Essentials of

# INFORMATION SYSTEMS

function haveGreatIdea(){
 startProject();
 loseMotivation();
 abandonProject();
 haveGreatIdea();
}

# Table of Contents

GLOBAL E-BUSINESS AND COLLABORATION	1	
COMPONENTS OF A BUSINESS	1	
ORGANIZING A BUSINESS: BASIC BUSINESS FUNCTIONS	1	
BUSINESS PROCESSES	1	
HOW INFORMATION TECHNOLOGY ENHANCES BUSINESS PROCESSES	1	
MANAGING A BUSINESS AND FIRM HIERARCHIES	1	
THE BUSINESS ENVIRONMENT	2	
THE ROLE OF INFORMATION SYSTEMS IN BUSINESS	2	
TYPES OF BUSINESS INFORMATION SYSTEMS	2	
SYSTEMS FOR MANAGEMENT DECISION MAKING AND BUSINESS INTELLIGENCE	2	
Systems for linking the enterprise	3	
INTRANETS AND EXTRANETS	4	
E-BUSINESS, E-COMMERCE, AND E-GOVERNMENT	4	
Systems for collaboration and teamwork	4	
BUILDING A COLLABORATIVE CULTURE	5	
TOOLS AND TECHNOLOGIES FOR COLLABORATION AND TEAMWORK	5	
CHECKLIST FOR MANAGERS	5	
THE INFORMATION SYSTEMS FUNCTION IN BUSINESS	6	
THE INFORMATION SYSTEMS DEPARTMENT	6	
ACHIEVING COMPETITIVE ADVANTAGE WITH INFORMATION SYSTEMS	7	
USING INFORMATION SYSTEMS TO ACHIEVE COMPETITIVE ADVANTAGE	7	
PORTER'S COMPETITIVE FORCES MODEL	7	
INFORMATION SYSTEM STRATEGIES FOR DEALING WITH COMPETITIVE FORCES	7	
THE BUSINESS VALUE CHAIN MODEL	8	
SYNERGIES, CORE COMPETENCIES, AND NETWORK-BASED STRATEGIES	9	
DISRUPTIVE TECHNOLOGIES	10	
COMPETING ON A GLOBAL SCALE	10	
GLOBAL BUSINESS AND SYSTEM STRATEGIES	10	
GLOBAL SYSTEM CONFIGURATION	10	
Competing on quality and design		
HOW INFORMATION SYSTEMS IMPROVE QUALITY	11	
COMPETING ON BUSINESS PROCESSES	11	
BUSINESS PROCESS MANAGEMENT	11	
FOUNDATIONS OF BI: DATABASES AND INFORMATION MANAGEMENT	13	
THE DATABASE APPROACH TO DATA MANAGEMENT	13	
ENTITIES AND ATTRIBUTES	13	
ORGANIZING DATA IN A RELATIONAL DATABASE	13	
ESTABLISHING RELATIONSHIPS	13	
DATABASE MANAGEMENT SYSTEMS	14	
OPERATIONS OF A RELATIONAL DBMS	14	
CAPABILITIES OF DATABASE MANAGEMENT SYSTEMS	14	
OBJECT-ORIENTED DATABASES	15	
USING DATABASES TO IMPROVE BUSINESS PERFORMANCE AND DECISION MAKING	15	
Data warehouses	15	
TOOLS FOR BUSINESS INTELLIGENCE: MULTIDIMENSIONAL DATA ANALYSIS AND DATA MINING	16	
DATA MINING	16	

DATABASES AND THE WEB	17
MANAGING DATA RESOURCES	17
ESTABLISH AN INFORMATION POLICY	17
ENSURING DATA QUALITY	18
TELECOMMUNICATIONS, THE INTERNET, AND WIRELESS TECHNOLOGY	19
TELECOMMUNICATIONS AND NETWORKING IN TODAY'S BUSINESS WORLD	19
WHAT IS A COMPUTER NETWORK?	19
Key digital networking technologies	19
COMMUNICATIONS NETWORKS	20
TYPES OF NETWORKS	20
Physical transmission media	21
THE GLOBAL INTERNET	22
INTERNET ADDRESSING AND ARCHITECTURE	22
THE WIRELESS REVOLUTION	24
CELLULAR SYSTEMS	24
WIRELESS COMPUTER NETWORKS AND INTERNET ACCESS	24
ACHIEVING OPERATIONAL EXCELLENCE AND CUSTOMER INTIMACY	26
ENTERPRISE SYSTEMS	26
ENTERPRISE SOFTWARE	26
BUSINESS VALUE OF ENTERPRISE SYSTEMS	26
SUPPLY CHAIN MANAGEMENT SYSTEMS	27
THE SUPPLY CHAIN	27
INFORMATION SYSTEMS AND SUPPLY CHAIN MANAGEMENT	27
GLOBAL SUPPLY CHAINS AND THE INTERNET	27
BUSINESS VALUE OF SUPPLY CHAIN MANAGEMENT SYSTEMS	28
CUSTOMER RELATIONSHIP MANAGEMENT SYSTEMS	28
CUSTOMER RELATIONSHIP MANAGEMENT SOFTWARE	28
OPERATIONAL AND ANALYTICAL CRM	29
BUSINESS VALUE OF CUSTOMER RELATIONSHIP MANAGEMENT SYSTEMS	29
ENTERPRISE APPLICATIONS: NEW OPPORTUNITIES AND CHALLENGES	30
ENTERPRISE APPLICATION CHALLENGES	30
NEXT-GENERATION ENTERPRISE APPLICATIONS	30
E-COMMERCE: DIGITAL MARKETS, DIGITAL GOODS	31
E-COMMERCE AND THE INTERNET	31
WHY E-COMMERCE IS DIFFERENT	31
KEY CONCEPTS IN E-COMMERCE	32
E-COMMERCE: BUSINESS AND TECHNOLOGY	33
TYPES OF E-COMMERCE	33
E-COMMERCE BUSINESS MODELS	33
E-COMMERCE REVENUE MODELS	34
Social networking and the wisdom of crowds	35
E-COMMERCE MARKETING	35
B2B E-COMMERCE: NEW EFFICIENCIES AND RELATIONSHIPS	36
THE MOBILE DIGITAL PLATFORM AND MOBILE E-COMMERCE	37
M-COMMERCE SERVICES AND APPLICATIONS	37
BUILDING AN E-COMMERCE PRESENCE	37
PIECES OF THE SITE-BUILDING PUZZLE	37

BUSINESS OBJECTIVES, SYSTEM FUNCTIONALITY, AND INFORMATION REQUIREMENTS	37
BUILDING THE WEBSITE: IN-HOUSE VS. OUTSOURCING	37
IMPROVING DECISION MAKING AND MANAGING KNOWLEDGE	39
DECISION MAKING AND INFORMATION SYSTEMS	39
BUSINESS INTELLIGENCE IN THE ENTERPRISE	39
	40
BUSINESS INTELLIGENCE AND ANALYTICS CAPABILITIES	40
BUSINESS INTELLIGENCE USERS	41
GROUP DECISION-SUPPORT SYSTEMS	42
INTELLIGENT SYSTEMS FOR DECISION SUPPORT	43
EXPERT SYSTEMS	43
CASE-BASED REASONING (CBR)	43
FUZZY LOGIC SYSTEMS	43
NEURAL NETWORKS	44
GENETIC ALGORITHMS	44
INTELLIGENT AGENTS	44
Systems for managing knowledge	44
ENTERPRISE-WIDE KNOWLEDGE MANAGEMENT SYSTEMS	44
KNOWLEDGE WORK SYSTEMS (KWS)	45
BUILDING INFORMATION SYSTEMS AND MANAGING PROJECTS	47
PROBLEM SOLVING AND SYSTEMS DEVELOPMENT	47
DEFINE AND UNDERSTAND THE PROBLEM	47
DEVELOP ALTERNATIVE SOLUTIONS	47
CHOOSE THE BEST SOLUTION	47
IMPLEMENT THE SOLUTION	47
ALTERNATIVE SYSTEMS-BUILDING APPROACHES	48
TRADITIONAL SYSTEMS DEVELOPMENT LIFECYCLE	48
Prototyping	48
END-USER DEVELOPMENT	49
PURCHASING SOLUTIONS: APPLICATION SOFTWARE PACKAGES AND OUTSOURCING	49
RAPID APPLICATION DEVELOPMENT FOR E-BUSINESS	49
MODELING AND DESIGNING SYSTEMS	50
STRUCTURED METHODOLOGIES	50
	50
COMPUTER-AIDED SOFTWARE ENGINEERING (CASE)	51
	51
PROJECT MANAGEMENT OBJECTIVES	51
SELECTING PROJECTS: MAKING THE BUSINESS CASE FOR A NEW SYSTEM	52
MANAGING PROJECT RISK AND SYSTEM-RELATED CHANGE MANAGING PROJECTS ON A GLOBAL SCALE	53
FTHICAL AND SOCIAL ISSUES IN INFORMATION SYSTEMS	55
	55
	55
	50

# Global e-business and collaboration

#### Components of a business

A **business** is a formal organization whose aim is to produce products or provide services for a profit.

#### Organizing a business: basic business functions

The decision of what to produce is called a *strategic choice* because it determines your likely customers, the kinds of employees you will need, the production methods and facilities needed, the marketing themes, etc.

- You need to develop a production division
- You need a sales and marketing group who will attract customers, sell the product, keep track of sales, etc.
- Once you generate sales, you will need a finance and accounting group to keep track of financial transactions
- You will need a group of people to focus on recruiting, hiring, training, and retaining employees
- The 5 basic entities in a business with which it must deal are:
  - $\circ$  Suppliers
  - $\circ$  Customers
  - o Employees
  - o Invoices/payments
  - $\circ \quad \text{Products and services}$

**Business processes**: the actual steps and tasks that describe how work is organized in a business.

- A business process is logically related set of activities that define how specific business task are performed
- Business processes also refer to the unique ways in which work, information, and knowledge are coordinated in a specific organization
- A company's business processes can be a source of competitive strength if they enable the company to innovate or to execute better than its rivals
- Can also be liabilities if they are based on outdated ways of working that impede organizational responsiveness and efficiency

#### How information technology enhances business processes

Information systems automate many steps in business processes that were formerly performed manually. New tech can actually change the flow of information

#### Managing a business and firm hierarchies

The hierarchy of management is composed of:

- Senior management: which makes long-range strategic decisions about products and services as well as ensures financial
- **Middle management**: which carries out the programs and plans of senior management

- **Operational management**: which is responsible for monitoring the daily activities of the business
- **Knowledge workers** design products or services and create new knowledge for the firm
- Data workers assist with administrative work at all levels of the firm
- **Production or service workers** actually produce the product and deliver the service

#### The business environment

Business firms depend heavily on their environments to supply capital, labor, customers, new tech, services and products, stable markets and legal systems, and general educational resources. Business environments are constantly changing.

#### The role of information systems in business

Businesses invest in information systems as a way to cope with and manage their internal production functions and to cope with the demands of key actors in their environments. Firms invest in information systems for the following business objectives:

- To achieve operational excellence
- To develop new products and services
- To attain customer intimacy and service
- To improve decision making
- To achieve competitive advantage
- To ensure survival

#### Types of business information systems

A typical business organization will have systems supporting processes for each of the major business functions: sales and marketing, manufacturing and production, finance and accounting, and human resources.

#### Systems for management decision making and business intelligence

A business firm has systems to support decision making and work activities at different levels of the organization. They include transaction processing systems and systems for business intelligence.

**Transaction processing systems (TPS)** are computerized systems that perform and record the daily routine transactions necessary to conduct business.

- The principal purpose of systems at this level is to answer routine questions and to track the flow of transactions through the organization
- At the operational levels, tasks, resources, and goals are predefined and highly structured
- Managers need TPS to monitor the status of internal operations and the firm's relations with the external environment
- TPS are also major producers of information for the other systems and business functions

#### Systems for business intelligence

**Business intelligence** is a contemporary term for data and software tools for organizing, analyzing, and providing access to data to help managers and other enterprise users make more informed decisions

- Addresses the decision-making needs of all levels of management
- BI systems for middle management help with monitoring, controlling, decision-making, and administrative activities
- **Management information systems (MIS)** also designates a specific category of information systems serving middle management
  - MIS provide middle managers with reports on the organization's current performance, used to monitor and control the business and predict future performance
- **Decision-support systems (DIS)** focus on problems that are unique and rapidly changing, for which the procedure for arriving at a solution may not be fully predefined in advance
  - DSS use internal information from TPS and MIS
  - DSS often bring in information from external sources, such as current stock prices or product prices from competitors
- BI systems also address the decision-making needs of senior management
  - Senior managers need systems that focus on strategic issues and long-term trends, both in the firm and in the external environment
- Executive support systems (ESS) help senior management make these decisions
  - Address non-routine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at a solution
  - ESS present graphs and data from many sources through an interface that is easy for senior managers to use
  - Often the information is delivered to senior executives through a portal
  - Designed to incorporate data about external events, but they also draw summarized information from internal MIS and DSS
  - **Digital dashboard**: displays, on a single screen, graphs and charts of key performance indicators for managing a company

#### Systems for linking the enterprise

Enterprise applications: systems that span functional areas, focus one executing business processes across the business firm, and include all levels of management.

