ST. PAUL'S UNIVERSITY

Private Bag 00217 LIMURU, KENYA
Email: dvcademics@stpaulslimuru.ac.ke
Website: www.stpaulslimuru.ac.ke

Tel Office: +254 (0)20 – 2020505/10
Mobile: +254 (0)728 - 669000
(0)736 - 424440

SPU Distance Learning Course Handbook

BMA 209: BUSINESS INFORMATION SYSTEMS

[EVANS KARANJA]

SPU Distance & e - Learning Program

COURSE OUTLINE

Course name	**BMA 209 :BUSINESS INFORMATION SYSTEMS**
Lecturer/email address	**ekaranja@spu.ac.ke**

1. Course objectives

This course provides an overview of information systems in the business world.

On successfully completing this course, you will be able to:

- Discuss the role of modern information technologies in managerial activities and decision making,
- Explain the basic theories, concepts, methods, and terminology used in information systems,
- Distinguish between different types of information systems used in organizations,
- Describe how information systems are used strategically and tactically in business,
- Describe the typical hardware, software, data, and telecommunications used in information systems,
- Discuss issues surrounding security and control measures as they relate to computer based Information Systems.
- Evaluate the benefits, costs and performance of Information Systems.

2. Course Content

Topics covered include:

- Information Systems Concepts.
- Classifications of Information Systems.
- Information System Infrastructure.
- Managing Information Resources.
- Application of BIS in organizations: Strategic Information Systems; Strategic Advantage of Information Technology, Transaction Processing and Management Reporting.
- Information Systems Development.
- The Planning Issues: IT Planning, The Evolution of IT Planning.
- Information Technology Economics: Evaluating IT Benefits, Costs and Performance.
- Managing Information System Resources: Control and Security.

3. Detailed Course content

Subject area(s)	Discussion topics	Assignments/Reading guide
IS Concepts	- Definition of terms, Need for information and overview of IS	Research on History and Components of IS.
Information Technologies	The Impact of New Technology on Business ; Computer Hardware and software	- Read further on computer hardware & computer software Applications
Development of Information Systems	Developing information system solutions: systems development cycle; end-user development; resource acquisition; and outsourcing; information value and information systems investment.	Revision Questions
Management Information Systems Enterprise Business Systems	- Types, characteristics and roles of the main IS within a business; types of management information systems by level and function. -Supply Chain Management, Customer Relationship Management, Enterprise Resource Planning Competitive Advantage as a Driver for Management Information Systems	Revision Questions
Data Resource Management	- Technical Foundations of Database Management systems and Managing Data Resources	Read on business' strategic/competitive advantage Created by Database systems
TeleCommunication and Networks	- The Network Enterprise -Basic Devices on the Network, - Topologies - Strategic benefits of Netwoks - Trend in Networked Enteprises	Revision Questions
Electronic Commerce E-commerce	- Foundations of Ecommerce - Categories of Electronic Commerce - Benefits and Challenges of E-commerce - Security issues in E-commerce	Revision Questions
	Continuous Assessment Test	**CAT**
Planning Issues	- IT Planning process - Evolution of IT Planning -Evaluating IT Benefits, Costs and - - Performance (Cost-Benefit Analysis)	Revision Questions
Enterprise And Global Management of Information Systems	Managing IT with a global View	Revision Questions

	Self Study & revision	
	Revision & Exams	End of Semester Exams

4. Teaching methodology

The module will be taught using a combination of mini lectures, problem solving and discussions, topic discussions, team work, supported by assignment work. Emphasis on Case Studies will based on Kenyan Environment and other developing economies

5. Course Text and Recommended Reading

Course Texts:

a) *Management Information Systems* Kenneth C. Laudon, Jane P. Laudon Pearson Publishers

b) *Management Information Systems: Managing Information Technology in the E-Business Enterprise*, 6th edition, by O'Brien, James A. 2004. Boston, Massachusetts: The McGraw-Hill Companies

Further reading

c) Post, G.V.&. Anderson, D. L. (2006) *Management Information systems; Solving Business Problems with Information Technology* 4th Ed**;** Boston, Mass McGraw-Hill/Irwin.

d) Mcleod, R. & Schell, G. (2007) *Management Information Systems***;** Upper Saddle River, N.J. Pearson.

e) Haag, S. & Cummings, M.(2008) *Management Information Systems for the Information Age* 7th Ed, Boston; McGraw-Hill/Irwin.

f) O'Brien J' A. & Marakas, G. M. (2008) *Management Information Systems* 8th Ed. Boston**;** Irwin.

6. Course evaluation

1.	Assignments	20%
2.	Test and quizzes	10%
3.	Final exam	70%

7. Ground rules

- Late assignments will not be accepted
- Group work must be completed on time as required
- Teamwork.

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BUSINESS INFORMATION SYSTEMS

CHAPTER ONE: INTRODUCTION TO BIS

After completing this chapter, you will be able to:

Define an information system

- Distinguish between computer literacy and information system literacy
- Explain why information systems are so important today and how they are transforming organization and management
- Identify the major management challenges to building and using information systems in organization.

1.1 Why Information System?

The environment of business has changed from the traditional environment where management processes are treated as a face-to-face, personal art and not a far-flung, global coordination process. Information itself is not treated as an important asset for a firm.

But today, most of the organization recognizes the importance of information. For individuals, information systems are needed for entertainment and as an enlightment to their life. Meanwhile for businesses, information systems are mostly needed to help in decision making and problem solving. Besides that, it is used to gather, store and manipulate information. There are three main factors that contribute to the recognition of the importance of information to any organization.

The first factor is the emergence and strengthening of the global economy. Globalization of the world's industrial economies greatly enhances the value of information to the firm and offers new opportunities to businesses. Information system

provides the communication and analytical power that firms need for conducting trade and managing businesses on a global scale.

The second factor is due to the transformation of industrial economies and societies into knowledge and information based service economies. In knowledge based economies, knowledge and information are key ingredients in creating wealth to an organization. Knowledge and information are becoming the foundation for many new services and products. Intensification of knowledge utilization in the production of traditional products has increased as well. New kinds of knowledge- and information-intense organizations have emerged that are devoted entirely to the production, processing, and distribution of information

The third factor is due to the transforming of the business enterprise. Traditional firms was and still is a hierarchical, centralized, structured arrangement of specialist that typically relies on a fixed set of standard operating procedures to deliver a mass-produced product or services. But the business enterprises has change into flattened, decentralized, flexible arrangement of generalists who rely on nearly instant information to deliver mass-customized products and services uniquely suited to specific markets or customers

Besides the above mentioned three main factors, there are also several trends that have made the use of information systems very important in business:

- Computers' power has grown tremendously, while their prices have dropped.
- Computer programs' variety and ingenuity have increased.
- Quick and reliable communication lines and access to the Internet and World Wide Web have become widely available and affordable.
- The fast growth of the Internet has opened opportunities, as well as competition in global markets.
- An increasing ratio of the workforce is computer literate.

In this environment, organizations will quickly lag behind if they do not take advantage of this progress and use the technologies and skills to meet their goals.

1.1.1 What is an Information System?

Information system consists of physical and nonphysical components working together. A computer alone is not an information system. A computer combines with a software program may constitute an information system, but only if the program is designed to produce information that helps an organization or person to achieve a specific goal. Information system can be further defined as a set of interrelated components that collect or retrieve, process, store and distribute information to support decision making and control in an organization. Information systems can also help managers and workers to analyze problems, visualize complex subjects and create new subjects. It may contain information about significant people, places and things within the organization or in the environment surrounding it.

All information systems (IS) operate in the same basic fashion whether they include a computer or not. However, the computer provides a convenient means to execute the four main operations of an information system. The four main activities are entering data into the IS (input), changing and manipulating the data in the IS (data processing), getting information out of the IS (output) and storing data and information (storage). Besides the four main operations, feedback is also needed to return the output to the appropriate people or activities in the organization to evaluate and refine the input.

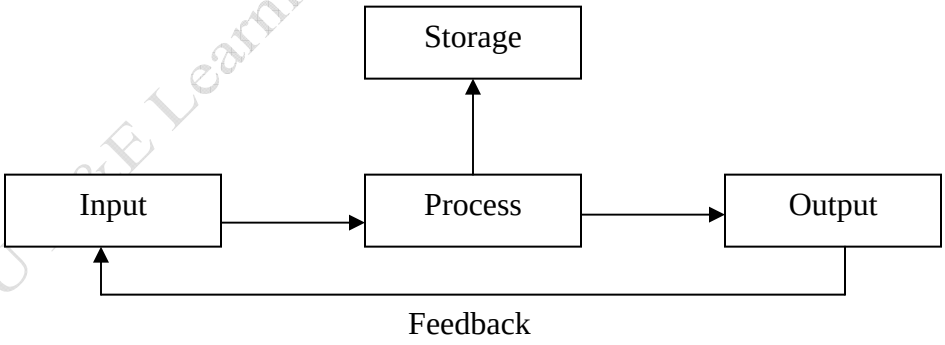


Figure 1.1 Diagram showing the four main operations

The first step in producing information is collecting and introducing data into the IS, known as input. Input captures or collect raw data from within the organization or from its external environment. Data are streams of raw facts representing events

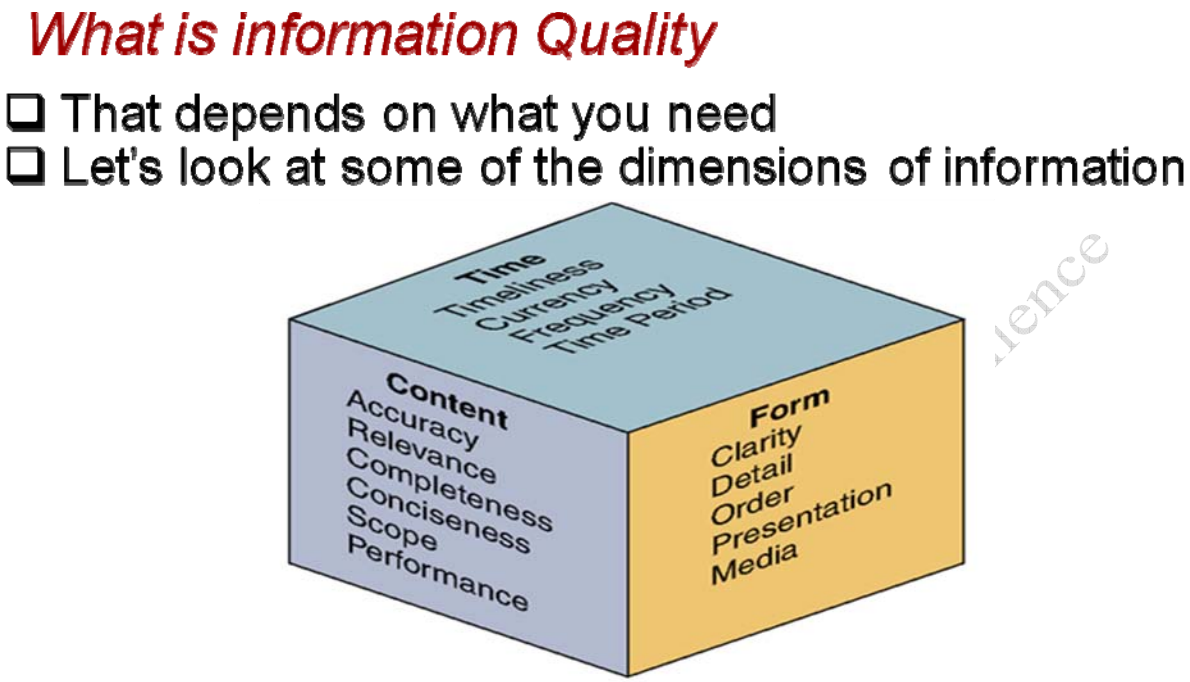
occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use. An input device is the tools used to enter data into an IS. Input devices include the keyboard, infrared devices that sense bar codes, and voice recognition systems.

