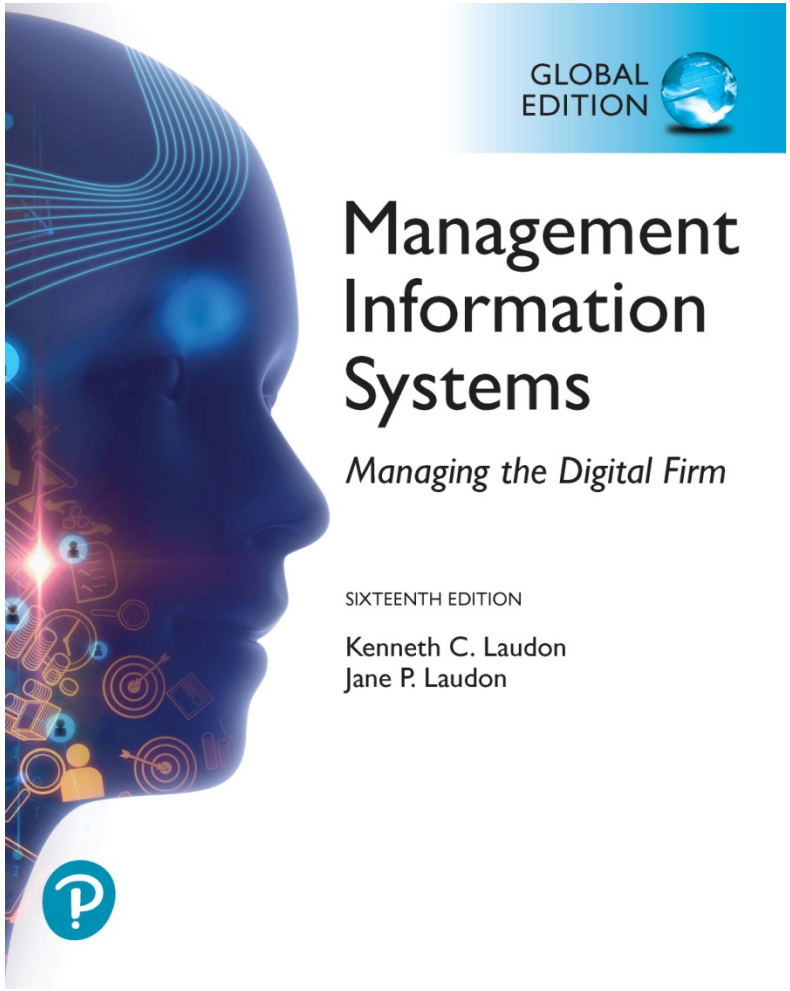
Management Information Systems: Managing the Digital Firm

Sixteenth Edition • Global Edition



Chapter 11

Managing Knowledge and Artificial Intelligence

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?

11.5 How will MIS help my career?

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.