- Help business become more flexible and productive by coordinating their business processes more closely and integrating groups of processes to they focus on efficient management of resources and customer service
- There are 4 major enterprise applications:
  - **Enterprise systems**: AKA *enterprise resource planning (ERP)* systems, are used by firms to integrate business processes in manufacturing and production, finance and accounting, sale and marketing, and human resources into a single software system
  - **Supply chain management systems**: (SCM) are used by firms to help manage relationships with their suppliers

- These systems help suppliers, purchasing firms, distributors, and logistics companies share information about orders, production, inventory levels, and delivery of products and services so that they can source, produce, and deliver goods and services efficiently
- Supply chain management systems are one type of interorganizational system because they automate the flow of information across organizational boundaries
- **Customer relationship management systems**: (CRM) are used by firms to help manage their relationships with their customers
  - Provide information to coordinate all of the business processes that deal with customers in sales, marketing, and service to optimize revenue, customer satisfaction, and customer retention
- Knowledge management systems: (KMS) enable organizations to better manage processes for capturing and applying knowledge and expertise

#### **Intranets and extranets**

- Intranets are simply internal company websites that are accessible only by employees
- Extranets are company websites that are accessible to authorized vendors and suppliers, and often used to coordinate the movement of supplies to the firm's production apparatus

#### E-business, e-commerce, and e-government

- **E-business** refers to the use of digital tech and the internet to execute the major business processes in the enterprise
  - Includes activities for the internal management of the firm and for coordination with suppliers and other business partners
  - Includes e-commerce, which is the part of e-business that deals with the buying and selling of goods and services over the internet
  - Encompasses activities supporting those market transactions, such as advertising, marketing, customer support, security, delivery, and payment
- **E-government** refers to the application of the internet and networking technologies to digitally enable government and public sector agencies' relationships with citizens, businesses, and other arms of government

#### Systems for collaboration and teamwork

**Collaboration** is working with others to achieve shared and explicit goals. **Teams** are part of the organization's business structure for getting things done. Collaboration and teamwork are important because of:

- Changing nature of work
- Growth of professional work
- Changing organization of the firm
- Changing scope of the firm
- Emphasis on innovation
- Changing culture of work and business

There is a general belief that the more a business firm is collaborative the more successful it will be, and that collaboration within and among firms is more essential than in the past.

#### **Building a collaborative culture**

- Command and control firms require lower-level employees to carry out orders without asking too many questions, with no responsibility to improve processes, and with no rewards for teamwork or team performance
- A collaborative business culture is very different. Senior managers are responsible for achieving results, but rely on teams of employees to achieve and implement results
- Teams are rewarded for their performance, and individuals are rewarded for their performance in a team
- In a collaborative culture, senior management establishes collaboration and teamwork as vital to the organization, and it actually implements collaboration for the senior ranks of the business as well

#### Tools and technologies for collaboration and teamwork

- Email and IM
- Social networking
- Wikis
- Virtual worlds
- Internet-based collaboration environments
  - Virtual meeting systems
    - Telepresence tech: an integrated audio and visual environment which allows a person to give the appearance of being present at a location other than their true physical location
    - o GAPPS
    - o Microsoft SharePoint
    - o Lotus notes

#### **Checklist for managers**

The time/space matrix focuses on 2 dimensions of the collaboration problem: time and space. Using this framework will help you to choose the most appropriate collaboration and teamwork tools for your firm.



#### The information systems function in business

End users manage their systems from a business standpoint, but managing the tech requires a special information systems function.

The **information systems department** is the formal organizational unit responsible for information technology services.

• Responsible for maintaining the hardware, software, data storage, and networks that comprise the firm's IT infrastructure

#### The information systems department

The information systems department consists of specialists, such as programmers, systems analysts, project leaders, and information systems managers.

- **Programmers** are highly trained technical specialists who write the software instructions for computers
- **Systems analysts** constitute the principal liaisons between the information systems groups and the rest of the organization
  - It's the systems analyst's job to translate business problems and requirements into information requirements and systems
- **Information systems managers** are leaders of teams of programmers and analysts, project managers, physical facility managers, telecommunications managers, or database specialists
- The information systems department is headed by a CIO
- The **chief security officer (CSO)** is in charge of information systems security for the firm and is responsible for enforcing the firm's information security policy
- **Chief privacy officer (CPO)** is responsible for ensuring that the company complies with existing data privacy laws
- **Chief knowledge officer (CKO)** is responsible for the firm's knowledge management program
- **End users** are representatives of departments outside of the information systems group for whom applications are developed

# Achieving competitive advantage with information systems

#### Using information systems to achieve competitive advantage

#### Porter's competitive forces model

**Competitive forces model:** The most widely used model for understanding competitive advantage.

- Provides a general view of the firm, its competitors, and the firm's environment
- All about the firm's general business environment
- 5 competitive forces shape the fate of the firm:
  - Traditional competitors
  - New market entrants
  - o Substitute products and services
  - Customers
  - $\circ$  Suppliers

#### Information system strategies for dealing with competitive forces

Basic strategy 101: align the IT with the business objectives

- The more successfully a firm can align its IT with its business goals, the more profitable it will be
- Only about one-quarter of firms achieve alignment of IT with business
- Basic ways to achieve alignment with IT:
  - o Identify your business strategy and goals
  - o Break these strategic goals down into concrete activities
  - o Identify how you will measure progress towards the business goals
  - o Measure actual performance
  - There are 4 generic strategies:
    - Low-cost leadership
      - Efficient customer response system: an efficient customer response system directly links consumer behavior to distribution and production and supply chains
    - Product differentiation
      - **Mass customization**: the ability to offer individually tailored products or services using the same production resources
    - Focus on market niche
    - Strengthen customer and supplier intimacy
      - **Switching costs**: the cost of switching from one product or service to competitor

Strategy	Description	Example
Low-cost leadership	Use information systems to produce products and services at a lower price than competitors while enhancing quality and level of service	Walmart
Product differentiation	Use information systems to differentiate products, and enable new services and products	Google, eBay, Apple, Starbucks
Focus on market niche	Use information systems to enable a focused strategy on a single market niche; specialize	Hilton Hotels, Harrah's
Customer and supplier intimacy	Use information systems to develop strong ties and loyalty with customers and suppliers	Toyota Corporation, Amazon

#### The business value chain model

- The **value chain model** highlights specific activities in the business where competitive strategies can best be applied and where information systems are most likely to have a strategic impact
  - This model identifies specific, critical leverage points where a firm can use information technology most effectively to enhance its competitive position
  - These activities can be categorized as either:
    - Primary activities are most directly related to the production and distribution of the firm's products and services, which create value for the customer
      - Include inbound logistics, operations, outbound logistics, sales and marketing, and service
        - Inbound logistics includes receiving and storing materials for distribution to production
        - Operations transforms inputs into finished goods
        - Outbound logistics entails storing and distributing finished goods
        - Sales and marketing includes promoting and selling the firm's products
        - The service activity includes maintenance and repair of the firm's goods and services
    - Support activities make the delivery of the primary activities possible and consist of organization infrastructure, human resources, technology, and procurement
  - Using the business value chain model will also cause you to consider benchmarking your business processes against your competitors or others in related industries, and identifying industry best practices
    - Benchmarking involves comparing the efficiency and effectiveness on your business processes against strict

standards and then measuring performance against those standards

- Best practices are usually identified by consulting companies, research organizations, government agencies, and industry associations as the most successful solutions or problemsolving methods for consistency and effectively achieving a business objective
- By making improvements in your own business value chain you can achieve competitive advantage by attaining operational excellence, lowering costs, improving profit margins, and forging a closer relationship with customers and suppliers

Extending the value chain: the value web

- Strategic advantage derives from your ability to relate your value chain to the value chains of other partners in the process
- A **value web** is a collection of independent firms that use information technology to coordinate their value chains to produce a product or service for a market collectively. It's more customer driven and operates in a less linear fashion than the traditional value chain

#### Synergies, core competencies, and network-based strategies

**Synergies** develop when the output of some units can be used as inputs to other units, or two organizations can pool markets and expertise, and these relationships lower costs and generate profits.

#### Enhancing core competencies

A **core competency** is an activity for which a firm is a world-class leader. Any information system that encourages the sharing of knowledge across business units enhances competency.

#### Network-based strategies

Business models based on a network may help firms strategically by taking advantage of **network economics** 

- In traditional economics production experiences diminishing returns
  - The more any given resource is applied to production, the lower the marginal gain in output, until a point is reached where the additional inputs produce no additional output – the law of traditional returns
- Network economics also provide strategic benefits to commercial software vendors
  - The value of their software and complementary software products increases as more people use them
- A virtual company, aka virtual organization, uses networks to link people, assets, and ideas, enabling it to ally with other companies to create and distribute products and services without being limited by traditional organizational boundaries or physical locations

#### **Disruptive technologies**

**Disruptive technologies** are substitute products that perform as well or better than anything currently being produced.

- Disruptive technologies sometimes simply extend the market, usually with less functionality and much less cost, than existing products
- Firms that invent disruptive technologies as first movers don't always benefit if they lack the resources to exploit the technology or fail to see the opportunity

#### Competing on a global scale

Firms pursuing a global strategy benefit from economics of scale and resource cost reduction

#### Global business and system strategies

There are 4 main ways of organizing businesses internationally:

- The **domestic exporter** strategy is characterized by heavy centralization of corporate activities in the home country of origin
  - Production, finance, sales, hr, and strategic management are set up to optimize resources in the home country
  - International sales are sometimes dispersed using agency agreements or subsidiaries, but foreign marketing is still totally reliant on the domestic home base for marketing themes and strategies
- A **multinational** strategy concentrates financial management and control out of a central home base while decentralizing production, sales, and marketing operations to units in other countries
  - The products and services on sale in different countries are adapted to suit local market conditions
- **Franchisers** have the product created, designed, financed, and initially produced in the home country but rely heavily on foreign personnel for further production, marketing, and human resources
- In a **transnational** strategy, nearly all the value-adding activities are managed from a global perspective without reference to national borders, optimizing sources of supply and demand wherever they appear and taking advantage of any local competitive advantages

#### **Global system configuration**

- *Centralized systems* are those in which systems development and operation occur totally at the domestic home base
- *Duplicated systems* are those in which development occurs at the home base but operations are handed over to autonomous units in foreign locations
- *Decentralized systems* are those in which each foreign unit designs its own unique solutions and systems
- *Networked systems* are those in which systems development and operations occur in an integrated and coordinated fashion across all units

#### Competing on quality and design

Quality can be defined from both producer and customer perspectives:

- From the perspective of the producer, quality signifies conformance to specifications or the absence of variation from those specifications
- A customer definition of quality is much broader
  - Customers are concerned with the quality of the physical product
  - Customers are concerned with the quality of service
  - Customer concepts of quality include psychological aspects
- **Total quality management (TQM)** makes quality the responsibility of all people and functions within an organization
  - TQM holds that the achievement of quality control is an end in itself
- **Six sigma** is a specific measure of quality, representing 3.4 defects per million opportunities
  - Most companies cannot achieve this level of quality but use six sigma as a goal to implement a set of methodologies and techniques for improving quality and reducing costs
  - Quality improvements not only raise the level of product and service quality but they can also lower costs

#### How information systems improve quality

- Reduce cycle time and simplify the production process
  - **Cycle time** refers to the total elapsed time from the beginning of a process to its end.
    - Shorter cycle times mean that problems are caught earlier in the process
    - Finding ways to reduce cycle time often means finding ways to simplify production steps
    - Information systems help eliminate steps in a process and critical time delays
- Benchmark
- Use customer demands to improve products and services
- Improve design quality and precision
  - A computer-aided design (CAD) system automates the creation and revision of designs, using computers and sophisticated graphics software
    - The software enables users to create a digital model of a part, a product, or a structure, and make changes to the design on the computer without having to build physical prototypes
- Improve production precision and tighter production tolerances

#### Competing on business processes

Tech alone is often not enough to make organizations more competitive, efficient, or quality-oriented. The organization needs to be changed to take advantage of the power of IT, often requiring the entire business process to be redesigned. BPM addresses these needs.

