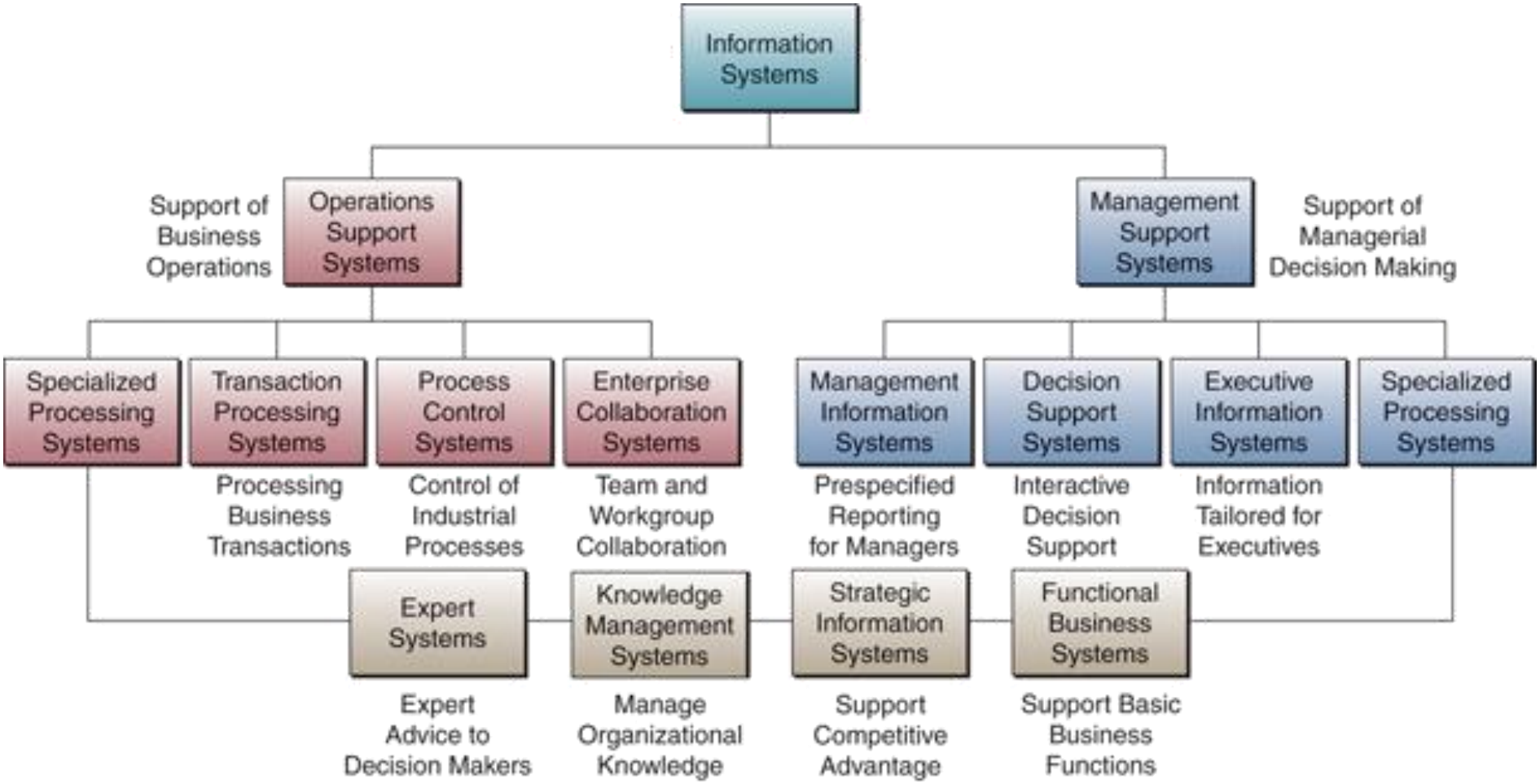
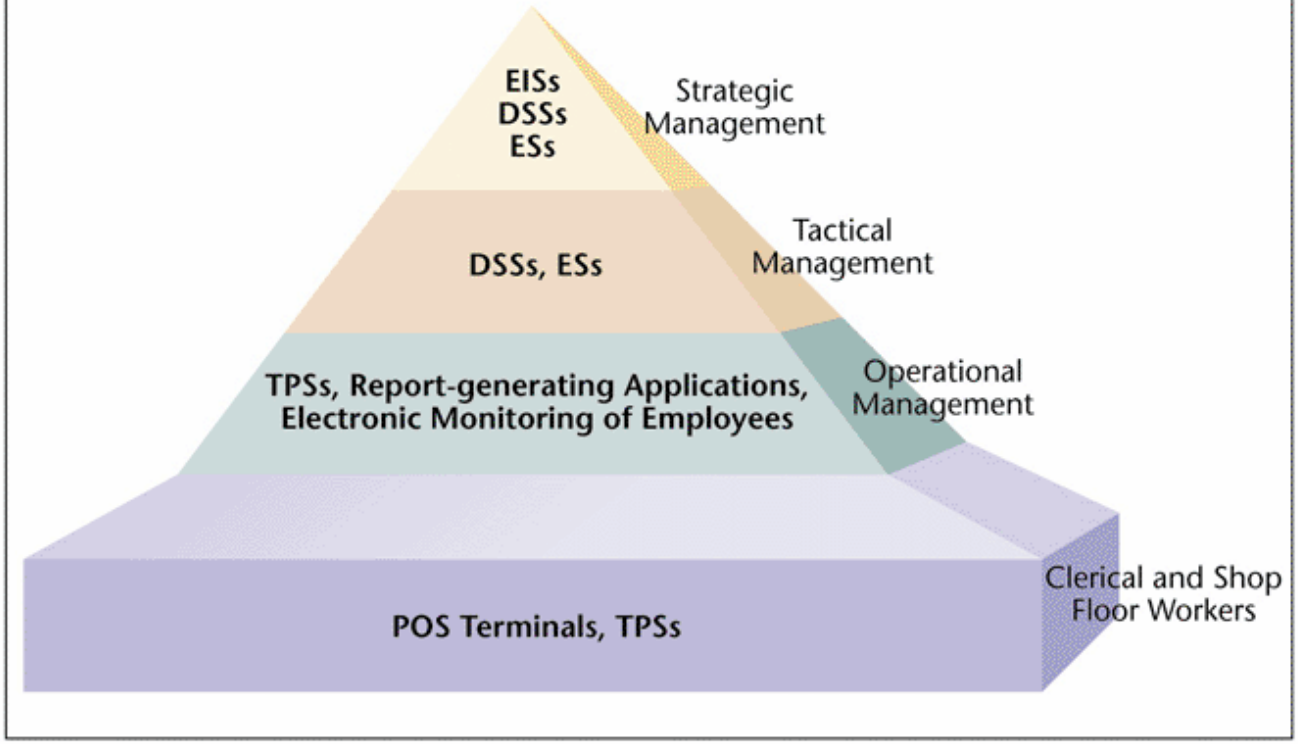
Types of Information Systems



MANAGERS AND THEIR INFORMATION SYSTEMS

FIGURE 9.13
Types of information systems typically used at different levels of an organization's hierarchy



Other Categories of Information Systems

Expert/ Knowledge-based Systems

provide expert advice and act as expert consultants to users.

Knowledge Management Systems

support the creation, organization, and dissemination of business knowledge to employees and managers throughout a company

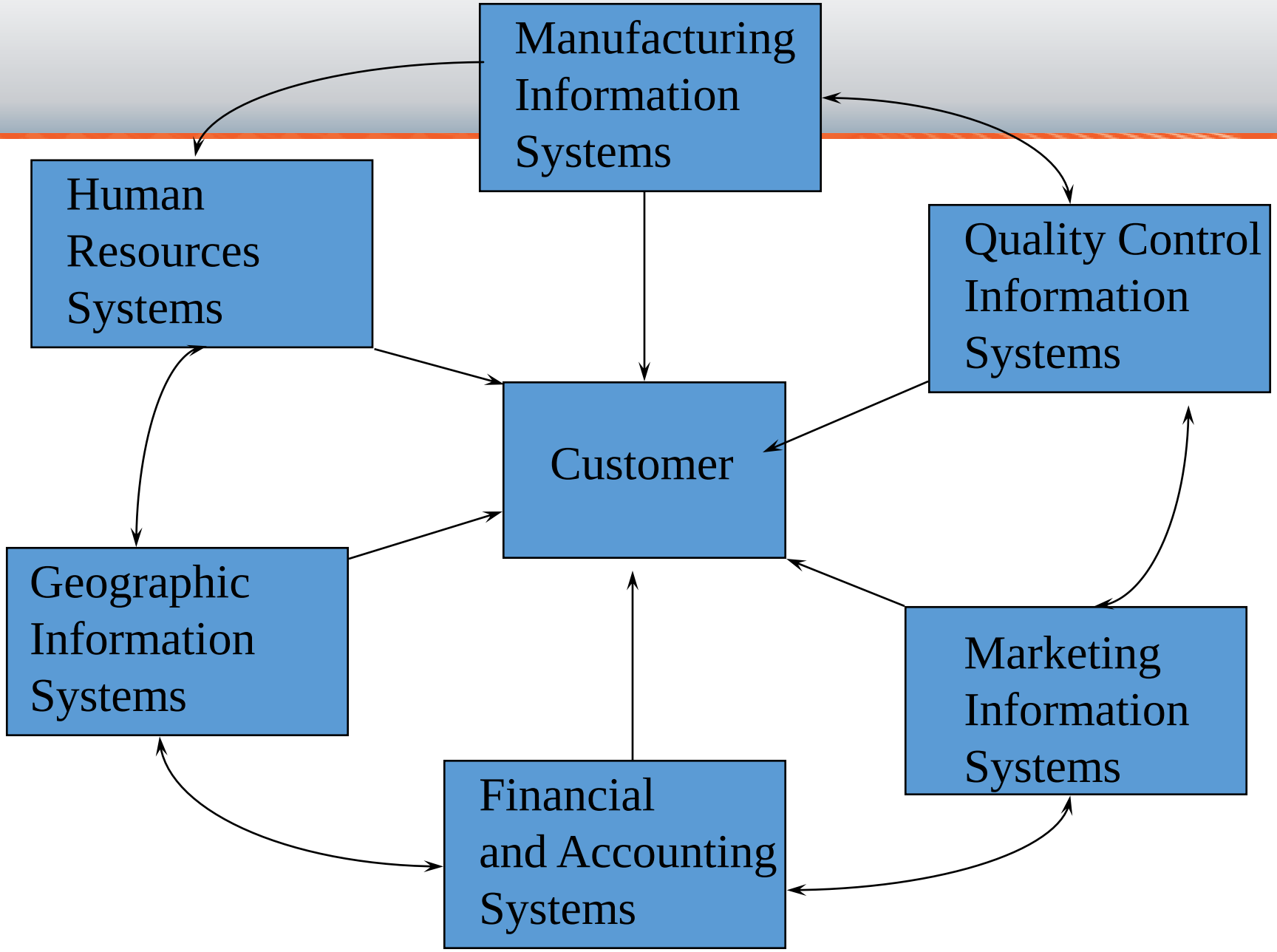
Cross-Functional Information Systems

integrated combinations of business information systems, thus sharing information resources across the functional units of an organization

Strategic Information Systems

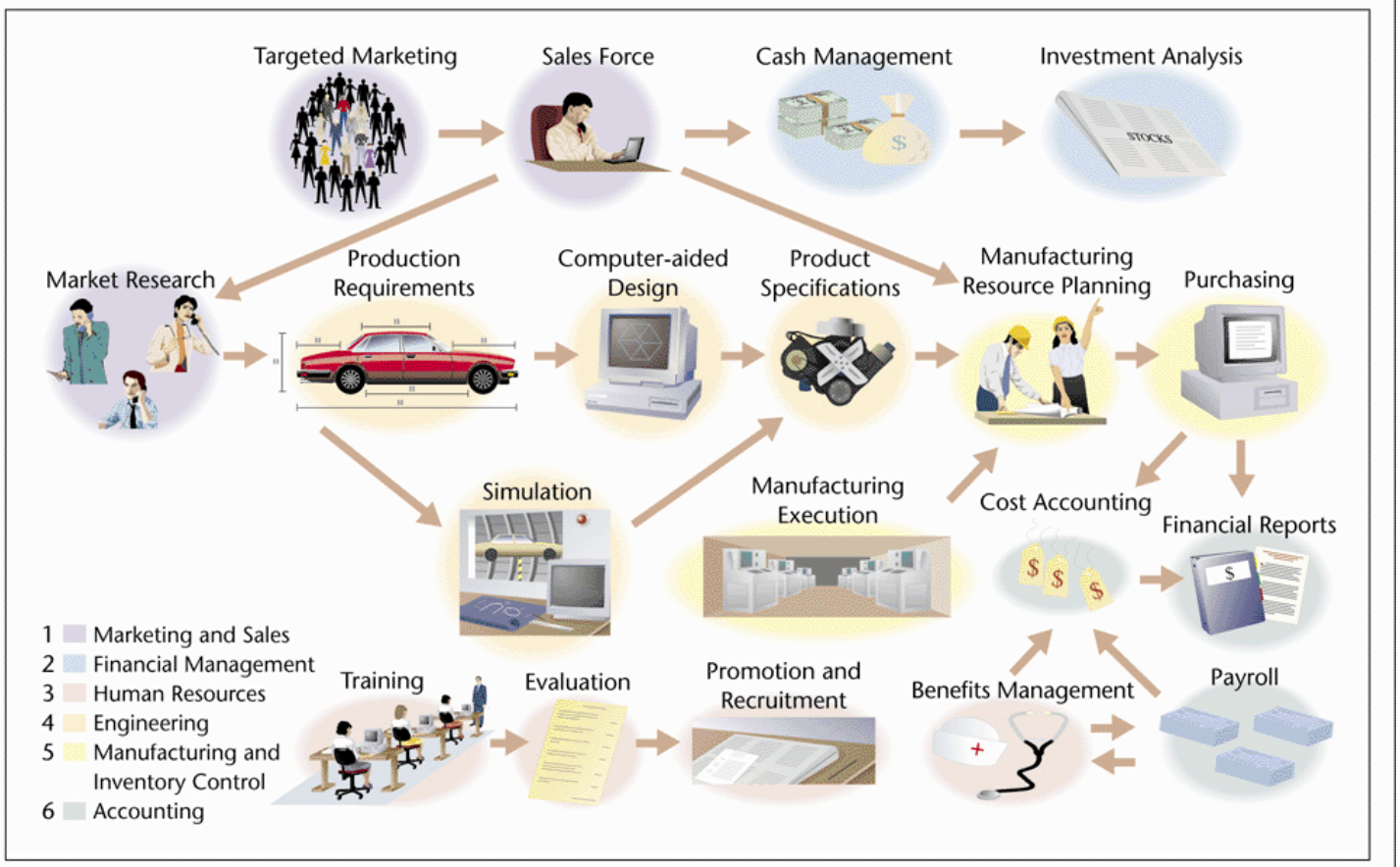
support operations or management processes that provide a firm with strategic products, services, and capabilities for competitive advantage.