The second step in producing information is processing. This is the step where computer contributes to the efficiency of the data processing, which is essential to a robust IS. In this step, computer helps in converting the raw input into a more meaningful form through various methods like conversion, manipulation and analysis. The computer's speed and accuracy let organizations process millions of pieces of data in several seconds.

Output is the information an IS produces and displays on an output device in the format most useful to an organization. Information is data that have been shaped into a form that is meaningful and useful to human beings. A good IS must be able to produce information that carries the following characteristics:

- Relevant – information must pertain to the problem at hand.
- Complete – partial information is often worst than no information.
- Accurate – erroneous information may lead to disastrous decisions.
- Current – decisions are often based upon the latest information available.
- Economical – in a business setting, the cost of obtaining information must be considered as one cost element involved in any decision.

Below are the Dimensions of Quality for information



The information needs to be transferred to the people or activities where it will be used. The most widely used output device is the video display, or video monitor, which displays output visually. However, computers can communicate output through speakers in the form of music of speech and can also transmit it to another computer or electronic device in computer-coded form for later interpretation.

One of the greatest benefits of using computers is their ability to store vast amount of data and information. Computer stores information on both devices that are internal to the machine and those that are external.

Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input.

The four basic components of the computer system within an IS:

- Input device that introduces data into the IS.
- The computer processes data through the IS.
- Output device that displays the information produces by the IS.
- Storage device to store data and information.

In addition to the above components, communication also occurs between computers. Communications technology lets users not only access multiple input, output and storage devices with a single computer, but access data and resources of more than one computer as well.

1.1.2 A Business Perspective on Information System

From a business perspective, an information system is an organizational and management solution, based on information technology, to a challenge posed by the environment. It emphasizes the organizational and management nature of information system: To understand information system – to be information system literate as opposed to computer literate – a manager must understand the broader organization, management and information technology dimensions of systems and their power to provide solutions to challenges and problems in the business environment

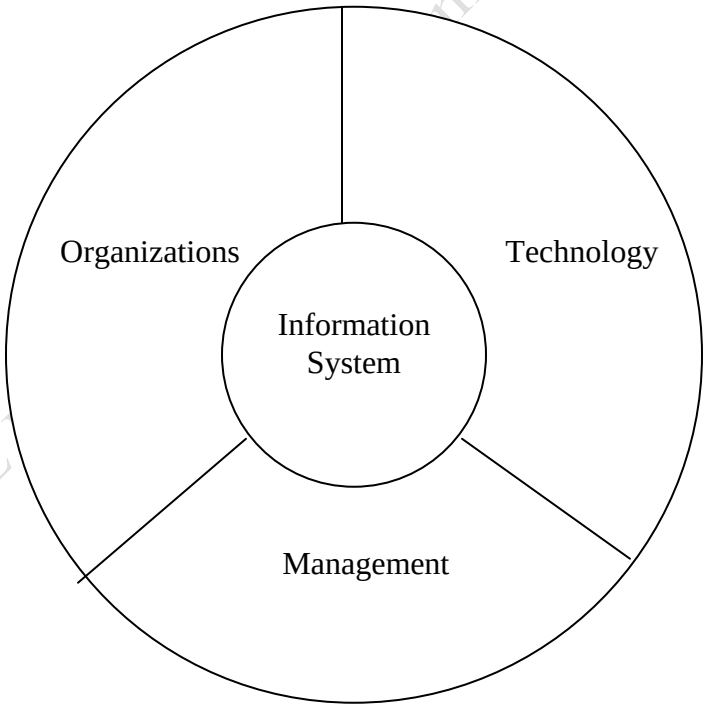


Figure 1-2

The key elements of an organization are its people, structure and operating procedures, politics and culture. An organization coordinates work through a structured hierarchy and formal standard operating procedures (SOPs). SOPs are formal rules for accomplishing tasks that have been developed over a long time. These rules guide

employees in variety of procedures. Most of the procedures are formalized and written down, but many others are informal work practices. Major organizational functions are like sales and marketing, manufacturing, finance, accounting and human resources

Management's job is to make sense out of many situations faced by organization and formulate action plans to solve organizational problems. A substantial part of management is creative work driven by new knowledge and information. Information technology can play a powerful role in redirecting and redesigning the organization. Managerial roles and decisions vary at different levels of the organization.

- Senior managers – make long-range strategic decisions about products and services to produce.
- Middle managers – carry out the programs and plans senior management.
- Operational managers – responsible for monitoring the firm's daily activities.

Information technology is one of many tools available to managers for coping with change which consists of computer hardware, computer software, storage technology and communication technology. Computer hardware is physical equipments used for input, processing and output activities in an information system. Computer software is detailed, preprogrammed instructions that control and coordinate the work of computer hardware components in an IS. Storage technology is physical media and software governing the storage and organization of data for use in an IS. Lastly, communication technology is physical devices and software that link various computer hardware components and transfer data for use in an IS. A network links two or more computers to share data or resources such as printer.

- **NB**: **Information systems (IS) describes all the components and resources necessary to deliver its information and functions to the organization. Information technology (IT) refers to the various hardware and software components necessary for the system to operate. Information systems is described as Information technology and people who work with technologies ,that is .. its concerned on how Efficienct(Minimize Costs; Minimize Time; Minimize Use of Information Resources) and Effective (Enable its business processes; Enhance organizational structure and culture; Increase customer business value**

1.2 Contemporary Approaches to Information Systems

Multiple perspectives on IS shows that the study of information systems is a multidisciplinary field, where no single theory or perspective dominates. Figure 1.3 shows the major disciplines that contribute problem, issues and solutions. In general, the field can be divided into technical, behavioral and socio-technical approaches.

Technical approach emphasizes mathematically based, normative models to study information systems as well as the physical technology and formal capabilities of these systems. Three disciplines that contribute to this approach are Management Science, Computer Science and Operation Research.

Behavioral approach is more concern with development and long-term maintenance of information systems, which emphasizes on issues like strategic business integration, design, implementation and utilization. Three disciplines that contribute to this approach are Psychology, Economics and Sociology.

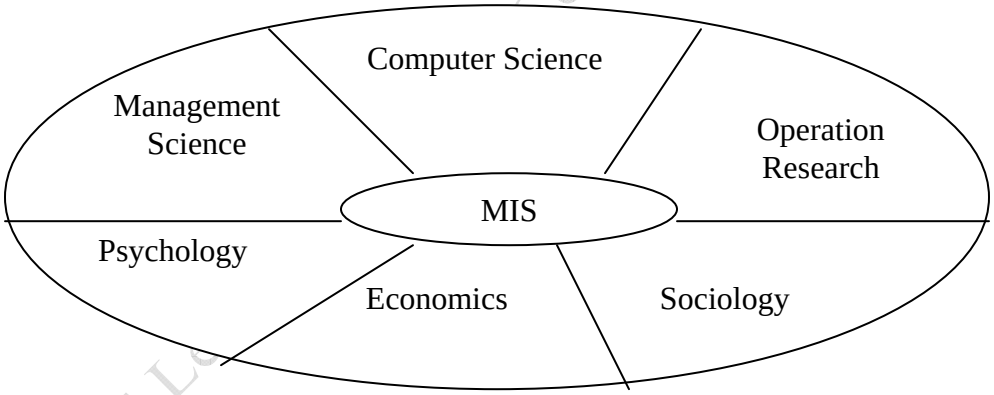


Figure 1-3

Socio-technical approach avoids a purely technological approach to information systems. This approach stress the need to optimize the performance of the system as a whole where both the technical and behavioral components needs attention, which means that the technology must be changed and designed in such a way as to fit organizational and individual needs meanwhile organization and individual must also be changed through training, learning and planned organizational change in order to allow the technology to operate and prosper.

1.3 The New Role of Information Systems in Organization

The new relationship (as illustrated in Figure 1.4) between organization and IS shows that there is a growing interdependence between organizational business strategy, rules and procedures on the one hand and information system software, hardware, databases and telecommunications on the other. The changes in strategy, rules and procedures require changes in hardware, software, databases and telecommunications. This relationship becomes critical when management plans for the future.

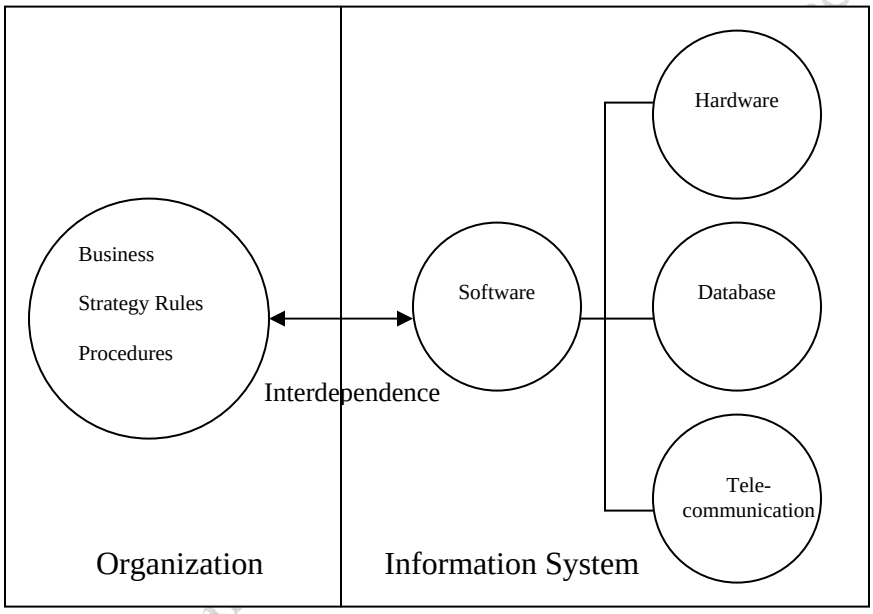


Figure 1-4

A second change in the relationship of IS and organizations results from the growing complexity and scope of system projects and applications. Over time, information systems have come to play a larger role in the life of the organization. Early information systems brought about largely technical changes that were relatively easy to achieve and accomplish and affects few people. Later systems affected managerial control and behavior (who has what information about whom, when and how often); ultimately systems influenced "core" institutional activities (what products and services are produced, under what conditions and by whom) concerning products, markets, suppliers and customers.