#### **Business process management**

**Business process management (BPM)** is an approach to business which aims to continuously improve business processes. BPM uses a variety of tools and

methodologies to understand existing processes, design new processes, and optimize those processes. BPM is never concluded because continuous improvement requires continual change.

- Identify processes for change
- Analyze existing processes
- Design the new process
  - The new process design needs to be justified by showing how much it reduces time and cost or enhances customer service and value
- Implement the new process
- Continuous measurement

Business process reengineering

- Many business process improvements are incremental and ongoing, but occasionally, more radical change is required
- This radical rethinking and redesign of business processes is called **business process reengineering (BPR)**
- BPR can lead to dramatic gains in productivity and efficiency when properly implemented
- The largest single barrier to successful business process change is organizational culture
  - Employees don't like unfamiliar routines, and often try to resist change

# Foundations of BI: databases and information management

#### The database approach to data management

A **database** is a collection of related files containing records on people, places, or things. A powerful feature of computer databases is the ability to quickly relate one set of files to another.

#### **Entities and attributes**

- The first step is to identify the data you will need to run your business
- Each of these generalized categories representing a person, place, or thing on which we store and maintain information is called an **entity**
- Each entity has specific characteristics, called attributes

#### Organizing data in a relational database

- The relational database is the most common type of database
  - $\circ~$  Organize data into two-dimensional tables (relations) with columns and rows
  - o Each table contains data on an entity and its attributes
  - There is one table for each business entity
  - Fields in a relational database are also called columns
  - Rows are commonly referred to as **records**, or, in very technical terms **tuples**
    - This field uniquely identifies each record so that the record can be retrieved, updated, or sorted, and it's called a key field
  - $\circ~$  Each table in a relational database has one field designated as its  $$\mathbf{primary}\ \mathbf{key}$$ 
    - This key field is the unique identifier for all the information in any row of the table, and this primary key cannot be duplicated
  - Data are separated into the smallest elements that one would want to access separately to make it easy to select only the rows in the table that match the contents of one field
  - A **foreign key** is essentially a look-up field to find data about the supplier of a specific part
  - As we organize data into tables, it's important to make sure that all the attributes for a particular entity apply only to that entity

#### **Establishing relationships**

- A schematic called an **entity-relationship diagram** is used to clarify table relationships in a relational database
- The most important piece of information provided by an entity-relationship diagram is the manner in which two tables are related to each other
- Data may be one-to-one, one-to-many, and many-to-many relationships
- Whenever a many-to-many relationship exists between two tables, it's necessary to link these two tables in a table that joins this information
  - Creating a separate table for a line item in the order would serve this purpose

- $\circ$  This table is often called a join table or an intersection relation
- The process of streamlining complex groups of data to minimize redundant data elements and awkward many-to-many relationships, and increase stability and flexibility is called **normalization** 
  - A properly designed and normalized database is easy to maintain, and minimize duplicate data
- Relational database systems enforce **referential integrity** rules to ensure that relationships between coupled tables remain consistent
  - When one table has a foreign key that points to another table, you may not add a record to the table with the foreign key unless there is a corresponding record in the linked table
- What is important for any business is to have a good data model that includes all of its entities and the relationships among them, one that is organized to minimize redundancy, maximize accuracy, and make data easily accessible for reporting and analysis
- If the business doesn't get its data model right, the system will not be able to serve the business properly

# Database management systems

A **database management system (DBMS)** is a specific type of software for creating, storing, organizing, and accessing data from a database.

- The DBMS relieves the end user or programmer from the task of understanding where and how the data are actually stored by separating the logical and physical views of the data.
  - The *logical view* presents data as end users or business specialists would perceive them
  - The *physical view* shows how data are actually organized and structured on physical storage media

#### **Operations of a relational DBMS**

In a relational database, 3 basic operations are used to develop useful sets of data:

- Select
  - The *select* operation creates a subset consisting of all records in the file that meet stated criteria
  - $\circ$   $\,$  Select creates a subset of rows that meet certain criteria
- Project
  - The *project* operation creates a subset consisting of columns in a table, permitting the user to create new tables that contain only the information required
- Join
  - The *join* operation combines relational tables to provide the user with more information than is available in individual tables

#### Capabilities of database management systems

A DBMS includes capabilities and tools for organizing, managing, and accessing the data in the database. The most important are:

• Data definition capability

- DBMS have a **data definition** capability to specify the structure of the content of the database
  - It would be used to create database tables and to define the characteristics of the fields in each table
- Data dictionary
  - A **data dictionary** is an automated or manual file that stores definitions of data elements and their characteristics
  - Data dictionaries for large corporate databases may capture additional information, such as usage, ownership, authorization, security, and the individuals, business functions, programs, and reports that use each data element
- Data manipulation language
  - Most DBMS have a specialized language called database manipulation language that is used to add, change, delete, and retrieve the data in the database
  - $\circ$   $\,$  The most prominent data manipulation language today is SQL  $\,$

## **Object-oriented databases**

An **object-oriented DBMS** stores the data, and procedures that act on those data, as objects that can be automatically retrieved and shared.

- Object-oriented database management systems (OODBMS) are becoming popular
- Although object-orientated databases can store more complex types of information than relational DBMS, they are relatively slow compared with relational DBMS for processing large numbers of transactions
- Hybrid **OODBMS** are now available to provide capabilities of both objectoriented and relational DBMS

# Using databases to improve business performance and decision making

#### Data warehouses

A **data warehouse** is a database that stores current and historical data of potential interest to decision makers throughout the company.

- The data originate in many core operational transaction systems, such as systems for sales, customer accounts, manufacturing, etc.
- Consolidates and standardizes information from different operational databases so that the information can be used across the enterprise for management analysis and decision making
- Makes the data available for anyone to access as needed, but cannot be altered
- Also provides a range of ad hoc and standardized query tools, analytical tools, and graphical reporting facilities

#### Data marts

A **data mart** is a subset of a data warehouse in which a summarized or highly focused portion of the organization's data is placed in a separate database for a specific population of users.

# **Tools for business intelligence: multidimensional data analysis and data mining** Principal tools for business intelligence include software for database querying and reporting, tools for multidimensional data analysis and tools for data mining.

Online analytical processing (OLAP) supports multidimensional data analysis, enabling users to view the same data in different ways using multiple dimensions

- Each aspect of information represents a different dimension
- OLAP enables users to obtain online answers to ad hoc questions in a fairly rapid amount of time, even when the data are stored in very large databases
- A company would use either a specialized multidimensional database or a tool that creates multidimensional views of data in relational databases

Data mining is more discovery driven.

- Provides insights into corporate data that cannot be obtained with OLAP by finding hidden patterns and relationships in large databases and inferring rules from them to predict future behavior
- The patterns and rules are used to guide decision making and forecast the effect of those decisions
- The types of information obtainable from data mining include:
  - Associations are occurrences linked to a single event
  - In sequences, events are linked over time
  - *Classification* recognizes patterns that describe the group to which an item belongs by examining existing items that been classified and by inferring a set of rules
  - *Clustering* works in a manner similar to classification when no groups have yet been defined
  - Forecasting uses predictions in a different way. It uses a series of existing values to forecast what other values will be
- These systems perform high-level analyses of patterns or trends, but they can also drill down to provide more detail when needed
- **Predictive analytics** use data mining techniques, historical data, and assumptions about future conditions to predict outcomes of events

#### Text mining and web mining

Unstructured data accounts for over 80% of an organization's useful information.

- **Text mining** tools are now available to help businesses analyze these data
  - These tools are able to extract key elements from large unstructured data sets, discover patterns and relationships, and summarize the information
- The discovery and analysis of useful patterns and information for the internet is called **web mining** 
  - Web mining help firms understand customer behavior, evaluate the effectiveness of a particular website, quantify the success of a marketing campaign, etc.
  - Web mining looks for patterns in data through content mining, structure mining, and usage mining

- Web content mining is the process of extracting knowledge for the content of web pages, web structure mining examines data related to the structure of a particular website
- Analyzing such data helps companies determine the value of particular customers, cross marketing strategies across products, and effectiveness of promotional campaigns

#### Databases and the web

In a client/server environment, the DBMS resides on a dedicated computer called a **database server**.

- The DBMS receives the SQL requests and provides the require data
- The information is transferred from the organization's internal database back to the web server
- The application server software handles all application operations
- The application server takes requests from the web server, runs the business logic to process transactions bases on those requests, and provides connectivity to the organization's back-end systems or databases
- The software for handling these operations could be a custom program or a CGI script
- CGI = Common Gateway Interface
- Advantages to use web server to access an organization's internal databases:
  - Everyone knows how to use web browsers and employees require much less training than if they used proprietary query tools
  - The web interface requires few or no changes to the internal database

#### Managing data resources

In order to make sure that the data for your business remain accurate, reliable, and readily available a business will need special policies and procedures for data management.

#### Establish an information policy

An **information policy** specifies the organization's rules for sharing, disseminating, acquiring, standardizing, classifying, and inventory information.

- Information policies lay out specific procedures and accountabilities:
  - o Identifying which users and organizational units can share information
    - Where information can be distributed
    - $\circ$   $\;$  Who is responsible for updating and maintaining the information
- In a small business, the information policy would be established and implemented by the owners and managers
- In a large organization, managing and planning for information as a corporate resource often requires a formal data administration function
- **Data administration** is responsible for the specific policies and procedures through which data can be managed as an organizational resource
  - These responsibilities include:
    - Developing information policy
    - Planning for data
    - Overseeing logical database design and data dictionary development

- Monitoring how information systems specialists and end-user groups use data
- A large organization will also have a database design and management group within the corporate information systems division
  - In close cooperation with users, the design group establishes the physical database, the logical relations among elements, and the access rules and security procedures
    - The functions it performs are called **database administration**

# Ensuring data quality

Additional steps must be taken to ensure that the date in organizational databases are accurate and remain reliable.

- Data that are inaccurate, untimely, or inconsistent with other sources of information create serious operational and financial problems for businesses
- Some of these data quality problems are caused by redundant and inconsistent data produced by multiple systems feeding a data warehouse
- During the design process for the warehouse database, data describing entities should be named and defined consistently for all business areas using the database
- If a database is properly designed and enterprise-wide data standards established, duplicate or inconsistent data elements should be minimal
- Before a new database is in place, organizations need to identify and correct their faulty data and establish better routines for editing data
- Analysis of data quality often begins with a **data quality audit**, which is a structured survey of the accuracy and level of completeness of the data in an information system
- **Data cleansing**, aka *data scrubbing*, consists of activities for detecting and correcting data in a database that are incorrect, incomplete, improperly formatted, or redundant
  - It not only corrects, but also enforces consistency among different data sets

# Telecommunications, the internet, and wireless technology

# Telecommunications and networking in today's business world

#### What is a computer network?

The connection medium for linking network components can be a telephone wire, coaxial cable, or radio signal.

- The **network operating system (NOS)** routes and manages communications on the network and coordinates network resources
  - It can reside on every computer in the network, or it can reside primarily on a dedicated server computer for all the applications on the network
  - A server is a computer on a network that performs important network functions for client computers, such as webhosting, storing data, and storing the NOS
- **Hubs** connect network components, sending a packet of data to all other connected devices
- A **switch** has more intelligence than a hub and can filter and forward data to a specified destination on the network
- A **router** is a communications processor used to route packets of data through different networks

#### Key digital networking technologies

Contemporary digital networks and the internet are based on 3 key technologies:

- Client/server computing
- **Packet switching** is a method of slicing digital messages into parcels called packets, sending the packets along different communication paths as they become available, and then reassembling the packets once they arrive at their destinations
  - In circuit-switched networks, such as the telephone system, a complete point-to-point circuit is assembled, and then communication can proceed
- TCP/IP and connectivity
  - A **protocol** is a set of rules and procedures governing transmission of information between 2 points in a network
  - **TCP/IP** was developed during the early 70s to support DARPA efforts to help scientists transmit data among different types of computers over long distances
  - TCP/IP uses a suite of protocols, mainly TCP and IP
    - TCP handles the movement of data between computers
    - TCP establishes a connection between the computers, sequences the transfer of packets, and acknowledges the packets sent
    - IP is responsible for the delivery of packets and includes the disassembling and reassembling of packets during transmission
    - TCP/IP layers:

- Application layer
  - Enables client application programs to access to other layers and defines the protocols that applications use to exchange data
- Transport layer
  - Responsible for proving the application layer with communication and packet services
  - Includes TCP and other protocols
- Internet layer
  - Responsible for addressing, routing, and packing data packets called IP datagrams
- Network interface layer
  - Responsible for placing packets on and receiving them from the network medium

#### **Communications networks**

#### Signals: digital vs. analog

There are 2 ways to communicate a message in a network:

- An *analog signal* is represented by a continuous waveform that passes through a communications medium and has been used for voice communication
- A *digital signal* is a discrete, binary waveform, rather than a continuous waveform
  - Digital signals communicate information as strings of 2 discrete states: 1bit and 0bit, which are represented as on-off electrical pulses
- Modem stands for modulator-demodulator
  - Cable modems connect your computer to the internet using a cable network
  - DSL modems connect your computer to the internet using a telephone company's landline network
  - Wireless modems perform the same function as traditional modems, connecting your computer to a wireless network

# Types of networks

Local area networks

- A **local area network (LAN)** is designed to connect personal computers and other digital devices within a 500m radius
- LANs also are used to link to long-distance wide are networks (WAN)
- The server determines who gets access to what and in which sequence
- Ethernet is the dominant LAN standard at the physical network level
  - Ethernet supports a data transfer rate of 10 Mbps
  - Fast Ethernet supports a data transfer rate of 100 Mbps
  - Gigabit Ethernet supports a data transfer rate of 1 Gbps
- LANs may use a **peer-to-peer** architecture
  - A P2P network treats all processors equally and is used primarily in small networks with 10 or fewer users

- In LANs using the Windows server family of OSs, the P2P architecture is called the *workgroup network model*
- The Windows *domain network model* uses a dedicated server to manage the computers in the network
- LANs are described in terms of the way their components are connected together, aka **topology**
- The 3 major LAN topologies are:
  - Star topology
    - All devices on the network connect to a single hub
    - Bus topology

- One station transmits signals, which travel in both directions along a single transmission segment
- All of the signals are broadcast in both directions to the entire network
- The most common Ethernet topology
- Ring topology
  - · Connects network components in a closed loop
  - Messages pass from computer to computer in only one direction around the loop, and only one station at a time may transmit



Functions of the Modem

A modem is a device that translates digital signals into analog form (and vice versa) so that computers can transmit data over analog networks such as telephone and cable networks.

