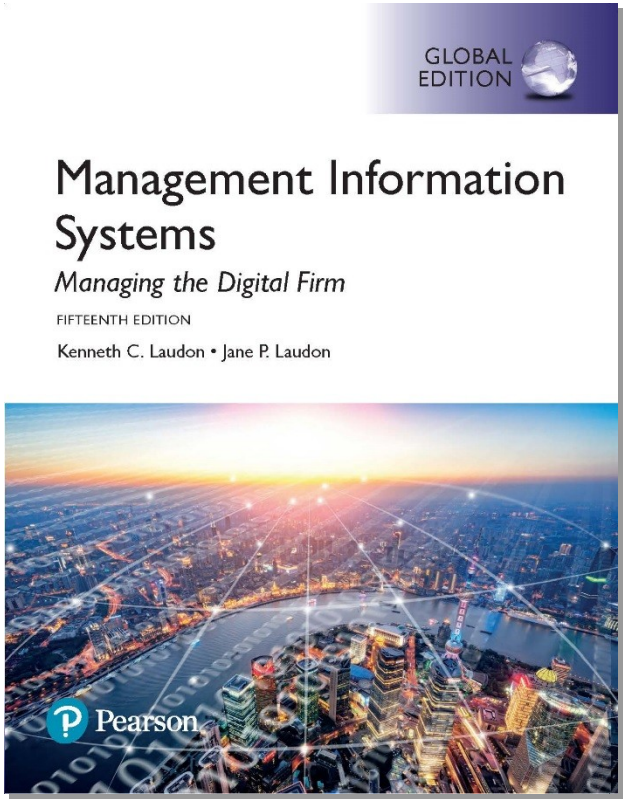
Management Information Systems: Managing the Digital Firm

Fifteenth edition



Chapter 11

Managing Knowledge

Pearson

Learning Objectives

- **11-1** What is the role of knowledge management systems in business?
- **11-2** What types of systems are used for enterprise-wide knowledge management, and how do they provide value for businesses?
- **11-3** What are the major types of knowledge work systems, and how do they provide value for firms?
- **11-4** What are the business benefits of using intelligent techniques for knowledge management?

Video Cases

- Case 1: How IBM’s Watson Became a Jeopardy Champion
- Case 2: Alfresco: Open Source Document Management and Collaboration

Fiat: Real Time Management with Business Intelligence (1 of 2)

- Problem
  - Various production centers had their own database systems
  - Information system challenges from purchase of Chrysler
- Solutions
  - New system analyzes automobile production across divisions
  - detailed view of dealer sales to final customers
  - Makes data and information more understandable

Fiat: Real Time Management with Business Intelligence (2 of 2)

- Fiat uses Oracle's Hyperion to provide near real-time information on its operations across the globe
- Demonstrates IT's role in helping organizations improve performance and remain competitive
- Illustrates the ability of IT systems to create new efficiencies

What Is the Role of Knowledge Management Systems in Business?

- Knowledge management systems among fastest growing areas of software investment
- Information economy
  - 37 percent U.S. labor force: knowledge and information workers
  - 55 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 (1 of 2)

- Data, knowledge, and wisdom
- Tacit knowledge and explicit knowledge
- Important dimensions of knowledge
  - Knowledge is a firm asset.
  - Knowledge has different forms.
  - Knowledge has a location.
  - Knowledge is situational.

TABLE 11.1 IMPORTANT DIMENSIONS OF KNOWLEDGE

KNOWLEDGE IS A FIRM ASSET
Knowledge is an intangible asset.
The transformation of data into useful information and knowledge requires organizational resources.
Knowledge is not subject to the law of diminishing returns as are physical assets but instead experiences network effects as its value increases as more people share it.
KNOWLEDGE HAS DIFFERENT FORMS
Knowledge can be either tacit or explicit (codified).
Knowledge involves know-how, craft, and skill.
Knowledge involves knowing how to follow procedures.
Knowledge involves knowing why, not simply when, things happen (causality).
KNOWLEDGE HAS A LOCATION
Knowledge is a cognitive event involving mental models and maps of individuals.
There is both a social and an individual basis of knowledge.
Knowledge is "sticky" (hard to move), situated (enmeshed in a firm's culture), and contextual (works only in certain situations).
KNOWLEDGE IS SITUATIONAL
Knowledge is conditional; knowing when to apply a procedure is just as important as knowing the procedure (conditional).
Knowledge is related to context; you must know how to use a certain tool and under what circumstances.

Important Dimensions of Knowledge (2 of 2)

- Knowledge-based core competencies
  - Key organizational assets
- Knowing how to do things effectively and efficiently in ways others cannot duplicate is a prime source of profit and competitive advantage
  - Example: Having a unique build-to-order production system
- Organizational learning
  - Process in which organizations gain experience through collection of data, measurement, trial and error, and feedback

The Knowledge Management Value Chain (1 of 3)

