Chapter 11
MANAGING KNOWLEDGE

Learning Objectives

• What is the role of knowledge management and knowledge management programs in business?
• What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?
• What are the major types of knowledge work systems and how do they provide value for firms?
• What are the business benefits of using intelligent techniques for knowledge management?

P&G Moves from Paper to Pixels for Knowledge Management

• Problem: Document-intensive research and development dependent on paper records
• Solutions: Electronic document management system stores research information digitally
• eLab Notebook documentum management software creates PDFs, enables digital signatures, embeds usage rights, enables digital searching of library
• Demonstrates IT’s role in reducing cost by making organizational knowledge more easily available
• Illustrates how an organization can become more efficient and profitable through content management

The Knowledge Management Landscape

• Knowledge management systems among fastest growing areas of software investment
• Information economy
  — 55% U.S. labor force: knowledge and information workers
  — 60% U.S. GDP from knowledge and information sectors
• Substantial part of a firm’s stock market value is related to intangible assets: knowledge, brands, reputations, and unique business processes
• Well-executed knowledge-based projects can produce extraordinary ROI
The Knowledge Management Landscape

- **Important dimensions of knowledge**
  - Knowledge is a firm asset
    - Intangible
    - Creation of knowledge from data, information, requires organizational resources
    - As it is shared, experiences network effects
  - Knowledge has different forms
    - May be explicit (documented) or tacit (residing in minds)
    - Know-how, craft, skill
    - How to follow procedure
    - Knowing why things happen (causality)

- **Knowledge has a location**
  - Cognitive event
  - Both social and individual
  - “Sticky” (hard to move), situated (enmeshed in firm’s culture), contextual (works only in certain situations)

- **Knowledge is situational**
  - Conditional: Knowing when to apply procedure
  - Contextual: Knowing circumstances to use certain tool

- **Organizational learning**
  - Process in which organizations learn
    - Gain experience through collection of data, measurement, trial and error, and feedback
    - Adjust behavior to reflect experience
      - Create new business processes
      - Change patterns of management decision making

• To transform information into knowledge, firm must expend additional resources to discover patterns, rules, and contexts where knowledge works

• Wisdom:
  - Collective and individual experience of applying knowledge to solve problems
  - Involves where, when, and how to apply knowledge

• Knowing how to do things effectively and efficiently in ways others cannot duplicate is prime source of profit and competitive advantage
  - E.g., Having a unique build-to-order production system
The Knowledge Management Landscape

- **Knowledge management**: Set of business processes developed in an organization to create, store, transfer, and apply knowledge

- **Knowledge management value chain**: Each stage adds value to raw data and information as they are transformed into usable knowledge
  1. Knowledge acquisition
  2. Knowledge storage
  3. Knowledge dissemination
  4. Knowledge application

**Knowledge management value chain (cont.)**

2. **Knowledge storage**
   - Databases
   - Document management systems
   - Role of management:
     - Support development of planned knowledge storage systems
     - Encourage development of corporate-wide schemas for indexing documents
     - Reward employees for taking time to update and store documents properly

**Knowledge management value chain (cont.)**

3. **Knowledge dissemination**
   - Portals
   - Push e-mail reports
   - Search engines
   - Collaboration tools
   - A deluge of information?
     - Training programs, informal networks, and shared management experience help managers focus attention on important information
The Knowledge Management Landscape

• Knowledge management value chain (cont.)

4. Knowledge application
   • To provide return on investment, organizational knowledge must become systematic part of management decision making and become situated in decision-support systems
     – New business practices
     – New products and services
     – New markets

The Knowledge Management Landscape

• New organizational roles and responsibilities
  – Chief knowledge officer executives
  – Dedicated staff / knowledge managers
  – Communities of practice (COPs)
    • Informal social networks of professionals and employees within and outside firm who have similar work-related activities and interests
    • Activities include education, online newsletters, sharing experiences and techniques
    • Facilitate reuse of knowledge, discussion
    • Reduce learning curves of new employees

The Knowledge Management Landscape

• 3 major types of knowledge management systems:
  1. Enterprise-wide knowledge management systems
     • General-purpose firm-wide efforts to collect, store, distribute, and apply digital content and knowledge
  2. Knowledge work systems (KWS)
     • Specialized systems built for engineers, scientists, other knowledge workers charged with discovering and creating new knowledge
  3. Intelligent techniques
     • Diverse group of techniques such as data mining used for various goals: discovering knowledge, distilling knowledge, discovering optimal solutions
Enterprise-Wide Knowledge Management Systems

- Three major types of knowledge in enterprise
  1. Structured documents
     - Reports, presentations
     - Formal rules
  2. Semistructured documents
     - E-mails, videos
  3. Unstructured, tacit knowledge