Metropolitan and wide area networks

- Wide area networks (WANs) span broad geographical distances
- Metropolitan area network (MAN) is a network that spans a metropolitan area

#### **Physical transmission media**

- **Twisted wire** consists of strands of copper wire twisted in pairs and is an older type of transmission medium
  - Twisted-pair cabling is limited to a maximum recommended run of 100m
- **Coaxial cable** consists of thickly insulated copper wire that can transmit a larger volume of data than twisted wire
  - Coaxial has speed up to 1 Gbps
- **Fiber-optic cable** consists of bound strands of clear glass fiber, each the thickness of a human hair
  - Data are transformed into pulses of light, which are sent through the fiber-optic cable by a laser device at rates varying from 500kbps to several trillion bits per second

- Fiber-optic is faster, lighter, and more durable than wire media, but is more expensive and harder to install
- There are 3 kinds of wireless networks used by computers:
  - **Microwave** systems, both terrestrial and celestial, transmit highfrequency radio signals through the atmosphere and are widely used for high-volume, long-distance, point-to-point communication
    - Follows a straight line and don't bend with the curvature of the earth
    - Long-distance terrestrial transmission systems require that transmission stations be positioned about 60km apart
    - Download speeds via satellite are as high as 2 Mbps
  - **Cellular** systems also use radio waves and a variety of different protocols to communicate with radio antennas
    - Communications transmitted from a cellphone to a local cell pass from antenna to antenna, cell-to-cell, until they reach their final destination
  - o Wi-Fi

# • Transmission speed

- The transmission capacity of each type of telecommunications medium is a function of its frequency
- $\circ~$  The number of cycles per second that can be sent through the medium is measured in <code>hertz</code> 1 hertz = 1 cycle of the medium
- The range of frequencies that can be accommodated on a particular telecommunications channels is called its **bandwidth**

# The global internet

- An **internet service provider (ISP)** is a commercial organization with a permanent connection to the internet that sells temporary connections to retail subscribers
- **Digital subscriber line (DSL)** technologies operate over existing telephone lines to carry voice, data, and video at transmission rates ranging from 385 Kbps all the way up to 40 Mbps
- Cable internet connections provided by cable television vendors use digital cable coaxial lines to deliver high-speed internet access to homes and businesses
- T1 and T3 are international telephone standards for digital communication
  - T1 lines offer guaranteed delivery at 1.54 Mbps
  - T3 lines offer delivery at 45 Mbps

# Internet addressing and architecture

- Every computer on the internet is assigned a unique **internet protocol (IP) address**, which currently is a 32-bit number represented by 4 strings of numbers ranging from 0 to 255 separated by periods
- The domain name system (DNS) converts domain names to IP addresses
  - The **domain name** is the English-line name that corresponds to the IP address for each computer connected to the internet
  - At the top of the DNS hierarchy is the root domain

- The child domain of the root is called a top-level domain, and the child domain of a top-level domain is called a second-level domain
- $\circ$   $\,$  Top-level domains are 2 and 3 character names, like .com, .org, etc.
- The old addressing system is being replaced by a new version of the IP addressing schema called IPv6 which contains 128-bit addresses
  - $\circ$   $\;$  Not compatible with the existing internet addressing system  $\;$
- Voice over IP (VoIP) technology delivers voice information in digital form using packet switching, avoiding the tolls charged by local and long-distance telephone networks
  - Can reduce communication and network management costs by 20-30%
  - VoIP is flexible
- **Unified communications** integrates disparate channels for voice communications, data communications, instant messaging, email, and electronic conferencing into a single experience where users can seamlessly switch back and forth between different communication modes
- A virtual private network (VPN) is a secure, encrypted, private network that has been configured within a public network to take advantage of the economies of scale and management facilities of large networks
  - Provides your firm with secure, encrypted communications at a much lower cost
  - Provide a network infrastructure for combining voice and data networks
- **Hypertext transfer protocol (HTTP)** is the communications standard used to transfer pages on the web
  - The address is called a uniform resource locator (URL)
- Search engines have become major shopping tools by offering what is called **search engine marketing** 
  - Search engine optimization (SEO) is the process of improving the quality and volume of web traffic to a website by employing a series of techniques that help a website achieve a higher ranking with the major search engines
  - One technique is to make sure that the keywords used in the website description match the keywords likely to be used as search terms by prospective customers
  - It's advantageous to link your website to as many other websites as possible because search engines evaluate such links to determine the popularity of a web page
  - Hot prospects are people who are looking for information and often intend to buy
  - Social search is an effort to provide fewer, more relevant, and trustworthy search results based on a person's network of social contacts
  - **Intelligent agent shopping bots** describe the capabilities of software agents with built-in intelligence that can gather or filter information and perform other tasks to assist users
  - **Shopping bots** use intelligent agent software for searching the internet for shopping information

# The wireless revolution

#### **Cellular systems**

- Digital cellular service uses several competing standards
  - In Europe and much of the world, the standard is Global System for Mobile Communication (GSM)
    - GSM's strength is its international roaming capability
  - The major standard in the US is Code Division Multiple Access (CDMA)
    - It transmits over several frequencies, occupies the entire spectrum, and randomly assigns users to a range of frequencies over time
- **3G networks**, with transmission speeds ranging from 144 Kbps for mobile users to more than 2 Mbps for stationary users
- **4G networks** is entirely packet switched and capable of 100 Mbps transmission speed with premium quality and high security

#### Wireless computer networks and internet access

- **Bluetooth** is the popular name for the 802.15 wireless networking standard, which is useful for creating small **personal area networks (PANs)** 
  - It links up to 8 devices within a 10m area using low-power, radio-based communication and can transmit up to 722 Kbps in the 2.4GHz band
- The 802.11 set of standards for wireless LANs and wireless internet access is also known as **Wi-Fi** 
  - 802.11b can transmit up to 11 Mbps in the unlicensed 2.4GHz band and has an effective distance of 30-50m
  - the 802.11g standard can transmit up to 54 Mbps in the 2.4GHz range
  - o 802.11n is capable of transmitting over 100 Mbps
  - **Hotspots** typically consist of one or more access points providing wireless internet access in a public place
  - Wi-Fi technology poses several challenged:
    - Wi-Fi's security features
    - Susceptibility to interference from nearby systems operating in the same spectrum
      - Wireless networks based on the 802.11n standard are able to solve this problem by using multiple wireless antennas in tandem to transmit and receive data and technology called *MIMO*
- **WiMAX**, Worldwide Interoperability for Microwave Access, is the popular term for IEEE standard 802.16
  - It has a wireless access range of up to 50km and transmission speed of up to 75 Mbps
- **Radio frequency identification (RFID)** systems provide a powerful technology for tracking the movement of goods throughout the supply chain
  - RFID systems use tiny tags with embedded microchips containing data about an item and its location to transmit radio signals over a short distance to RFID readers
  - $\circ$   $\,$  The RFID readers pass the data over a network to a computer for processing
  - RFID tags don't need line-of-sight contact to be read

- The RFID tag is electronically programmed with information that can uniquely an item plus other information about the item such as location, where and when it was made, or its status during production
- $\circ~$  Embedded in the tag is a microchip for storing the data, the rest of the tag is an antenna that transmits data to the reader
- The reader emits radio waves in ranges anywhere from 3cm to 30m, depending on its power output, the radio frequency employed, and surrounding environmental conditions
- When an RFID tag comes within the range of the reader, the tag is activated and starts sending data
- Active RFID tags are powered by an internal battery and typically enable data to be rewritten and modified
- Passive RFID tags don't have their own power source and obtain their operating power from the radio frequency energy transmitted by the RFID reader. They are smaller, lighter, and less expensive than active tags, but only have a range of less than a meter
- $\circ$   $\,$  The cost of RFID tags starts at 5¢ per passive tag in the US  $\,$
- In addition to installing RFID readers and tagging systems, companies may need to upgrade their hardware and software to process the massive amounts of data produced by RFID systems
- Wireless sensor networks (WSNs) are networks of interconnected wireless devices that are embedded into the physical environment to provide measurement of many points over large spaces
  - These devices have built-in processing, storage, and radio frequency sensors and antennas
  - They are linked into an interconnected network that routes the data they capture to a computer for analysis
  - Wireless sensor networks are valuable in areas such as monitoring environmental changes, monitoring traffic or military activity, protecting property, etc.

# Achieving operational excellence and customer intimacy

#### Enterprise systems

Enterprise resource planning (ERP) systems, which are based on a suite of integrated software modules and a common central database.

- The database collects data from many different divisions and departments in a firm, and from a large number of key business processes in manufacturing and production, finance, sales, and hr
- When new information is entered by one process, the information is made immediately available to other business processes

**Enterprise software** is built around thousands of predefined business processes that reflect best practices.

- Select the functions of the system they wished to use and then map their business processes to the predefined business processes in the software
- If the enterprise software doesn't support the way the organization does business, companies can rewrite some of the software to support the way their business processes work
- Enterprise software is unusually complex, and extensive customization may degrade system performance, compromising the information and process integration that are the main benefits of the system
- If companies want to reap the maximum benefits from enterprise software, they must change the way they work to conform to the business process in the software
- Leading enterprise software vendors include SAP, Oracle, IBM, IGS, and Microsoft
- Enterprise systems have become more externally oriented and capable of communicating with customers, suppliers, and other entities

#### **Business value of enterprise systems**

Enterprise systems provide value both by increasing operational efficiency and by providing firm-wide information to help managers make better decisions.

- Enterprise systems help firms respond rapidly to customer requests for information or products
- Because the system integrates order, manufacturing, and delivery data, manufacturing is better informed about producing only what customers have ordered
- Enterprise systems provide much valuable information for improving management decision making
  - Corporate headquarters has access to up-to-the-minute data on sales, inventory, and production and uses this information to create more accurate sales and production forecasts
  - Includes analytical tools
- Enterprise system data have common standardized definitions and format that are accepted by the entire organization

## Supply chain management systems

#### The supply chain

A firm's **supply chain** is a network of organizations and business processes for:

- Procuring raw materials
- Transforming these materials into intermediate and finished products
- o Distributing the finished products to customers
- It links suppliers, manufacturing plants, distribution centers, retail outlets, and customers to supply goods and services from source through consumption
- Materials, information, and payments flow through the supply chain in both directions
- Goods start out as raw materials, and, as they move through the supply chain, are transformed into intermediate products, aka components or parts, and finally into finished goods
- The *upstream* portion of the supply chain includes the company's suppliers, the suppliers' suppliers, and the processes for managing relationships with them
- The *downstream* portion consists of the organizations and processes for distributing and delivering products to the final customers
- Companies doing manufacturing also manage their own *internal supply chain* processes for transforming materials, components, and services furnished by their suppliers into finished products or intermediate products for their customers and for managing materials and inventory

#### Information systems and supply chain management

Inefficiencies in the supply chain are caused by inaccurate or untimely information.