Functional Business Systems

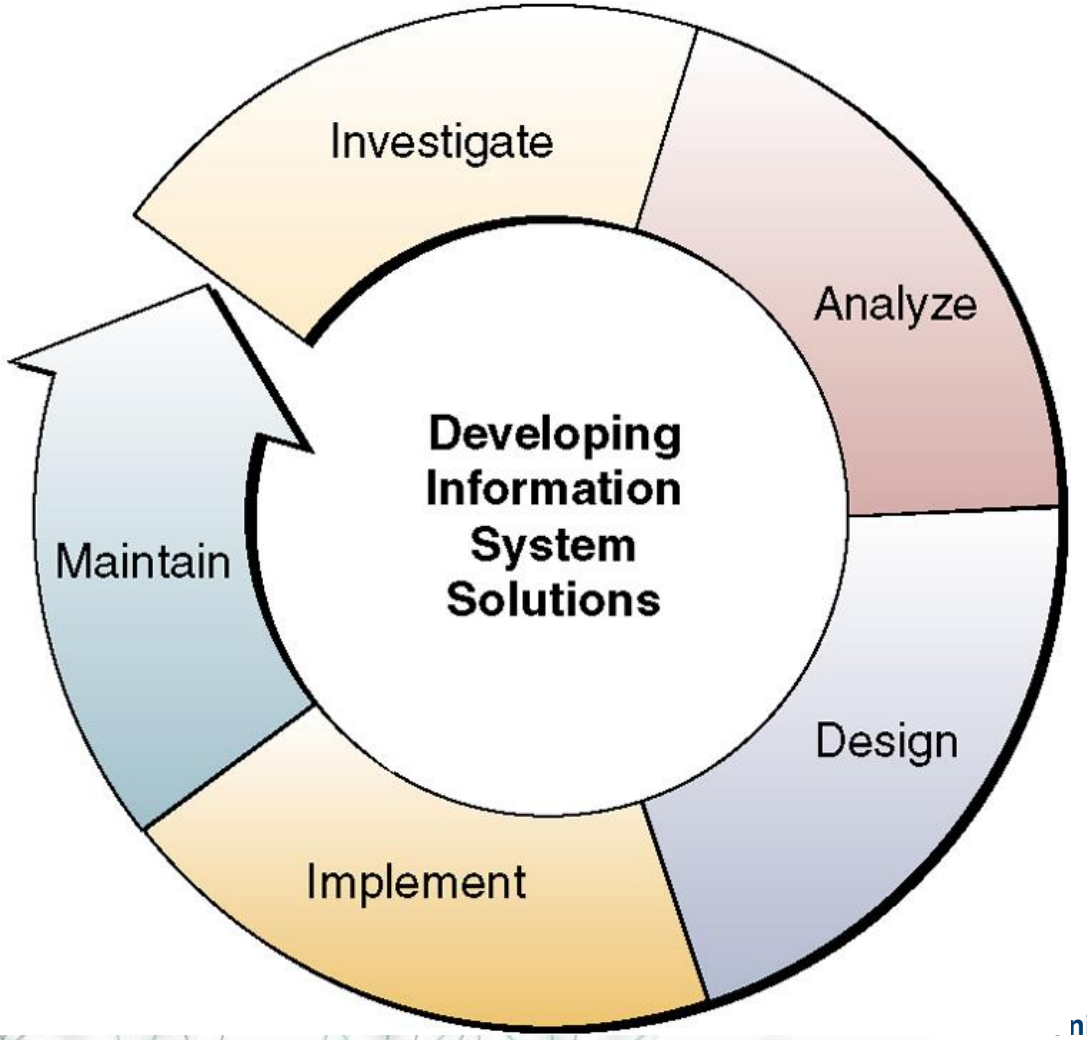


EFFECTIVENESS AND EFFICIENCY

FIGURE 3.2
Information systems in different business functions are interdependent.



The Information Systems Development Process



Types of Business Information Systems

- Support and Managerial Decision Making

- **Transaction processing systems**
  - Keep track of basic activities and transactions of organization (e.g. sales, receipts, cash deposits, payroll, credit decisions, flow of materials in a factory)
- **Management information systems and decision-support systems**
  - Help with monitoring, controlling, decision-making, and administrative activities
- **Executive support systems:**
  - Help address strategic issues and long-term trends, both in firm and in external environment

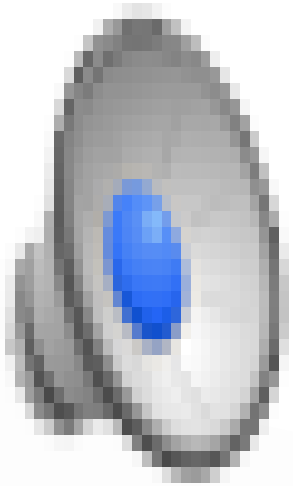
Types of Business Information Systems - Support and Managerial Decision Making

- Transaction
  - Any **business-related exchange**, such as
    - payments to employees
    - sales to customers
    - the movement of parts from one phase of manufacturing to another, from raw materials to finished products

Types of Business Information Systems - Support and Managerial Decision Making

- Transaction processing system (**TPS**)
  - An organized collection of people, procedures, software, databases, and devices
  - Used to **perform basic processing** and **record completed business transactions**
  - record data collected at the boundaries of organizations, in other words, at the point where the organization transacts business with other parties. For example, Cash registers and ATMs

Enterprise Systems: Transaction Processing Systems



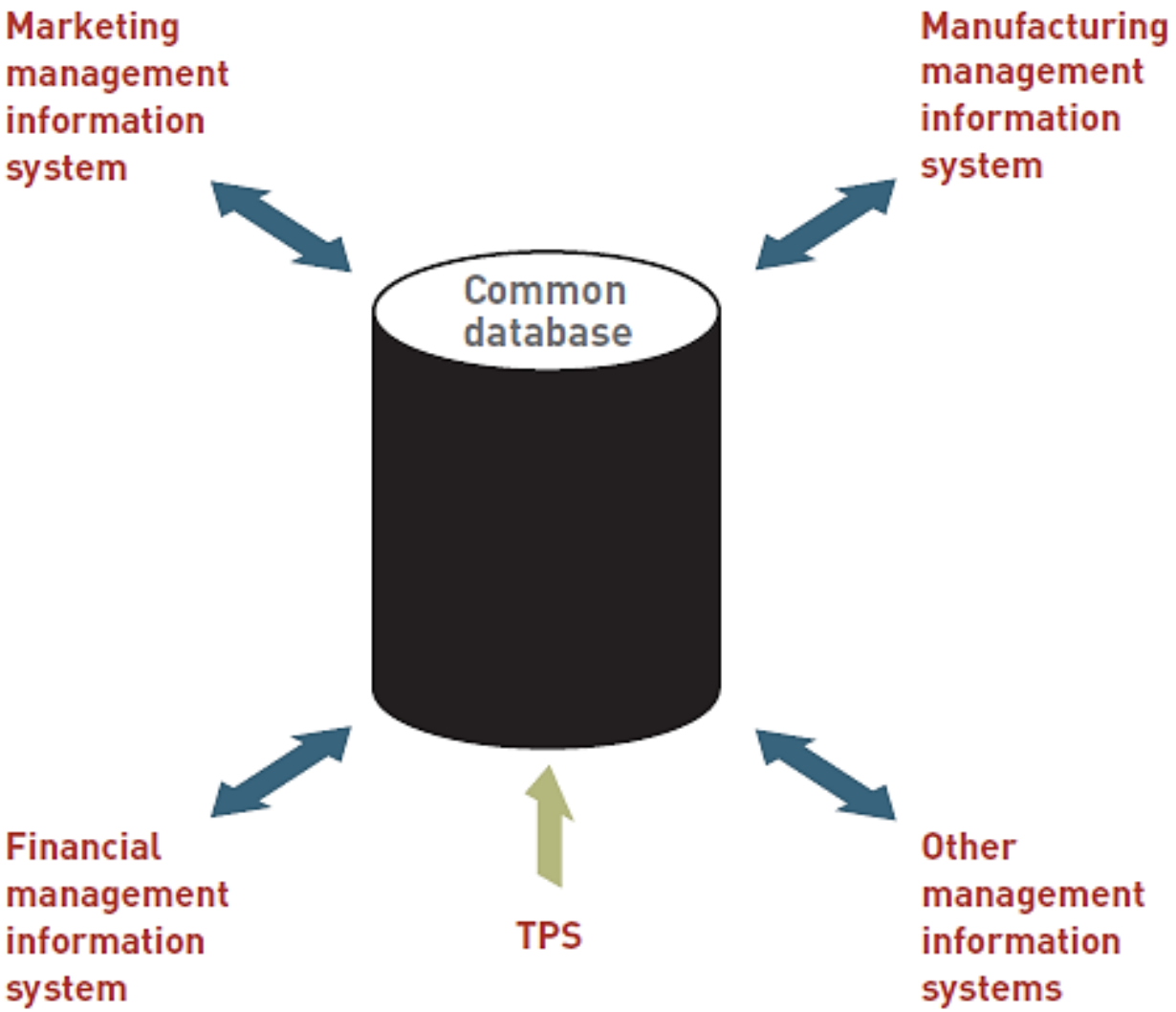
Types of Business Information Systems - Support and Managerial Decision Making

- Management information system (**MIS**)
  - Organized collection of people, procedures, software, databases, and devices
  - Provides **routine information** to managers and decision makers
  - **produce information for problem solving and decision making**
  - Focuses on **operational efficiency**
  - Provides **standard reports** generated with data and information from the **TPS or ERP**

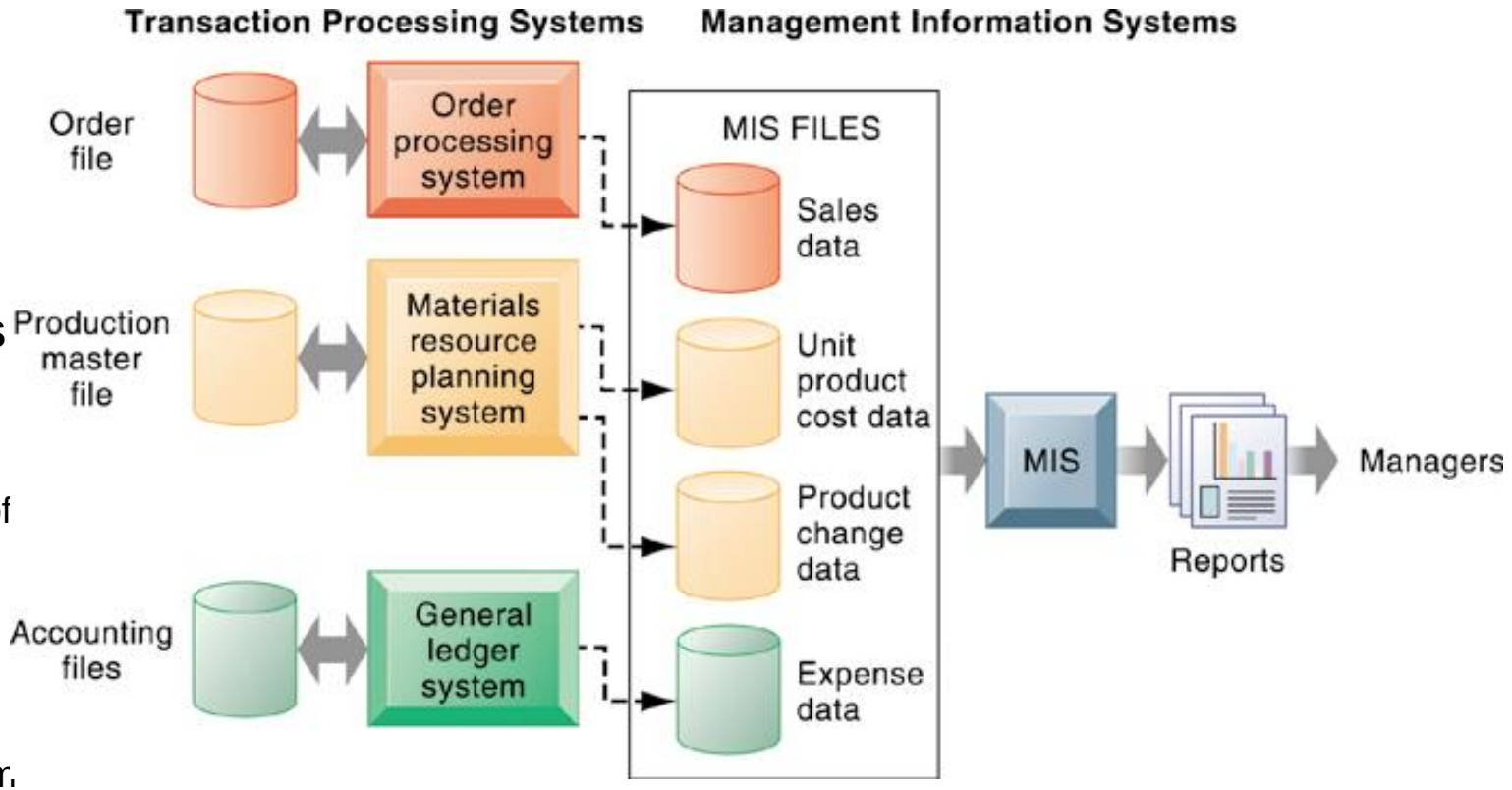
Types of Business Information Systems - Support and Managerial Decision Making

- **Management information systems**
  - Provide middle managers with reports on firm's performance
    - To monitor firm and help predict future performance
  - Summarize and report on basic operations using data from TPS
  - Provide weekly, monthly, annual results, but may enable drilling down into daily or hourly data
  - Typically not very flexible systems with little analytic capability

Management Information System



How MIS Obtain Data from Organization's TPS



In the system illustrated by this diagram, **three TPS** supply summarized transaction data to the MIS reporting system at the end of the time period. Managers gain access to the organizational data through the MIS, which provides them with the appropriate reports.