1.3.1 New Options for Organizational Design: The Networked Enterprise

The explosive growth in computing power and networks is turning organizations into networked enterprises, allowing information to be instantly distributed within and beyond the organization. This capability can be used to redesign and reshape organizations, transforming their structure, scope of operations, reporting and control mechanisms, work practices, work flows, products and services. The following describes the new ways of conducting business electronically.

Flattening organizations will results in fewer levels of management, with lower-level employees being given greater decision-making authority. Those employees are empowered to make more decisions than in the past are no longer work standard 8 hours and no longer necessary work in an office and they can be scattered geographically. Contemporary information technology makes more information available to line workers so they can make decisions that previously had been made by managers. Networked computers have made it possible for employees to work together as a team. Team members can collaborate closely even from distant locations. These changes mean that the management span of control has also been broadened, allowing high-level managers to manage and control more workers spread over greater distances.

Separating work from location is possible as organizing globally while working locally is made possible through technologies like e-mail, the Internet, video conferencing. Communication technology eliminates distance as a factor for many types of work in many situations. Collaborative teamwork across thousands of miles has become a reality designer's work on the design of a new product together even if they are located on different continents. Companies are not limited to physical locations or their own organizational boundaries for providing products and services. Virtual organization becomes reality where organization using network linking people, assets and ideas to create and distribute products and services without being limited by traditional organizational boundaries or physical location.

Reorganizing work flows as IS have been progressively replacing manual work procedures with automated work procedures, work flows and work processes. Improved

work flow management enabled many organizations not only to cut cost significantly but also to improve customer service at the same time.

Increases flexibility of organization as companies uses communication technology to organize in more flexible way, increases their ability to respond to changes in the marketplace and to take advantage of new opportunities. Large organization can use information technology to achieve some of the agility and responsiveness of small organizations like mass customization, the use of software and computer networks to finely control production so that products can be easily customized with no added cost for small production runs. The result is a dynamically responsive environment in which products can be turned out in a greater variety.

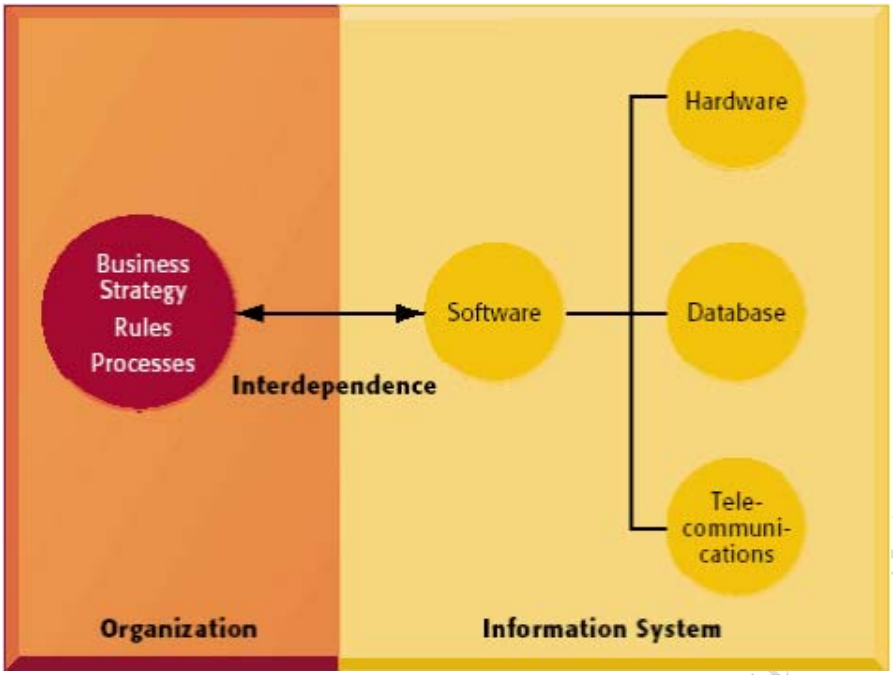
Information technology is recasting the process of management, providing powerful new capabilities to help managers plan, organize, lead and control. For example the use of Enterprise Resource Planning (ERP) is a business management that integrates all facets of the business, including planning, manufacturing, sales and finance so that they can become closely coordinated by sharing information with each other.

Reducing organizational boundaries as networked information system enables transactions to be exchanged electronically among different companies, hence reducing the cost of obtaining products and services from outside the firm. An inter-organizational system is a system that automates the flow of information across organizational boundaries and links a company to its customers, distributors or suppliers.

Capital management: IT is currently the largest component in capital investment, this includes hardware, software and staff training .

"If you make wise choices, your firm can outperform competitors. If you make poor choices, you will be wasting valuable capital" adopted laudon and laudon management of information systems – the digital firm

Foundations of doing business - There is a growing interdependence between a firm's ability to use information technology and its ability to implement corporate strategies and achieve corporate goals. What a firm will do in the coming five years depend on what their systems will permit it to do(as shown in figure (Fig 1.5) below).



(Figure 1.5 adopted from Laudon and Laudon)

Productivity – IT plays a vital role in increasing productivity in the firm and to bring together innovations

Strategic opportunity and advantage: To effectively take advantage of new opportunities in markets, develop new products, and create new services, chances are quite high you will need to make substantial investments in IT to realize these new business opportunities. If you want to achieve a strategic advantage over your rivals, to differentiate yourself from your competitors, IT is one avenue for achieving such advantages along with changes in business practices and management. We talk more about IT contributions to competitive strategy . However this advantage is always short lived but like in athletics a few steps ahead of others may be all you need to win that specific race,

1.4 Why IT Now? Information Systems In Business Organisation

A mix of IT innovations and a changing domestic and global business environment makes the role of IT in business even more important than it was a few years back. A good example is the revolution that internet has brought to businesses.

Currently there are five factors to consider while assessing the impact of IT in businesses. These are :

1. **Internet growth and technology convergence – this includes** e-commerece,e-government,rapid changes to markets and their structures, the fading traditional models.

2.Transformation of the business enterprise- location independence, low running costs of transactions, collaborations and team work.

3. Growth of a globally connected economy- Competition, management in global m,arkets, delivery systems and work groups.

4. Growth of knowledge and information-based economies- knowledge based economies and knowledge as strategic asset, time based competition,, short product life,

5. Emergence of the digital firm- digitally connected relationships with actors in the value chain(customers,suppliers e.t.c), core business conducted in digital secure networks, Agile sensing and responding to business environment.

"The traditional business firm was—and still is—a hierarchical, centralized, structured arrangement of specialists who typically relied on a fixed set of standard operating procedures to deliver a mass-produced product (or service). The new style of business firm is a flattened (less hierarchical), decentralized, flexible arrangement of generalists who rely on nearly instant information to deliver mass-customized products and services uniquely suited to specific markets or customers. The traditional management group relied—and still relies—on formal plans, a rigid division of labor, and formal rules. The new managers relies on informal commitments and networks to establish goals (rather than formal planning), a flexible arrangement of teams and individuals working in task forces, and a customer orientation to achieve coordination among employees. "

Adopted from laudon and laudon book

CHAPTER 2

COMPUTER HARDWARE

After completing this chapter, you will be able to:

- Describe the specific categories of hardware devices
- Describe the application of a given hardware device to a business scenario
- Describe the feature and characteristics of different hardware devices
- Classify software into its right category
- State the functions of an Operating System

PERIPHERAL DEVICES

Peripheral is the generic name given to all input, output, and secondary storage devices that are part of a computer system. Peripherals depend on direct connections or telecommunications links to the central processing unit of a computer system. Thus, all peripherals are **online** devices; that is, they are separate from, but can be electronically connected to and controlled by a CPU. (This is the opposite of **offline** devices that are separate from and not under the control of the CPU.)

INPUT DEVICES

They are used to transform instructions and data into electronic form for computer processing. There has been a major trend toward the increased use of input technologies that provide a more **natural user interface** for computer users. You can now enter data and commands directly and easily into a computer system through pointing devices like electronic mice and touch pads, and technologies like optical scanning, handwriting recognition, and voice recognition. These developments have made it unnecessary to always record data on paper source documents (such as sales order forms, for example) and then keyboard the data into a computer in an additional data entry step. Further improvements in voice recognition and other technologies should enable an even more natural user interface in the future.

Input hardware devices are categorized as three types: keyboards, pointing devices, and source data-entry devices. Quite often a computer system will combine all three. The

objective is to enhance end user-computer interaction. That is making data entry and drawing of curves easy and fast, and giving of instruction easy and fast. Data items such as account numbers could be captured directly while those like bills could be keyed in.

a) Keyboards

A keyboard is a device that converts letters, numbers, and other characters into electrical signals that can be read by the computer's processor. Traditional keyboard looks like a typewriter keyboard to which some special keys have been added. The other kinds of keyboards are specialty keyboards and terminals. Specialty keyboards range from Touch-Tone telephone keypads to keyboards featuring pictures of food for use in fast-food restaurants. Terminals may be dumb terminals, smart terminals, intelligent terminals, and Internet terminals.

A dumb terminal has a display screen and a keyboard and can input and output but not process data**.** A dumb terminal**,** also called a video display terminal, has a display screen and a keyboard and can input and output but not process data**.** Usually the output is text only. For instance, airline reservations clerks use these terminals to access a mainframe computer containing flight information. Dumb terminals cannot perform functions independent of the mainframe to which they are linked. Smart terminals make possible some processing but do not have full fledged capabilities of an intelligent terminal.