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

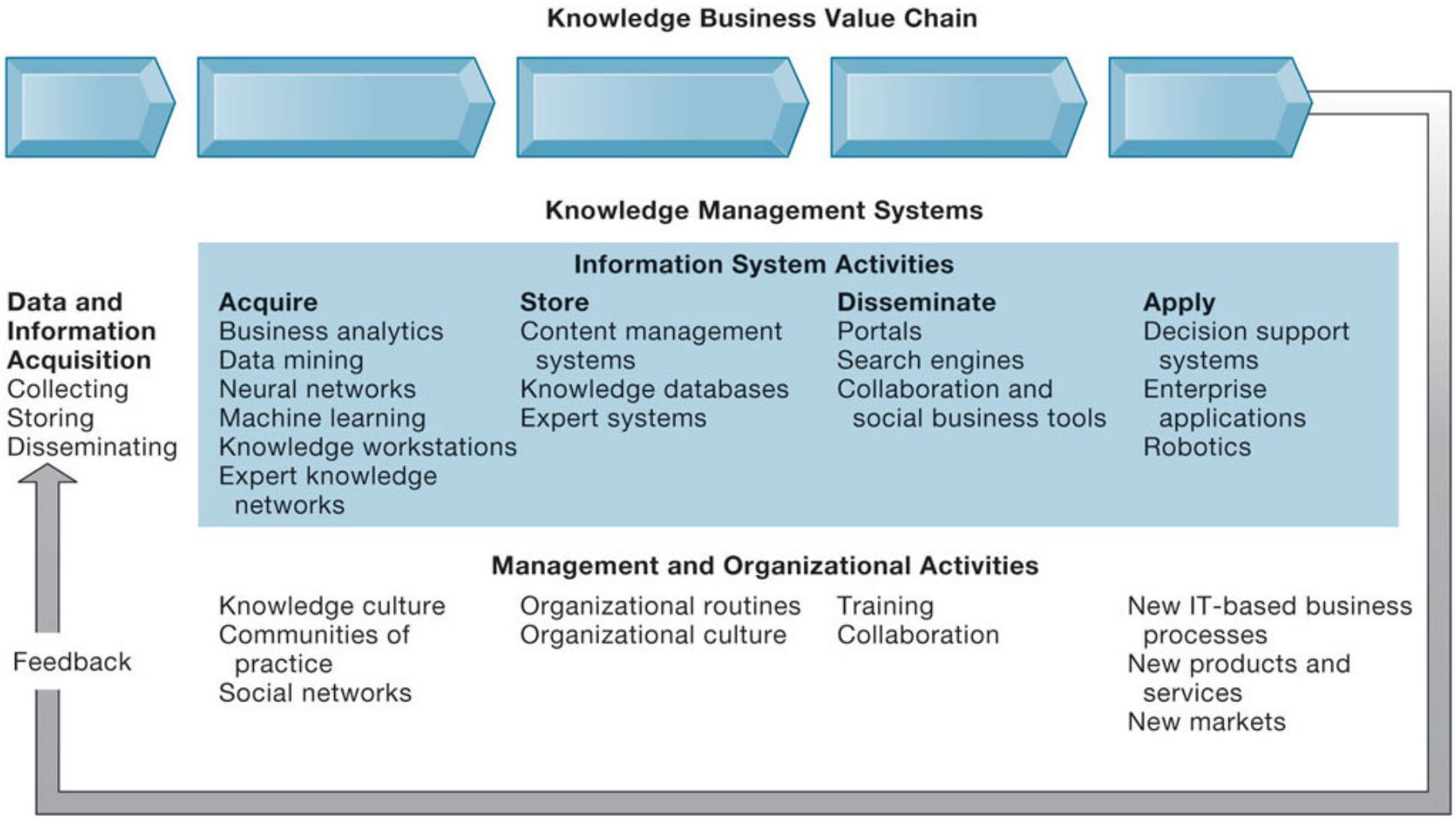
The Knowledge Management Value Chain
(2 of 3)

- 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



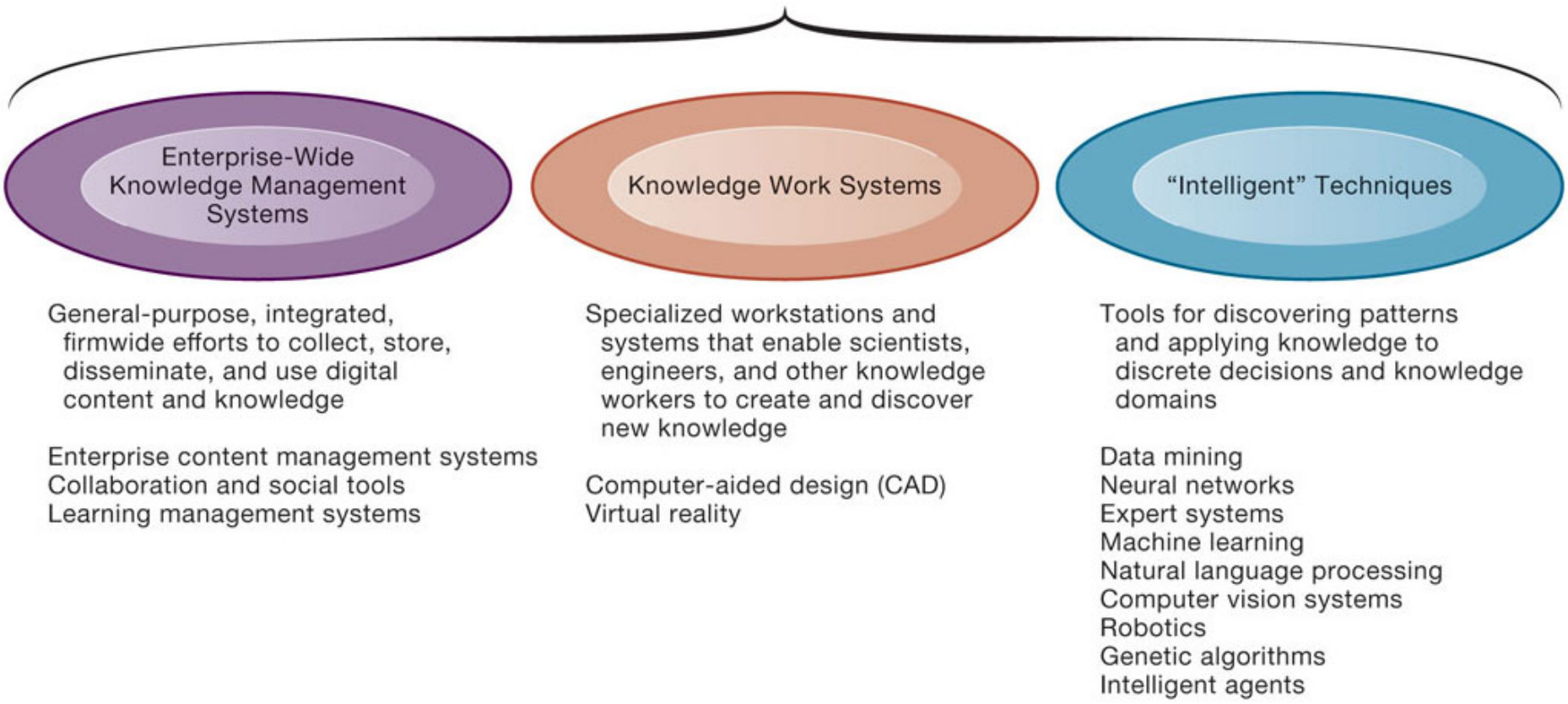
Building Organizational and Management Capital:
Collaboration, Communities of Practice, and Office Environments