Management Information System

Types of Business Information Systems

- Support and Managerial Decision Making

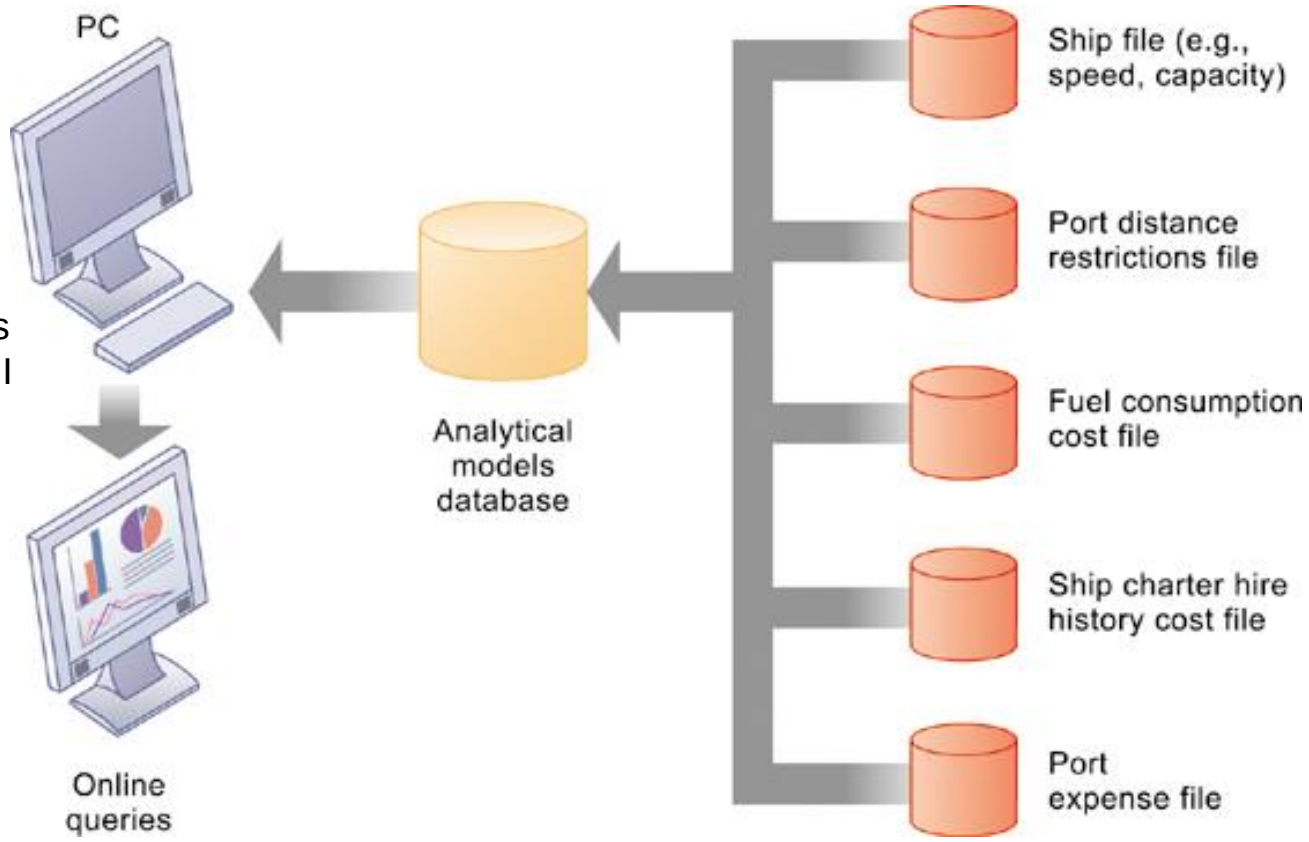
- **Decision support systems (DSS)**
  - Support **non-routine decision making for middle management**
    - E.g. What would impact on production schedules be if sales doubled in December?
  - Use **information** from TPS, MIS, and external sources
  - Use **models** to analyze data
    - E.g. voyage estimating system of metals company that calculates financial and technical voyage details
  - Focus on extracting, analyzing information from large amounts of data

Decision Support System (DSS)

- An organized collection of people, procedures, software, databases, and devices that support problem-specific decision making
  - Focus is on **making effective decisions**
  - Contain models, or formulas, that manipulate data into information
  - Often answer “what if?” questions
- A **DSS** can include the following:
  - Model base
  - Database
  - User interface or dialogue manager

Voyage-Estimating Decision Support System

This DSS operates on a powerful PC. I is used daily by managers who must develop bids on shipping contracts.

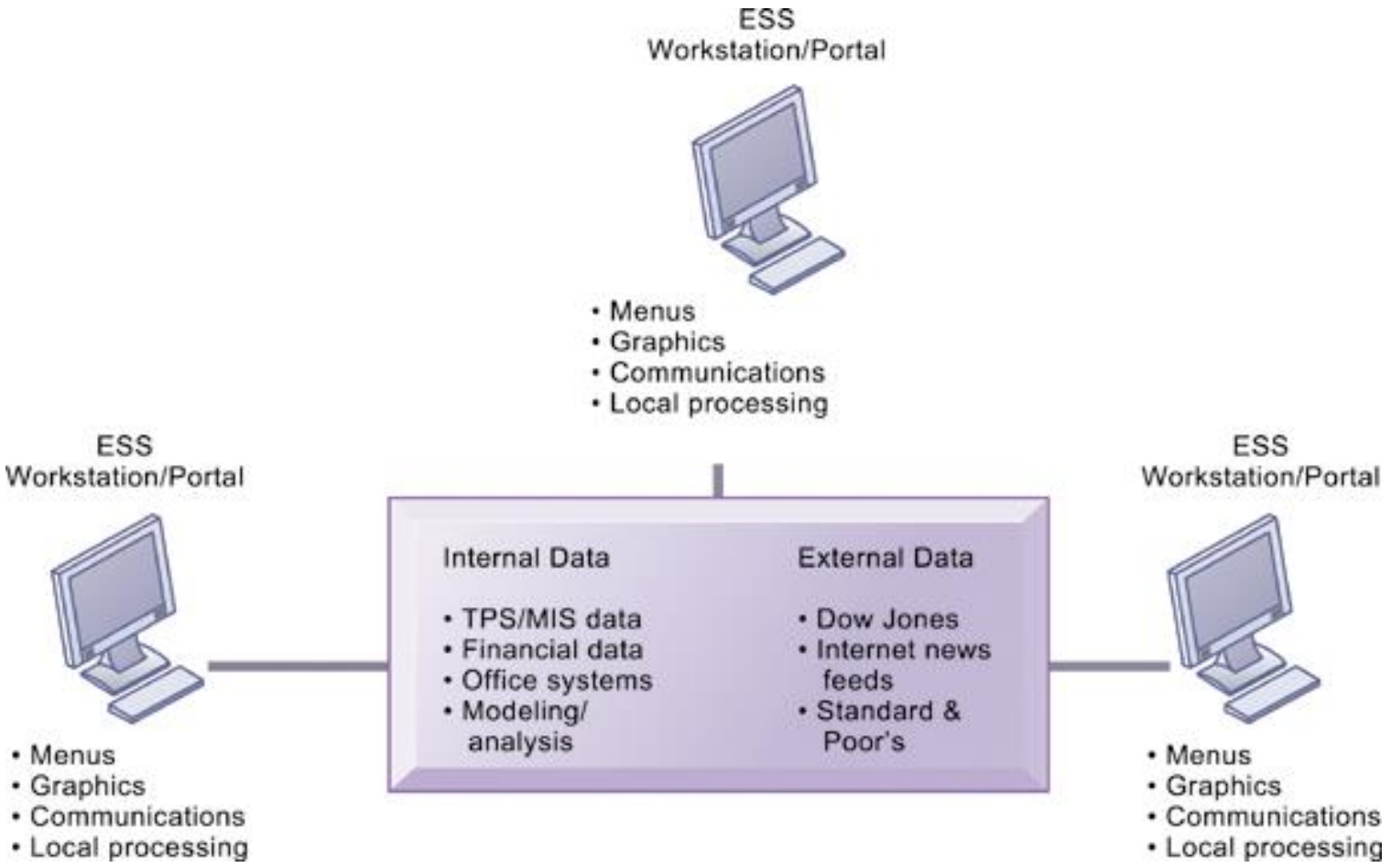


Types of Business Information Systems - Support and Managerial Decision Making

- **Executive support systems (ESS)**
  - Serve senior managers
  - Address **strategic issues** and long-term trends
    - E.g. What products should we make in 5 years?
  - Address non-routine decision-making
  - Provide generalized computing capacity that can be applied to changing array of problems
  - Draw summarized information from MIS, DSS and data from external events
  - Typically use portal with Web interface to present content

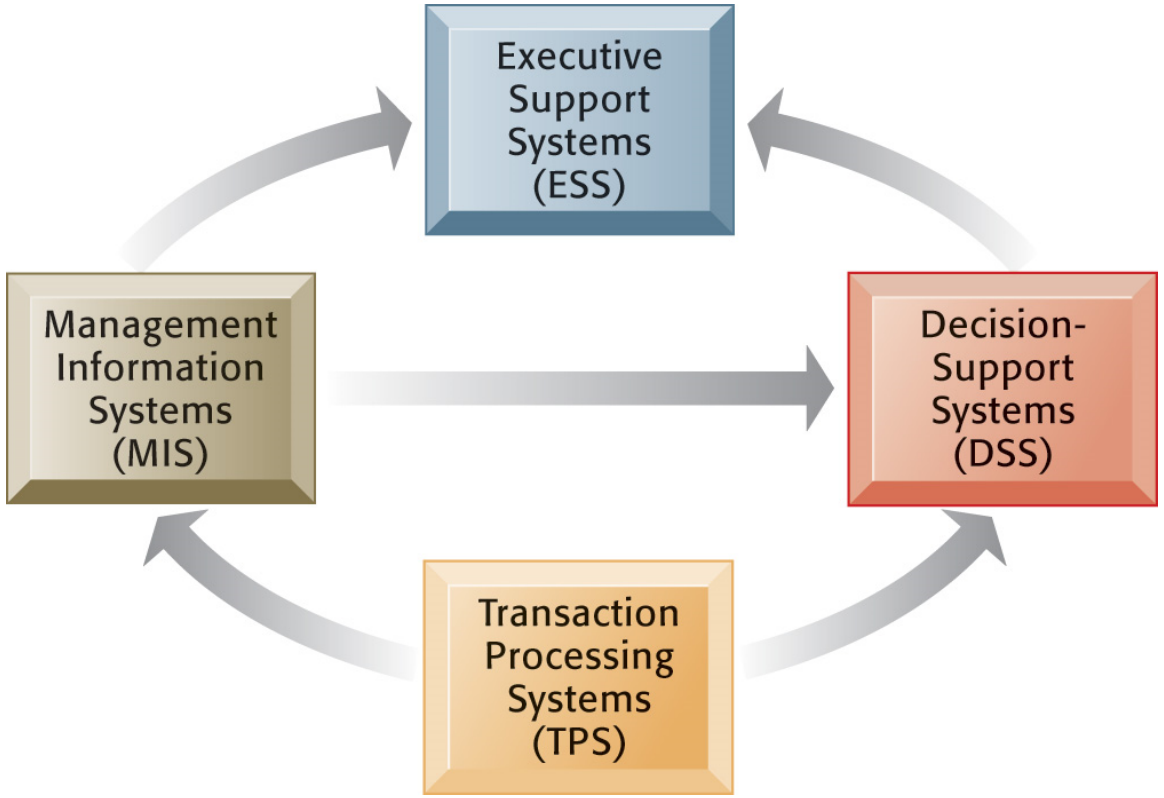
Model of an Executive Support System

This system pools data from diverse internal and external sources and makes them available to executives in an easy-to-use form.



Interrelationships Among Systems

The various types of systems in the organization have interdependencies. TPS are major producers of information that is required by many other systems in the firm, which, in turn, produce information for other systems. These different types of systems have been loosely coupled in most organizations.



Types of Business Information Systems

- Support of Business Operations

Enterprise Applications

- Enterprise applications are systems that span functional areas and automate processes for multiple business functions and organizational areas, they include:
  - **Enterprise systems**
  - **Supply chain management systems**
  - **Customer relationship management systems**
  - **Knowledge management systems**

Enterprise Application Architecture

Enterprise applications automate processes that span multiple business functions and organizational levels and may extend outside the organization.

Enterprise Systems

- **Enterprise Systems**
  - Enterprise resource planning (ERP) systems
  - Suite of integrated software modules and a common central database
  - Collects data from many divisions of firm for use in nearly all of firm's internal business activities
  - Information entered in one process is immediately available for other processes

ENTERPRISE RESOURCE PLANNING (ERP)

- All business functions served by one system that supports different activities for different departments

- Support supply chain management, the series of main and supporting activities from order **to delivery**

Enterprise Systems: Enterprise Resource Planning

- **Enterprise Software**
  - **Built around thousands of predefined business processes that reflect best practices**
    - Finance and accounting
    - Human resources
    - Manufacturing and production
    - Sales and marketing
    - purchasing raw materials,
    - manufacturing and assembly,
    - packing and shipping,
    - billing, collection, and after- the-sale services

INFORMATION SYSTEMS IN FUNCTIONAL BUSINESS AREAS

- **Accounting**
  - Record business transactions, produce periodic financial statements, and create reports required by law
- **Finance**
  - Organise budgets, manage the flow of cash, analyse investments, and make decisions that could reduce interest payments and increase revenues
- **Marketing**
  - Analyse demand for various products in different regions and population groups

