrate hard on what you are doing and on where the arm is at all times.
  - Do the exercise slowly, allow a minimum of 20 seconds to do it.

- Did you succeed in touching the tip of your nose?
  - About 90% of people find their nose!
A Little Experiment in Tacit Knowledge

- **A Second Experiment**
  - Assume that you have to write an essay on exactly how you do the exercise
  - Describe mentally how you hold your finger, every movement of your arm, all different angles, all the way to your nose
  - Allow 30 seconds to do this exercise
- **Did you succeed in finding the tip of your nose?**
- **Was it easy to describe in words how you did the exercise?**
  - About 54% find this more difficult
- **Which hand did you use in the exercise?**
  - About 75% use their best hand
  - Why did you not use your other hand?
    - It was automatic?

Ten Challenges in Change Programs

- **Challenges when initiating Change**
  - “We don’t have time for this stuff”
    - People need enough flexibility to devote time to reflection and practice
  - “We have no help”
    - People need coaching, guidance and support
  - “This stuff isn’t relevant!”
    - Showing why changing is needed
  - “They are not walking the talk”
    - Mismatch between management’s speech and daily actions
- **Challenges when sustaining Change**
  - “This stuff is [X]!”
    - Fear, vulnerability, and anxiety

Senge, 1999
Ten Challenges in Change Programs

- Challenges when sustaining Change
  - “This stuff isn’t working!”
  - Challenge of measuring progress of pilot project when resources are scarce
  - “We have the right way!” “They don’t understand us!”

- Challenges of redesigning when confronting established “ways”
  - “Who is in charge of this stuff?”
    - Conflict between pilot project seeking greater autonomy and management concerned about autonomy leading to chaos
  - “We keep reinventing the wheel!”
    - Difficult for people in the system to build upon other’s successes

Senge, 1999

“It is almost impossible to earn above normal, exceptional economic returns by doing what “everyone else” is doing… It is also impossible to achieve some lasting competitive advantage simply by making purchases in the open market - something that anyone can do.”

J. Pfeffer, The Human Equation
Bibliography


Bibliography


- Paul, M., Moving from Blame to Accountability, The Systems Thinker, Volume 8, Number 1, Feb 1997, Pegasus Communications.


## Bibliography


- Shostak, B., Personal Communication, 1999