- 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
  - Semi-structured documents
    - E-mails, videos
  - Unstructured, tacit knowledge
- 80% of an organization's business content is semi-structured or unstructured

What Is Artificial Intelligence? (1 of 3)

- Grand vision
  - Computer hardware and software systems that are as "smart" as humans
  - So far, this vision has eluded computer programmers and scientists
- Realistic vision
  - Systems that take data inputs, process them, and produce outputs (like all software programs) and that can perform many complex tasks that would be difficult or impossible for humans to perform.

What Is Artificial Intelligence? (2 of 3)

- Examples:
  - Recognize millions of faces in seconds
  - Interpret millions of CT scans in minutes
  - Analyze millions of financial records
  - Detect patterns in very large Big Data databases
  - Improve their performance over time (“learn”)
  - Navigate a car in certain limited conditions
  - Respond to questions from humans (natural language); speech activated assistants like Siri, Alexa, and Cortana

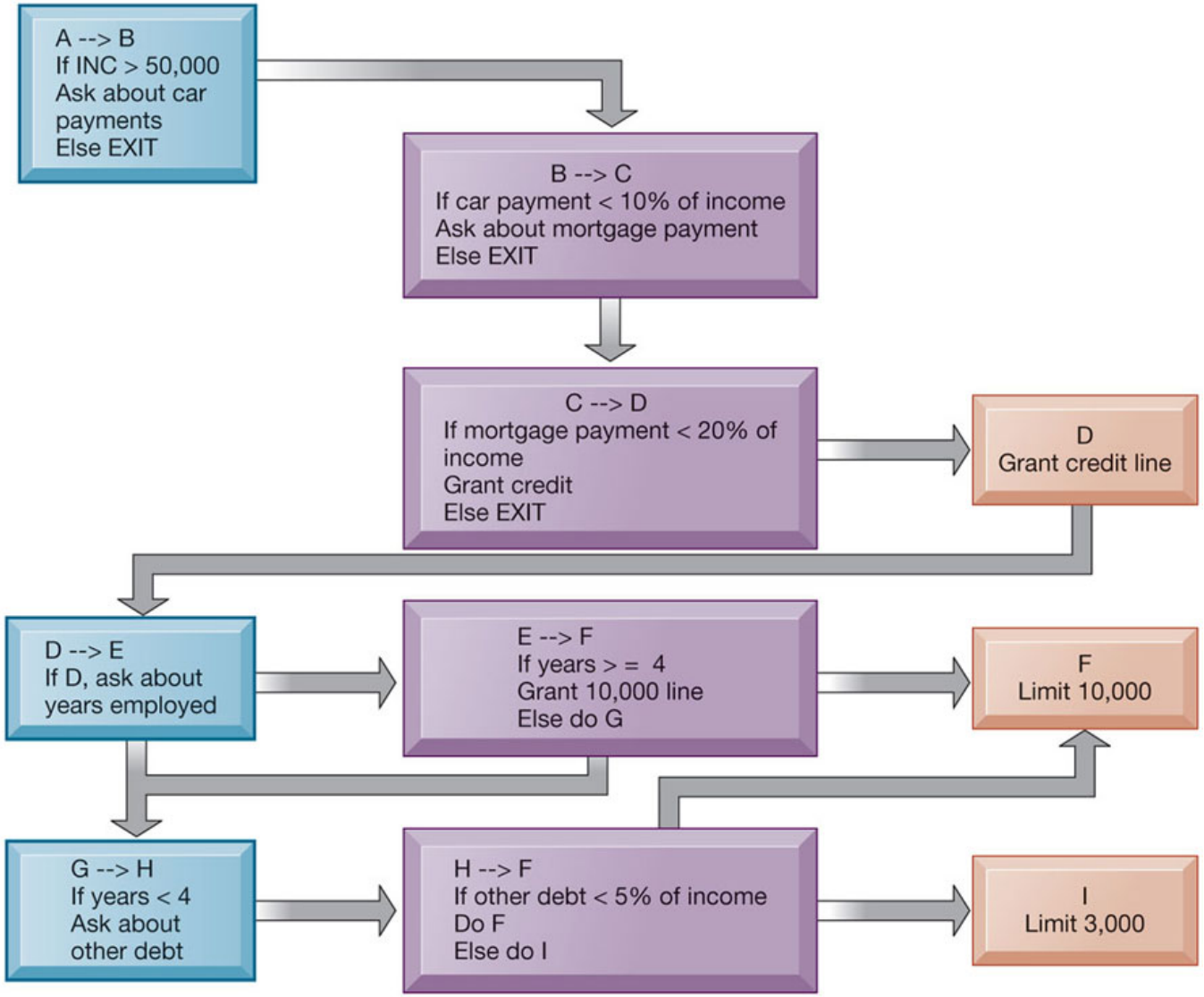
What Is Artificial Intelligence? (3 of 3)