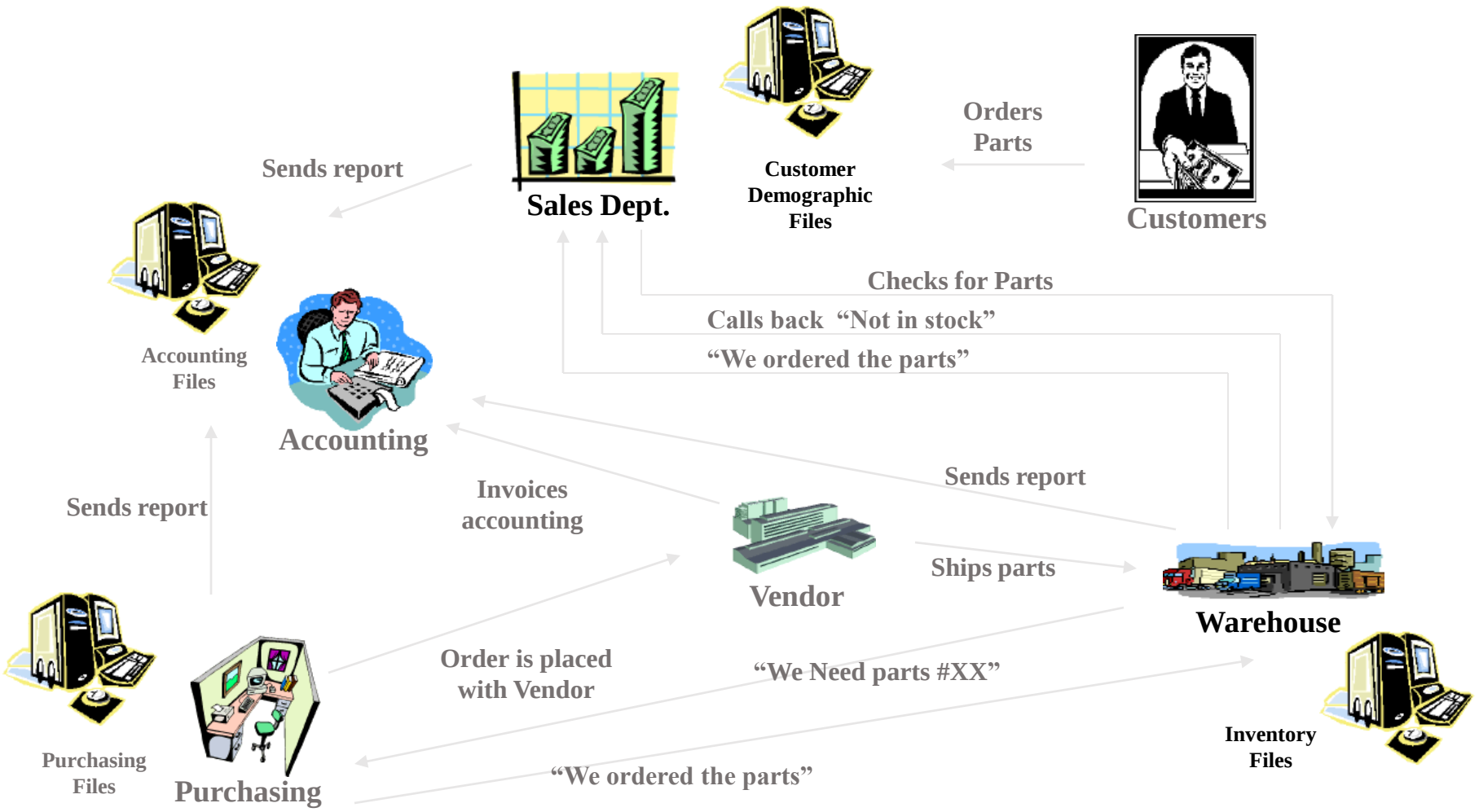
INFORMATION SYSTEMS IN FUNCTIONAL BUSINESS AREAS…cont.

- **Human Resources**
  - Help with record keeping and employee evaluation
- **Manufacturing**
  - Allocate resources such as personnel, raw material, and time
  - Control inventory, process customer orders, prepare production schedules, perform quality assurance, and prepare shipping documents

INFORMATION SYSTEMS IN FUNCTIONAL BUSINESS AREAS…cont.

- **Service**
  - ISs are often the backbone of service organisations
- **Retail**
  - Some retail stores (e.g., Wal-Mart, Sears) are now linked to communication networks by satellite
  - Management can determine which items move quickly and which do not

An ERP Example: Before ERP



An ERP Example: After ERP

Customers

Orders
Parts

Sales Dept.

Inventory Data
If no parts,
order is placed
through DB

Accounting

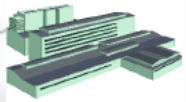
Financial Data exchange;
Books invoice against PO

Database

Order is submitted
to Purchasing.
Purchasing record
order in DB

Books inventory
against PO

Order is placed
with Vendor



Vendor

Purchasing

Warehouse

Ships parts

And invoices accounting

ENTERPRISE RESOURCE PLANNING (ERP)

UNIVERSITIES OF THE FUTURE

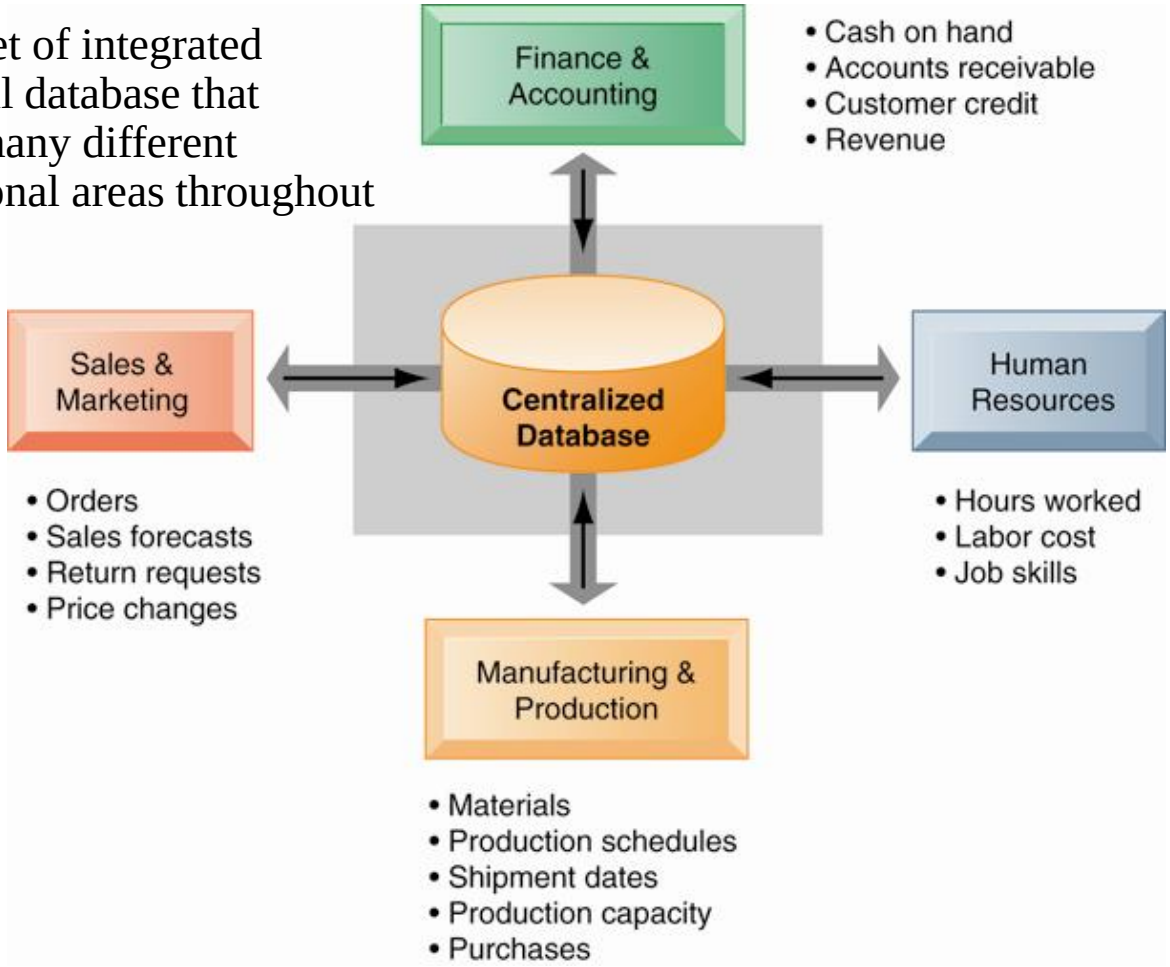
FIGURE 3.10
Supply chain activities supported by ERP applications

Enterprise Systems: Enterprise Resource Planning

- Enterprise resource planning (**ERP**) system
  - A set of integrated programs
  - **Manages** the **vital business operations** for an entire multisite, **global organization**
- Most ERP systems provide **integrated software** to support manufacturing and finance

Enterprise Systems

Enterprise systems feature a set of integrated software modules and a central database that enables data to be shared by many different business processes and functional areas throughout the enterprise

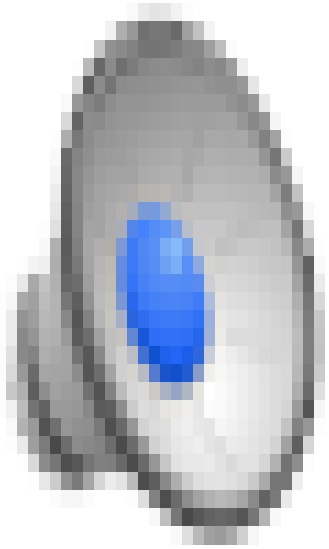


How Enterprise Systems Work

Enterprise Systems: Enterprise Resource Planning

- **Business value of enterprise systems**
  - **Increase operational efficiency**
  - Provide **firm-wide information to support decision making**
  - Enable **rapid responses to customer requests** for information or products
  - Include **analytical tools to evaluate overall organizational performance**

Enterprise Systems: Enterprise Resource Planning



Supply Chain Management Systems

Supply Chain Management Systems

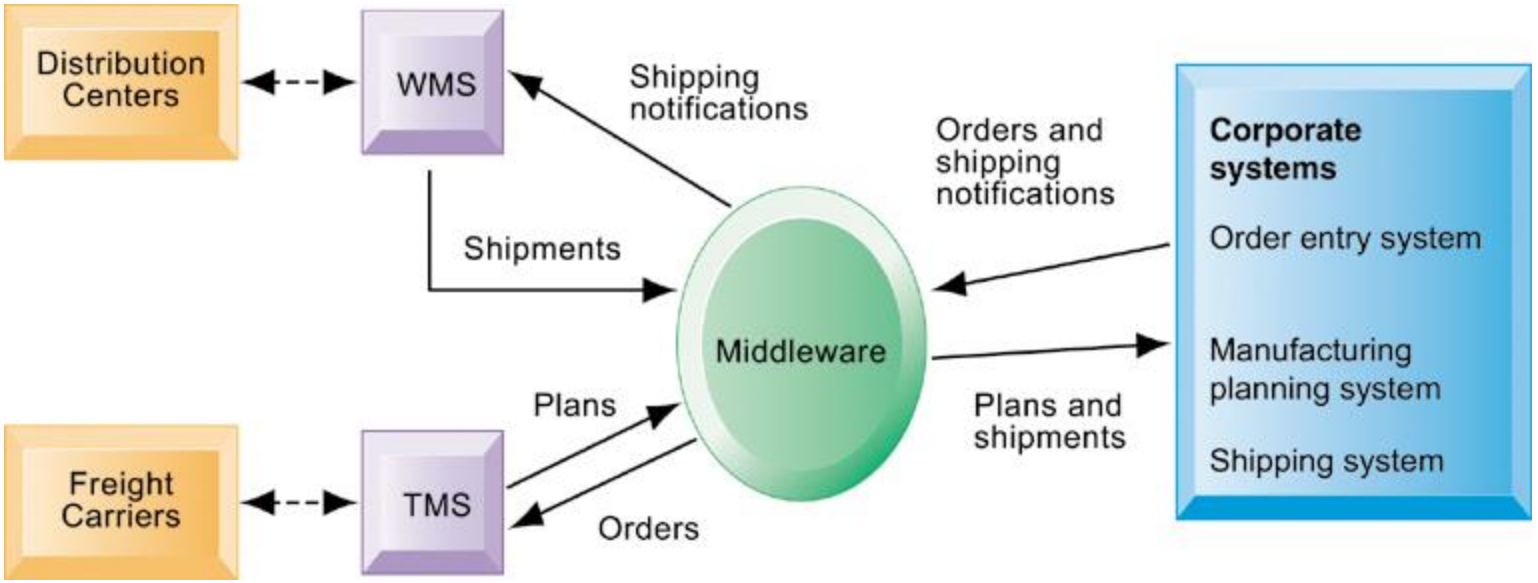
- **Manage relationships with suppliers, purchasing firms, distributors, and logistics companies**
- **Manage shared information about orders, production, inventory levels, etc.**
  - **Goal is to move correct amount of product from source to point of consumption as quickly as possible and at lowest cost**
- **Type of interorganizational system:**
  - **Automating flow of information across organizational boundaries**

Supply Chain Management Systems

- **Supply Chain**
  - **refers to the sequence of activities involved in producing and selling a product or service.**
  - **Network of organizations and processes for:**
    - Procuring materials, transforming them into products, and distributing the products
  - **Upstream supply chain:**
    - Firm's suppliers, suppliers' suppliers, processes for managing relationships with them
  - **Downstream supply chain:**
    - Organizations and processes responsible for delivering products to customers
  - **Internal supply chain**

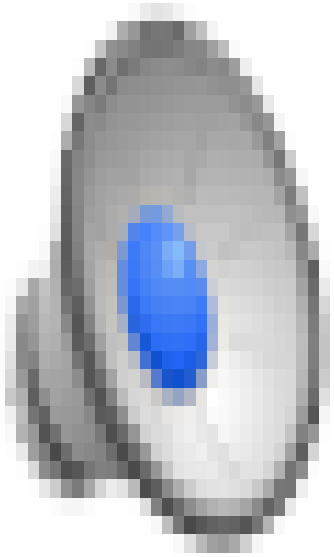
Supply Chain Management Systems

Example of a Supply Chain Management System



Customer orders, shipping notifications, optimized shipping plans, and other supply chain information flow among Haworth's Warehouse Management System (WMS), Transportation Management System (TMS), and its back-end corporate systems.

Supply Chain Management Systems



Supply Chain Management Systems

- **Supply Chain Management Software**
  - **Supply chain planning systems**
    - Model existing supply chain
    - Enable demand planning
    - Optimize sourcing, manufacturing plans
    - Establish inventory levels
    - Identify transportation modes
  - **Supply chain execution systems**
    - Manage flow of products through distribution centers and warehouses

Customer Relationship Management Systems

- Help manage relationship with customers
- **Coordinate business processes** that deal with customers to optimize revenue and **customer satisfaction**, and increase sales
- **Combine sales, marketing**, and service record data from multiple communication channels to provide **unified view of customer**, eliminate duplicate efforts

Customer Relationship Management Systems

- **Customer relationship management (CRM)**
  - Knowing the customer
  - In large businesses, too many customers and too many ways customers interact with firm
- **CRM systems:**

  help manage an organization's relationships with its customers
  - Capture and integrate customer data from all over the organization
  - Consolidate and analyze customer data
  - Distribute customer information to various systems and customer touch points across enterprise
  - Provide single enterprise view of customers

Customer Relationship Management Systems

CRM systems examine customers from a multifaceted perspective.

These systems use a set of integrated applications to address all aspects of the customer relationship, including customer service, sales, and marketing.