- 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

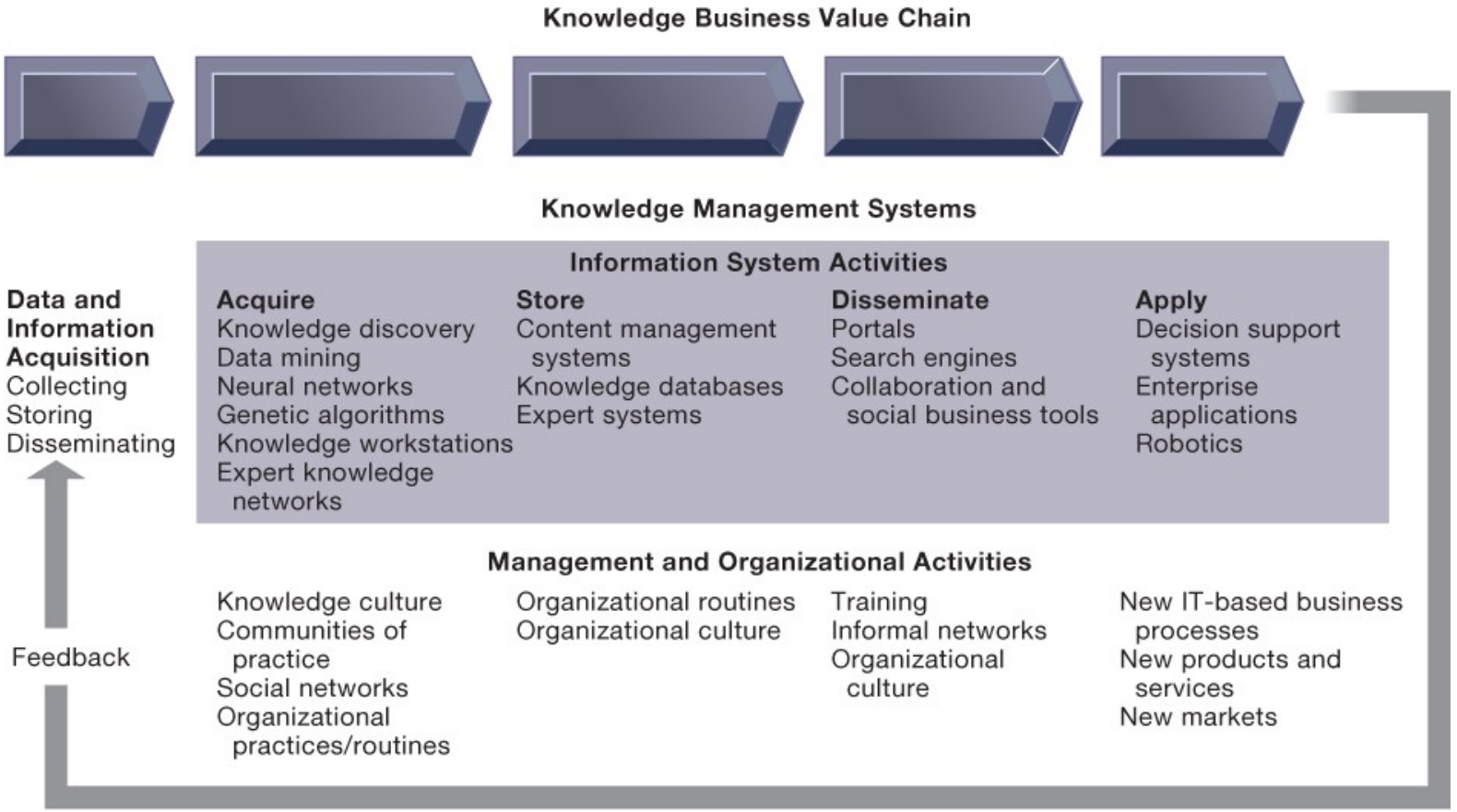
The Knowledge Management Value Chain (2 of 3)

- 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
- Knowledge storage
  - Databases
  - Document management systems
  - Role of management

The Knowledge Management Value Chain (3 of 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 application
  - New business practices
  - New products and services
  - New markets

Figure 11.1: The Knowledge Management Value Chain



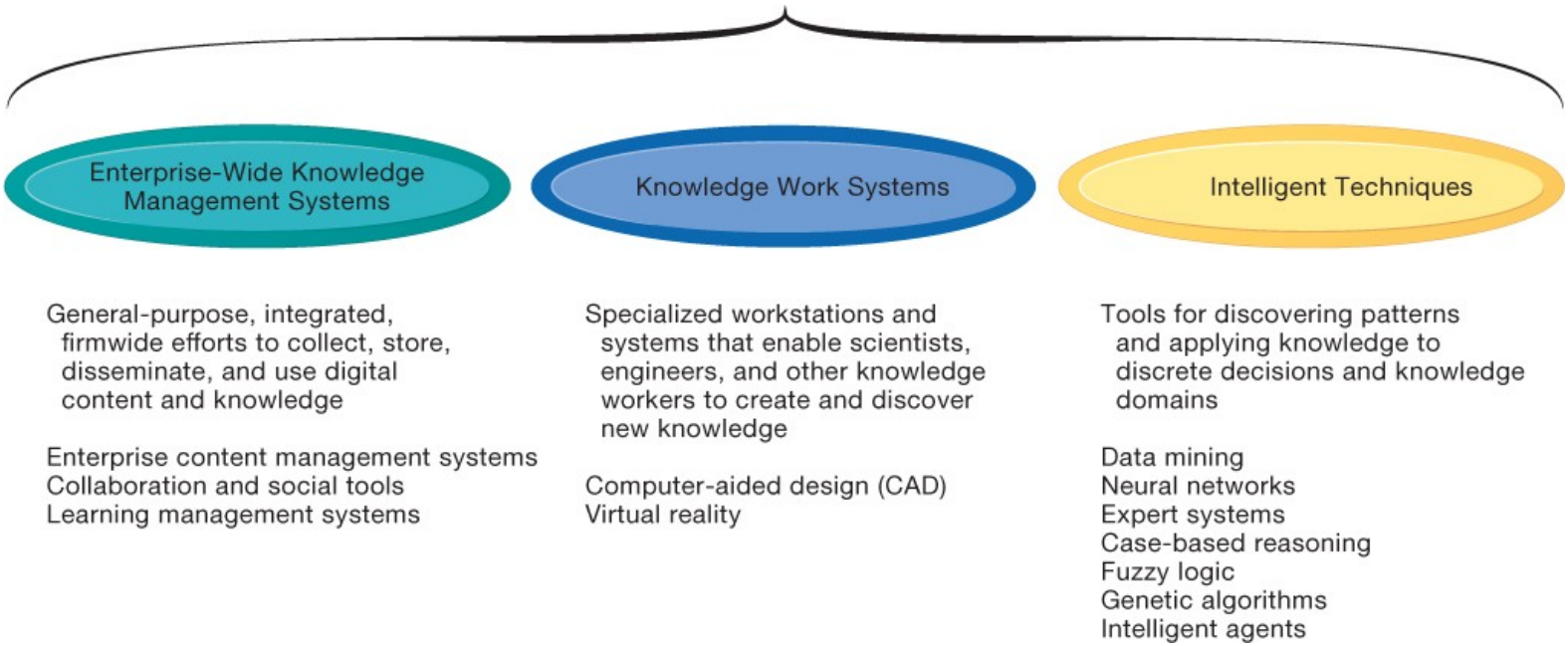
Building Organizational and Management Capital: Collaboration, Communities of Practice, and Office Environments