- Major Types of AI
  - Expert systems
  - Machine learning
  - Neural networks and deep learning networks
  - Genetic algorithms
  - Natural Language Processing
  - Computer vision
  - Robotics

Capturing Knowledge: Expert Systems

- 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 11.3 Rules in an Expert System



Machine Learning

- How computer programs improve performance without explicit programming
  - Recognizing patterns
  - Experience
  - Prior learnings (database)
  - Supervised vs. unsupervised learning

- 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 from human experts.
- Used in medicine, science, and business for problems in pattern classification, prediction, financial analysis, and control and optimization

Figure 11.4 How a Neural Network Works

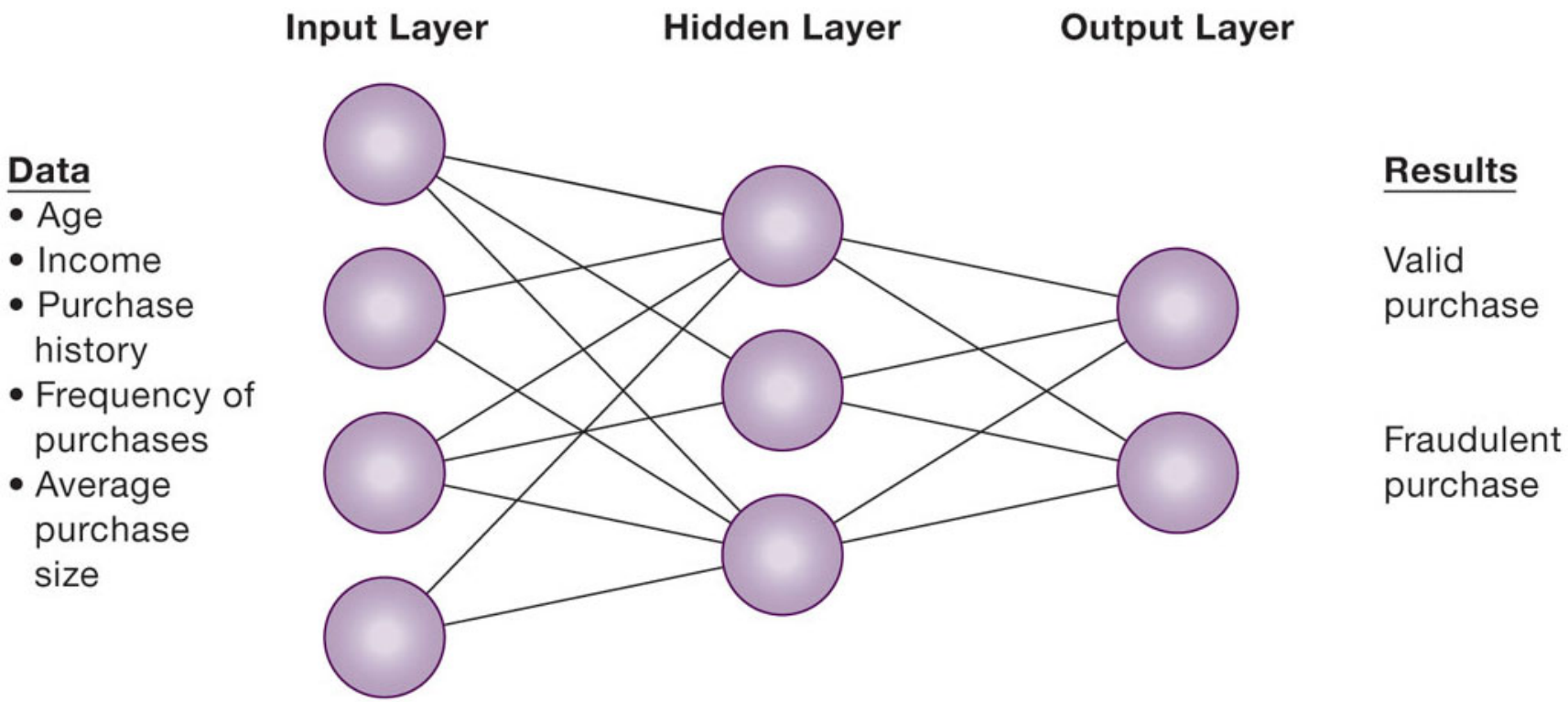
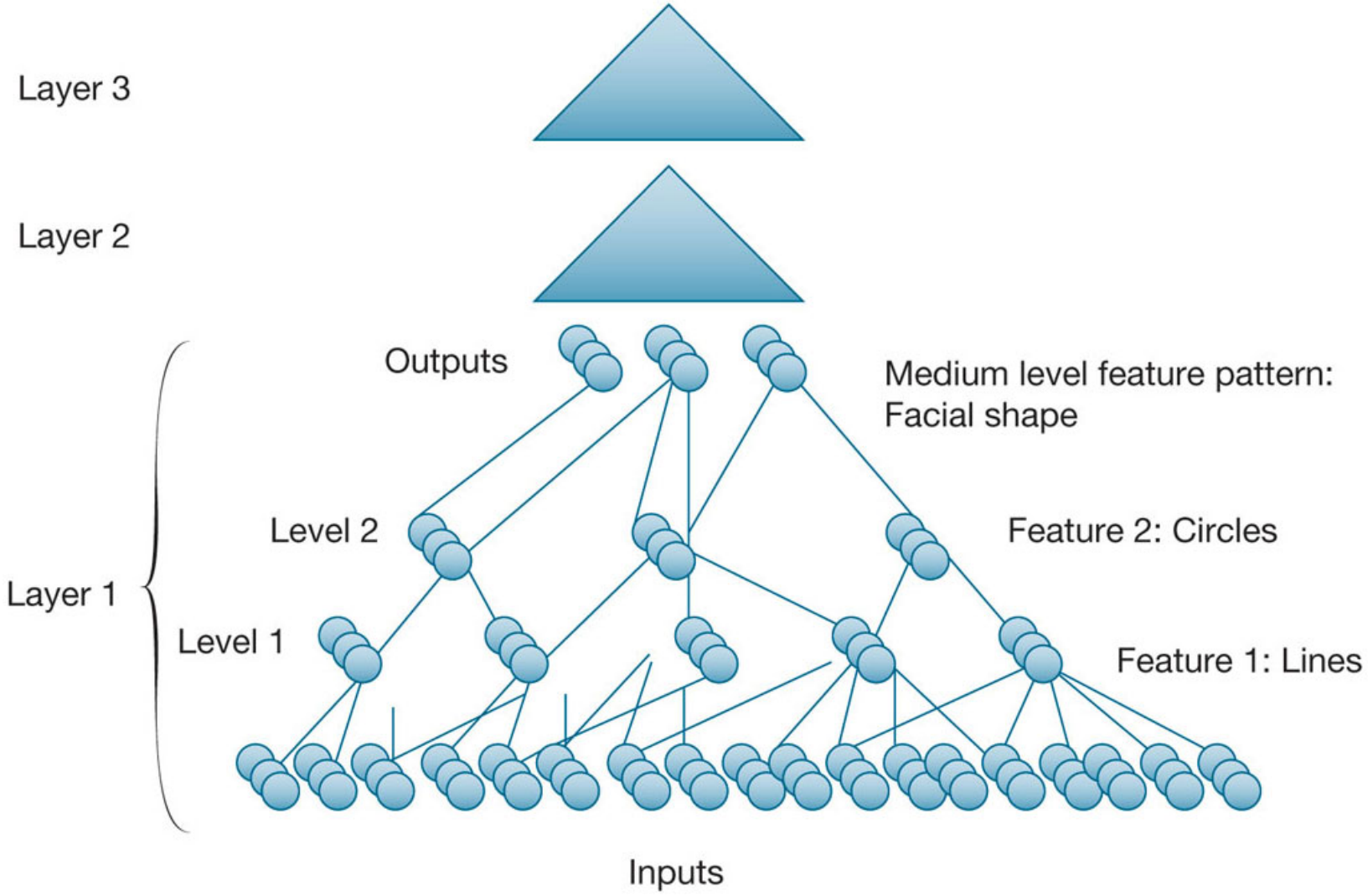