#### Global supply chains and the internet

A manager uses a web interface to tap into suppliers' systems to determine whether inventory and production capabilities match demand for the firm's products.

Global supply chain issues

- Global supply chains typically span greater geographic distances and time differences than domestic supply chains and have participants from a number of different countries
- Performance standards may vary from region
- May need to reflect foreign government regulations and cultural differences
- The internet helps companies manage many aspects of their global supply chains, including sourcing, transportation, communications, and international finance
- Globalization has encouraged outsourcing warehouse management, transportation management, and related operations to 3<sup>rd</sup> party logistics providers

Demand-driven supply chains: from push to pull manufacturing and efficient customer response

• Earlier supply chain management systems were driven by a push-based model

- In a push-based model, production master schedules are based on forecasts or best guesses of demand for products, and products are pushed to customers
- In a **pull-based model**, aka demand-driven or build-to-order model, actual customer order or purchases trigger events in the supply chain
- The internet makes it possible to move from sequential supply chains, where information and materials flow sequentially from company to company, to concurrent supply chains, where information flows in many directions simultaneously among members of a supply chain network

#### Business value of supply chain management systems

By implementing a networked and integrated supply chain management system, companies match supply to demand, reduce inventory levels, improve delivery service, speed product time to market, and use assets more effectively.

In addition to reducing costs, supply chain management systems help increase sales.

#### Customer relationship management systems

Customer relationship management (CRM) systems capture and integrate customer data from all over the organization, consolidate the data, analyze the data, and then distribute the results to various systems and customer touch points across the enterprise.

A touch point, aka contact point, is a method of interaction with the customer.

#### Customer relationship management software

Commercial CRM software packages range from niche tools that perform limited functions, to large scale enterprise applications that capture myriad interactions with customers, analyze them with sophisticated reporting tools, and link to other major enterprise applications.

- The more comprehensive CRM packages contain modules for:
  - Partner relationship management (PRM)
    - Uses many of the same data, tools, and systems as customer relationship management to enhance collaboration between a company and its selling partners

#### • Employee relationship management (ERM)

 Deals with employee issues that are closely related to CRM, such as setting objectives, employee performance management, performance-based compensation, and employee training

Sales force automation (SFA) help sales staff increase their productivity by focusing sales efforts on the most profitable customers, those who are good candidates for sales and services.

• CRM systems provide sales prospect and contact information, product information, product configuration capabilities, and sales quote generation capabilities

**Customer service** modules in CRM systems provide information and tools to increase the efficiency of call centers, help desks, and customer support staff. They have capabilities for assigning and managing customer service requests.

Marketing

- CRM systems support direct-marketing campaigns by providing capabilities for capturing prospect and customer data, for providing product and service information, for qualifying leads for targeted marketing, and for scheduling and tracking direct-marketing mailings or email
- Marketing modules also include tools for analyzing marketing and customer data, identifying profitable and unprofitable customers, designing products and services to satisfy specific customer needs and interests, and identifying opportunities for cross-selling
- Cross-selling is the marketing of complementary products to customers
- To achieve maximum benefit, companies need to revise and model their business processes to conform to the best-practice business processes in the CRM software
- Directly servicing customers provides firms with opportunities to increase customer retention by singling out profitable long-term customers for preferential treatment

## **Operational and analytical CRM**

- **Operational CRM** includes customer-facing applications, such as tools for sales force automation, call center and customer service support, and marketing automation
- Analytical CRM includes applications that analyze customer data generated by operational CRM applications to provide information for improving business performance
  - Based on data warehouses that consolidate the data from operational CRM systems and customer touch points for use with online analytical processing (OLAP), data mining, and other data analysis techniques
  - Customer data collected by the organization might be combined with data from other sources, such as customer lists for direct-marketing campaigns purchased from other companies or demographic data
  - Such data are analyzed to identify buying patterns, to create segments for targeted marketing, and to pinpoint profitable and unprofitable customers
- **Customer lifetime value (CLTV)** is based on the relationship between the revenue produced by a specific customer, the expenses incurred in acquiring and servicing that customer, and the expected life of the relationship between the customer and the company

#### Business value of customer relationship management systems

Companies with effective customer relationship management systems realize many benefits, including increased customer satisfaction, reduced direct-marketing costs, more effective marketing, and low costs for customer acquisition and retention.

• The **churn rate** measures the number of customers who stop using or purchasing products or services from a company

## Enterprise applications: new opportunities and challenges

#### **Enterprise application challenges**

- To obtain value, you must clearly understand how your business has to change to use these systems effectively
- Enterprise applications require not only deep-seated technological changes but also fundamental changes in the way the business operates
- Supply chain management systems require multiple organizations to share information and business processes
- Some firms experienced enormous operating problems and losses when they first implemented enterprise applications because they didn't understand how much organizational change was required
- Enterprise applications are based on organization-wide definitions of data
- CRM systems typically require some data cleansing work
- Enterprise software vendors are addressing these problems by offering pareddown versions of their software and fast-start programs for small and medium-sized businesses and best-practice guidelines for larger companies
- Companies adopting enterprise applications can also save time and money by keeping customizations to the minimum

#### **Next-generation enterprise applications**

- The major enterprise software vendors have created what they call *enterprise solutions, enterprise suites,* or *e-business* suites to make their customer relationship management, supply chain management, and enterprise systems work closely with each other, and link to systems of customers and suppliers
- Next generation enterprise applications also include open source and ondemand solutions, as well as more functionality available on mobile platforms

#### Social CRM and business intelligence

- CRM software vendors are enhancing their products to take advance of social networking technologies
- These social enhancements help firms identify new ideas more rapidly, improve team productivity, and deepen interactions with customers
- **Social CRM** tools enable a business to connect customer conversations and relationships from social networking sites to CRM processes
- **Business intelligence in enterprise applications**: enterprise application venders have added business intelligence features to help managers obtain more meaningful information from the massive amounts of data generated by these systems
  - Included are tools for flexible reporting, ad hoc analysis, interactive dashboards, what-if scenario analysis, and data visualization

# E-commerce: digital markets, digital goods

## E-commerce and the internet

#### Why e-commerce is different

Ubiquity

- **Marketspace**: a marketplace extended beyond traditional boundaries and removed from a temporal and geographic location
- Ubiquity reduces transaction costs: the costs of participating in a market

#### **Global reach**

E-commerce technology permits commercial transactions to cross cultural and national boundaries far more conveniently and cost effectively than is true in traditional commerce.

Universal standards

- One strikingly unusual feature of e-commerce technologies is that the technical standards of the internet, and the technical standards for conducting e-commerce are universal standards
- The universal technical standards of the internet and e-commerce greatly lower **market entry costs**: the cost merchants must pay simply to bring their goods to market
- For consumers, universal standards reduce **search costs**: the effort required to find suitable products

#### Richness

Information richness refers to the complexity and content of a message

#### Interactivity

E-commerce technologies are interactive, meaning they allow for two-pay communication between merchant and consumer

Information density

- **Information density**: the total amount and quality of information available to all market participants, consumers, and merchants alike
- E-commerce technologies reduce information collection, storage, processing, and communication costs while greatly increasing the currency, accuracy, and timeliness of information
- Information density in e-commerce market make prices and costs more transparent
- **Price transparency** refers to the ease with which consumers can find out the variety of prices in a market
- **Cost transparency** refers to the ability of consumers to discover the actual costs merchants pay for products
- Advantage for merchants:

- Online merchants can discover much more about consumers than in the past, allowing merchants to segment the market into groups that are willing to pay different prices and permits the merchants to engage in **price discrimination**: selling the same goods, or nearly the same goods, to different targeted groups at different prices
- $\circ~$  Information density also helps merchants differentiate their products in terms of cost, brand, and quality

#### Personalization/Customization

- E-commerce technologies permit **personalization**: merchants can target their marketing messages to specific individuals by adjusting the message to a person's click stream behavior, name, interests, and past purchases
- The technology also permits **customization**: changing the delivered products or service based on a user's preferences or prior behavior

#### Social technology

All previous mass media in modern history use a broadcast model (one-to-many) where content is created in a central location by experts and audiences are concentrated in huge numbers to consume a standardized product.

#### Key concepts in e-commerce

- The location, timing, and revenue models of business are based in some part on the cost and distribution of information
- The internet reduces information asymmetry
  - An information asymmetry exists when one party in a transaction has more information that is important for the transaction than the other party
  - That information helps determine their relative bargaining power
- Digital markets are very flexible and efficient because:
  - They operate with reduced search and transaction costs
  - Lower menu costs: merchants' costs of changing prices
  - Greater price discrimination
  - The ability to change prices dynamically based on market conditions
    - In dynamic pricing, the price of a product varies depending on the demand characteristics of the customer or the supply situation of the seller
- These new digital markets may either reduce or increase switching costs, depending on the nature of the product or service being sold, and they may cause some extra delay in gratification
- Digital markets provide many opportunities to sell directly to the consumer, bypassing intermediaries, such as distributors or retail outlets
  - Eliminating intermediaries in the distribution channel can significantly lower purchase transaction costs
- By selling directly to consumers or reducing the number of intermediaries, companies are able to raise profits while charging lower prices
- The removal of organizations or business process layers responsible for intermediary steps in a value chain is called **disintermediation**

#### Digital goods

The internet digital marketplace has greatly expanded sales of digital goods. **Digital goods** are goods that can be delivered over a digital network.

In general, for digital goods, the marginal cost of producing another unit is about 0, however, the cost of producing the original first unit is relatively high.

# E-commerce: business and technology

#### **Types of e-commerce**

The 3 major electronics commerce categories are:

- **Business-to-consumer (B2C)** electronic commerce involves retailing products and services to individual shoppers
- **Business-to-business (B2B)** electronic commerce involves sales of goods and services among businesses
- **Consumer-to-consumer (C2C)** electronic commerce involves consumers selling directly to consumers

Another way of classifying electronic commerce transactions is in terms of the platforms used by participants in a transaction.

The use of handheld wireless devices for purchasing goods and services from any location is termed **mobile commerce** or **m-commerce**.

#### **E-commerce business models**

**Portals** offer powerful web search tools as well as an integrated package of content and services.

• Generate revenue primarily by attracting very large audiences, charging advertisers for ad placement, collecting referral fees for steering customers to other sites, and charging for premium services

E-tailer: online retail stores.

#### Content provider

**Intellectual property** refers to all forms of human expression that can be put into a tangible medium, or stored on any digital media. Content providers distribute information content over the web.

- The value proposition of online content providers is that consumers can find a wide range of content online and purchase this content inexpensively, be played or viewed on multiple computer devices or smartphones
- Providers don't have to be creators and are more likely internet-based distributors of content produced and created by others
- **Podcasting** is a method of publishing audio or video broadcasts via the internet
- **Streaming** is a publishing method for music and video files that flows a continuous stream of content to a user's device without being stored locally on the device

#### Transaction broker

Sites that process transactions for consumers normally handled in person, by phone, or by mail are transaction brokers.

- Largest industries using this model are financial and travel services
- The online transaction broker's primary value proposition are savings of money and time, as well as providing an extraordinary inventory of financial products and travel packages, in a single location

Market creators build a digital environment in which buyers and sellers can meet, display products, search for products, and establish prices.

• The value proposition of online market creators is that they provide a platform where sellers can easily display their wares and where purchasers can buy directly from sellers

While e-tailers sell products online, service providers offer services online.

**Community providers** are sites that create a digital online environment where people with similar interests can transact, share interests, photos, videos; communicate with like-minded people; receive interest-related information; and even play out fantasies by adopting online personalities called avatars.

Finding and solidifying the right internet business model isn't always easy.

#### E-commerce revenue models

A firm's **revenue model** describes how the firm will earn revenue, generate profits, and produce a superior ROI. Most companies rely on one, or some combination, of the following 6 revenue models:

- In the **advertising revenue model**, a website generates revenue by attracting a large audience of visitors who can then be exposed to advertisements
  - It's the most widely used revenue model in e-commerce
  - Websites with the largest viewership or that attract a highly specialized, differentiated viewership and are able to retain user attention are able to charge higher advertising rates
- In the **sales revenue model**, companies derive revenue by selling goods, information, or services to customers
  - Content providers make money by charging for downloads of entire files
  - Micropayment systems provide content providers with a cost-effective method for processing high volumes of very small monetary transactions
- In the subscription revenue model, a website offering content or services charges a subscription fee for access to some or all of its offerings on an ongoing basis
  - Content providers often use this model
  - To be successful, the subscription model requires that the content be perceived as having high added value, differentiated, and not readily available elsewhere nor easily replicated

- In the **transaction fee revenue model**, a company receives a fee for enabling or executing a transaction
  - The transaction revenue model enjoys wide acceptance in part because the true cost of using the platform is not immediately apparent to the user
- In the **affiliate revenue model**, websites send visitors to other websites in return for a referral fee or percentage of the revenue from any resulting sales
  - Some bloggers are paid directly by manufacturers, or receive free products, for speaking highly of products and providing links to sales channels

#### Social networking and the wisdom of crowds

Social networking is one of the fastest growing areas of e-commerce.