- Developing new organizational roles and responsibilities for the acquisition of knowledge
- Chief knowledge officer executives
- Dedicated staff / knowledge managers
- Communities of practice (COPs)
  - Informal social networks of professionals and employees
  - Activities include education, online newsletters, sharing knowledge
  - Reduce learning curves of new employees

Types of Knowledge Management Systems

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

Figure 11.2: Major Types of Knowledge Management Systems



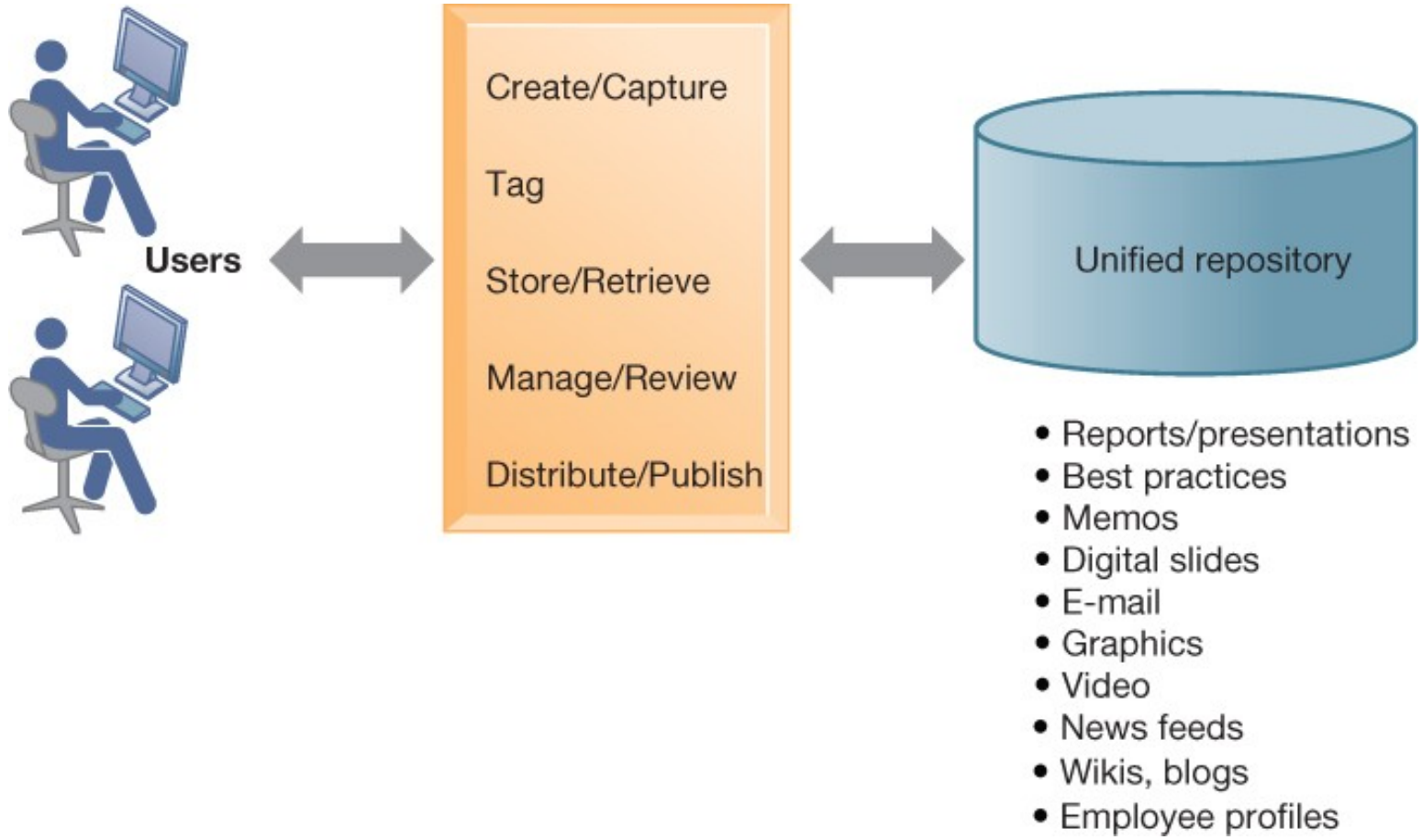
What Types of Systems Are Used for Enterprise-Wide Knowledge Management?