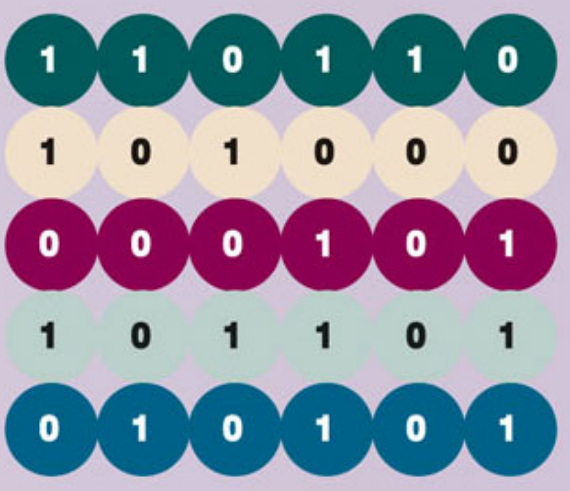
Figure 11.5 A Deep Learning Network



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 11.6 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**

Natural Language Processing

- Understand, and speak in natural language. Read natural language and translate
- Typically today based on machine learning, aided by very large databases of common phrases and sentences in a given language
- Example: Google Translate
- Spam filtering systems
- Customer call-center interactions: What is the customer's problem? What solutions worked in the past?
- Digital assistances: Sire, Alexa, Cortana, Google Assistant
- Not useful for an ordinary common sense human conversation but can be very useful in limited domains, e.g. interacting with your car's heating system.

Computer Vision Systems

- Digital image systems that create a digital map of an image (like a face, or a street sign), and recognize this image in large data bases of images in near real time
- Every image has a unique pattern of pixels
- Facebook's DeepFace can identify friends in photos across their system, and the entire web
- Autonomous vehicles can recognize signs, road markers, people, animals, and other vehicles with good reliability
- Industrial machine (robot) vision
- Passport control at airports
- Identifying people in crowds