An intelligent terminal is like a PC and has its own memory and processor, as well as a display screen and keyboard. Such a terminal can perform some functions independent of any mainframe to which it is linked. One example is the familiar automated teller machine (ATM), a self-service banking machine that is connected through a telephone network to a central computer. Another example is the point-of-sale (POS) terminal, used to record purchases at a store's checkout counter. An Internet terminal provides access to the Internet and includes the network computer and the wireless pocket PC etc.

b) Pointing Devices

One of the most natural of all human gestures, the act of pointing, is incorporated in several kinds of input devices. Pointing devices **control the position of the cursor or pointer on the screen.** Pointing devices include the mouse and its variants, the touch screen, and various forms of pen input.

The mouse and its variants—trackball, pointing stick, and touchpad. The **electronic mouse** is the most popular pointing device used to move the cursor on the screen, as well as to issue commands and make icon and menu selections. The trackball, pointing stick, and touchpad are other pointing devices most often used in place of the mouse. For a **trackball** is a stationary device related to the mouse. You turn a roller ball with only its top exposed outside its case to move the cursor on the screen. A **pointing stick** (also called a trackpoint*)* is a small button-like device, sometimes likened to the eraserhead of a pencil. It is usually centered one row above the space bar of a keyboard. The cursor moves in the direction of the pressure you place on the stick. The **touchpad** is a small rectangular touch-sensitive surface usually placed below the keyboard. The cursor moves in the direction your finger moves on the pad. Trackballs, pointing sticks, and touchpads are easier to use than a mouse for portable computer users and are thus built into most notebook computer keyboards.

Touch screens are devices that allow you to use a computer by touching the surface of its video display screen. Some touch screens emit a grid of infrared beams, sound waves, or a slight electric current that is broken when the screen is touched. The computer senses the point in the grid where the break occurs and responds with an appropriate action. For example, you can indicate your selection on a menu display by just touching the screen next to that menu item.

Pen input: Some input devices use variations on an electronic pen. Examples are pen-based systems, light pens, and digitizers.

Pen-based computer systems allow users to enter handwriting and marks onto a computer screen by means of a penlike stylus rather than by typing on a keyboard. Pen computers use

handwriting recognition software that translates handwritten characters made by the pen, or stylus, into data that is usable by the computer. Many handheld computers and PDAs have pen input, as do digital notebooks.

The light pen is a light-sensitive penlike device connected by a wire to the computer terminal. The user brings the pen to a desired point on the display screen and presses the pen button, which identifies that screen location to the computer. Light pens are used by engineers, graphic designers, and illustrators. Some light pens require special monitors.

A digitizer uses a mouselike copying device called a puck, or an electronic pen, which can convert drawings and photos to digital data. One form of digitizer is the digitizing tablet, an electronic plastic board on which each specific location corresponds to a location on the screen. When you use the puck or the pen, the tablet converts your movements into digital signals that are input to the computer. Digitizing tablets are often used to make maps and engineering drawings.

c) Source Data-Entry Devices

Source data automation technology captures data in computer-readable form at the time and place they are created. Point-of-sale systems, optical bar code scanners used in supermarkets, and other optical character recognition devices are examples of source data automation. With source data automation, many errors that occur when people use key-boards to enter data are almost eliminated. Also, time taken to get the data to computer is reduced. Source data-input devices do not require keystrokes (or require only a few keystrokes) to input data to the computer.

Rather data is entered directly from the source, with little or no human intervention. Source data-entry devices create machine-readable data on magnetic media or paper or feed it directly into the computer's processor. Included among the devices are:

1. Scanning devices—imaging systems, bar-code readers, mark- and character-recognition devices, and fax machines
2. Audio-input devices, Web cameras and video input, and photographic input (digital cameras)
3. Voice-recognition systems, sensors, radio-frequency identification devices, and human-biology input devices

i) Scanning devices

Imaging systems: Scanners use light-sensing equipment to translate images of text, drawings, photos, and the like into digital form. The images can then be processed by a computer, displayed on a monitor, stored on a storage device, or transmitted to another computer. Scanners are similar to photocopy machines except they create electronic files of scanned items instead of paper copies. One type of scanner is the imaging systems—or image scanner, or graphics scanner—which converts text, drawings, and photographs into digital form that can be stored in a computer system and then manip-ulated, output, or sent via modem to another computer.

Bar-code readers: Another scanning device reads bar codes, the vertical zebra-striped marks you see on most manufactured retail products—everything from candy to

cosmetics to comic books. Bar-code readers are photoelectric (optical) scanners that translate the symbols in the bar code into digital code. In this system, the price and other details of a particular item is set within the store's computer. Once the bar code has been scanned, the corresponding price and other details that describe the product appear on the salesclerk's point-of-sale terminal and on your receipt. Records of sales from the bar-code readers are input to the store's computer and used for accounting, restocking store inventory, and weeding out products that don't sell well.

ii) Mark-recognition and character-recognition devices:

There are three types of scanning devices that sense marks or characters. They are usually referred to by their abbreviations MICR, OMR, and OCR.

- **Magnetic-ink character recognition (MICR)** reads the strange-looking numbers printed at the bottom of checks. MICR characters, which are printed with magnetized ink, are read by MICR equipment, producing a digitized signal. The bank's reader/sorter machine employs this signal to sort checks.

- **Optical mark recognition (OMR)** uses a device that reads pencil marks and converts them into computer-usable form. The best-known example is the OMR technology used to read the College Board Scholastic Aptitude Test (SAT) and the Graduate Record Examination (GRE).

- **Optical character recognition (OCR)** uses a device that reads preprinted characters in a particular font (typeface design) and converts them to digital code. OCR characters appear on utility bills and price tags on department-store

Voice-recognition systems: A voice-recognition system, using a microphone (or a telephone) as an input device, converts a person's speech into digital signals by comparing the electrical patterns produced by the speaker's voice with a set of prerecorded patterns stored in the computer. **Speech recognition** promises to be the easiest method for data entry, word processing, and conversational computing, since

speech is the easiest, most natural means of human communication. Speech recognition systems digitize, analyze, and classify your speech and its sound patterns. The software compares your speech patterns to a database of sound patterns in its vocabulary and passes recognized words to your application software. Typically, speech recognition systems require training the computer to recognize your voice and its unique sound patterns in order to achieve a high degree of accuracy. Training such systems involves repeating a variety of words and phrases in a training session, as well as using the system extensively.

d) **Human biology-input devices:**

Characteristics and movements of the human body, when interpreted by sensors, optical scanners, voice recognition, and other technologies, can become forms of input. Two examples are biometric systems and line-of-sight systems.

Biometrics is the science of measuring individual body characteristics**.** Biometric security devices identify a person through a fingerprint, voice intonation, or other biological characteristic. For example, retinal-identification devices use a ray of light to identify the distinctive network of blood vessels at the back of the eyeball. Line-of-sight systems enable you to use your eyes to point at the screen. This technology allows some physically disabled users to direct a computer. For example, the Eyegaze System from LC Technologies allows you to operate a computer by focusing on particular areas of a display screen. A camera mounted on the computer analyzes the point of focus of the eye to determine where you are looking. You operate the computer by looking at icons on the screen and "press a key" by looking at one spot for a specified period of time.

OUTPUT DEVICES

There are several types of output devices. Included are: first, softcopy output—display screens; second, hardcopy output—printers; and, third, other output—sound, voice, animation, and video.

Softcopy Output: Display Screens

Display screens—also variously called monitors, CRTs(cathode-ray tube), or simply screens— are output devices that show programming instructions and data as they are being input and information after it is processed

Hardcopy Output: Printers

Printers can be separated into two categories, according to whether or not the image produced is formed by physical contact of the print mechanism with the paper. Impact printers do have contact with paper- nonimpact printers do not.

• Impact printers: An impact printer forms characters or images by striking a mechanism such as a print hammer or wheel against an inked ribbon, leaving an image on paper. An example of impact printer is dot matrix that creates images with dots.

• Nonimpact printers: Nonimpact printers are faster and quieter than impact printers because they have fewer moving parts. Nonimpact printers form characters and images without direct physical contact between the printing mechanism and paper. Two types of nonimpact printers often used with microcomputers are laser printers and ink-jet printers. A third kind, the thermal printer is seen less frequently.

A laser printer creates images with dots as is in a photocopying process. Laser printers are also called page printers, because they print one page at a time. Ink-jet printers spray small, electrically charged droplets of ink from four nozzles through holes in a matrix at high speed onto paper. Like laser and dot-matrix printers, ink-jet printers form images with little dots. The advantages of ink-jet printers are that they can print in color, are quieter, and are much less expensive than color laser printers. The disadvantages are that they print in a somewhat lower resolution than laser printers and they are slower.

Thermal printers use colored waxes and heat to produce images by burning dots onto special paper**.** They are expensive, and they require expensive paper. For people who

want the highest-quality color printing available with a desktop printer, thermal printers are the answer.

Plotters: A plotter is a specialized output device designed to produce high-quality graphics in a variety of colors. Plotters are used to create hardcopy items such as maps, architectural drawings, and three-dimensional illustrations, which are usually too large for regular printers.

Considerations when buying a printer.

Do I need color, or will black-only do? Are you mainly printing text or will you need to produce color charts and illustrations (and, if so, how often)? If you print lots of black text, consider getting a laser printer. If you might occasionally print color, get an ink-jet that will accept cartridges for both black and color. Unless you are in the publishing or design business, you will probably not need an expensive color laser printer.

Do I have other special output requirements? Do you need to print envelopes or labels? special fonts (type styles)? multiple copies? transparencies or on heavy stock? unusual paper size? Find out if the printer comes with envelope feeders, sheet feeders holding at least 100 sheets, or whatever will meet your requirements.

Is the printer easy to set up? Can you easily put the unit together, plug in the hardware, and adjust the software (the "driver" programs) to make the printer work with your computer?

Is the printer easy to operate? Can you add paper, replace ink/toner cartridges or ribbons, and otherwise operate the printer without much difficulty?

Does the printer provide the speed and quality I want? A. regular laser printer prints 4-30 pages per minute (ppm); a color ink-jet printer prints 1-12 ppm. Colors and graphics take longer to print. Are the blacks dark enough and the colors vivid enough?

Will I get a reasonable cost per page? Special paper, ink or toner cartridges (especially color), and ribbons are all ongoing costs. Ink-jet color cartridges, for example, may last 100-500 pages and cost $25-$30 new. Laser toner cartridges last longer but are more expensive. Ribbons for dot-matrix printers are inexpensive. Ask the seller what the cost per page works out to.

Does the manufacturer offer a good warranty and good telephone technical support? Find out if the warranty lasts at least 2 years. See if the printer's manufacturer offers telephone support in case you have technical problems. The best support systems offer toll-free numbers and operate evenings and weekends as well as weekdays.