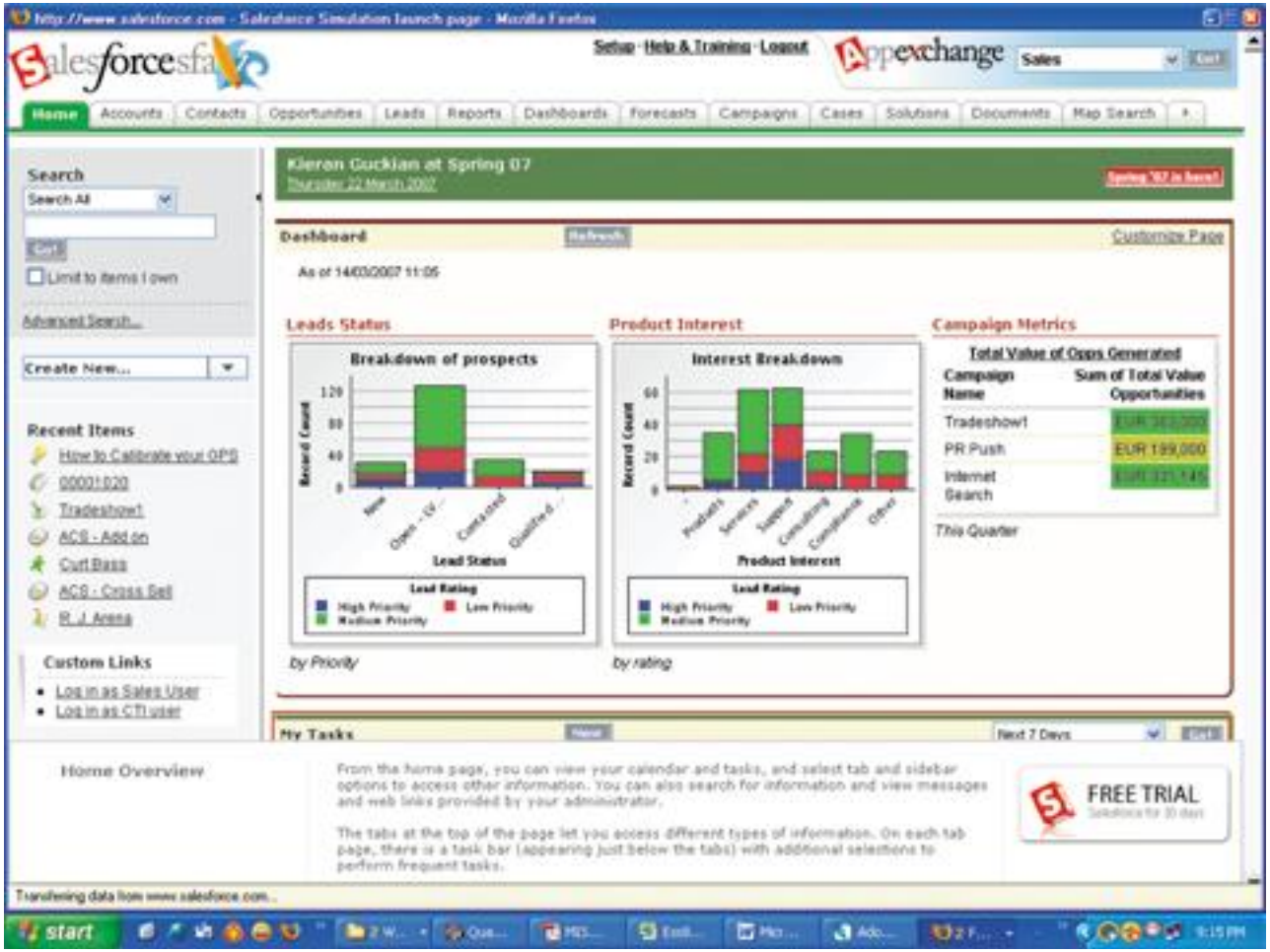
Customer Relationship Management (CRM)

Customer Relationship Management Systems

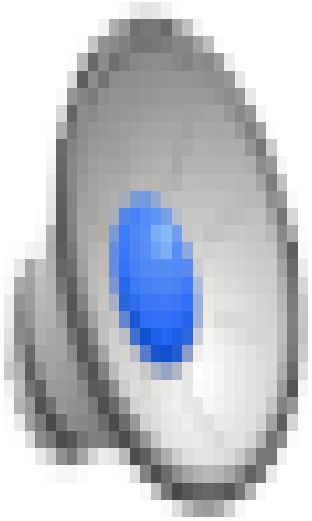
- **CRM Software**
  - Packages range from niche tools to large-scale enterprise applications.
  - **More comprehensive have modules for:**
    - Partner relationship management (PRM)
      - Integrating lead generation, pricing, promotions, order configurations, and availability
      - Tools to assess partners' performances
    - Employee relationship management (ERM)
      - Setting objectives, employee performance management, performance-based compensation, employee training

Customer Relationship Management Systems

Illustrated here are some of the capabilities of Salesforce.com, a market-leading provider of on-demand customer relationship management (CRM) software. CRM systems integrate information from sales, marketing, and customer service.



ERP vs CRM



Specialized Business Information Systems: Knowledge Management

- Knowledge management systems (**KMSs**)
  - An organized collection of people, procedures, software, databases, and devices
  - **Create, store, share**, and **use** the **organization's knowledge** and experience

Knowledge Management

- **Intangible knowledge assets**
  - Knowledge about producing and delivering products
  - Source of value and advantage for firms

- **Knowledge management systems:**
  - Help capture, storage, distribute, and apply knowledge so that it can be leveraged for strategic benefit
  - Include systems for:
    - **Managing and distributing** documents, graphics, other digital knowledge objects
    - **Creating knowledge** directories of employees with specialized expertise
    - **Distributing** knowledge

Information Systems Are More than Computers

Using information systems effectively requires an understanding of the:

organization,

people,

information technology

shaping the systems.

An **information system** provides a **solution** to important **business problems** or challenges facing the firm.

Most business problems involve a number of major factors that can fall into three main categories:

- **Organization**
- **Technology**
- **People**

- **Organizations**
  - **Coordinate work t**hrough **structured hierarchy and business processes.**
    - **Business processes:** related tasks and behaviors for accomplishing work
      - Examples: fulfilling an order, hiring an employee
      - May be informal or include formal rules
  - **Culture embedded in information systems**
    - **Example:** UPS's concern with placing service to customer first

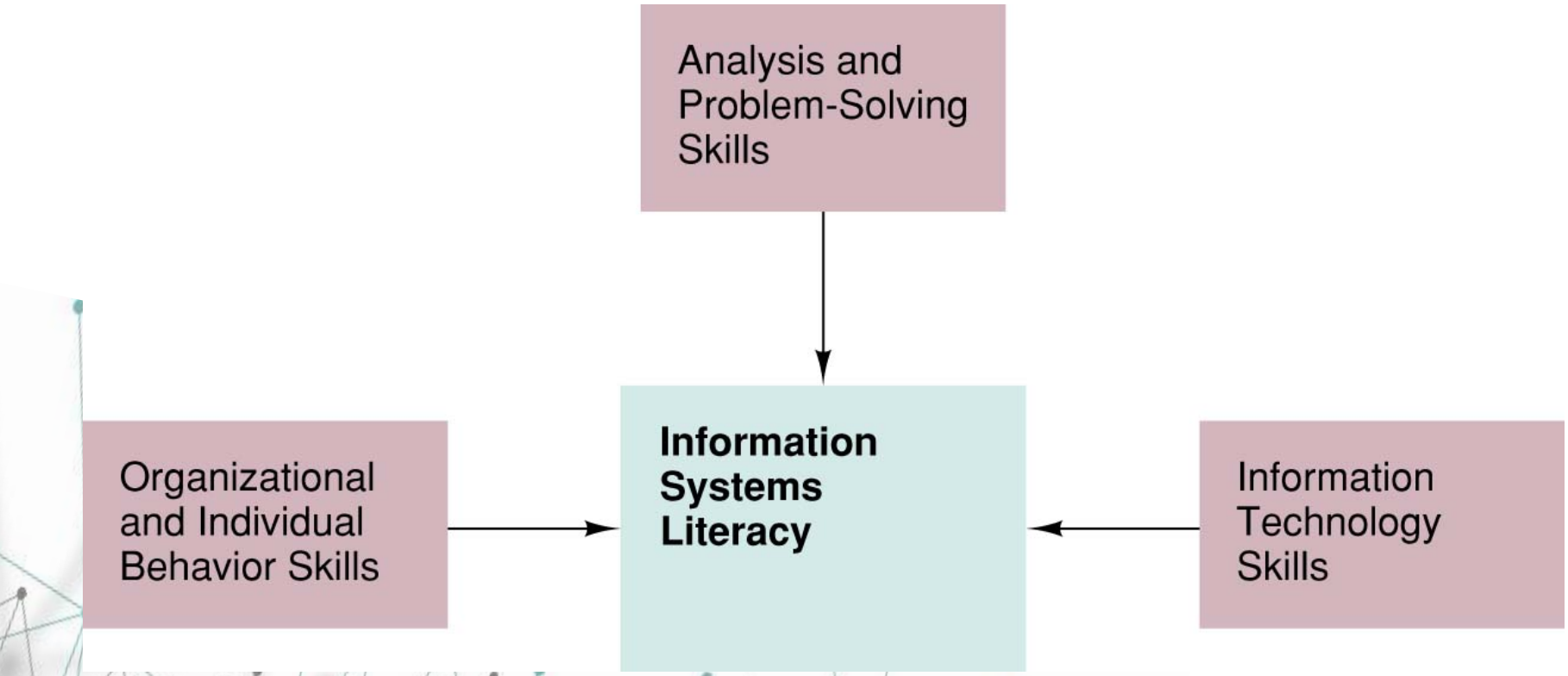
Dimensions of Information Systems

- **People**
  - Information systems require skilled people to build, maintain, and use them.
  - Employee attitudes affect ability to use systems productively.
  - **Role of managers**
    - Perceive business challenges.
    - Set organizational strategy.
    - Allocate human and financial resources.
    - Creative work: new products, services.

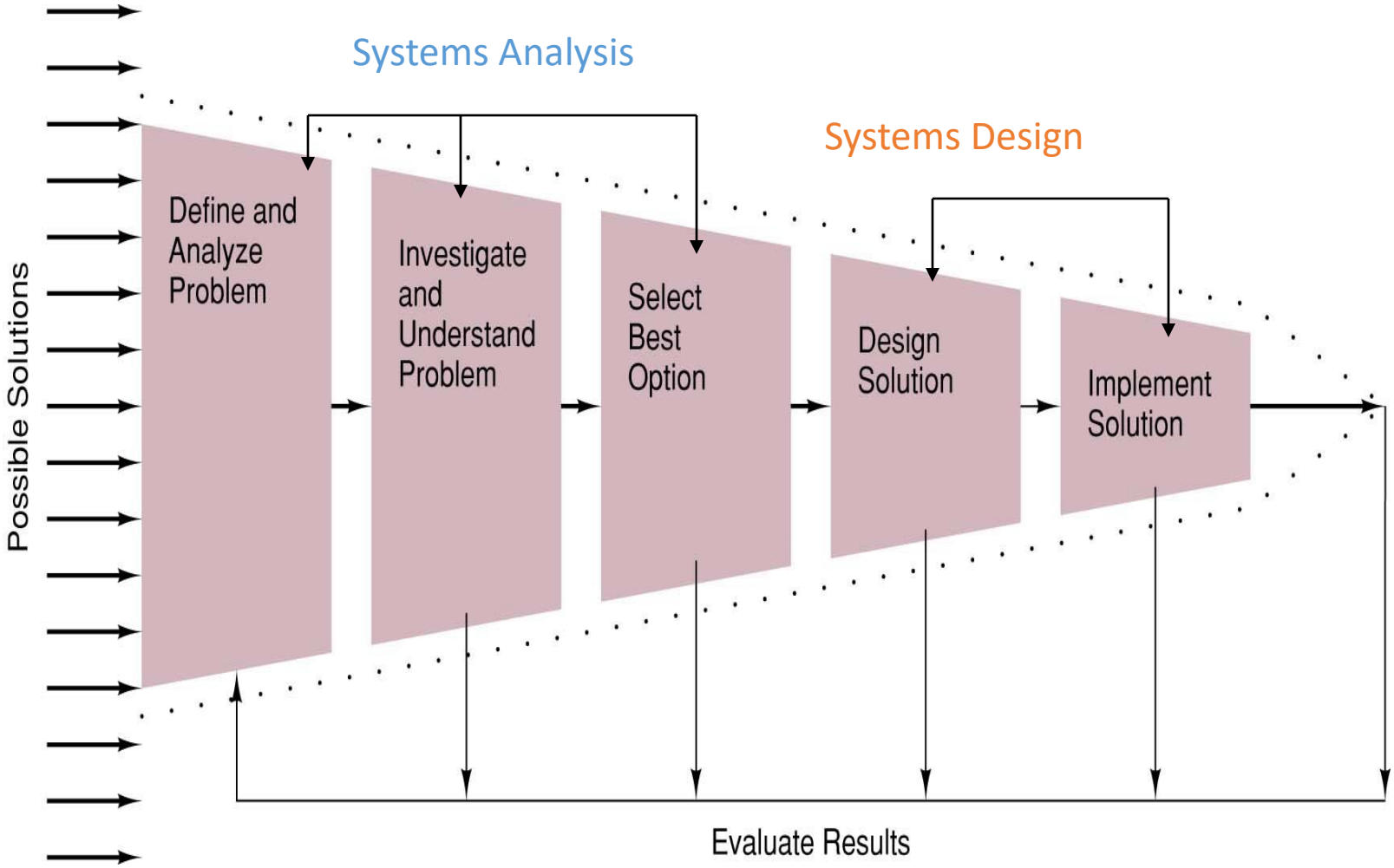
Dimensions of Information Systems

- **Technology**
  - **IT Infrastructure: Foundation or platform that information systems built on**
    - Computer hardware
    - Computer software
    - Data management technology
    - Networking and telecommunications technology
      - Internet and Web, extranets, intranets
      - Voice, video communications