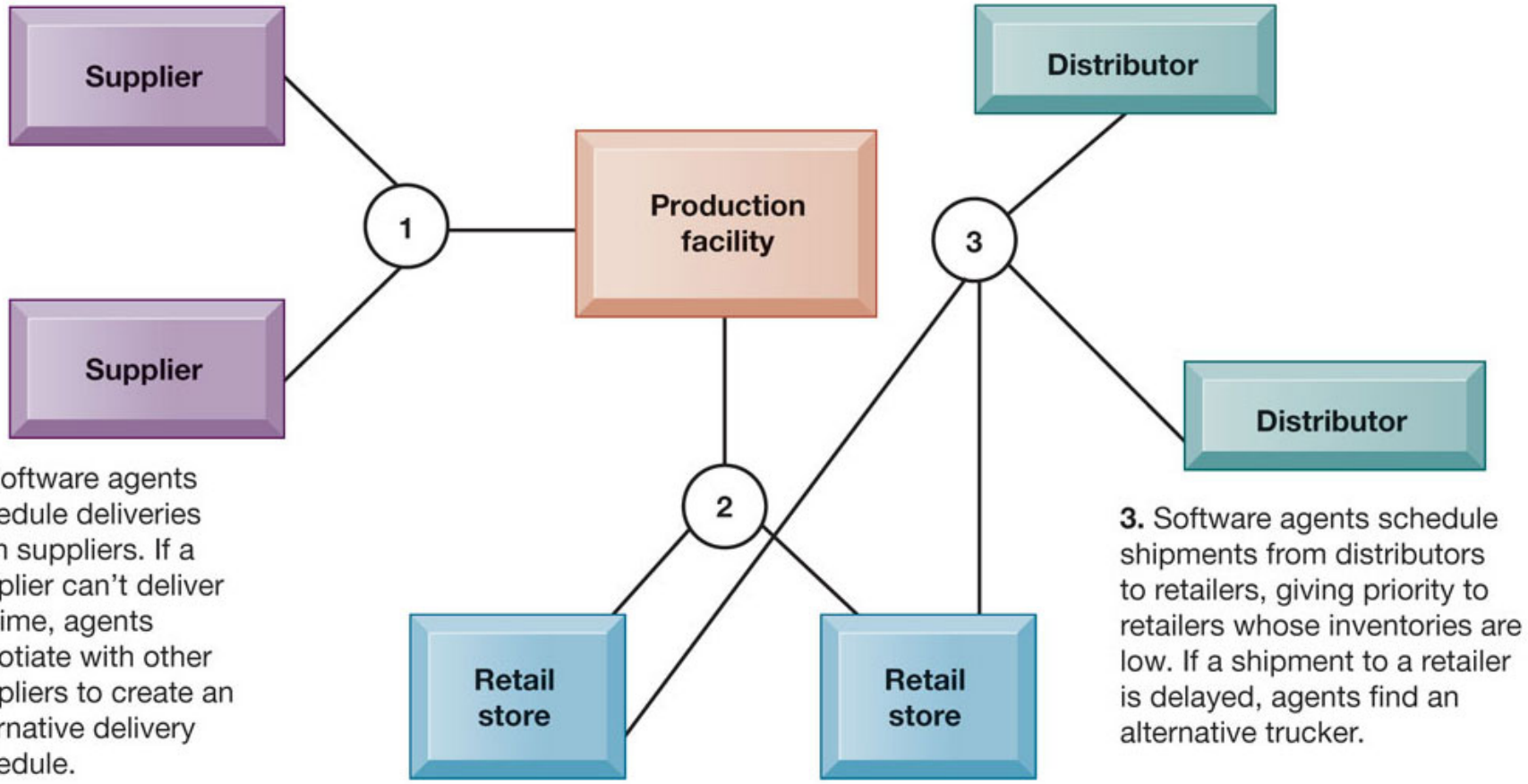
Robotics

- Design, construction, and operation of machines that can substitute for humans in many factory, office, and home applications (home vacuums).
- Generally programmed to perform specific and detailed actions in limited domains, e.g. robots spray paint autos, and assemble certain parts, welding, heavy assembly movement.
- Used in dangerous situations like bomb disposal
- Surgical robots are expanding their capabilities

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

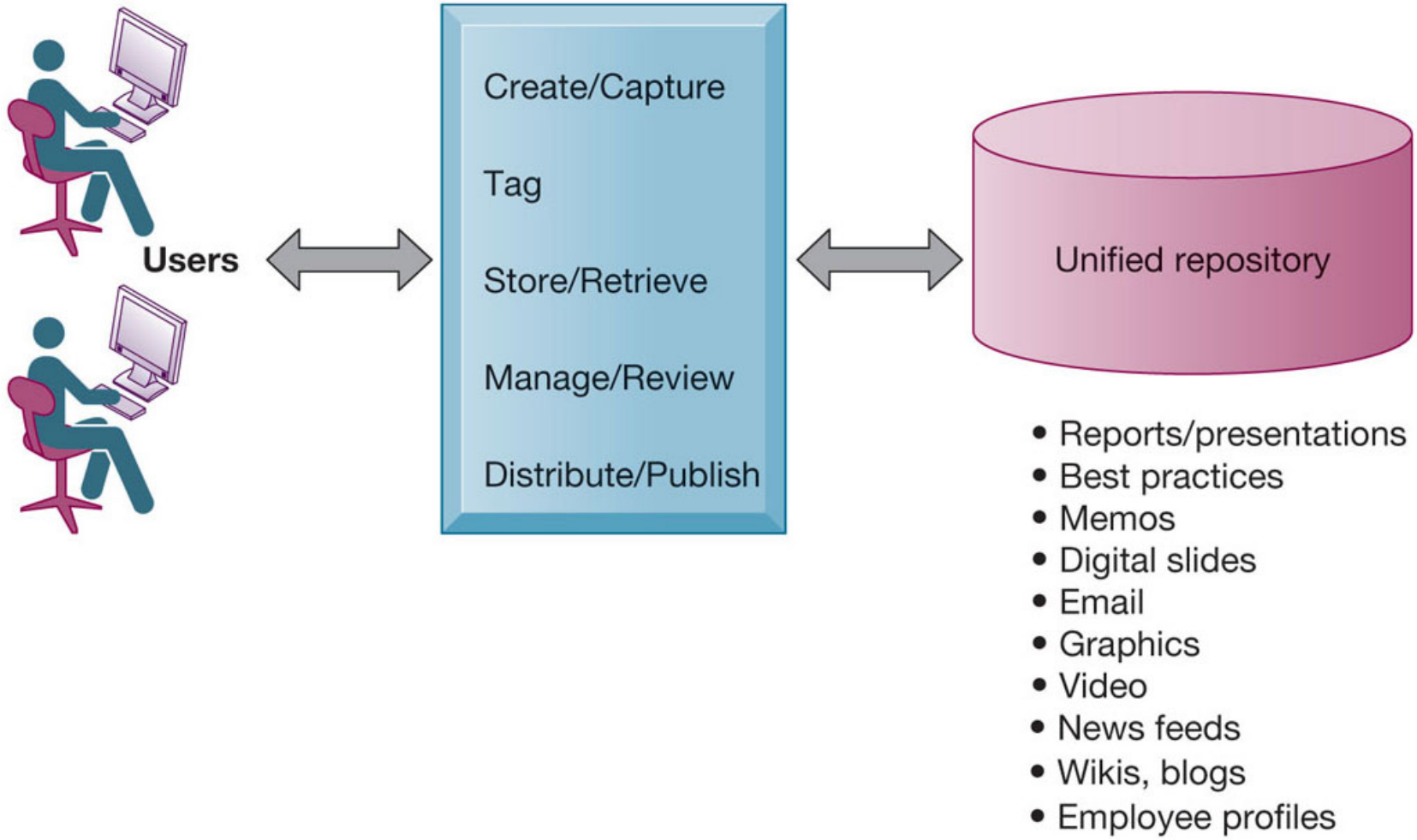
Figure 11.7
Intelligent Agents in P&G's Supply Chain Network