SECONDARY STORAGE

Information systems need to store information outside of the computer in a nonvolatile state and to store volumes of data too large to fit into a computer. The relatively long-term storage of data outside the CPU and primary storage is called secondary storage. Secondary storage is nonvolatile and retains data even when the computer is turned off. There are many kinds of secondary storage; the most common are magnetic disk, optical disk, and magnetic tape. These media can transfer large bodies of data rapidly to the CPU. However, secondary storage requires mechanical movement to gain access to the data, so in contrast to primary storage, it is relatively slow.

Magnetic disk

The most widely used secondary storage medium today is magnetic disk. There are two kinds of magnetic disks: floppy disks (used in PCs) and hard disks (used on commercial disk drives and PCs).

Floppy disks are removable and are made of plastics. Hard disks are thin metallic platters with iron oxide coating. A hard disk drive contains one or more hard disks mounted on a vertical shaft. Read/write heads attached to access arms move across the spinning disk or disks to read or write data on concentric, circular tracks. Data are recorded in form of

magnetized spots as disks rotate. The read process converts data in magnetized spots form into electronic pulse form and relays them to CPU.

All the parts of the hard disk are combined into a sealed module so as to prevent any foreign matter from getting inside and causing head crash

Optical disks

Optical disks, also called compact disks or laser optical disks, store data at densities many times greater than those of magnetic disks and are available for both PCs and large computers. Optical disks include: CD-ROM, CD-R and CD-RW. The most common optical disk system used with PCs is CD-ROM (compact disk read-only memory).

CD-R (compact disk-recordable) optical disk system allow users to record data only once on an optical disk. Once written, the data cannot be erased but can be read indefinitely.

CD-RW (CD-ReWritable) technology has been developed to allow users to create rewritable optical disks.

Digital video disks (DVDs), also called digital versatile disks, are optical disks that are the same size as CD-ROMs but of even higher capacity. They can hold a minimum of 4.7 gigabytes of data, enough to store a full-length, high-quality motion picture. DVDs are initially being used to store movies and multimedia applications using large amounts of video and graphics

Flash disk

Flash disk is a storage device that is likely to replace floppy drives and even optical disks in the long run. Already laptops that do not have floppy disk drives are being produced. Flash disks are also known as pen drives; USB drives; Key drives; and Memory sticks. They have data retention time of up to 10 years. They are faster at data transfer. Some are water proof. They are low cost, easy to use, flexible, durable and portable - but could easily be misplaced being very small.

Choosing a secondary storage device

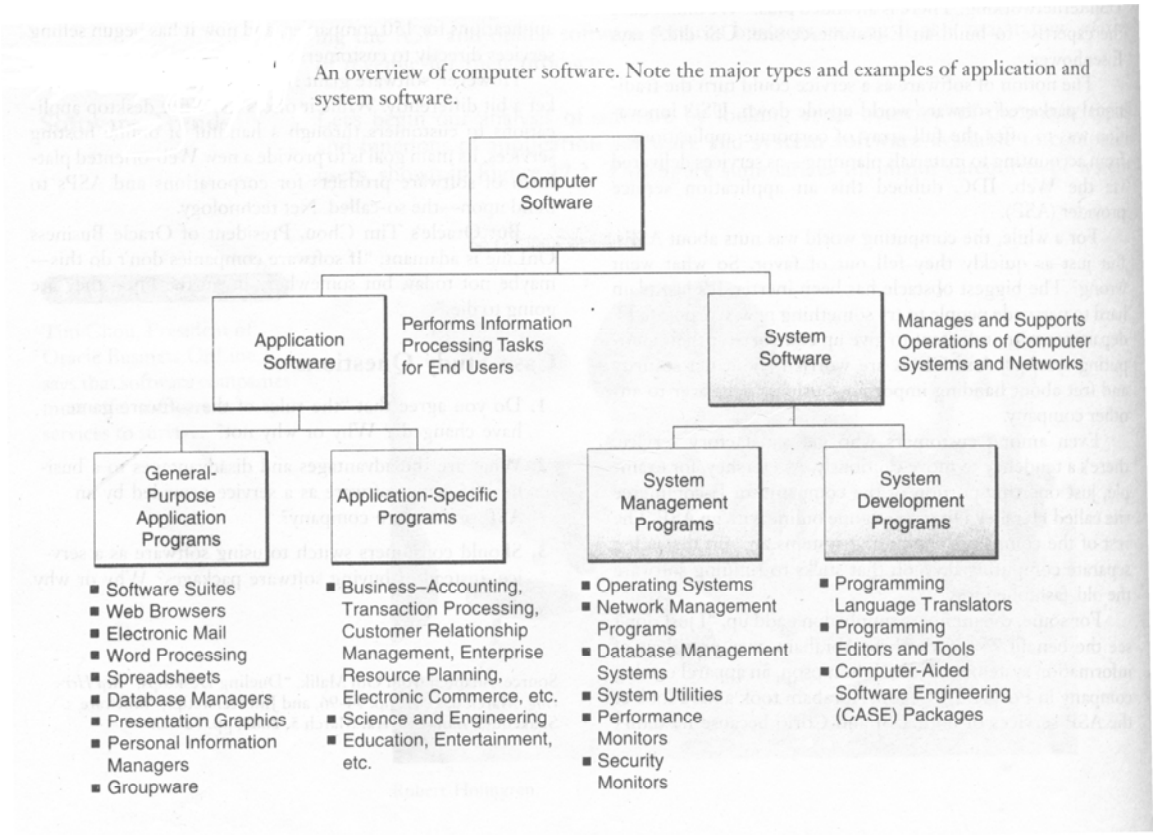
To choose a secondary storage device, we may consider the following**:**

- Manner of access supported by the device – is it direct or sequential and what does the operation need?
- Secondary storage medium storage capacity – how large is it and what does the application need?
- Durability: medium and data retention – if data were to be stored for long time, would it still retain it?
- Speed of access – data transfer rate. How fast can data be accessed and transferred to RAM?
- Availability of technical, hardware and software support – from suppliers
- Cost of the device acquisition and maintenance

Data stored amenability to edit – can the data be edited, and is it necessary for the kind of data stored or the data are ready for archival storage?

COMPUTER SOFTWARE

Software is a detailed set of instructions that control operation of a computer system. It is of two types: System and application software. System software enables the application software to interact with the computer and helps the computer manage its internal and external resources. There are only a handful of systems software packages for personal computers. Applications software on the other hand performs useful work on general-purpose tasks, such as word processing or spreadsheets, or that is used for entertainment. Hundreds of application software packages are available for personal computers. A diagram showing software classes is as follows:



SYSTEM SOFTWARE

Components of system software include operating system, device drivers, utility programs and language translators and other software as shown in the diagram above.

Operating systems

An operating system is the principal component of system software in any computing system. It is the most important system software package. An operating system is an integrated system of programs that manages the operations of the CPU, controls the input/output and storage resources and activities of the computer system, and provides various support services as the computer executes the application programs of users.

The primary purpose of an operating system is to maximize the productivity of a computer system by operating it in the most efficient manner. An operating system minimizes the amount of human intervention required during processing. It helps your application programs perform common operations such as accessing a network, entering data, saving and retrieving files, and printing or displaying output. The operating system must be loaded and activated before other computer tasks could be accomplished. This is so as the operating systems is the software

interface between users and the hardware and application software and hardware. Operating system is also called the software platform. Together with processor they are termed platform.

The work of the operating system begins as soon as you turn on, or "boot," the computer. Booting is the process of loading an operating system into a computer's main memory. This loading is accomplished by programs stored permanently in the computer's electronic circuitry. When you turn on the machine, programs called diagnostic routines test the main memory, the central processing unit, and other parts of the system to make sure they are running properly. Next, BIOS (for basic input/output system) programs are copied to main memory and help the computer interpret keyboard characters or transmit characters to the display screen or to a diskette. Then the boot program obtains the operating system, usually from hard disk, and loads it into the computer's main memory, where it remains until you turn the computer off.

When you power up a computer by turning on the power "on" switch, it is called a cold boot. If your computer is already on and you restart it, this is called a warm boot or a warm start (by simultaneously pressing the Ctrl+Alt+Del keys or pressing the Reset button on your computer). Normally, your computer would boot from the hard drive, but if that drive is damaged you can use a floppy disk called a boot disk to start up your computer.

An operating system performs five basic functions in the operation of a computer system: Providing a user interface; resource management; task management; file management; and utilities and support services.

The user interface

The user interface is the part of the operating system that allows you to communicate with it so you can load programs, access files, and accomplish other tasks. Three main types of user interfaces are the command-driven, menu-driven, and graphical user interfaces. The trend in user interfaces for operating systems and other software is moving away from the entry of brief end user commands, or even the selection of choices from menus of options. Instead, most software provide an easy-to-use graphical user interface (GUI) that uses icons, bars, buttons, boxes, and other images. GUIs rely on pointing devices like the electronic mouse or touch-pad to make selections that help you get things done.

Resource Management

An operating system uses a variety of resource management programs to manage the hardware and networking resources of a computer system, including its CPU, memory, secondary storage devices, telecommunications processors, and input/output peripherals. For example, memory management programs keep track of where data and programs are stored. They may also subdivide memory into a number of sections and swap parts of programs and data between memory and magnetic disks or other secondary storage devices. This can provide a computer system with a virtual memory capability that is significantly larger than the real memory capacity of its primary storage circuits. So, a computer with a virtual memory capability can process large programs and greater amounts of data than the capacity of its memory chips would normally allow.

File Management

An operating system contains file management programs that control the creation, deletion, and access of files of data and programs. File management also involves keeping track of the physical location of files on magnetic disks and other secondary storage devices. Operating systems maintain directories of information about the location and characteristics of files stored on a computer system's secondary storage devices.

Task Management

The task management programs of an operating system manage the accomplishment of the computing tasks of end users. They give each task a slice of a CPU's time and interrupt the CPU operations to substitute other tasks. Task management may involve a multitasking capability where several computing tasks can occur at the same time as follows:

Multitasking—executing more than one program concurrently: Earlier microcomputers could do only single-tasking, whereby an operating system could run only one application program at a time. Thus, users would have to shut down the application program they were working in before they opened another application, which was inconvenient. Today, multitasking operating systems are used. Multitasking is the execution of two or more programs by one user concurrently on the same computer with one central processor. You may be writing a report on your computer with one program while another program plays a music CD. How does the computer handle both programs at once?

