Chapter 11

Managing Knowledge

VIDEO CASES
Video Case 1: How IBM’s Watson Became a Jeopardy Champion
Video Case 2: Tour: Alfresco: Open Source Document Management System
Instructional Video 1: Analyzing Big Data: IBM Watson: Watson After Jeopardy
Instructional Video 2: Teamwork and Collaboration: John Chambers on Collaboration vs. Command and Control in Web 2.0

• Problem: Fragmented systems and data; complex business processes
• Solutions: Implement new product lifetime management (PLM) system and collaborative 3D product design environment
• Demonstrates IT’s role in creating and sharing knowledge to improve business efficiency
• Illustrates how information systems for knowledge management can increase productivity and quality

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?

Management Information Systems
Chapter 11: Managing Knowledge

Jaguar Land Rover Transforms with New Design and Technology

• Knowledge management systems among fastest growing areas of software investment
• Information economy
  – 37 percent U.S. labor force: knowledge and information workers
  – 45 percent 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
• 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)

• 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
  – For example, Having a unique build-to-order production system

• Important dimensions of knowledge (cont.)
  – 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
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
  - Knowledge acquisition
  - Knowledge storage
  - Knowledge dissemination
  - Knowledge application

Knowledge management value chain
1. Knowledge acquisition
   - Documenting tacit and explicit knowledge
     - Storing documents, reports, presentations, best practices
     - Unstructured documents (e.g., e-mails)
     - Developing online expert networks
   - Creating knowledge
   - Tracking data from TPS and external sources

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.

3. Knowledge dissemination
   - Portals, wikis
   - E-mail, instant messaging
   - Search engines
   - Collaboration tools
   - A deluge of information?
     - Training programs, informal networks, and shared management experience help managers focus attention on important information.
• Knowledge management value chain

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

• 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

• Three 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
Three major categories of knowledge management systems, and each can be broken down further into more specialized types of knowledge management systems.

1. Structured documents
   - Reports, presentations
   - Formal rules

2. Semistructured documents
   - E-mails, videos

3. Unstructured, tacit knowledge
   - 80 percent of an organization’s business content is semistructured or unstructured.

Enterprise content management systems:
- Help capture, store, retrieve, distribute, preserve
  - Documents, reports, best practices
  - Semistructured knowledge (e-mails)
- Bring in external sources
  - News feeds, research
- Tools for communication and collaboration
  - Blogs, wikis, and so on

Enterprise-wide knowledge management systems:
- General-purpose, integrated, remote efforts to collect, store, disseminate, and use digital content and knowledge
- Specialized workstations and systems that create, store, organize, and access knowledge
to create and discover new knowledge
- Tools for discovering patterns and applying knowledge to diverse decisions and knowledge domains
- Data mining
- Natural language processing
- Case-based reasoning
- Expert systems
- Visual realism
- Virtual reality
- Intelligent agents

Enterprise content management system has capabilities to classify, organize, and manage content and making it available throughout the enterprise.
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

Locating and sharing expertise

- Provide online directory of corporate experts in well-defined knowledge domains
- Search tools enable employees to find appropriate expert in a company
- Social networking and social business tools for finding knowledge outside the firm
  - Saving, tagging, sharing Web pages

Learning management systems (LMS)

- Provide tools for management, delivery, tracking, and assessment of employee learning and training
- Support multiple modes of learning
  - CD-ROM, Web-based classes, online forums, and so on
  - Automates selection and administration of courses
  - Assembles and delivers learning content
  - Measures learning effectiveness

- Massively open online courses (MOOCs)
  - Web course open to large numbers of participants

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
Knowledge Work Systems

• Requirements of knowledge work systems
  – Sufficient 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)

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

Is 3D Printing a Game-Changer?

Read the Interactive Session and discuss the following questions:

• Describe the technologies used in 3D printing. How does 3D printing differ from CAD?
• What are the advantages and disadvantages of using 3D printing?
• What kinds of businesses are most likely to benefit from 3D printing? Why? Give two examples.
• How could 3D printing impact companies’ supply chains and business models?
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

• Expert systems:
  - Capture tacit knowledge in very specific and limited domain of human expertise
  - Capture knowledge of skilled employees as set of rules in software system that can be used by others in organization
  - Typically perform limited tasks that may take a few minutes or hours, for example:
    - Diagnosing malfunctioning machine
    - Determining whether to grant credit for loan
  - Used for discrete, highly structured decision making

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

How expert systems work

- 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
An inference engine works by searching through the rules and "firing" those rules that are triggered by facts gathered and entered by the user. Basically, a collection of rules is similar to a series of nested IF statements in a traditional software program; however, the magnitude of the statements and degree of nesting are much greater in an expert system.

**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

**Case-based reasoning (CBR)**
- Descriptions of past experiences of human specialists (cases), stored in knowledge base
- System searches for cases with characteristics similar to new one 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

**INFESSION ENGINES IN EXPERT SYSTEMS**

**FIGURE 11-6**

**Intelligent Techniques**

**HOW CASE-BASED REASONING WORKS**

**FIGURE 11-7**
• 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

• Machine learning
  - How computer programs improve performance without explicit programming
    • Recognizing patterns
    • Experience
    • Prior learnings (database)
  - Contemporary examples
    • Google searches
    • Recommender systems on Amazon, Netflix

• 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
A neural network uses rules it "learns" from patterns to create 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.

**Interactive Session: Organizations**

Read the Interactive Session and discuss the following questions:

- What are some of the benefits of using facial recognition technology? Describe some current and future applications of this technology.
- How does facial recognition technology threaten the protection of individual privacy? Give several examples.
- Would you like DeepFace to track your activities on Facebook and in the physical world? Why or why not?

**Facial Recognition Systems: Another Threat to Privacy?**

- 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

**The Components of a Genetic Algorithm**

[Diagram of a population of chromosomes with varying lengths, widths, weights, and fitness values.]

- This example illustrates a simplified population of "chromosomes," each representing a different solution. The genetic algorithm uses an iterative process to refine the initial solutions so that the better ones, those with the highest fitness, are more likely to emerge as the best solutions.
• **Intelligent agents**
  - Work without direct human intervention to carry out specific, repetitive, and predictable tasks for user, process, or application
    - Deleting junk e-mail
    - Finding cheapest airfare
  - Use limited built-in or learned knowledge base
    - Some are capable of self-adjustment, for example: Siri
  - **Agent-based modeling applications:**
    - Systems of autonomous agents
    - Model behavior of consumers, stock markets, and supply chains, used to predict spread of epidemics

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**Hybrid AI systems**

- Genetic algorithms, fuzzy logic, neural networks, and expert systems integrated into single application to take advantage of best features of each
  - For example: Matsushita “neurofuzzy” washing machine that combines fuzzy logic with neural networks