Computer vs IS literacy



IS Approach to Problem Solving



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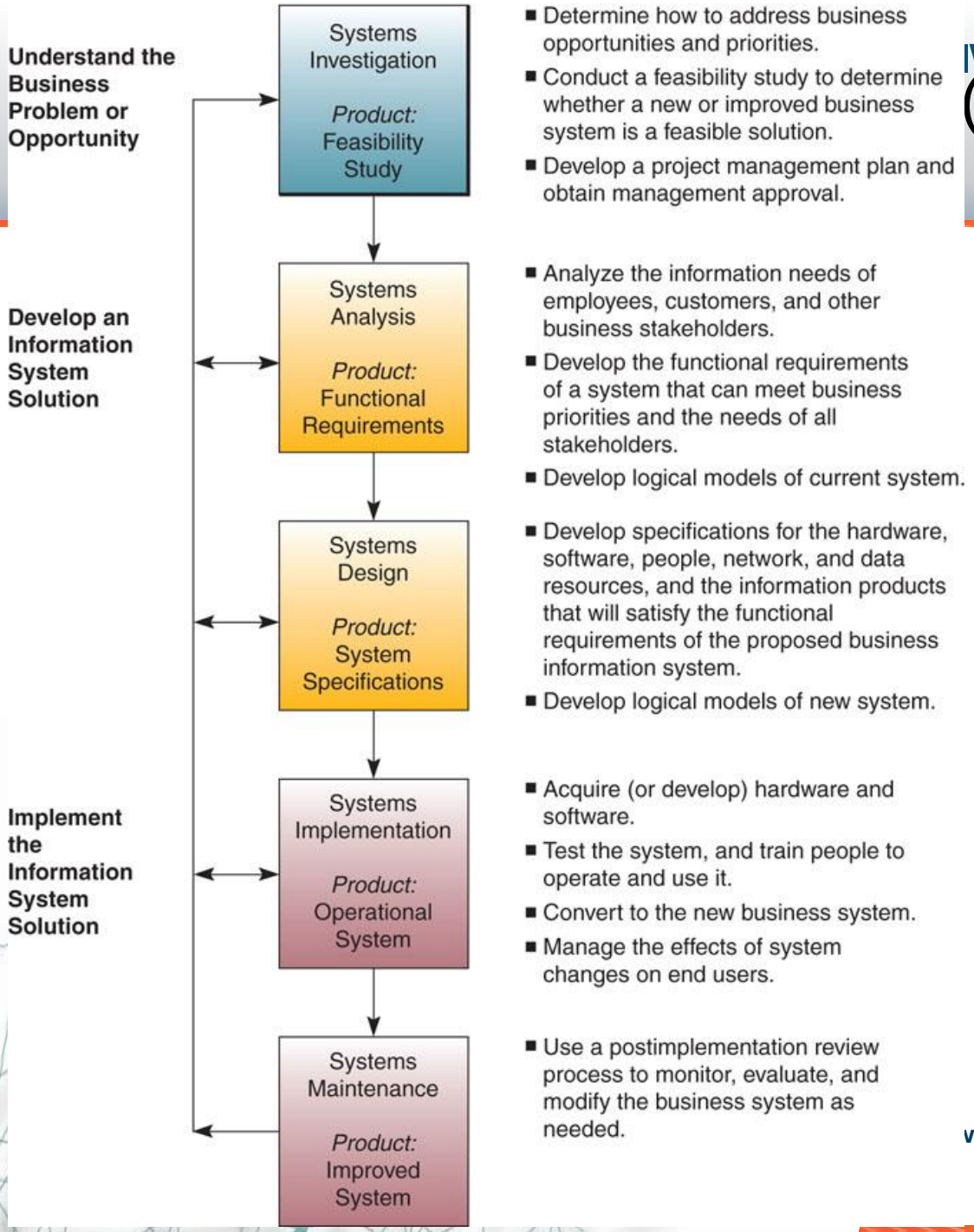

Understand the Business Problem or Opportunity
Develop an Information System Solution
Implement the Information System Solution
Systems Investigation
Product: Feasibility Study
Systems Analysis
Product: Functional Requirements
Systems Design
Product: System Specifications
Systems Implementation
Product: Operational System
Systems Maintenance
Product: Improved System
Determine how to address business opportunities and priorities.
Conduct a feasibility study to determine whether a new or improved business system is a feasible solution.
Develop a project management plan and obtain management approval.
Analyze the information needs of employees, customers, and other business stakeholders.
Develop the functional requirements of a system that can meet business priorities and the needs of all stakeholders.
Develop logical models of current system.
Develop specifications for the hardware, software, people, network, and data resources, and the information products that will satisfy the functional requirements of the proposed business information system.
Develop logical models of new system.
Acquire (or develop) hardware and software.
Test the system, and train people to operate and use it.
Convert to the new business system.
Manage the effects of system changes on end users.
Use a postimplementation review process to monitor, evaluate, and modify the business system as needed.

Systems Development

- The activity of **creating** or **modifying** existing business systems
- Actual issues in projects systems development
  - Applying data computation **analytics** to large amounts of data
  - Leveraging advantages of **cloud computing**
  - Creating more mobile applications
  - **Big data** concerns… (data lakes rather then datawarehouses > 2015=
- Companies may outsource some or all of a systems development project

An opportunity (proactive)

Potential increase in revenue

Reduction of costs

Gain in competitive advantage

A problem (reactive) - Undesired situation

Problem identification includes:

- Agreement that problem exists
- Definition of problem
- Causes of problem
- What can be done given resources of firm

A directive

An order to take action

- **Typical organizational problems**
  - Outdated business processes
  - Unsupportive culture and attitudes
  - Political in-fighting
  - Turbulent business environment, change
  - Complexity of task
  - Inadequate resources

Systems Development: Investigation, Analysis

- Systems **investigation**:
  - gain clear **understanding** of the **specifics of the problem** to be solved or the **opportunity** to be addressed
  - Developers interview managers and perspective users to determine business needs

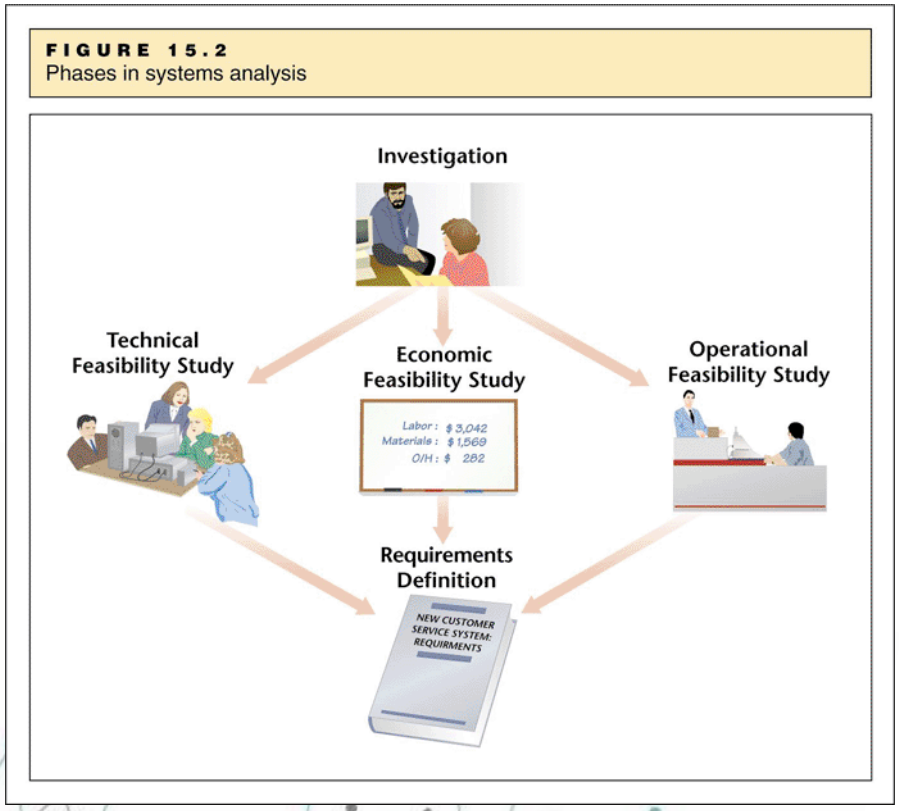
- Systems **analysis**
  - Study the existing system to uncover its strengths and weaknesses
    - Information gathering (**where & why**)
  - Identify what the new system must do to meet the needs of the users and the organization
    - Problem analysis (**what**)
  - Decision making (**how**)
    - Establish objectives
    - Determine feasibility
    - Choose best solution

Systems Development: Analysis

- Systems **analysis** - Three feasibility studies performed

- **Technical Feasibility Study**
  - Ensures hardware and software exist to build the system
- **Economic Feasibility Study**
  - Determines resources needed for implementation
  - Determines if benefits outweigh the costs
- **Operational Feasibility Study**
  - Determines if system will be used as intended at its full capacity
- **Requirements Definition**
  - Specific features and interface requirements of the system defined

SYSTEMS DEVELOPMENT



System Design

- System **Design**

Translation of user requirements into detailed functions of the system

- Logical design (**what will the system do**?)
  - Input: content, format, source, volume, frequency, timing
  - Process: rule, model, formula, timing
  - Output: content, format, organization, volume, freq., timing
  - Storage: data, format, organization, relationship, volume
  - Procedure: manual activities, rule, sequence, timing, location
  - Control: security, accuracy, validity, supervision
- Physical design (**how the system will work**?)
  - Input: keyboard, voice, scanner
  - Process: PC, operating system, software
  - Output: print-outs, files, audio
  - Storage: tape, CD
  - Procedure: batching, backup, auditing, data entry
  - Control: batch control, password, audit logs
- Identify **what inputs** are required
- Ascertain **what outputs** must be produced

Systems Development: Development

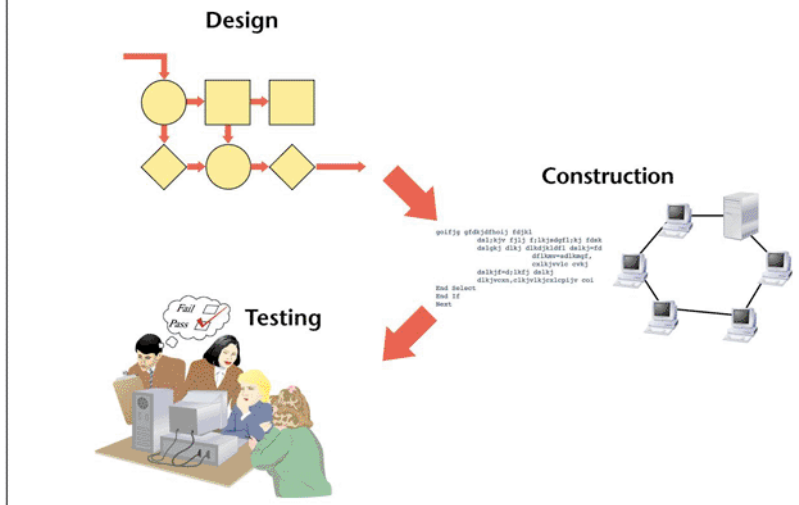
- **Convert** the system **design** into an **operational information system – Programming**
  - Acquire and install hardware and software
  - **Coding** and **testing** software programs
  - Create and load data into databases
  - Perform initial program **testing**
    - Checked against system requirements
    - Attempts to make system fail

Systems Development: Integration and Testing

- **Link** together all the **components** of the system
  - Demonstrates that the system as a whole does indeed meet the user and business requirements

SYSTEMS DEVELOPMENT

FIGURE 15.4
Phases in systems design



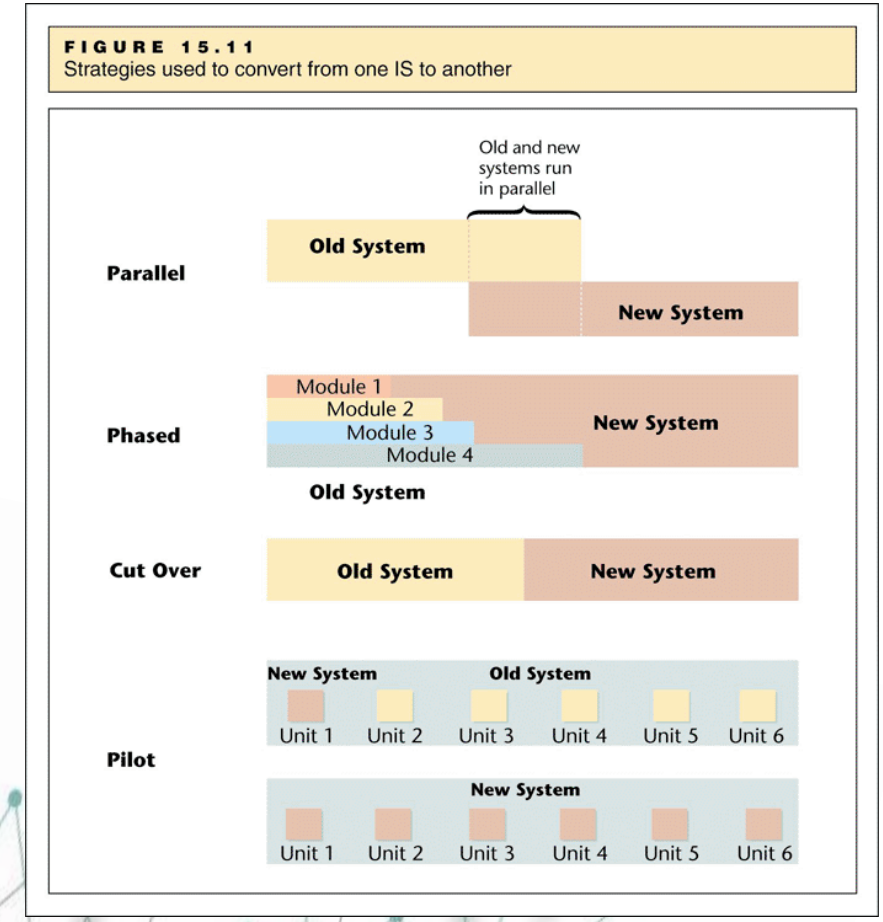
Systems Development: Implementation

- **Install** the new system into the actual **production** computer environment in which it is expected to run
- Training

- **Conversion**
  - Parallel Conversion
  - Phased Conversion
  - Cut Over Conversion
  - Pilot Conversion