- Three major types of knowledge in an enterprise
  - Structured documents
    - Reports, presentations
    - Formal rules
  - Semistructured documents
    - E-mails, videos
  - Unstructured, tacit knowledge
- 80% of an organization's business content is semistructured or unstructured

Enterprise Content Management Systems

- Help capture, store, retrieve, distribute, preserve documents and semistructured knowledge
- Bring in external sources
  - News feeds, research
- Tools for communication and collaboration
  - Blogs, wikis, and so on
- Key problem: developing taxonomy
- Digital asset management systems

Figure 11.3: An Enterprise Content Management System



Interactive Session: Organizations: ECM in the Cloud Empowers New Zealand Department of Conservation

- Class discussion
  - Describe the knowledge management problem discussed in this case study.
  - What management, organization, and technology factors contributed to the problem?
  - How did implementing enterprise content management solve the problem? How did the new ECM system change the way the DOC worked?
  - How successful was this solution? Explain.

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

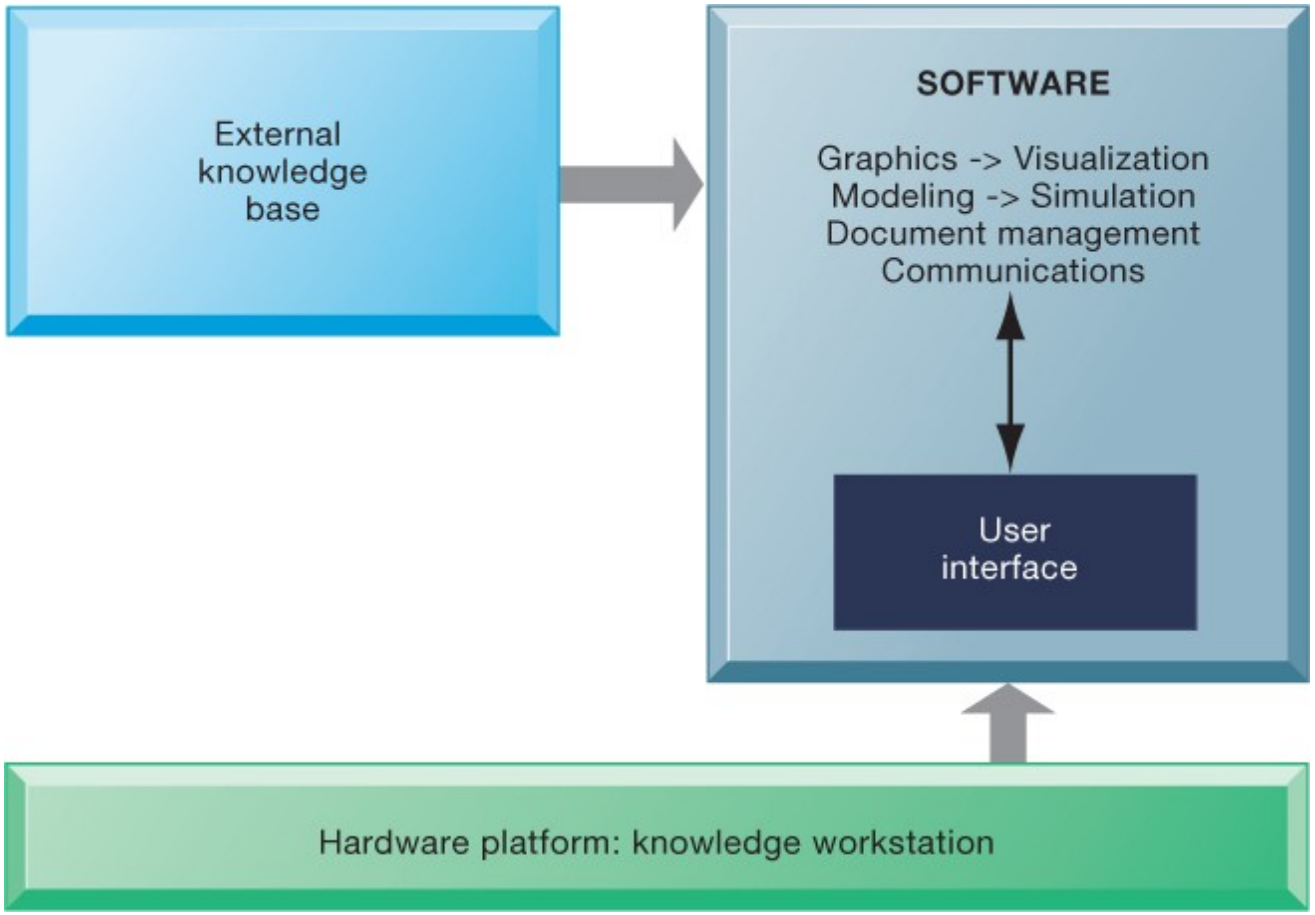
Knowledge Workers and Knowledge Work

- Knowledge workers
  - Researchers, designers, architects, scientists, engineers who create knowledge for the organization
  - Three key roles
    - Keeping organization current in knowledge
    - Serving as internal consultants regarding their areas of expertise
    - Acting as change agents, evaluating, initiating, and promoting change projects
- Knowledge work systems
  - Systems for knowledge workers to help create new knowledge and integrate that knowledge into business

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)

Figure 11.4: Requirements of Knowledge Work Systems



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

What Are the Business Benefits of Using Intelligent Techniques for Knowledge Management?

- 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

Interactive Session: Technology: Will Robots Replace People in Manufacturing?

- Class discussion
  - Why have robots caught on in manufacturing? What knowledge to they require?
  - Can robots replace human workers in manufacturing? Explain your answer.
  - If you were considering introducing robots in your manufacturing plant, what management, organization, and technology issues would you need to address?