The answer is that the operating system directs the processor to spend a predetermined amount of time executing the instructions for each program, one at a time. Thus, a small part of the first program is processed, and then the processor moves to the remaining programs, one at a time, processing small parts of each. The cycle is repeated until processing is complete. Because the processor is usually very fast, it may appear that all the programs are being executed at the same time. However, the processor is still executing only one instruction at a time.

Multiprogramming—concurrent execution of different users' programs: Multiprogramming is the execution of two or more programs concurrently on a multiuser operating system. As with multitasking, the processor spends a certain amount of time executing each user's program. Once again, because the processor works so quickly, it seems as though all the programs are being run at the same time.

Time-sharing-- In time-sharing, a single computer processes the tasks of several users at different stations in round-robin fashion. Time-sharing is used when several users are linked by a communications network to a single computer. The computer will first work on one user's task for a fraction of a second, then go on to the next user's task, and so on. This is accomplished through time slicing. Because computers operate so quickly, they can alternately apportion slices of time (fractions of a second) to various tasks. Thus, the computer may rapidly switch back and forth among different tasks, just as a hairdresser or dentist works with several clients or patients concurrently. Users are generally unaware of the switching process.

Multitasking and time-sharing differ slightly. With multitasking, the processor directs the programs to take turns accomplishing small tasks or events, such as making a calculation, searching for a record, or printing out part of a document. Each event may take a different amount of time to complete. With time-sharing, the computer spends a fixed amount of time with each program before going on to the next one.

Multiprocessing—simultaneous processing of two or more programs by multiple computers: Multiprocessing is processing done by two or more computers or processors linked together to perform work simultaneously—that is, at precisely the same time. This can entail processing instructions from different programs or different instructions within the same program at once.
As in multitasking, which involves only a single processor, the processing should be so fast that, by spending a little bit of time working on each program in turn, several programs can be run at

the same time. With both multitasking and multiprocessing, the operating system keeps track of the status of each program so that it knows where it left off and where to continue processing. But an operating system capable of multiprocessing is much more sophisticated than that required for multitasking.

Two possible approaches to multiprocessing are coprocessing and parallel processing. In coprocessing, the controlling CPU works together with specialized microprocessors called coprocessors, each of which handles a particular task, such as creating display-screen graphics or performing high-speed mathematical calculations. Many microcomputer systems have coprocessing capabilities.

In parallel processing, several full-fledged processors work together on the same tasks, sharing memory. Parallel processing is often used in large computer systems designed to keep running if one of the CPUs fails. These are called fault-tolerant systems; they have many processors and redundant components, such as memory and input, output, and storage devices. Fault-tolerant systems are used, for example, in airline reservation systems.

Formatting or initializing

Formatting or initializing a disk is the process of preparing that disk so that it can store data or programs.

Security Management

Operating systems now allow users to control access to their computers; this is especially important when several people use one computer and when on networks, in which various people use one system. Users gain access in the same manner as accessing their e-mail—via a user name and a password. If you are using a computer at work, you may be assigned a password.

Choice of an operating system

- What application software runs on the operating system?
- What kind of hardware does the operating system run on?
- How quickly does the operating system run?
- How easy is the operating to learn and use?
- Is the operating system designed for single users or for multiple users on networks?

- Does the operating system have strong multitasking capabilities?
- How reliable is the operating system?
- What about the cost to acquire and install?
- What technical support and assistance is required to install and run it? Where is this support available?

Device drivers

Device drivers are specialized software programs that allow input and output devices to communicate with the rest of the computer system. Many basic device drivers come with system software when you buy a computer, and the system software will guide you through choosing and installing the necessary drivers. If, however, you buy a new peripheral device, such as a mouse, scanner, or printer, the package will include a device driver (probably on a CD-ROM). You'll need to install the driver on your computer's hard-disk drive.

Utilities

Utility programs, also known as service programs, perform tasks related to the control and allocation of computer resources. They enhance existing functions or provide services not supplied by other system software programs. Most computers come with built-in utilities as part of the system software. However, they may also be bought separately as external utility programs (such as Norton Desktop and McAfee utilities).

Among the tasks performed by utilities are the following:

Backup: Used to make a backup, or duplicate copy, of the information on hard disk – e.g. Norton Backup

Data recovery: One day in the 1970s, so the story goes, programming legend Peter Norton was working at his computer and accidentally deleted an important file. This was, and is, a common enough error. However, instead of re-entering all the information, Norton decided to write a computer program to recover the lost data. He called the program The Norton Utilities. Ultimately it and other utilities made him very rich. A data-recovery utility is used to restore data that has been physically damaged or corrupted. Data can be damaged by viruses, bad software, hardware failure, and power fluctuations that occur while data is being written/recorded.

Virus protection

A virus consists of hidden programming instructions that are buried within an applications or systems program. Sometimes they copy themselves to other programs, causing havoc. Sometimes the virus is merely a simple prank that pops up in a message. Other times, however, it can destroy programs and data and wipe your hard disk clean. Viruses are spread when people exchange floppy disks or download (make copies of) information from computer networks. It is essential, therefore, that you install antivirus software. Antivirus software is a utility program that scans hard disks, floppy disks, and memory to detect viruses. Some utilities destroy the virus on the spot. Others notify you of possible viral behavior. Because new viruses are constantly being created, you need the type of antivirus software that can detect unknown viruses. Examples of antivirus software are Norton AntiVirus, Dr. Solomon's Anti-Virus Toolkits, McAfee's VirusScan, and Webscan. New viruses appear every day, so it's advisable to look for an antivirus utility that offers frequent updates without additional cost.

Although it's important to install an antivirus utility on your computer, virus risks are sometimes exaggerated. With few exceptions, if you don't boot your computer with a diskette in the drive, directly run programs downloaded from a network, open unknown files attached to e-mail, or use illegally copied program diskettes, your risk of virus infection is low.

Data compression: As you continue to store files on your hard disk, it will eventually fill up. You can use a data compression utility, such as PK Zip to remove redundant elements, gaps, and unnecessary data from a computer's storage space so that less space (fewer bits) is required to store or transmit data. With a data compression utility, files can be made more compact for storage on your hard-disk drive. Given today's huge-capacity hard drives, you may never fill yours up. Still, data compression remains an issue.

With the increasing use of large graphic, sound, and video files, data compression is necessary both to reduce the storage space required and to reduce the time required to transmit such large files over a network. You may also want to compress a file to fit on a floppy disk, for portability.
As the use of sophisticated multimedia becomes common, compression and decompression will be increasingly taken over by built-in hardware boards that specialize in this process. That will leave the main processor free to work on other things, and compression/decompression software utilities will become obsolete.

File defragmentation

Over time, as you delete old files from your hard disk and add new ones, something happens: the files become fragmented. Fragmentation is the scattering of portions of files about the disk in nonadjacent areas, thus greatly slowing access to the files. When a hard disk is new, the operating system puts files in the disk contiguously (next to one another). However, as you update a file over time, new data for that file is distributed to unused spaces. These spaces may not be contiguous to the older data in that file. It takes the operating system longer to read these fragmented files. A defragmenter utility program will find all the scattered files on your hard disk and reorganize them as contiguous files. Defragmenting the file will speed up the drive's operation.

Disk scanner (Scan Disk) and disk cleanup:

These utilities detect and correct certain types of common problems on hard disks and floppies and search for and remove unnecessary files, such as temporary files ("temp files"). (The Windows OS creates files needed only for short tasks and auto-recovery. The computer should delete temp files when a program is closed, but this doesn't always happen. Thus temp files can take up space.)

APPLICATION SOFTWARE

Application software performs information processing tasks for end-users. It includes a variety of programs that can be subdivided into general-purpose and application-specific categories. Thousands of application-specific software packages are available to support specific applications of end users in business and other fields. For example, application-specific packages in business support managerial, professional, and business uses such as transaction processing, decision support, accounting, sales management, investment analysis, and electronic commerce.

General-purpose application programs are programs that perform common information processing jobs for end users. For example, word processing programs, spreadsheet programs, database management programs, and graphics programs are popular with microcomputer users for home, education, business, scientific, and many other purposes. Because they significantly increase the productivity of end users, they are sometimes known as productivity packages. Other examples include Web browsers, electronic mail, and groupware, which help support communication and collaboration among workgroups and teams.

The trend in software has been towards easier to use software. With this trend software developed tend to be inefficient: execution speed and memory.

The trend has been as follows:

- User-Written Programs Machine Languages
- Packaged Programs Symbolic Languages
- Operating Systems High-Level Languages
- Database Management Systems Fourth-Generation Languages Microcomputer Packages
- Natural and Object-Oriented Languages Multipurpose Graphic-Interface Network-Enabled Expert-Assisted Packages

Application specific software

They support specific applications of end-users.

General purpose software:

Software Suites and Integrated Packages

The most widely used productivity package come bundled together as software suites such as Microsoft Office, Lotus Smart. Suite, Corel WordPerfect Office, and Sun's StarOffice. Each suite integrates software packages for word processing, spreadsheets, presentation graphics, database management, and personal information management. Microsoft, Lotus, Corel, and Sun bundle several other programs in each suite, depending on the version you select. Examples include programs for Internet access, E-mail, Web publishing, desktop publishing, voice recognition financial management, electronic encyclopedias, and so on.

A software suite costs a lot less than the total cost of buying its individual packages separately. Another advantage is that all programs use a similar graphical user interface (GUI) of icons, tool and status bars, menus, and so which gives them the same look and feel, and makes them easier to learn an use. Software suites also share common tools, such as spell checkers and help wizards to increase their efficiency. Another big advantage of suites is that their programs are designed to work together seamlessly and import each other's files easily, no matter which program you are using at the time. These capabilities make them more efficient and easier to use than using a variety of individual package versions.

Putting so many programs and features together in one super-size package however, has some disadvantages. Industry critics argue that many software suite features are never used by most end users. The suites take up a lot of disk space. These drawbacks are one reason for the continued use of integrated packages like Microsoft Works, AppleWorks, and so on.

Integrated packages combine some of the functions of several programs—word processing, spreadsheets, presentation graphics, database management, and so on—into one software package. These packages leave out many features and functions that are in individual packages and software suites and so they cannot do as much as those packages do. However, they use a lot less disk space, cost less, and are frequently pre-installed on many low-end microcomputer systems. So integrated packages have proven that they can offer enough functions and features for many computer users, while providing some of the advantages of software suites in smaller packages.