- **Resolve** any **problems** uncovered in integration and testing

IMPLEMENTATION

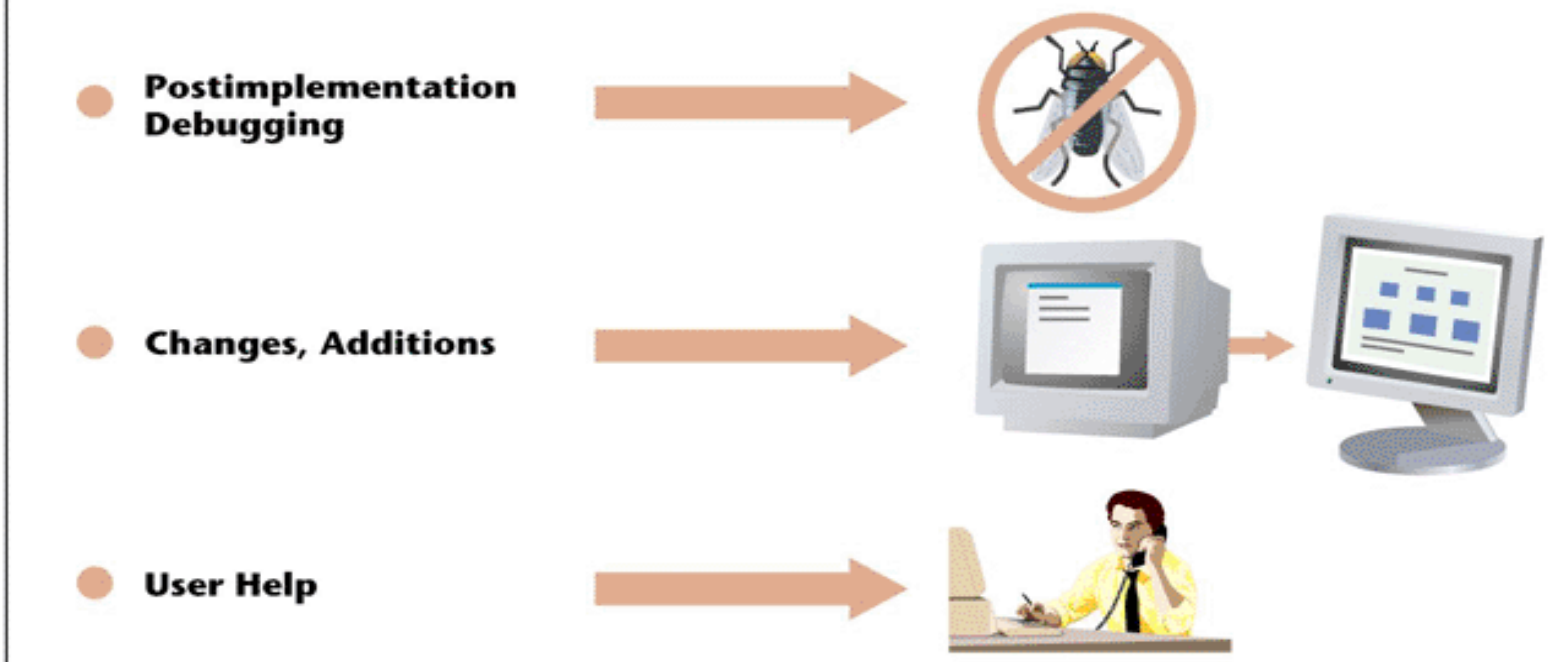


Systems Development: Operation, Maintenance, and Disposition

- **Operation** and **maintenance**:
  - identify and make necessary changes to the system
- **Disposition**:
  - **activities** at the **end of the useful life** of the system
    - Extract data from the system's database
    - Convert data to new format for the replacement system

Maintenance

FIGURE 15.12
Activities in systems support

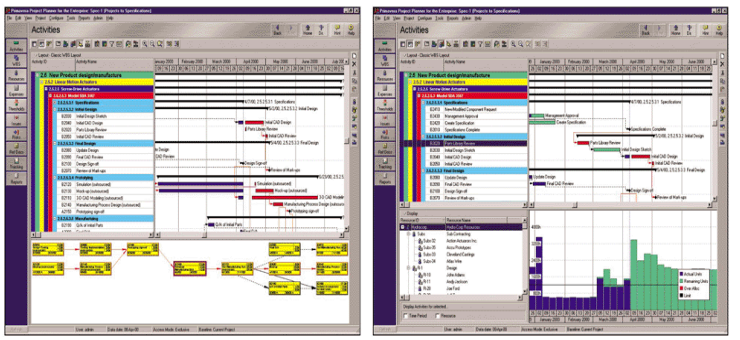


PROJECT MANAGEMENT OF INFORMATION SYSTEM

UNIVERSITIES OF THE FUTURE

FIGURE 15.16
Dimensions of project management

FIGURE 15.15
Project management software allows managers to use both PERT charts (left) and Gantt charts (right).

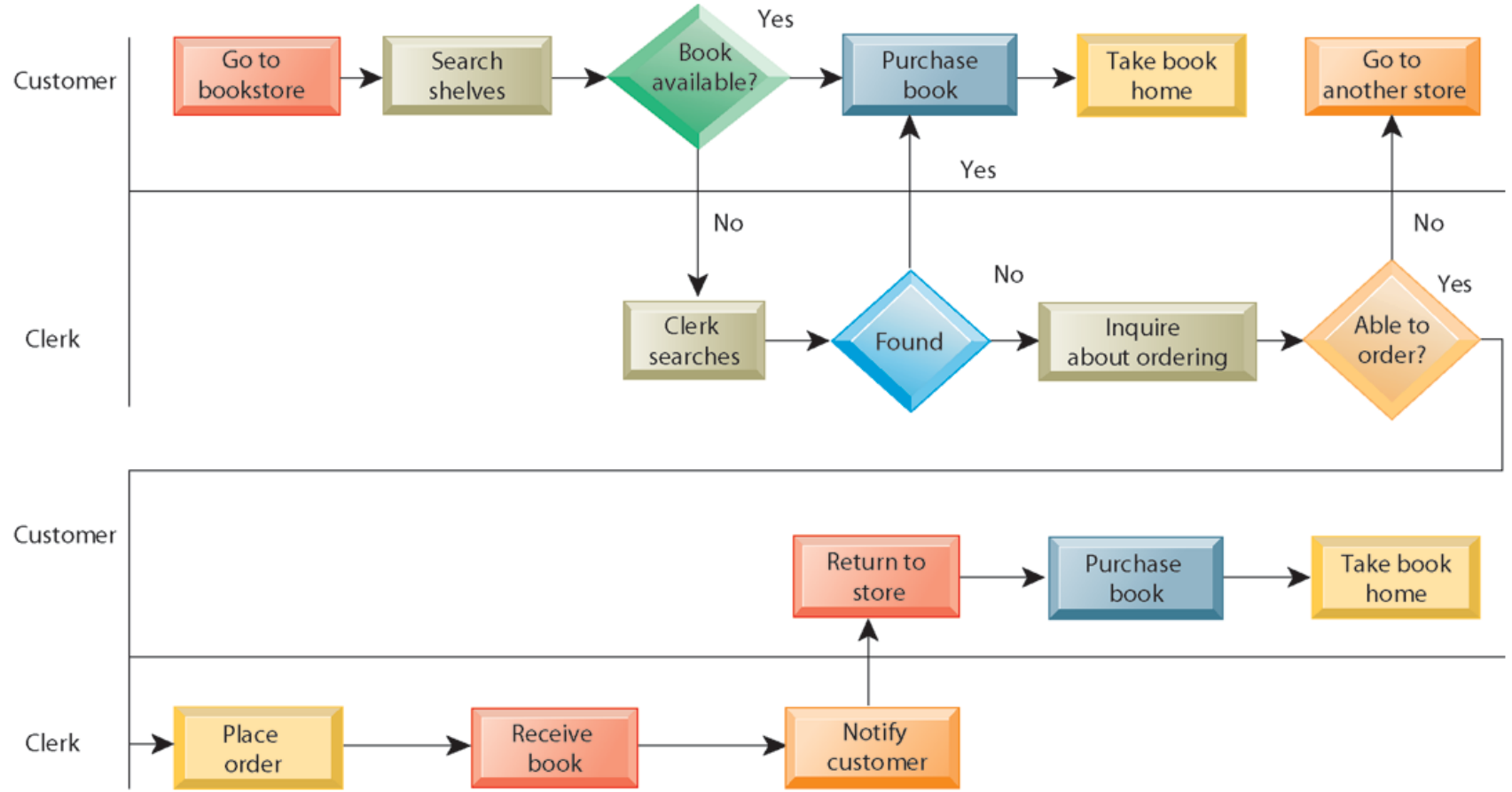


Courtesy of Primavera Systems

SUMMARY OF SYSTEMS DEVELOPMENT ACTIVITIES	
CORE ACTIVITY	**DESCRIPTION**
Systems analysis	**Identify problem(s)** **Specify solutions** **Establish information requirements**
Systems design	**Create design specifications**
Programming	**Translate design specifications into code**
Testing	**Unit test** **Systems test** **Acceptance test**
Conversion	**Plan conversion** **Prepare documentation** **Train users and technical staff**
Production and maintenance	**Operate the system** **Evaluate the system** **Modify the system**

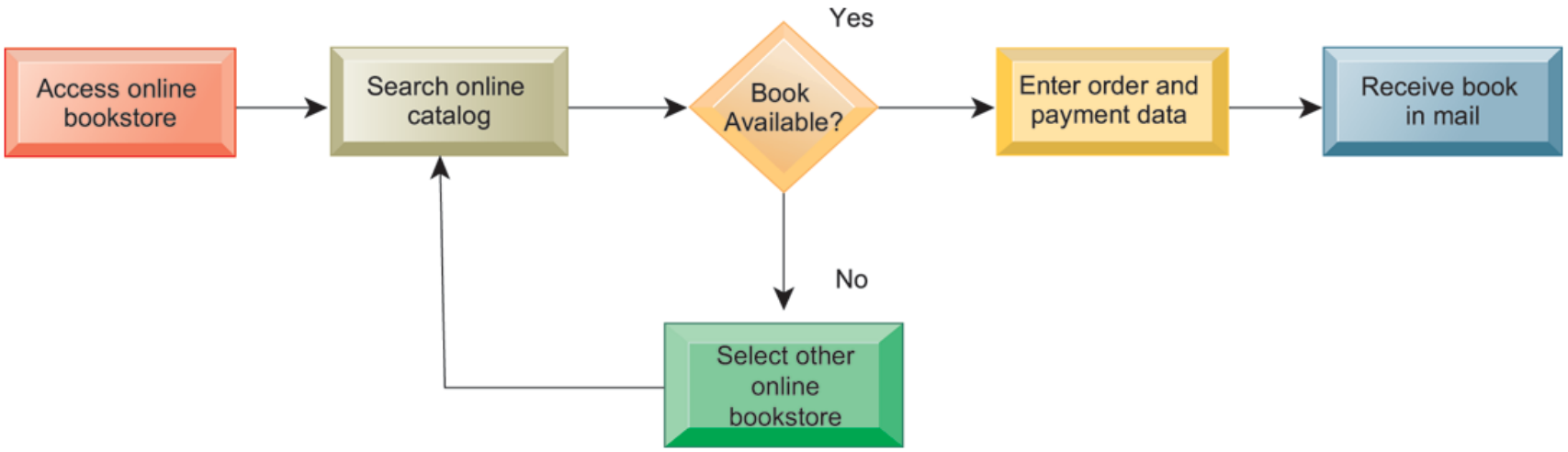
Reengineering - Systems Development:

AS-IS BUSINESS PROCESS FOR PURCHASING A BOOK FROM A PHYSICAL BOOKSTORE



Purchasing a book from a physical bookstore requires many steps to be performed by both the seller and the customer.

Reengineering - Systems Development:



REDESIGNED PROCESS FOR PURCHASING A BOOK ONLINE

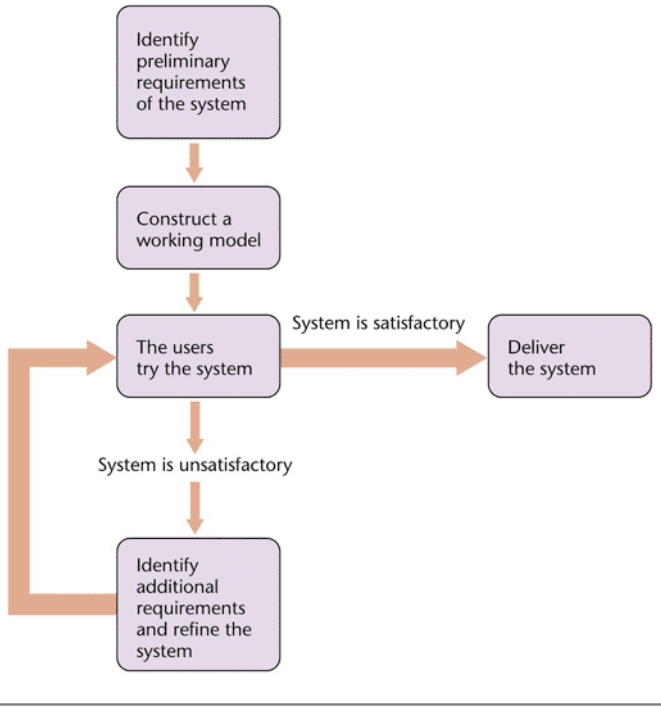
Using Internet technology makes it possible to redesign the process for purchasing a book so that it requires fewer steps and consumes fewer resources.

PROTOTYPING

- **Systems developed using an iterative process**
  - Purpose is to develop a working model as quickly as possible, which can be tweaked and revised
  - Significantly shortens systems development backlog
  - Can increase risk of incompatibility and other unforeseen mishaps

PROTOTYPING …cont.

FIGURE 15.13
In prototyping, refinement of the system continues until users are satisfied.



PROTOTYPING …cont.

FIGURE 15.14
When to prototype and when not to prototype

WHEN TO PROTOTYPE	WHEN NOT TO PROTOTYPE
Small-scale systems	Large-scale systems
Systems solving unstructured problems	Complex systems
When it's difficult for users to specify system requirements	Systems with interfaces to other systems

SYSTEMS INTEGRATION

- **Takes a look at the information needs of an entire organisation (or a major division)**

- **Analysts integrate existing systems so that:**
  - Data can flow more easily among business units
  - Users can access different types of data via a single interface

SYSTEMS INTEGRATION …cont.