Capturing Knowledge: Expert Systems (1 of 2)

- Capture tacit knowledge in very specific and limited domain of human expertise
- Capture knowledge as set of rules
- Typically perform limited tasks
  - Diagnosing malfunctioning machine
  - Determining whether to grant credit for loan
- Used for discrete, highly structured decision making
- Knowledge base: Set of hundreds or thousands of rules
- Inference engine: Strategy used to search knowledge base
  - Forward chaining
  - Backward chaining

Figure 11.5: Rules in an Expert System

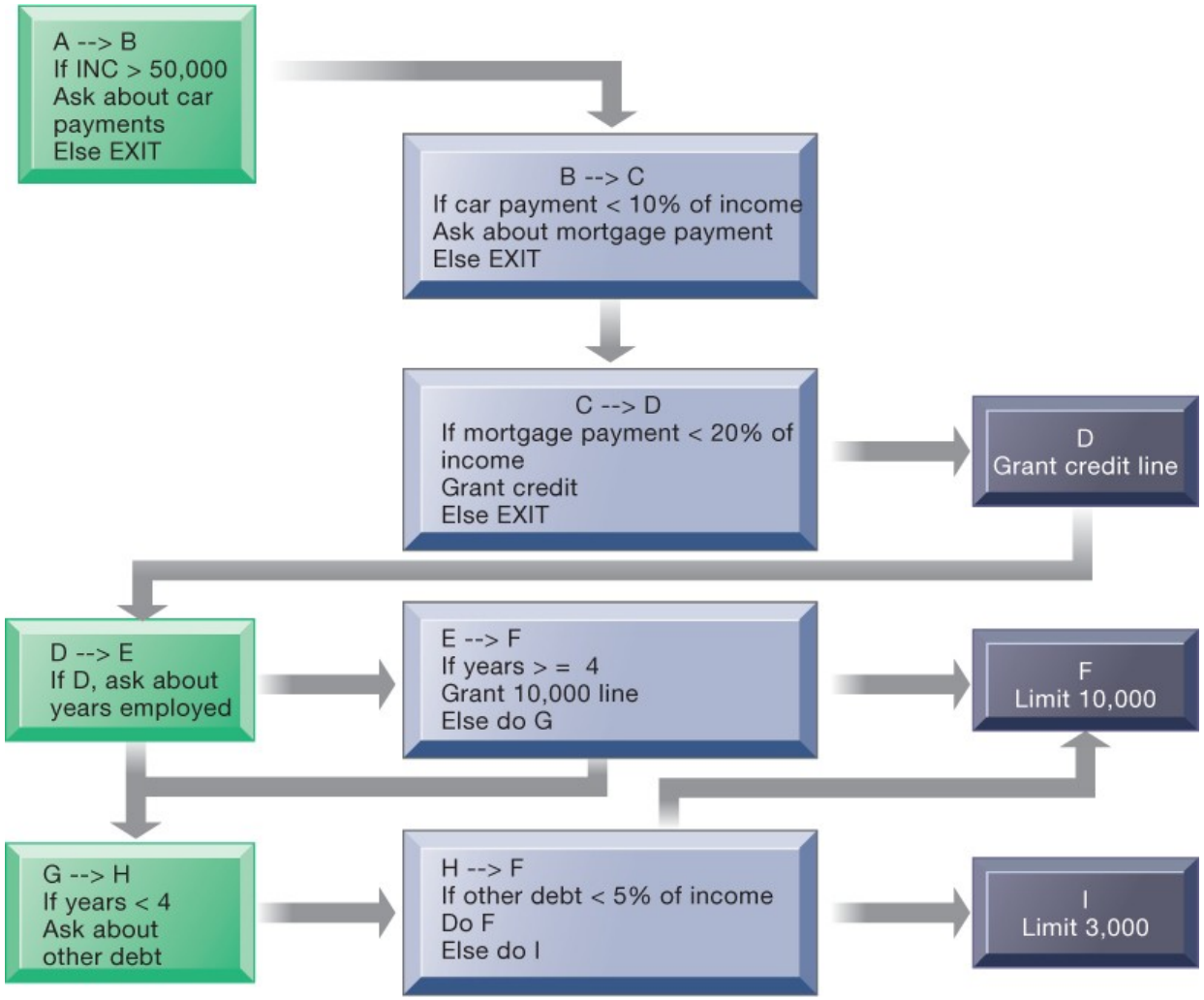
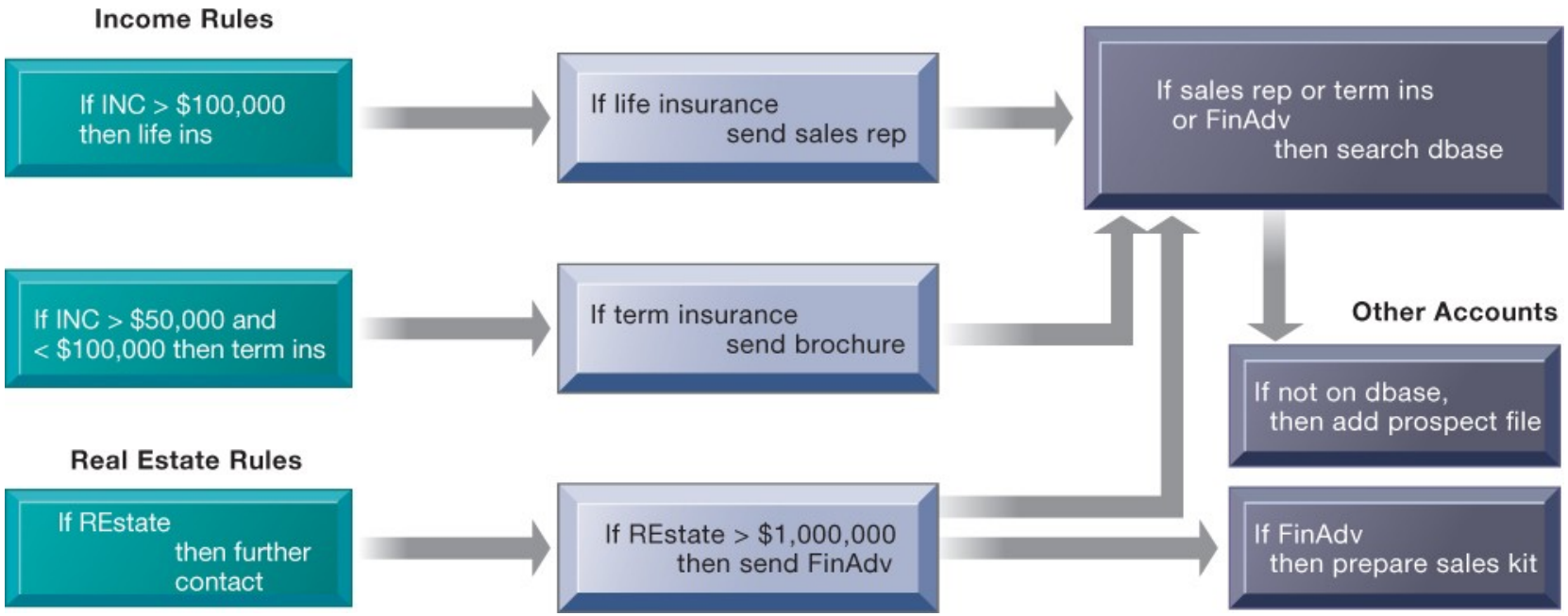