- 80% of an organization’s business content is semistructured or unstructured
Enterprise-Wide Knowledge Management Systems

• Enterprise content management systems
  – Key problem – Developing taxonomy
    • Knowledge objects must be tagged with categories for retrieval
  – Digital asset management systems
    • Specialized content management systems for classifying, storing, managing unstructured digital data
    • Photographs, graphics, video, audio

• Knowledge network systems
  – Provide online directory of corporate experts in well-defined knowledge domains
  – Use communication technologies to make it easy for employees to find appropriate expert in a company
  – May systematize solutions developed by experts and store them in knowledge database
    • Best-practices
    • Frequently asked questions (FAQ) repository

AN ENTERPRISE KNOWLEDGE NETWORK SYSTEM

A knowledge network maintains a database of firm experts, as well as accepted solutions to known problems, and then facilitates the communication between employees looking for knowledge and experts who have that knowledge. Solutions created in this communication are then added to a database of solutions in the form of FAQs, best practices, or other documents.

FIGURE 11-4

• Portal and collaboration technologies
  – Enterprise knowledge portals: Access to external and internal information
    • News feeds, research
    • Capabilities for e-mail, chat, videoconferencing, discussion
  – Use of consumer Web technologies
    • Blogs
    • Wikis
    • Social bookmarking
Enterprise-Wide Knowledge Management Systems

• Learning management systems
  – Provide tools for management, delivery, tracking, and assessment of various types of employee learning and training
  – Support multiple modes of learning
    • CD-ROM, Web-based classes, online forums, live instruction, etc.
  – Automates selection and administration of courses
  – Assembles and delivers learning content
  – Measures learning effectiveness

Knowledge Work Systems

• Requirements of knowledge work systems
  – Substantial computing power for graphics, complex calculations
  – Powerful graphics and analytical tools
  – Communications and document management
  – Access to external databases
  – User-friendly interfaces
  – Optimized for tasks to be performed (design engineering, financial analysis)

• Knowledge work systems
  – Systems for knowledge workers to help create new knowledge and integrate that knowledge into business

• Knowledge workers
  – Researchers, designers, architects, scientists, engineers who create knowledge for the organization
  – Three key roles:
    1. Keeping organization current in knowledge
    2. Serving as internal consultants regarding their areas of expertise
    3. Acting as change agents, evaluating, initiating, and promoting change projects

REQUIREMENTS OF KNOWLEDGE WORK SYSTEMS

Knowledge work systems require strong links to external knowledge bases in addition to specialized hardware and software.

FIGURE 11-5
Knowledge Work Systems

• **Examples of knowledge work systems**
  – CAD (computer-aided design):
    • Creation of engineering or architectural designs
  – Virtual reality systems:
    • Simulate real-life environments
    • 3-D medical modeling for surgeons
    • Augmented reality (AR) systems
    • VRML
  – Investment workstations:
    • Streamline investment process and consolidate internal, external data for brokers, traders, portfolio managers

Intelligent Techniques

• **Intelligent techniques**: Used to capture individual and collective knowledge and to extend knowledge base
  – To capture tacit knowledge: Expert systems, case-based reasoning, fuzzy logic
  – Knowledge discovery: Neural networks and data mining
  – Generating solutions to complex problems: Genetic algorithms
  – Automating tasks: Intelligent agents

• **Artificial intelligence (AI) technology**:  
  – Computer-based systems that emulate human behavior

AUGMENTED REALITY: REALITY GETS BETTER

Read the Interactive Session and discuss the following questions

• **What is the difference between virtual reality and augmented reality?**
• **Why is augmented reality so appealing to marketers?**
• **What makes augmented reality useful for real estate shopping applications?**
• **Suggest some other knowledge work applications for augmented reality**
An expert system contains a number of rules to be followed. The rules are interconnected; the number of outcomes is known in advance and is limited; there are multiple paths to the same outcome; and the system can consider multiple rules at a single time. The rules illustrated are for simple credit-granting expert systems.