- At social shopping sites you can swap shopping ideas with friends
- Online communities are also ideal venues to employ viral marketing techniques

In a phenomenon called, the wisdom of crowds, some argue that large numbers of people can make better decisions about a wide range of topics or products than a single person or even a small committee of experts.

- Beyond merely soliciting advice, firms can be actively helped in solving some business problems using what is called **crowdsourcing**
- **Prediction markets** are established as P2P betting markets where participants make bets on specific outcomes

#### **E-commerce marketing**

The internet provides marketers with new ways of identifying and communicating with millions of potential customers at costs far lower than traditional media, including search engine marketing, data mining, recommender systems, and targeted email.

- The internet enables long tail marketing
- The internet also provides new ways to gather information from customers, adjust product offerings, and increase customer value
- **Behavioral targeting** refers to tracking the clickstream of individuals on thousands of websites for the purpose of understanding their interests and intentions, and exposing them to advertisements that are uniquely suited to their behavior
  - $\circ$   $\;$  This can lead to the invasion of personal privacy without user consent
  - Behavioral targeting takes place at 2 levels: at individual websites and on various advertising networks that track users across thousands of websites
    - This information enables firms to understand how well their website is working, create unique personalized web pages, improve customer's experience, and create additional value through a better understanding of the shopper
    - By using personalization tech, marketers achieve some of the benefits of using individual salespeople at dramatically lower costs

## Social e-commerce and social network marketing

Social e-commerce is commerce based on the idea of the digital social graph.

- The digital social graph is a mapping of all significant online social relationships
- The social graph is synonymous with the idea of a social network used to describe offline relationships
- Social interactions and customer sentiment are not always easy to manage, presenting new challenges for companies eager to protect their brands

#### **B2B e-commerce: new efficiencies and relationships**

The trade between business firms represents a huge marketplace.

- The process of conducting trade among business firms is complex and requires significant human intervention, thus consuming significant resources
- Administrative overhead includes processing paper, approving purchase decisions, etc.
- The challenge of B2B e-commerce is changing existing patterns and systems of procurement, and designing and implementing new internet-based B2B solutions
- About 80% of online B2B e-commerce is still based on proprietary systems for electronic data interchange (EDI)
  - EDI enables the C2C exchange between 2 organizations of standard transactions such as invoices, bills of lading, shipment schedules, or purchase orders
  - Although many organizations still use private networks for EDI, they are increasingly web-enabled because internet technology provides a much more flexible and low-cost platform for linking to other firms
- Procurement involves not only purchasing goods and materials but also sourcing, negotiating with suppliers, paying for goods, and making delivery arrangements
- The internet enables businesses to create new electronic storefronts for selling to other businesses with multimedia graphic displays and interactive features similar to those for B2C commerce
- **Private industrial networks** typically consist of a large firm using a secure website to link to its suppliers and other key business partners
  - The network is owned by the buyer, and it permits the firm and designated suppliers, distributors, and other business partners to share product design and development, marketing, production scheduling, etc.
  - Another term for private industrial network is a **private exchange**
- **Net marketplaces**, aka e-hubs, provide a single, digital marketplace based on internet technology for many different buyers and sellers
  - They are industry owned or operate as independent intermediaries between buyers and sellers
  - Net marketplaces generate revenue from purchase and sale transactions and other services provided to clients
  - Can establish prices through online negotiations, auctions, or requests for quotations, or they can use fixed pricing

- *Direct goods* are goods used in a production process
- Indirect goods are all other goods not directly involved in the production process
- **Exchanges** are independently owned 3<sup>rd</sup> party net marketplaces that connect thousands of suppliers and buyers for spot purchasing
  - Many exchanges provide vertical markets for a single industry

# The mobile digital platform and mobile e-commerce

#### **M-commerce services and applications**

The main areas of growth in mobile e-commerce are location-based services, software application sales, entertainment downloads, mobile display advertising, direct shopping services, and e-book sales.

#### Building an e-commerce presence

The 2 most important management challenges in building a successful e-commerce presence are:

- Developing a clear understanding of your business objectives
- Knowing how to choose the right technology to achieve those objectives

#### Pieces of the site-building puzzle

- You must be aware of the main areas where you will need to make decisions
- You will also need to make decisions about your site's hardware, software, and telecommunications infrastructure
  - $\circ$   $\,$  The demands of your customers should drive your choices of tech  $\,$

#### Business objectives, system functionality, and information requirements

- Your planning should identify the specific business objectives for your sites, and then develop a list of system functionalities and information requirements
- Business objectives are simply capabilities you want your site to have
- System functionalities are types of information systems capabilities you will need to achieve your business objectives
- The information requirements for a system are the information elements that the system must produce in order to achieve the business objectives
- The objectives must be translated into a description of system functionalities and ultimately into a set of precise information requirements
- The business objectives of an e-commerce site are similar to those of a physical retail store, but they must be provided entirely in digital form, 24/7

#### Building the website: in-house vs. outsourcing

There are many choices for building and maintaining websites.

- Much depends on how much money you're willing to spend
- Choices range from outsourcing the entire website development to an external vendor to building everything in-house

The building decision

- Given the complexity of features such as shopping arts, credit card authentication and processing, inventory management, and order processing, development costs are high, as are the risks of doing a poor job
- You will be reinventing what other specialized firms have already built, and your staff may face a long, difficult learning curve, delaying your entry to market
- On the positive side, you may be able to build a site that does exactly what you want, and develop the in-house knowledge to revise the site rapidly if necessitated by a changing business environment
- If you choose more expensive site-building packages, you will be purchasing state-of-the-art software that is well tested, allowing you to get to market sooner

## The hosting decision

Most businesses choose to outsource hosting and pay a company to host their website.

- With a **co-location** agreement, your firm purchases or leases a web server but locates the server in a vendor's physical facility
- The vendor maintains the facility communications lines, and the machinery
- It's much less expensive to host your website in virtualized computing facilities

# Website budgets

Simple website can be built and hosted with a first-year cost of \$5000 or less.

- Websites of large firms with high levels of interactivity and linkage to corporate systems cost several million dollars a year to create and operate
- The cost of hardware, software, and telecommunications for building and operating a website has fallen dramatically
- The costs of system maintenance and content creation have risen to make up more than half of typical website budgets
- Providing content and smooth 24/7 operations are both labor-intensive

# Improving decision making and managing knowledge

## Decision making and information systems

Types of decisions

- **Unstructured decisions** are those in which the decision maker must provide judgment, evaluation, and insight to solve the problem
  - Each of these decisions is novel, important, and non-routine, and there is no well-understood or agreed-on procedure for making them
- Structured decisions are repetitive and routine, and they involve a definite procedure for handling them so that they don't have to be treated each time as if they were new
  - Many decisions have elements of both types and are semi-structured decisions, where only part of the problem has a clear-cut answer provided by an accepted procedure
  - Structured decisions are more prevalent at lower organizational levels, whereas unstructured problems are more common at higher levels of the firm
  - Middle management faces more structured decision scenarios, but their decisions may include unstructured components
  - Operational management and rank-and-file employees tend to make more structured decisions

#### The decision-making process

Making a decision is a multistep process, consisting of 4 different stages:

- **Intelligence** consists of discovering, identifying, and understanding the problems occurring in the organization
- **Design** involves identifying and exploring various solutions to the problem
- Choice consists of choosing among solution alternatives
- **Implementation** involves making the chosen alternative work and continuing to monitor how well the solution is working
- Accuracy is one important dimension of quality

Many decisions made by organizations aren't made by managers or any humans.

- The intelligence, design, choice, and implementation parts of the decisionmaking process are captured by computer algorithms that precisely define the steps to be followed to produce a decision
- Organizations are making decisions faster than what managers can monitor or control, and great care needs to be taken to ensure the proper operation of these systems to prevent significant harm

# Business intelligence in the enterprise

- Bl is a term used by hardware and software vendors and IT consultant to describe the infrastructure for warehousing, integrating, reporting and analyzing data that come from the business environment
- Business analytics (BA) is also a vendor-defined term that focuses more on tools and techniques for analyzing and understanding data

- BI and BA are essentially about integration all the information streams produced by a firm into a single, coherent enterprise wide set of data, and then using modeling, statistical analysis and data mining tools to make sense out f all these data so managers can make better decisions and better plants
- BI and BA are products defined by tech vendors and consulting firms

#### The business intelligence environment

There are 6 elements in this BI environment:

- Data from the business environment
  - Business must deal with both structured and unstructured data from many different sources
  - The data need to be integrated and organized so that they can be analyzed and used by human decision makers
- Business intelligence infrastructure
  - The underlying foundation of business intelligence is a powerful database system that captures all the relevant data to operate the business
- Business analytics toolset
  - A set of software tools are used to analyze data and produce reports, respond to questions posed by managers, and track the progress of the business using key indicators of performance

#### • Managerial users and methods

- BI hardware and software are only as intelligent as the human beings who use them
- Managers impose order on the analysis of data using a variety of managerial methods that define strategic business goals and specify how progress will be measured
- Delivery platform MIS, DSS, ESS
  - One suite of hardware and software tools in the form of a BI and BA package is able to integrate all this information and bring it to managers' desktop or mobile platforms
- User interface (UI)

#### **Business intelligence and analytics capabilities**

There are 5 analytic functionalities that BI systems deliver correct, near real-time information, and the analytic tools needed to understand the information:

- **Production reports**: these are pre-defined reports based on industry-specific requirements
- **Parameterized reports**: users enter several parameters as in a pivot table to filter data and isolate impacts of parameters
- **Dashboards/scorecards**: these are visual tools for presenting performance data defined by users
- Ad hoc query/search/report creation: these allow users to create their own reports based on queries and searches
- **Drill down**: this is the ability to move from a high level summary to a more detailed view
- **Forecasts, scenarios, models**: these include capabilities for linear forecasting, what if scenario analysis, and analyzing data using standard statistical tools

The most widely used output of a BI suite of tools is pre-packaged production reports.

**Predictive analytics** 

- Predictive analytics use statistical analysis and other techniques to extract information from data and use it to predict future trends and behavior patterns
- One of the most established business applications of predictive analytics is predicting response to direct marketing campaigns
- Predictive analytics are helping companies understand other customerrelated behaviors

Data visualization, visual analytics, and geographic information systems

- By presenting data is visual form, **data visualization** and visual analytics tools help users see patterns and relationships in large amounts of data that would be difficult to discern if the data were presented as traditional lists of text or numbers
- **Geographic information systems (GIS)** are a special category of tools for helping decision makers visualize problems requiring knowledge about the geographic distribution of people or other resources

#### **Business intelligence users**

Support for semi-structured decisions

- Many BI pre-packaged production reports are MIS reports supporting structured decision making for operational and middle managers
- Decision-support systems (DSS) are the BI delivery platform for super-users
  - DSS rely more heavily on modeling than MIS, using mathematical or analytical models to perform what-if or other kinds of analysis
  - Working forward from known or assumed conditions allows the user to vary certain values to test results to predict outcomes if changes occur in those values
- Sensitivity analysis models ask what-if questions repeatedly to predict a range of outcomes when one or more variables are changed multiple times
  - $\circ$   $\;$  Backward sensitivity analysis helps decision makers with goal seeking  $\;$
- Spreadsheets have a similar feature for multidimensional analysis called a **pivot table** 
  - Super user managers and analysts employ a pivot table to identify an understand patters in business information that may be useful for semi-structured decision making

Decision support for senior management

- BI delivered in the form of executive support systems (ESS) helps senior executives focus on the really important performance information that affects the overall profitability and success of the firm
- The leading methodology for understanding the most important information needed by a firm's executives is called the **balanced scorecard method**

- The balanced scorecard is a framework for operationalizing a firm's strategic plan by focusing on measurable outcomes on 4 dimensions of performance: financial, business process, customer, and learning and growth
- Performance on each dimension is measured using **key performance indicators (KPIs)** which are the measures proposed by senior management for understanding how well the firm is performing along any given dimension
- The balanced scorecard framework is thought to be balanced because it causes managers to focus on more than just financial performance
- Another closely related management methodology is **business performance management (BPM)** 
  - BPM attempts to systematically translate a firm's strategies into operational targets
  - Once identified, a set of key performance indicators are developed to measure progress toward the targets
- Corporate data for contemporary ESS are supplied by the firm's existing enterprise applications
  - ESS provide access to news services, financial market databases, economic information, etc.
  - $\circ~$  ESS have significant  $\mbox{drill-down}$  capabilities if managers need more detailed views of data
  - ESS help senior executives monitor organizational performance, track activities of competitors, recognize changing market conditions, and identify problems and opportunities
  - Employees lower in the corporate hierarchy can monitor and measure business performance in their areas of responsibility
  - For these and other BI systems to be truly useful, the information must be actionable – readily available and easy to use

# Group decision-support systems

A **group decision-support system (GDSS)** is an interactive computer-based system for facilitating the solution of unstructured problems by a set of decision makers working together as a group in the same location or in different locations.