Figure 11.6: Inference Engines in Expert Systems



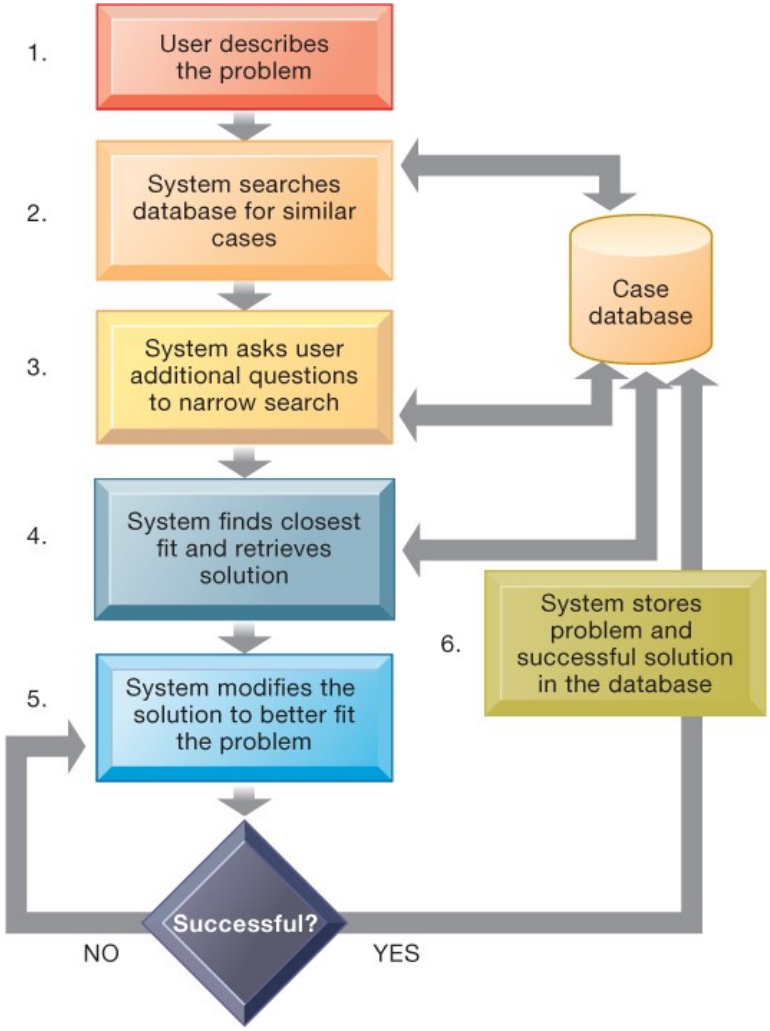
Capturing Knowledge: Expert Systems (2 of 2)

- Successful expert systems
  - Con-Way Transportation's system to automate and optimize planning of overnight shipment routes
- 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

Organizational Intelligence: Case-Based Reasoning

- 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
- CBR found in:
  - Medical diagnostic systems
  - Customer support