FIGURE 15.18
Situations calling for systems integration

- Linking existing ISs to Web sites
- Linking databases to Web sites
- Interfacing legacy systems with new systems
- Linking legacy databases with enterprise applications
- Sharing information systems among organizations

Information Systems in Business and Society

- Information systems have been developed to
  - meet the **needs of all types of organizations** and **people**

Information Systems in Business

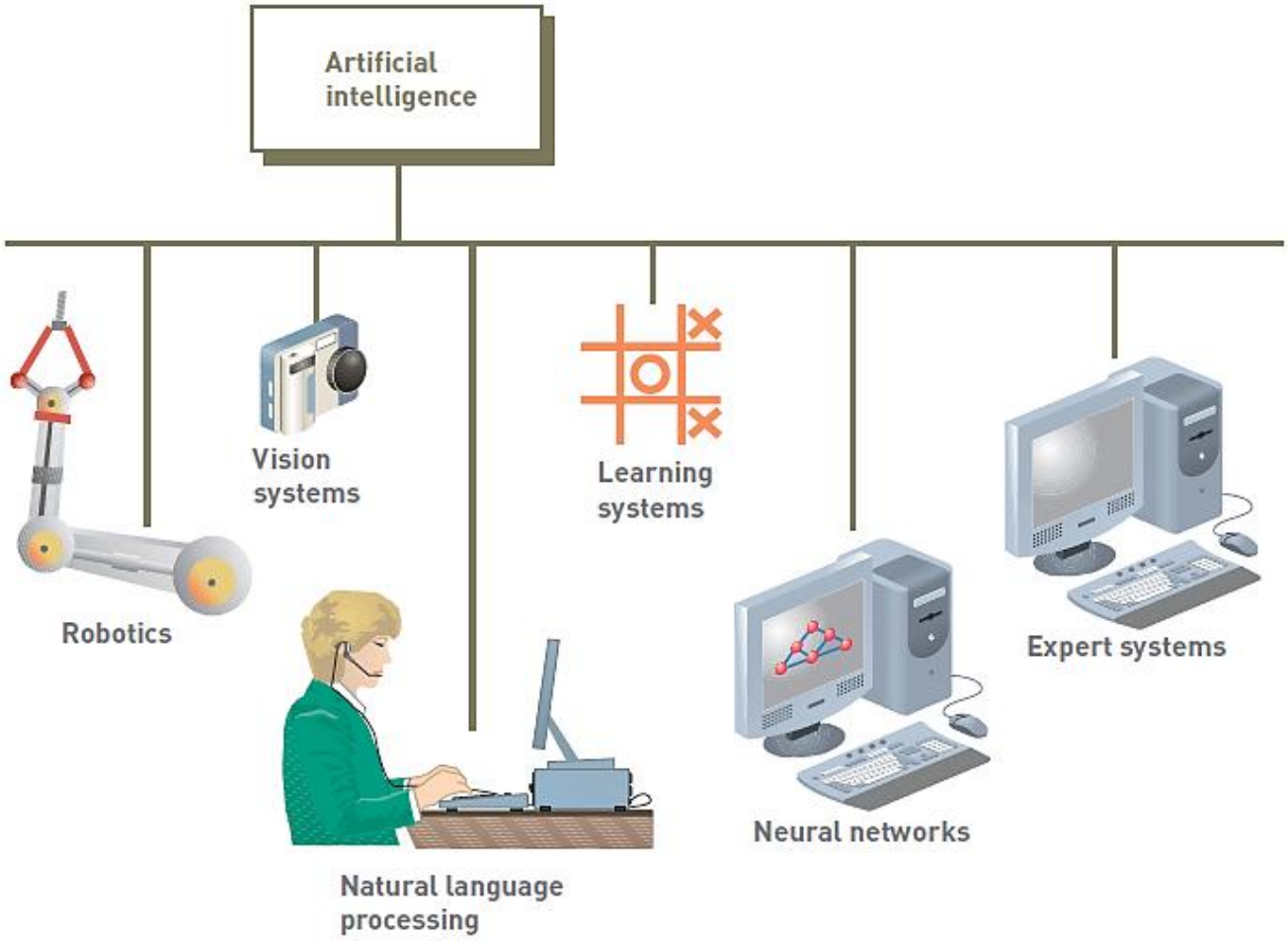
- Examples of **functional areas** of **business organizations** which employ information systems
    - Finance and accounting
    - Sales and marketing
    - Manufacturing
    - Human resource management
    - Legal information systems
  - **All functional areas**…..

Specialized Business Information Systems: Artificial Intelligence (AI)

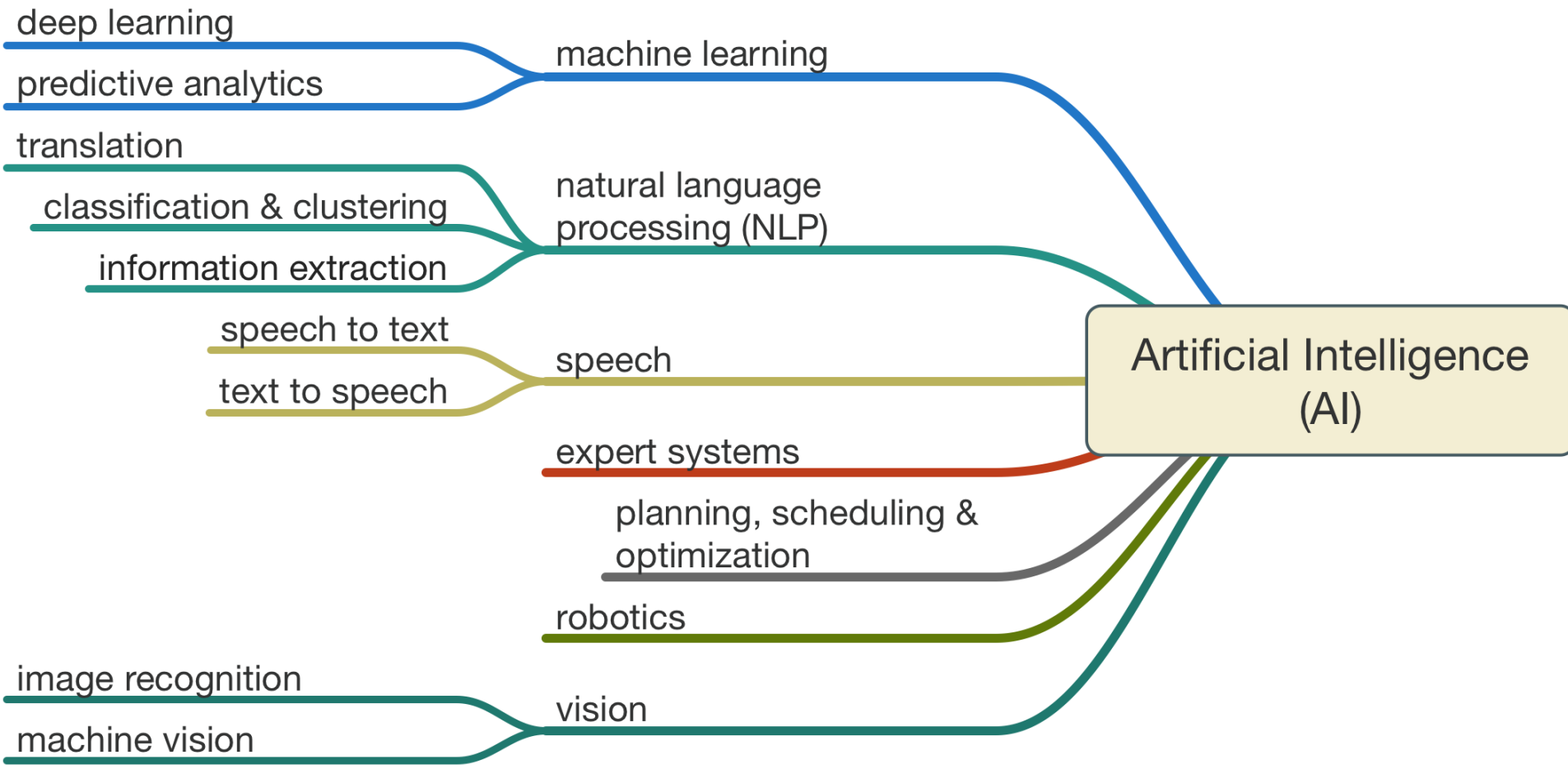
- A computer system takes on characteristics of human intelligence

- Examples of **AI applications**:
  - games, medical diagnoses, and automobile operation, manufacturing, simulation,

Major Branches of Artificial Intelligence



Major Branches of Artificial Intelligence



Artificial Intelligence Subfields

The main branches of Artificial Intelligence are:

- **Perception** - understanding images, audio, etc.
- **Reasoning** - answering questions from data
- **Planning** - inferring the required steps to reach a goal
- **Motion -** moving a robot in an environment
- **Natural language processing** - understanding human language
- Note that often, these areas overlap and real world projects use many branches at once.
- *Example #1*: an autonomous car might use perception to build a world model, then planning and motion to get to its goal.
- *Example #2*: an online bot might use NLP and sentiment analysis to understand your query, and reasoning to offer you a satisfactory answer.

Artificial Intelligence Subfields

- **Robotics**:
  - machines take over complex, dangerous, routine or boring tasks
- **Vision systems**
  - allow devices to see, store and process images
- **Natural language processing**
  - involves computers understanding and acting on verbal or written commands

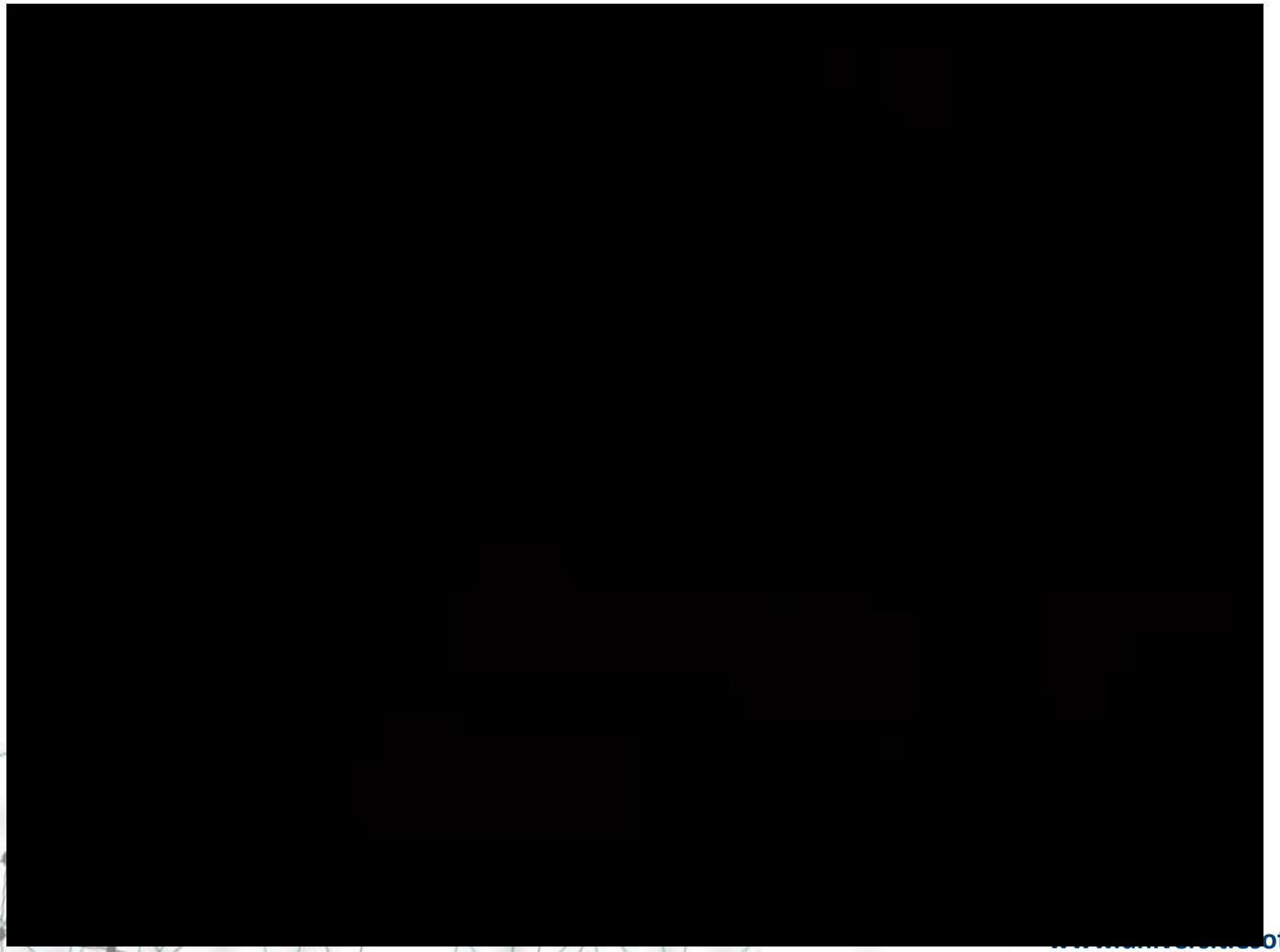
Artificial Intelligence Subfields (cont'd.)

- **Learning systems - KBS**
  - allow computers to learn from past mistakes or experiences
- **Neural networks**
  - allow computers to recognize and act on patterns or trends

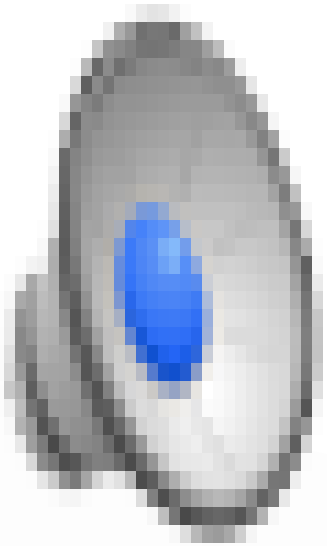
Expert Systems and Virtual Reality

- **Expert systems**
  - give computers the ability to make suggestions and function like an expert in a particular field
    - Knowledge base contains data, rules, procedures, and relationships used by expert system
- **Virtual reality**
  - simulation of a real or imagined environment that can be experienced visually in three dimensions

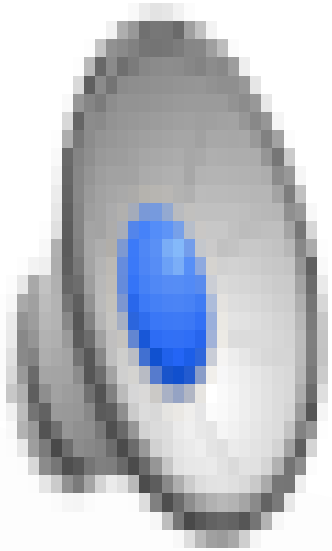
Robotics – Kia production line



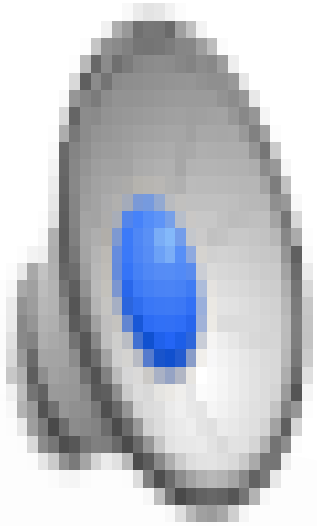
Robotics – Assembly line with humans - MIT



Virtual Reality – Re-Mission game – cancer - linfoma

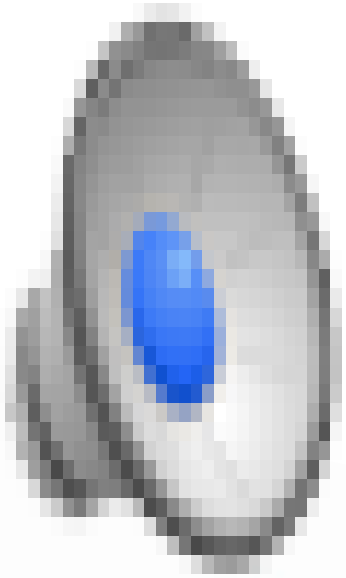


Virtual Reality – 3DExperience@city -Virtual Singapore- Dessault systéms



Virtual Reality – The World´s Largest 3D Experience | King Kong 360 3D at Universal Studios Hollywood

- The biggest 3D screen of the world (2 x 61m x 12m)



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