- GDSS provide tools and technologies geared explicitly toward group decision making
- GDSS-guided meetings take place in conference rooms with special hardware and software tools to facilitate group decision making
  - The hardware includes computer and networking equipment, overhead projects, and display screens
  - Special electronic meeting software collects, documents, rank, edits, and stores the ideas offered in a decision-making meeting
  - The more elaborate GDSS use a professional facilitator and support staff
  - A sophisticated GDSS provides each attendee with a dedicated desktop computer under that person's individual control
  - GDSS make it possible to increase meeting size while at the same time increasing productivity because individuals contribute simultaneously
  - Promotes a collaborative atmosphere

- GDSS software tools follow structured methods for organizing and evaluating ideas and for preserving the results
- The effectiveness of GDSS depends on the nature of the problem and how well a meeting is planned and conducted

## Intelligent systems for decision support

Decision making is also enhanced by:

- Intelligent techniques consist of expert systems, case-based reasoning, genetic algorithms, neural networks, fuzzy logic, and intelligent agents
  - These techniques are based on artificial intelligence (AI), which consists of computer-based systems that attempt to emulate human behavior and thought patterns
- **Knowledge management systems** and knowledge work systems provide tools for knowledge discovery, communication, and collaboration that make knowledge more easily available to decision makers and integrate it into the business processes of the firm

#### **Expert systems**

An **expert system** captures human expertise in a limited domain of knowledge as a set of rules in a software system that can be used by others in the organization.

• They are useful in decision-making situations where expertise is expensive or in short supply

How expert systems work

- Human knowledge must be modeled or represented in a form that a computer can process
- Expert systems model human knowledge as a set of rules that collectively are called the **knowledge base**
- The strategy used to search through the collection of rules and formulate conclusions is called the **inference engine** 
  - The inference engine works by searching through the rules and firing those rules that are triggered by facts gathered and entered by the user
- Expert systems provide businesses with an array of benefits, including improved decisions, reduced errors, reduced costs, reduced training time, and improved quality and service
- Expert systems lack the robust and general intelligence of human beings, but can provide benefits to organizations if their limitations are understood
- Expert systems are much less useful for dealing with unstructured problems typically encountered by managers

**Case-based reasoning (CBR)**, knowledge and past experiences of human specialists are represented as cases and stored in a database for later retrieval when the user encounters a new case with similar parameters.

#### Fuzzy logic systems

**Fuzzy logic** is a rule-based tech that represents imprecision by creating rules that use approximate or subjective values.

Fuzzy logic provides solutions to problems requiring expertise that is difficult to represent in the form of crisp IF-THEN rules.

**Neural networks** are used for solving complex, poorly understood problems for which large amounts of data have been collected.

- They find patterns and relationships in massive amounts of data that would be too complicated and difficult for a human being to analyze
- Neural networks discover this knowledge by using hardware and software that parallel the processing patterns of the biological brain
- Neural networks learn patterns from large quantities of data by sifting through data, searching for relationships, building models, and correcting over and over again the model's own mistakes
- A neural network has a large number of sensing and processing nodes that continuously interact with each other
- Self-organizing neural networks can be trained by exposing them to large amounts of data and allowing them to discover the patterns and relationships in the data

**Genetic algorithms** are useful for finding the optimal solution for a specific problem by examining a very large number of alternative solutions to the problem.

- They are based on techniques inspired by evolutionary biology
- A genetic algorithm works by representing a solution as a string of 0s and 1s
- It searches a population of randomly generated strings of binary digits to identify the right string representing the best possible solution for the problem
- They are used to solve complex problems that are very dynamic and complex, involving hundreds or thousands of variables or formulas

**Intelligent agents** are software programs that work in the background without direct human intervention to carry out specific, repetitive, and predictable tasks for an individual user, business process, or software application.

# Systems for managing knowledge

Systems for knowledge management improve the quality and utilization of knowledge used in the decision-making process.

- **Knowledge management** refers to the set of business processes developed in an organization to create, store, transfer, and apply knowledge
- Knowledge management increases the ability of the organization to learn from its environment to incorporate knowledge into its business processes and decision making
- Self-generated business knowledge is a strategic resource and can provide strategic advantage
- There are 2 major types of knowledge management systems:

# Enterprise-wide knowledge management systems

- Firms must deal with at least 3 kinds of knowledge:
  - Some knowledge exists within the firm in the form of structured text documents

- Decision makers also need knowledge that is semistructured
- Tactic knowledge: knowledge that resides in the heads of employees
- Enterprise-wide knowledge management systems deal with all 3 types of knowledge and are general-purpose, firm-wide systems that collect, store, distribute, and apply digital content and knowledge

Enterprise content management systems

- **Structured knowledge** is explicit knowledge that exists in formal documents, as well as in formal rules that organizations derive by observing experts and their decision-making behaviors
- Enterprise content management systems help organizations manage both types of information
  - They have capabilities for knowledge capture, storage, retrieval, distribution, and preservation to help firms improve their business processes and decisions
- A key problem in management knowledge is the creation of an appropriate classification scheme to organize information into meaningful categories
- **Digital asset management systems** help classify, store, and distribute digital objects such as photographs, graphic images, video, and audio

Knowledge network systems, aka expertise location and management systems, address the problem that arises when the appropriate knowledge isn't in the form of a digital document but instead resides in the memory of expect individuals in the firm

 Knowledge network systems provide an online directory of corporate experts in well-defined knowledge domains and use communication technologies to make it easy for employees to find the appropriate expert in a company

Collaboration tools and learning management systems

- Social bookmarking makes it easier to search for and share information by allowing users to save their bookmarks to web pages on a public website and tag these bookmarks with keywords
- The user-created taxonomies created for shared bookmarks and social tagging are called **folksonomies**
- A **learning management systems (LMS)** provides tools for the management, delivery, tracking, and assessment of various types of employee learning and training

**Knowledge work systems (KWS)** are specialized systems for engineers, scientists, and other knowledge workers that are designed to promote the creation of knowledge and to ensure that new knowledge and technical expertise are properly integrated into the business Requirements of knowledge work systems

- Knowledge work systems give knowledge workers the specialized tools they needs
- These systems require great computer power to handle the sophisticated graphics or complex calculations necessary for such knowledge workers as scientific researchers, product designers, and financial analysts
- Must give the worker quick and easy access to external databases
- Typically feature user-friendly interfaces that enable users to perform needed tasks without having to spend a lot of time learning how to use the computer
- Often designed and optimized for the specific tasks to be performed

Examples of knowledge work systems

- Virtual reality systems use interactive graphics software to create computer-generated simulations that are so close to reality that users almost believe they are participating in a real-world situation
- Augmented reality (AR) is a related tech for enhancing visualization. It provides a live direct or indirect view of a physical real-world environment whose elements are augmented by virtual computer-generated imagery
- Virtual reality modeling language (VRML) is a set of specifications for interactive, 3d modeling on the internet that organizes multiple media types, including animation, images, and audio, to put users in a simulated real-world environment. VRML is platform independent, operated over a desktop computer, and requires little bandwidth
- The financial industry is using specialized **investment workstations** to leverage the knowledge and time of its brokers, traders, and portfolio managers

# Building information systems and managing projects

#### Problem solving and systems development

Apply this problem-solving process to system building, the first 3 problem-solving steps are called **system analysis**:

#### Define and understand the problem

- Information systems problems in the business world typically result from a combination of people, organization, and technology factors
- At the most basic level, the **information requirements** of a new system identify who needs what information, where, when, and how
  - Requirements analysis carefully defines the objectives of the new or modified system and develops a detailed description of the functions that the new system must perform

#### **Develop alternative solutions**

#### Choose the best solution

- The systems analysis includes a **feasibility study** to determine whether each proposed solution is feasible, or achievable, from a financial, technical, and organizational standpoint
- A written systems proposal report describes the costs and benefits, and advantages and disadvantages of each alternative solution

#### Implement the solution

- The first step in implementing a system solution is to create detailed design specifications
- Systems design shows how the chosen solution should be realized
  - It's the model or blueprint for an information system solution and consists of all the specifications that will deliver the functions identified during systems analysis

Completing implementation

- Final steps to be performed:
  - Hardware selection and acquisition
  - Software development and programming
  - Testing
    - The testing process requires detailed testing of individual computer programs, called unit testing, as well as system testing, which tests the performance of the information system as a whole
    - Acceptance testing provides the final certification that the system is ready to be used in a production setting
    - The systems development team works with users to device a systematic test plan
      - The test plan includes all of the preparations for the series of tests described
  - Training and documentation

- Detailed **documentation** showing how the system works from both a technical and end-user standpoint must be prepared
- **Conversion** is the process of changing from the old to the new system
  - There are 3 main conversion strategies:
    - In a parallel strategy, both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly
    - The direct cutover strategy replaces the old system entirely with the new system on an appointed day, carrying the risk that there is no system to fall back on if problems arise
    - The phased approach strategy introduces the system in stages
- Production and maintenance
  - After the new system is installed and conversion is complete, the system is said to be in **production**
  - Changes in hardware, software, documentation, or procedures to a production system to correct errors, meet new requirements, or improve processing efficiency are termed **maintenance**

## Alternative systems-building approaches

#### Traditional systems development lifecycle

The **systems development lifecycle (SDLC)** is the oldest method for building information systems.

- The lifecycle methodology is a phased approach to building a system, dividing systems development into a series of formal stages
- It's predominantly a waterfall approach in which tasks in one stage are completed before work for the next stage begins
  - This approach maintains a very formal division of labor between end users and information systems specialists
    - Technical specialists are responsible for much of the systems analysis, design, and implementation work
    - End users are limited to providing information requirements and reviewing the technical staff's work
  - The lifecycle also emphasizes formal specifications and paperwork, so many documents are used for building large complex systems that require rigorous and formal requirements analysis, predefined specifications, and tight controls over the systems building process

**Prototyping** consists of building an experimental system rapidly and inexpensively for end users to evaluate.

- Step 1: identify the user's basic requirements
- Step 2: develop an initial prototype
- Step 3: use the prototype

• *Step 4:* revise and enhance the prototype

Prototyping is especially useful in designing an information system's user interface, making it more likely to produce systems that fulfill user requirements.

Rapid prototyping may gloss over essential steps in systems development, such as thorough testing and documentation.

**End-user development** allows end users, with little or no formal assistance from technical specialists, to create simple information systems, reducing the time and steps required to produce a finished application.

- Completed more rapidly than those developed with conventional programming tools
- Improves requirements gathering and often leads to a higher level of user involvement and satisfaction with the system
- Cannot easily handle the processing of large numbers of transactions or applications with extensive procedural logic and updating requirements
- Poses organizational risks because systems are created rapidly, without a formal development methodology, testing, and documentation

#### Purchasing solutions: application software packages and outsourcing

Selection of the software is often based on a **request for proposal (RFP)**, which is a detailed list of questions submitted to external vendors to see how well they meet the requirements for the proposed system.

#### Application software packages

**Customization** features allow a software package to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software

Outsourcing

- If a firm doesn't want to use its internal resources to build or operate information systems, it can outsource the work to an external organization that specializes in providing these services
- Domestic outsourcing is driven primarily by the fact that outsourcing firms possess skills, resources, and assets that their clients don't have
- In the case of offshore outsourcing, the decision tends to be driven by cost
  - In addition to cost savings, many offshore outsourcing firms offer world-class tech assets and skills
  - Outsourcing offshore incurs additional costs for coping with cultural differences that drain productivity and dealing with hr issues
  - Firms should be especially cautious when using an outsourcer to develop or to operate applications that give it some type of competitive advantage

#### **Rapid application development for e-business**

Agility and scalability have become critical elements of system solutions.