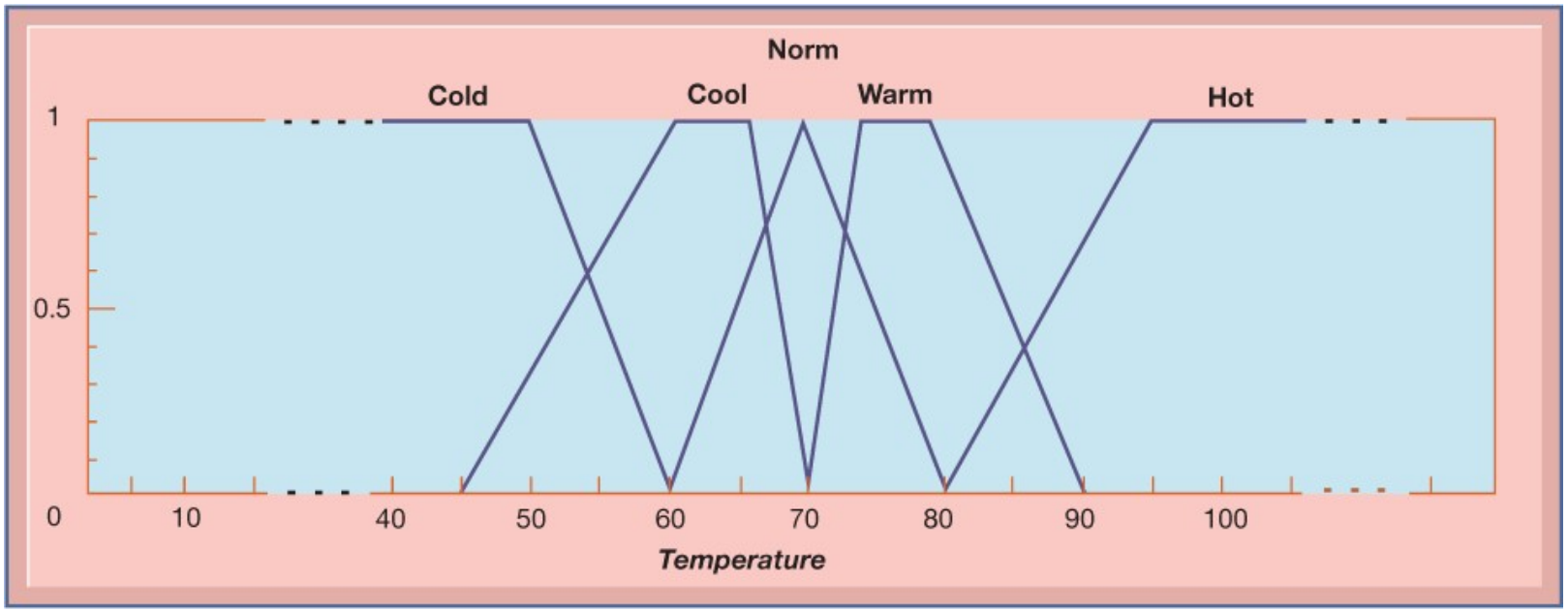
Figure 11.7: How Case-Based Reasoning Works