**Rules in an Expert System**

- **Knowledge base:** Set of hundreds or thousands of rules
- **Inference engine:** Strategy used to search knowledge base
  - **Forward chaining:** Inference engine begins with information entered by user and searches knowledge base to arrive at conclusion
  - **Backward chaining:** Begins with hypothesis and asks user questions until hypothesis is confirmed or disproved

**Successful expert systems**

- Con-Way Transportation built expert system to automate and optimize planning of overnight shipment routes for nationwide freight-trucking business

**Most expert systems deal with problems of classification**

- Have relatively few alternative outcomes
- Possible outcomes are known in advance

**Many expert systems require large, lengthy, and expensive development and maintenance efforts**

- Hiring or training more experts may be less expensive
Intelligent Techniques

- **Case-based reasoning (CBR)**
  - Descriptions of past experiences of human specialists (cases), stored in knowledge base
  - System searches for cases with problem characteristics similar to new one, finds closest fit, and applies solutions of old case to new case
  - Successful and unsuccessful applications are grouped with case
  - Stores organizational intelligence: Knowledge base is continuously expanded and refined by users
  - CBR found in
    - Medical diagnostic systems
    - Customer support

- **Fuzzy logic systems**
  - Rule-based technology that represents imprecision used in linguistic categories (e.g., “cold,” “cool”) that represent range of values
  - Describe a particular phenomenon or process linguistically and then represent that description in a small number of flexible rules
  - Provides solutions to problems requiring expertise that is difficult to represent with IF-THEN rules
    - Autofocus in cameras
    - Detecting possible medical fraud
    - Sendai’s subway system acceleration controls

HOW CASE-BASED REASONING WORKS

Case-based reasoning represents knowledge as a database of past cases and their solutions. The system uses a six-step process to generate solutions to new problems encountered by the user.

FUZZY LOGIC FOR TEMPERATURE CONTROL

The membership functions for the input called temperature are in the logic of the thermostat to control the room temperature. Membership functions help translate linguistic expressions such as warm into numbers that the computer can manipulate.
Humans network by feeding it data inputs for which outputs are known, to help neural network learn solution by example. “Learn” patterns by searching for relationships, building models, and correcting over and over again. Used in medicine, science, and business for problems in pattern classification, prediction, financial analysis, and control and optimization. Machine learning: Related AI technology allowing computers to learn by extracting information using computation and statistical methods.

THE FLASH CRASH: MACHINES GONE WILD?

Read the Interactive Session and discuss the following questions:

• Describe the conditions that preceded the flash crash.
• What are some of the benefits of electronic trading?
• What features of electronic trading and automated trading programs contributed to the crash?
• Could this crash have been prevented? Why or why not?

Intelligent Techniques

HOW A NEURAL NETWORK WORKS

- Neural networks
  - Find patterns and relationships in massive amounts of data too complicated for humans to analyze
  - “Learn” patterns by searching for relationships, building models, and correcting over and over again
  - Humans “train” network by feeding it data inputs for which outputs are known, to help neural network learn solution by example
  - Used in medicine, science, and business for problems in pattern classification, prediction, financial analysis, and control and optimization
  - Machine learning: Related AI technology allowing computers to learn by extracting information using computation and statistical methods

- Genetic algorithms
  - Useful for finding optimal solution for specific problem by examining very large number of possible solutions for that problem
  - Conceptually based on process of evolution
    • Search among solution variables by changing and reorganizing component parts using processes such as inheritance, mutation, and selection
  - Used in optimization problems (minimization of costs, efficient scheduling, optimal jet engine design) in which hundreds or thousands of variables exist
  - Able to evaluate many solution alternatives quickly

A neural network uses it “learns” from patterns in data to construct a hidden layer of logic. The hidden layer then processes inputs, classifying them based on the experience of the model. In this example, the neural network has been trained to distinguish between valid and fraudulent credit card purchases.
Intelligent Techniques

THE COMPONENTS OF A GENETIC ALGORITHM

- Hybrid AI systems
  - Genetic algorithms, fuzzy logic, neural networks, and expert systems integrated into single application to take advantage of best features of each
  - E.g., Matsushita “neurofuzzy” washing machine that combines fuzzy logic with neural networks

Intelligent agents
- Work in background to carry out specific, repetitive, and predictable tasks for user, process, or application
- Use limited built-in or learned knowledge base to accomplish tasks or make decisions on user’s behalf
  - Deleting junk e-mail
  - Finding cheapest airfare
- Agent-based modeling applications:
  - Systems of autonomous agents
  - Model behavior of consumers, stock markets, and supply chains; used to predict spread of epidemics

INTELLIGENT AGENTS IN P&G’S SUPPLY CHAIN NETWORK

1. Software agents schedule deliveries from suppliers. If a supplier can't deliver on time, agents negotiate with other suppliers to create an alternative delivery schedule.
2. Retail stores
3. Software agents analyze real-time sales data on each P&G product from multiple retail stores. They relay the data to P&G's production for replenishing orders and to sales and marketing for trend analysis.
4. Production
5. Software agents schedule shipments from distributors to retailers, giving priority to retailers whose inventories are low. If a shipment to a retailer is delayed, agents find an alternative truck.
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