Web Browsers and More

The most important software component for many computer users today is the once simple and limited, but now powerful and feature-rich, Web browser. A browser like Netscape Navigator or Microsoft Explorer is the key software interface you use to point and click your way through the hyperlinked resources of the World Wide Web and the rest of the Internet, as well as corporate intranets and extranets. Once limited to surfing the Web, browsers are becoming the universal software platform on which end users launch into information searches, E-mail, multimedia file transfer, discussion groups, and many other Internet, intranet, and extranet applications. Industry experts are predicting that the Web browser will be the model for how most people will use networked computers in the future.

Electronic Mail

Email software is used for E-mail exchange. E-mail software is now a component of top software suites and Web browsers. Free E-mail packages like Microsoft HotMail and Netscape WebMail are available to Internet users from online services and Internet service providers. Full-featured E-mail software like Microsoft Exchange E-Mail or Netscape Messenger can route messages to multiple end users based on predefined mailing lists and provide password security, automatic message forwarding, and remote user access. They also allow you to store messages in folders with provisions for adding attachments to message files. E-mail packages may also enable you to edit and send graphics and multimedia as well as text, and provide bulletin board and computer conferencing capabilities. Finally, your E-mail software may automatically filter and sort incoming messages (even news items from online services) and route them to appropriate user mailboxes and folders.

Word processing

Word processing packages computerize the creation, editing, revision; and printing of documents (such as letters, memos, and reports) by electronically processing your text data (words, phrases, sentences, and paragraphs). Top word processing packages like Microsoft Word, Lotus WordPro, and Corel WordPerfect can provide a wide variety of attractively printed documents with their desktop publishing capabilities. These packages can also convert all documents to HTML format for publication as Web pages on corporate intranets or the World Wide Web. Word processing packages also provide advanced features. For example, a spelling checker capability can identify and correct spelling errors, and a thesaurus feature helps you find a better choice of words to

express ideas. You can also identify and correct grammar and punctuation errors, as well as suggest possible improvements in your writing style, with grammar and style checker functions.

Desktop publishing

End users and organizations can use desktop publishing (DTP) software to design and print their own newsletters, brochures, manuals, and books with several type styles, graphics, photos, and colors on each page – thus looking professionally published. Word processing packages and desktop publishing packages like Adobe PageMaker are used to do desktop publishing. Typically, text material and graphics can be generated by word processing and graphics packages and imported as text and graphics files. Optical scanners may be used to input text and graphics from printed material. You can also use files of clip art, which are predrawn graphic illustrations provided by the software package or available from other sources.

Electronic Spreadsheets

Electronic spreadsheet packages like Lotus 1-2-3, Microsoft Excel, and Corel QuattroPro are for processing, summarizing and analyzing data presented in tabular form. They are thus used for business analysis, planning, and modeling. They help you develop an electronic spreadsheet, which is a worksheet of rows and columns that can be stored on your PC or a network server, or converted to HTML format and stored as a Web page on the World Wide Web. Developing a spreadsheet involves designing its format and developing the relationships (formulas) that will be used in the worksheet. In response to your input, the computer performs necessary calculations based on the formulas you defined in the spreadsheet, and displays results immediately, whether at your workstation or website. Most packages also help you develop graphic displays of spreadsheet results.

Database management programs

Microcomputer versions of database management programs have become so popular that they are now viewed as general-purpose application software packages like word processing and spreadsheet packages. Database management packages such as Microsoft Access and Corel Paradox allow you to set up and manage databases on your PC, network server, or the World Wide Web. They are used for organizing data in databases in such a way that their processing, update and retrieval is easy. Most database managers can perform four primary tasks which include:

- Database development. Define and organize the content, relationships, and structure of the data needed to build a database, including any hyperlinks to data on Web pages.
- Database interrogation. Access the data in a database to display information in a variety of formats. End users can selectively retrieve and display information and produce forms, reports, and other documents, including Web pages.
- Database maintenance. Add, delete, update, and correct the data in a database, including hyperlinked data on Web pages.
- Application development. Develop prototypes of Web pages, queries, forms, reports, and labels for a proposed business application. Use a built-in 4GL or application generator to program the application.

Presentation graphics packages

Presentation graphics packages are for presenting data in chart and graphics form. They help to convert numeric data into graphics displays such as line charts, bar graphs, pie charts, and many other types of graphics. Most of the top packages also help you prepare multimedia presentations of graphics, photos, animation, and video clips, including publishing to the World Wide Web. Not only are graphics and multimedia displays easier to comprehend and communicate than numeric data but multiple-color and multiple-media displays also can more easily emphasize key points, strategic differences, and important trends in the data. Presentation graphics have proved to be much more effective than tabular presentations of numeric data for reporting and communicating in advertising media, management reports, or other business presentations.

Hypertext and hypermedia

Hypertext and hypermedia are software technologies for multimedia presentations. By definition, hypertext contains only text and a limited amount of graphics. Hypermedia are electronic documents that contain multiple forms of media, including text, graphics, video, and so on. Key topics and other presentations in hypertext or hypermedia documents are indexed by software links so that they can be quickly searched by the reader. For example, if you click your mouse button on an underlined term on a hypermedia document, your computer may instantly bring up another display using text, graphics, and sound related to that term. Once you finish viewing that presentation, you can return to what you were reading originally, or jump to another part of the document. Hypertext and hypermedia are developed by using software packages that rely on specialized programming languages like Java and the Hypertext Markup Language (HTML).

Personal Information Managers

The personal information manager (PIM) is a popular software package for end user productivity and collaboration, and is a popular application for personal digital assistant (PDA) hand-held devices. PIMs such as Lotus Organizer and Microsoft Outlook help end users store, organize, and retrieve information about customers, clients, and prospects, or schedule and manage appointments, meetings, and tasks. The PIM package will organize data you enter and retrieve information in a variety of forms, depending on the style and structure of the PIM and the information you want. For example, information can be retrieved as an electronic calendar or list of appointments, meetings, or other things to do; the timetable for a project; or a display of key facts and financial data about customers, clients, or sales prospects.

Information managers are sold as independent programs or are included in software suites, and vary widely in their style, structure, and features. For example, Lotus Organizer uses a notebook with tabs format, while Microsoft Outlook organizes data about people as a continuous A-to-Z list. Most PIMs emphasize the maintenance of contact lists, that is, customers, clients, or prospects. Scheduling appointments and meetings and task management are other top PIM applications. PIMs are now changing to include the ability to access the World Wide Web and provide E-mail capability. Also, some PIMs use Internet and E-mail features to support team collaboration by sharing information such as contact lists, task lists, and schedules with other networked PIM users.

Groupware

Groupware is collaboration software, that is, software that helps workgroups and teams work together to accomplish group assignments. Groupware is a fast-growing category of general-purpose application software that combines a variety of software features and functions to facilitate collaboration. For example, groupware products like Lotus Notes, Novell GroupWise, Microsoft Exchange, and Netscape Communicator support collaboration through electronic mail, discussion groups and databases, scheduling, task management, data, audio and videoconferencing, and so on. They make possible information availability, communication and coordination of project activities.

Groupware products are changing in several ways to meet the demand for better tools for collaboration. Groupware is now designed to use the Internet and corporate intranets and extranets to make collaboration possible on a global scale by virtual teams located anywhere in

the world. For example, team members might use the Internet for global E-mail, project discussion forums, and joint Web page development. Or they might use corporate intranets to publish project news and progress reports, and work jointly on documents stored on Web servers. Collaborative capabilities are also being added to other software to give them groupware features. For example, in the Microsoft Office software suite, Microsoft Word keeps track of who made revisions to each document, Excel tracks all changes made to a spreadsheet, and Outlook lets you keep track of tasks you delegate to other team members.

CHAPTER 3

After completing this sub- chapter on Information System Development, you will be able to:

- Describe the stages in the systems development Lifecycle (SDLC)
- Discuss the alternative to SDLC such as Prototyping
- Analyse the the Software outsourcing process
- Justify the factors to consider while selecting a software package

a) INFORMATION SYSTEMS DEVELOPMENT

Information systems have to be developed and improved. This could be done with, prototyping, application software packages acquisition, end-user development, and outsourcing as systems-building alternatives to the traditional systems lifecycle method.

The Traditional Systems Lifecycle

The systems lifecycle is the oldest method for building information systems and is still used today for medium or large complex systems projects. The lifecycle methodology has a very formal division of labor between end users and information systems specialists. Technical specialists such as systems analysts and programmers 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. Formal agreements between end users and technical specialists are required as each stage is completed.

Stages of the Systems Lifecycle

Traditional systems development life cycle (SDLC) consist of several stages or steps. Each stage consists of basic activities that must be performed before the next stage can begin. Specialists tend to differ as to the number of stages, the order of stages and even the terminologies used in systems lifecycle.

SDLC employs systems approach (SA) to problem solving. In SA, a problem is solved by examining it as a whole first and then the parts that make it up. This way, the problem through analysis into parts can easily be understood. By examining the problem as a whole, the relationships among its parts are considered in problem solution. The resulting solution would fit the parts as well as the problem as a whole. This is why SA is used and is applicable to information development.

SDLC may consist of the following steps: Systems investigation; Systems analysis; Systems design; Systems implementation; Systems maintenance

Systems investigation

- Determines whether a business problem exists
- Conducts a feasibility study to determine whether or not a new or improved information system is a feasible solution
- Develop a project management plan and obtain management approval

The product is feasibility study.

System analysis

- Describes what a system should do to meet the information needs of end-users
- Analyze the information needs of end-users, the organization environment and any system currently used
- Develop the functional requirements of a system that can meet the needs of end-users covering: interface requirements; processing requirements; storage requirements; control requirements.

The product is functional requirements.

Systems design

- Specifies how the system will accomplish the objective of developing a system that meets the information needs of end-users
- In this step then, the following specifications are developed:
    - Hardware
    - Software
    - People
    - Data resources
    - Information products

The product is systems specifications.

Systems implementation

- Involves several activities
- Acquisition of hardware and software (software might be developed)
- Testing of systems – programs and procedures
- Performance of a variety of installation activities
- Training people to operate and use systems
- Development of documentation
- Converting to new system

The product is operational system.

Conversion approaches are several and include:

- Direct approach where the old system is abandoned and new one is started
- Parallel approach where an old and new systems are operated side by side until the new one shows it is reliable
- Pilot approach where a new system is tried out in a part of the organization. Later it is implemented throughout the other parts of the organization when it proves successful
- Phased approach where a new system is implements gradually over a period of time in phases

A combination of the approaches could be used, the choice being based on a number of factors which include:

- Risks involved in the approach
- Costs expected
- Size of the system
- Extent of the systems tests
- Extent of expected user knowledge of the new system and ability to use it
- Complexity of system and the value of the old (or existing) system.

Systems maintenance

- Involves the monitoring, evaluating and modifying of a system to ensure that it works as expected.