- **Rapid application development (RAD)** refers to the process of creating workable systems in a very short period of time
  - RAD includes the use of visual programming and other tools for building GUIs, iterative prototyping of key system elements, the automation of code generation, and close teamwork among end users and information systems specialists
- Joint application design (JAD) will be used to accelerate the generation of information requirements and to develop the initial systems design
  - JAD brings end users and information systems specialists together in an interactive session to discuss the system's design
  - $\circ~$  JAD sessions can significantly speed up the design phase and involve users at an intense level

# Modeling and designing systems

#### Structured methodologies

- **Structured** refers to the fact that the techniques are step by step, with each step building on the previous one
  - Structured methodologies are top-down, progressing from the highest, most abstract level to the lowest level of detail
  - Structured development methods are process-oriented, focusing primarily on modeling the processes, or actions, that capture, store, manipulate, and distribute data as the data flow through a system
    - These methods separate data from processes
- The primary tool for representing a system's component processes and the flow of data between them is the **data flow diagram (DFD)** 
  - The data flow diagram offers a logical graphic model of information flow, partitioning a system into modules that show manageable levels of detail
  - $\circ~$  It rigorously specifies the processes or transformations that occur within each module and the interfaces that exist between them
- Through leveled data flow diagrams, a complex process can be broken down into successive levels of detail
  - $\circ~$  An entire system can be divided into subsystems with a high-level data flow diagram
- **Process specifications** describe the transformation occurring within the lowest level of the data flow diagrams, showing the logic for each process
- In structured methodology, software design is modeled using hierarchical structure charts
  - The structure chart is a top-down chart, showing each level of design, its relationship to other levels, and its place in the overall design structure
  - The design first considers the main function of a program or system, then breaks this function into sub-functions, and decomposes each sub-function until the lowest level of detail has been reached

**Object-oriented development** uses the object as the basic unit of systems analysis and design.

- An object combines data and the specific processes that operate on those data
- Data encapsulated in an object can be accessed and modified only by the operations, or methods, associated with that object
- Objects must collaborate with each other to make the system work
- Object-oriented modeling is based on the concepts of *class* and *inheritance*
- Objects belonging to a certain class have the features of that class
- Classes of objects in turn inherit all the structure and behaviors of a more general class and then add variables and behaviors unique to each object
- Object-oriented development is more iterative and incremental than traditional structured development
- During systems analysis, systems builders document the functional requirements of the system, specifying its most important properties and what the proposed system must do
- Interactions between the system and its users are analyzed to identify objects, which include both data and processes
- The object-oriented design phase describes how the objects will behave and how they will interact with one other
- The information system is implemented by translating the design into code
- Implementation may also involve the creation of an object-oriented database
- The resulting system must be thoroughly tested and evaluated
- Object-oriented development could potentially reduce the time and cost of writing software if organizations reuse software objects

Component-based development, web services, and cloud-based development To further expedite software creation, groups of objects have been assembled into software components for common functions, such as a GUI or online ordering capability, and these components can be combined to create large-scale business applications called **component-based development**.

**Computer-aided software engineering (CASE)**, sometimes called computer-aided systems engineering, provides software tools to automate the methodologies we have just described to reduce the amount of repetitive work in systems development.

- CASE tools provide automated graphics facilities for producing and diagrams, screen and report generators, data dictionaries, extensive reporting facilities, analysis and checking tools, code generators, and documentation generators
- Also contain features for validating design diagrams and specifications
- Facilitate clear documentation and coordination of team development efforts

#### Project management

There is a very high failure rate among information systems projects because they haven't been properly managed.

#### **Project management objectives**

 A project is a planned series of related activities for achieving a specific business objective

- **Project management** refers to the application of knowledge, skills, tools, and techniques to achieve specific targets within specified budget and time constraints
- Scope defines what work is or isn't included in a project
- Project management defines all the work required to complete a project successfully, and should ensure that the scope of a project doesn't expand beyond what was originally intended
- Time is the amount of time required to complete the project
- Cost is based on the time to complete a project multiplied by the daily cost of hr required to complete the project
- Quality is an indicator of how well the end result of a project satisfies the objectives specified by management
- Risk refers to potential problems that would threated the success of a project

# Selecting projects: making the business case for a new system

Determining project costs and benefits

- The systems analysis includes an assessment of the economic feasibility of each alternative solution
- Tangible benefits can be quantified and assigned a monetary value
- **Intangible benefits**, such as more efficient customer service or enhanced decisions making, cannot be immediately quantified

The information systems plan shows how specific information systems fit into a company's overall business plan and business strategy.

- The plan contains a statement of corporate goals and specifies how information technology will help the business attain these goals
- The report shows how general goals will be achieved by specific systems projects
- It identifies specific target dates and milestones that can be used later to evaluate the plan's progress in terms of how many objectives were actually attained in the time frame specified in the plan
- It should describe organizational changes

# Portfolio analysis and scoring models

Once you have determined the overall direction of systems development, **portfolio analysis** will help you evaluate alternative system projects.

- Portfolio analysis inventories all of the firm's information systems projects and assets, including infrastructure, outsourcing contracts, and licenses
- You begin first by focusing on systems of high benefit and low risk
- Second, high-benefit, high-risk systems should be examined
  - Low-benefit, high-risk systems should be avoided
  - Low-benefit, low-risk systems should be reexamined for the possibility of rebuilding and replacing them with more desirable systems having higher benefits
- Another method for evaluating alternative system solutions is a scoring model

 Scoring models give alternative systems a single score based on the extent to which they meet selected objectives

#### Managing project risk and system-related change

The level of project risk is influenced by project size, project structure, and the level of technical expertise of the information systems staff and project team.

## Implementation and change management

Dealing with these project risks requires an understanding of the implementation process and change management.

- A broader definition of **implementation** refers to all the organizational activities working toward the adoption and management of an innovation
- Successful implementation requires a high level of user involvement in a project and management support
- The relationship between end users and information systems specialists has traditionally been a problem area for information systems implementation efforts because of differing backgrounds, interest, and priorities
- These differences create a **user-designer communications gap**
- If an information systems project has the backing and commitment of management at various levels, it's more likely to receive higher priority from both users and the technical information systems staff
- Management backing also ensures that a systems project receives sufficient funding and resources to be successful
- To be enforced effectively the changes in work habits and procedures and any organizational realignments associated with a new system depend on management backing

**Controlling risk factors** 

- Large projects benefit from appropriate use of **formal planning and tools** for documenting and monitoring project plans
  - The 2 most commonly used methods for documenting are:
    - A **Gantt chart** lists project activities and their corresponding start and completion dates
      - It visually represents the timing and duration of different tasks in a development project as well as their hr requirements
      - It shows each task as a horizontal bar whose lengths is proportional to the time required to complete it
      - They don't depict task dependencies or how tasks should be ordered
    - **PERT charts** are useful
      - Graphically depicts project tasks and their interrelationships
      - It lists the specific activities that make up a project and the activities that must be completed before a specific activity can start

• Portrays a project as a network diagram consisting of numbered nodes representing project tasks

#### Overcoming user resistance

You can overcome user resistance by promoting user participation, by making user education and training easily available, and by providing better incentives for users who cooperate.

- You should pay special attention to areas where users interface with the system, with sensitivity to ergonomics issues
- **Ergonomics** refers to the interaction of people and machines in the work environment
  - It considers the design of jobs, health issues, and the end-user interface of information systems
- In addition to procedural changes, transformation in job functions, organizational structure, power relationships, and behavior should be identified during systems analysis using an **organizational impact analysis**

#### Managing projects on a global scale

The project management challenges for global systems are similar to those for domestic systems, but they are complicated by the international environment.

- Involving people in change is a key tactic for convincing users to adopt global systems and standards
- Information systems projects should involve users in the design process without giving up control over the project to parochial interests
- One tactic is to permit each country unit in a global corporation to develop one transnational application first in its home territory, and then throughout the world
- A second tactic is to develop new transnational centers of excellence, or a single center of excellence

# Ethical and social issues in information systems

Ethical choices are decisions made by individuals who are responsible for the consequences of their actions.

- **Responsibility** is a key element of ethical action, it means that you accept the potential costs, duties, and obligations for the decisions you make
- Accountability is a feature of systems and social institutions: it means that mechanisms are in place to determine who took responsible action, and who is responsible
  - Systems and institutions in which it's impossible to find out who took what action are inherently incapable of ethical analysis or ethical action
- Liability extends the concept of responsibility further to the area of laws
  - Liability is a feature of political systems in which a body of laws is in place that permits individuals to recover the damages done to them by other actors, systems, or organizations
- **Due process** is a related feature of law-governed societies and is a process in which laws are known and understood, and there is an ability to appeal to higher authorities to ensure that the laws are applied correctly
- 1. Information technologies are filtered through social institutions, organizations, and individuals
- 2. Responsibility for the consequences of technology falls clearly on the institutions, organizations, and individual managers who choose to use the technology
- 3. In an ethical, political society, individuals and others can recover damages done to them through a set of laws characterized by due process

#### **Ethical analysis**

- Identify and describe the facts clearly
- Define the conflict or dilemma and identify the higher-order values involved
- Identify the stakeholders
- Identify the options that you can reasonably take
- Identify the potential consequences of your options

#### **Candidate ethical principles**

- Golden rule: do unto others as you would have them do unto you
- **Immanuel Kant's categorical imperative**: if an action is not right for everyone to take, it is not right for anyone
- **Descartes' rule of change**: if an action cannot be taken repeatedly, it is not right to take at all
- **Utilitarian principle**: take the action that produces the least harm or the least potential cost
- **Risk aversion principle**: take an action that produces the least harm or the least potential cost

• Ethical "no free lunch" rule: assume that virtually all tangible and intangible objects are owned by someone else unless there is a specific declaration otherwise

# The moral dimensions of information systems

- **Privacy** is the claim of individuals to be left alone, free from surveillance or interference from other individuals or organizations, including the state
- Most American and European privacy law is based on a regime called **Fair Information Practices (FIP)**, which is a set of principles governing the collection and use of information about individuals
  - FIP principles are based on the notion of a mutuality of interest between the record holder and the individual
    - The individual has an interest in engaging in a transaction
    - The record keeper requires information about the individual to support the transaction
- European countries don't allow businesses to use personally identifiable information without consumers' prior consent
- **Informed consent** can be defined as consent given with knowledge of all the facts needed to make a rational decision
- A **safe harbor** is a private, self-regulating policy and enforcement mechanism that meets the objectives of government regulators and legislation but doesn't involve government regulation or enforcement
- **Cookies** are small text files deposited on a computer hard drive when a user visits websites
  - Cookies identify the visitor's web browser software and track visits to the website
- Web beacons, aka web bugs or tracking files, are tiny objects invisibly embedded in email messages and web pages that are designed to monitor the behavior of the user
  - Captures and transmits information such as the IP address of the user's computer, the time a web page was viewed and for how long, the type of web browser, and cookies
- Other **spyware** can secretly install itself on an internet user's computer by piggybacking on larger application
- An **opt-out** model of informed consent permits the collection of personal information until the consumer specifically requests that the data not be collections
  - Privacy advocated would like to see wider use of an **opt-in** model
- The Platform for Privacy Preferences proposed automatic communication of privacy policies between en e-commerce site and is visitors. **P3P** was intended to provide a standard for communicating a website's privacy policy
  - P3P didn't work for lack of industry support and difficulties for users to understand the privacy settings
- Intellectual property is considered to be intangible property created by individuals or corporations
- Any intellectual work product used for a business purpose can be classified as a **trade secret**, provided it isn't based on information in the public domain

- **Copyright** is a statutory grant that protects creators of intellectual property from having their work copied by others for any purpose during the life of the author plus and additional 70 years after the author's death
  - $\circ$   $\,$  For corporate-owned works, this lasts for 95 years after initial creation  $\,$
  - Copyright protects against copying an entire program or its parts
- A **patent** grants the owner an exclusive monopoly on the idea behind an invention for 20 years
  - The key concepts in patent law are originality, novelty, and invention
- The digital millennium copyright act (DMCA) of 1998 is also providing some copyright protection
  - The DMCA implemented a World Intellectual Property Organization Treaty that makes it illegal to circumvent technology-based protections of copyright materials
- 3 principal sources of poor system performance are:
  - Software bugs and errors
  - Hardware or facility failures caused by natural or other causes
  - Poor input data quality
- **Computer crime** is the commission of illegal acts through the use of a computer or against a computer system
- **Computer abuse** is the commission of acts involving a computer that may not be illegal but are considered unethical
- **Spam** is junk email sent by an organization or individual to a mass audience of internet users who have expressed no interest in the product or service being marketed
- The most common occupational disease today is repetitive stress injury (RSI)
  - RSI occurs when muscle groups are forced through repetitions under low-impact loads
  - The single largest source of RSI is computer keyboards
  - The most common kind of computer-related RSI is **carpal tunnel syndrome (CTS)**, in which pressure on the median nerve through the wrist's bony structure, called a carpal tunnel, produces pain
- **Computer vision syndrome (CVS)** refers to any eyestrain condition related to display screen use in desktop computers, laptops, etc.
- The newest computer related malady is **technostress**, which is stress induced by computer use
  - $\circ\;$  Its symptoms include aggravation, hostility towards human, impatience, and fatigue