Enterprise Content Management Systems

- Help capture, store, retrieve, distribute, preserve documents and semi-structured 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 11.8
An Enterprise Content Management System



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

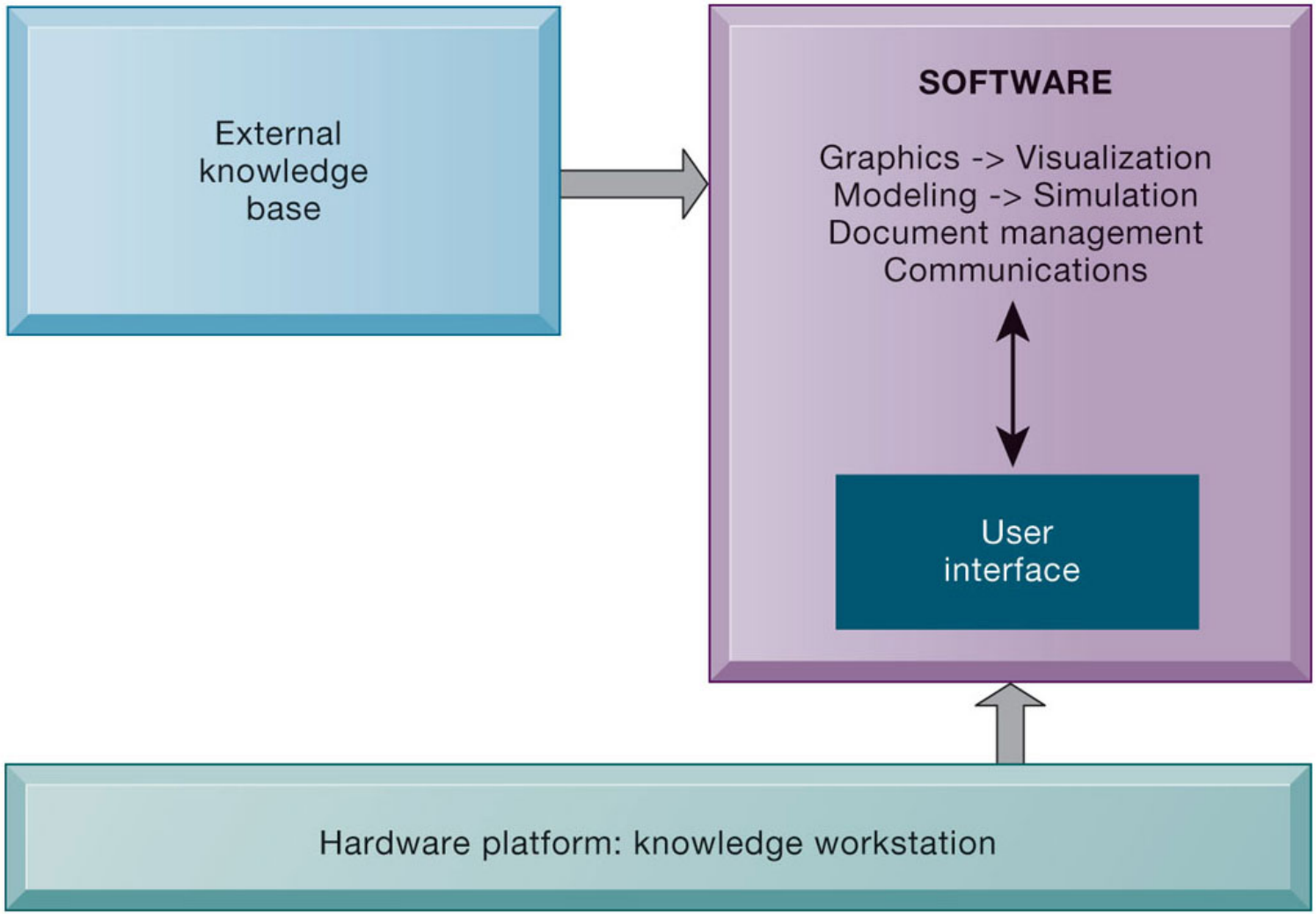
Knowledge Workers and Knowledge Work

- 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 11.9
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

Video Cases

- Enterprise Content Management Systems
  - https://www.youtube.com/watch?v=HFSZ0chJHqs
  - https://www.youtube.com/watch?v=mDPbrvbAves
- Roche on personalised healthcare
  - https://www.youtube.com/watch?v=e-tWa1YhCN0
- Will Robots Replace People in Manufacturing?
  - https://www.youtube.com/watch?v=SimCBnbPdP4
  - https://www.youtube.com/watch?v=a-7Azih0D98

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