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

Figure 11.8: Fuzzy Logic for Temperature Control



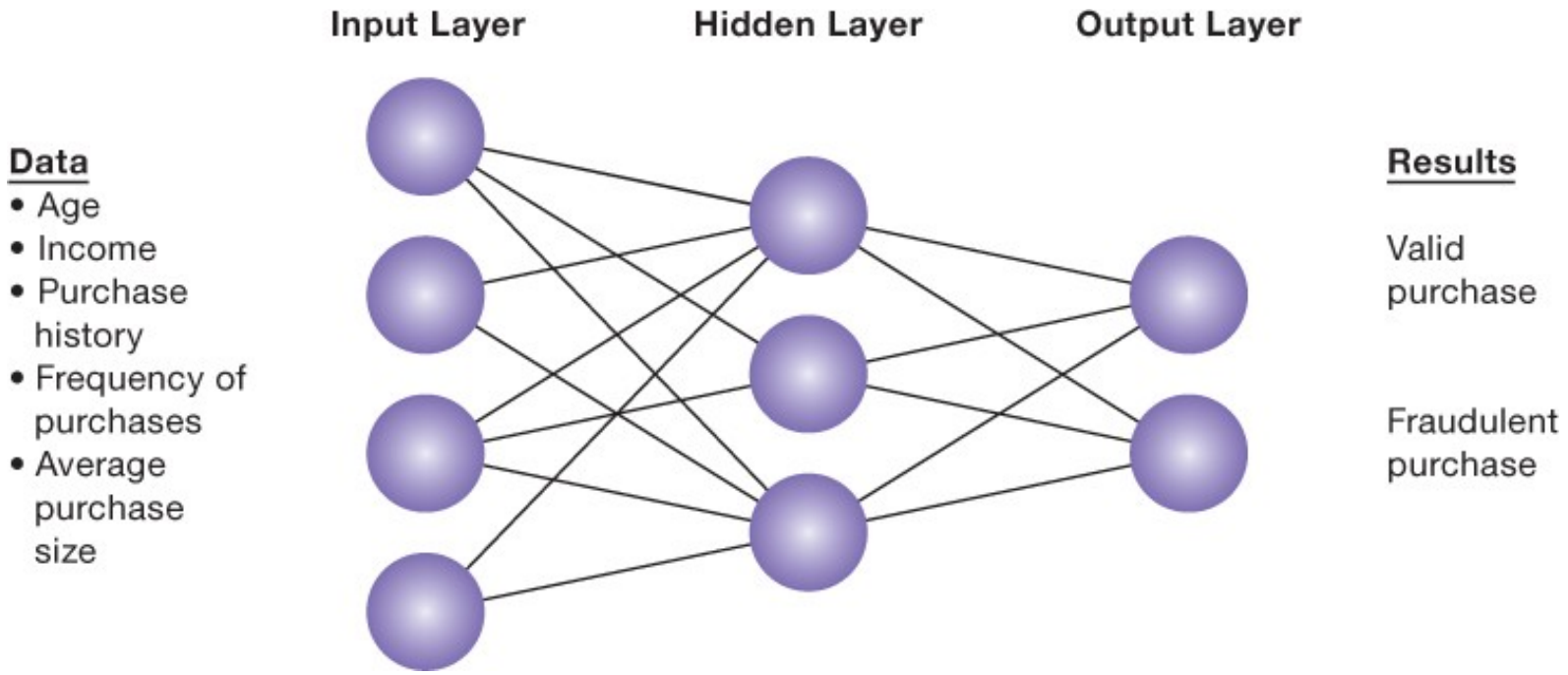
Machine Learning

- 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

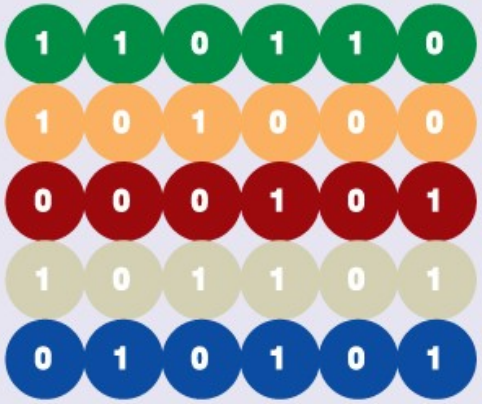
Figure 11.9: How a Neural Network Works



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

Figure 11.10: The Components of a Genetic Algorithm



	Length	Width	Weight	Fitness
1	Long	Wide	Light	55
2	Short	Narrow	Heavy	49
3	Long	Narrow	Heavy	36
4	Short	Medium	Light	61
5	Long	Medium	Very light	74

A population of chromosomes

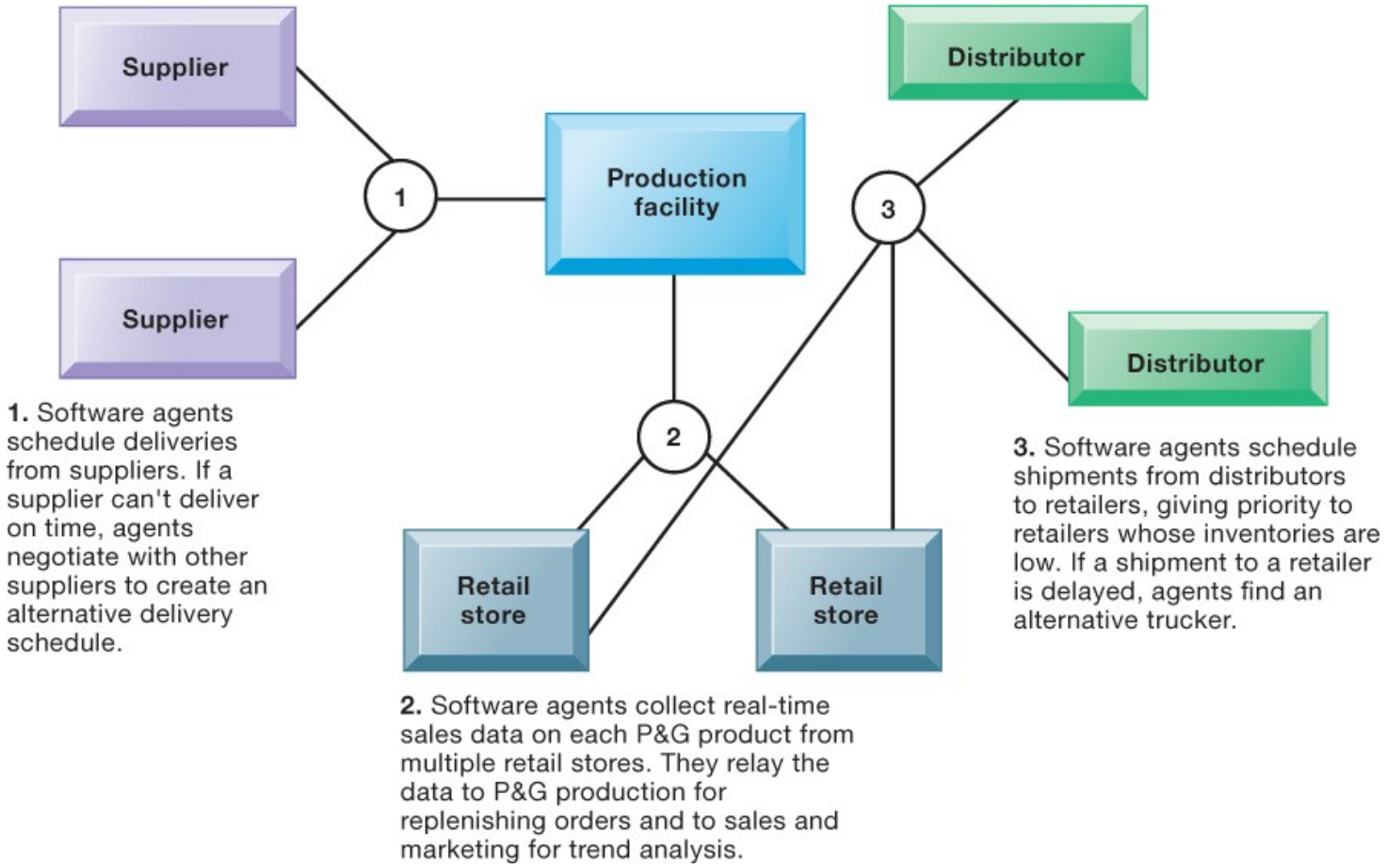
Decoding of chromosomes

Evaluation of chromosomes

Intelligent Agents

- Work without direct human intervention to carry out repetitive, predictable tasks
  - Deleting junk e-mail
  - Finding cheapest airfare
- Use limited built-in or learned knowledge base
  - Some are capable of self-adjustment, for example: Siri
- Chatbots
- Agent-based modeling applications:
  - Model behavior of consumers, stock markets, and supply chains; used to predict spread of epidemics

Figure 11.11: Intelligent Agents in P&G's Supply Chain Network



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