Product is improved system.

Limitations of the Lifecycle Approach

The systems lifecycle is still used for building large transaction processing systems and management information systems where requirements are highly structured and well defined. It will also remain appropriate for complex technical systems such as space launches, air traffic control, and refinery operations. Such applications need a rigorous and formal requirements analysis, predefined specifications, and tight controls over the systems-building process.

However, the systems lifecycle approach is costly, time consuming, and inflexible. Volumes of new documents must be generated and steps repeated if requirements and specifications need to be revised. Because of the time and cost to repeat the sequence of lifecycle activities, the methodology encourages freezing of specifications early in the development process, discouraging change. The lifecycle method is ill-suited to decision-oriented applications where decision makers may need to experiment with concrete systems to clarify the kinds of decisions they wish to make. Formal specification of requirements may inhibit system-builders from exploring and discovering the problem structure. Likewise, the lifecycle approach is not suitable for many small desktop systems, which tend to be less structured and more individualized.

Alternative System-Building Approaches

- Alternative system-building approaches can solve some of the problems of the traditional systems lifecycle. These approaches include prototyping, application software packages, end-user development, and outsourcing. In addition, to these approaches, computer aided systems engineering (CASE) could be used.

Computer aided software engineering

- Involves using software packages (case tools) to perform many of the systems development cycle activities
- Included are software packages for:
    - Project management
    - User interface
    - Database design

- Software development

Prototyping

Prototyping consists of building an experimental system rapidly and inexpensively for end users to evaluate. By interacting with the prototype, users can get a better idea of their information requirements. The prototype endorsed by the users can be used as a template to create the final system.

The prototype is a working version of an information system or part of the system, but it is meant to be only a preliminary model. Once operational, the prototype will be further refined until it conforms precisely to users' requirements. Once the design has been finalized, the prototype can be converted to a polished production system.

The process of building a preliminary design, trying it out, refining it, and trying again has been called an iterative process of systems development because the steps required to build a system can be repeated over and over again. Prototyping is more explicitly iterative than the conventional lifecycle, and it actively promotes system design changes. It has been said that prototyping replaces unplanned rework with planned iteration, with each version more accurately reflecting users' requirements.

Steps in Prototyping

Prototyping process involves the following steps:

Step 1: Identify the user's basic requirements. The system designer (usually an information systems specialist) works with the user only long enough to capture his or her basic information needs.

Step 2: Develop an initial prototype. The system designer creates a working prototype quickly, using fourth-generation software, interactive multimedia, or computer-aided software engineering (CASE) tools.

Step 3: Use the prototype. The user is encouraged to work with the system in order to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

Step 4: Revise and enhance the prototype. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to step 3. Steps 3 and 4 are repeated until the user is satisfied.

When no more iterations are required, the approved prototype then becomes an operational prototype that furnishes the final specifications for the application. Sometimes the prototype itself is adopted as the production version of the system.

Advantages and Disadvantages of Prototyping

Prototyping is most useful when there is some uncertainty about requirements or design solutions. For example, a major securities firm requests consolidated information to analyze the performance of its account executives. But what should the measures of performance be? Can the information be extracted from the personnel system alone, or must data from client billings be incorporated as well? What items should be compared on reports? Initially users may not be able to see how the system will work.

Prototyping is especially valuable for the design of an information system's end-user interface (the part of the system that end users interact with, such as on-line display and data-entry screens, reports, or Web pages). The prototype enables users to react immediately to the parts of the system with which they will be dealing.

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Prototyping encourages intense end-user involvement throughout the systems development lifecycle and thus is likely to produce systems that fulfill user requirements. However, rapid prototyping can gloss over essential steps in systems development. Once finished, if the prototype works reasonably well, management may not see the need for reprogramming, redesign, or full documentation and testing. Some of these hastily constructed systems may not easily accommodate large quantities of data or a large number of users in a production environment. Successful prototyping requires management and mechanisms for defining expectations, assigning resources, signaling problems, and measuring progress.

Application Software Packages

Another alternative strategy is to develop an information system by purchasing an application software package. An application software package is a set of prewritten, preceded application software programs that are commercially available for sale or lease. Application software packages may range from a simple task (e.g., printing address labels from a database on a PC) to more than 400 program modules with 500,000 lines of code for a complex mainframe system.

Packages have flourished because there are many applications that are common to all business organizations—for example, payroll, accounts receivable, general ledger, or inventory control. For such universal functions with standard procedures, a generalized system will fulfill the requirements of many organizations.

Advantages and Disadvantages of Software Packages

When an appropriate software package is available, it is often not necessary for a company to write its own programs; the prewritten, predesigned, pretested software package can fulfill most of the requirements and can be substituted instead. The package vendor has already done most of the design, programming, and testing, so the time frame and costs for developing a new system should be considerably reduced. Vendors provide much of the ongoing maintenance and support for the system, supplying enhancements to keep the system in line with ongoing technical and business developments.

To maximize market appeal, packages are geared to the most common requirements of all organizations. What happens if an organization has unique requirements that the package does not address? To varying degrees, package software developers anticipate this problem by providing features for customization that do not alter the basic software. Customization features allow a software package to be modified to meet an organization's unique requirements without destroying the integrity of the package software. For instance, the package may allocate parts of its files or databases to maintain an organization's own unique pieces of data. Some packages have a modular design that allows clients to select only the software functions with the processing they need from an array of options. An alternative way of satisfying organizational information

requirements unmet by a software package is to supplement the package with another piece of software.

Ultimately, required customization and additional programming may become so expensive and time consuming that they eliminate many of the advantages of software packages.

Selecting Software Packages

Application software packages must be thoroughly evaluated before they can be used as the foundation of a new information system. The most important evaluation criteria are the functions provided by the package, flexibility, user-friendliness, hardware and software resources, database requirements, installation and maintenance effort, documentation, vendor quality, and cost. The package evaluation process often is based on a Request for Proposal (RFP), which is a detailed list of questions submitted to packaged software vendors.

When a system is developed using an application software package, systems analysis will include a package evaluation effort. Design activities will focus on matching requirements to package features. Instead of tailoring the system design specifications directly to user requirements, the design effort will consist of trying to mold user requirements to conform to the features of the package.

When a software package solution is selected, the organization no longer has total control over the system design process. At best, packages can meet only 70 percent of most organizations' requirements. If the package cannot adapt to the organization, the organization will have to adapt to the package and change its procedures.

Software Evaluation Factors

Efficiency

Is the software a well-written system of computer instructions that does not use much memory capacity or CPU time?

Flexibility

Can it handle its processing assignment easily without major modification?

Security

Does it provide control procedures for errors, malfunctions, and improper use

Language

Is it written in a programming language that is used by our computer programmers and users

Documentation

Is the software well documented? Does it include helpful user instructions?

Hardware

Does existing, hardware have the feature required to best use this software?

Other factors

What are its performance, cost, reliability, availability, compatibility, technology, ergonomics, and support characteristics?

End-user Development

In many organizations, end users are developing a growing percentage of information system with little or no formal assistance from technical specialists. This phenomenon is called end-user development. End-user development has been made possible by the special fourth-generation software tools. With fourth-generation languages, graphics languages and PC software tools, end users can access data, create reports, and develop entire information systems on their own, with little or no help from professional systems analysts or programmers. Many of these end-user developed systems can be created much more rapidly than with the traditional systems lifecycle.

End-User Computing Tools: Strengths and Limitations

Many organizations have reported gains in application development productivity by using fourth generation tools that in a few cases have reached 300 to 500 percent. Fourth-

generation tools have capabilities such as graphics spreadsheets, modeling, and ad hoc information retrieval that meet important business needs.

Unfortunately, fourth-generation tools still cannot replace conventional tools for some business applications because their capabilities remain limited. Fourth-generation software is relatively inefficient, processing individual transactions too slowly and at too high a cost to make these systems suitable for very large transaction processing systems. Slow response time and computer performance degradation often result when very large files are used.

Most fourth-generation tools likewise cannot easily handle applications with extensive procedural logic and updating requirements, such as systems used for optimal production scheduling or tracking daily trades of stocks, bonds, and other securities, that require comp: processing and often the matching of multiple files.

Management Benefits and Problems

Benefits

End-user development provides many benefits to organizations. These include the following:

Improved requirements determination as users specify their own business needs.
Increased user involvement and satisfaction.

As users develop their systems themselves and control the system development process, they are more likely to use the system.

Reduced application backlog as users are no longer totally reliant on overburdened information systems specialists.

Problems

At the same time, end-user computing poses organizational risks because it occurs outside of traditional mechanisms for information system management and control. Most organizations have not yet developed strategies to ensure that end-user-developed applications meet organizational objectives or meet quality assurance standards appropriate to their function. When systems are created rapidly, without a formal development methodology, testing and documentation may be inadequate.

Control over data can be lost in systems outside the traditional information systems department. When users create their own applications and files, it becomes increasingly difficult to determine where data are located and to ensure that the same piece of information (such as product number or annual earnings) is used consistently throughout the organization.

Outsourcing

If a firm does not want to use its internal resources to build or operate information systems, it can hire an external organization that specializes in providing these services to do the work. The process of turning over an organization's computer center operations, telecommunications networks, or applications development to external vendors is called outsourcing.

Its own computer center, which would be underutilized when there is no peak load. Outsourcing has become popular because some organizations perceive it as a cost effective measure that eliminates the need for maintaining their own computer center and information systems staff. The provider of outsourcing services benefits from economies of scale (the same knowledge, skills, and capacity can be shared with many different customers) and likely to charge competitive prices for information systems services. Outsourcing allows a company with fluctuating needs for computer processing to pay for only what it uses rather than build

Some firms outsource because their internal information systems staff cannot keep pace with technological change or innovative business practices or because they want to free scarce and costly talent for activities with higher payback. By outsourcing, companies hope to exploit the benefits of information technology in key business processes and improve the productivity of their information system resources.

When to Use Outsourcing

Not all organizations benefit from outsourcing, and the disadvantages of outsourcing can create serious problems for organizations if they are not well understood and managed. When a firm allocates the responsibility for developing and operating its information systems to another organization, it can lose control over its information systems function. Also, if the organization lacks the expertise to negotiate a sound contract, the firm's dependency on vendor could result in high costs or loss of control over technological direction. Trade secrets or proprietary information may leak out to competitors when a firm's information systems are run or developed by outsiders. This could be harmful if a

firm allows an outsourcer to develop or to operate applications that give it; type of competitive advantage.

Despite such drawbacks, there are a number of circumstances in which outsourcing application development to an external vendor is advantageous.

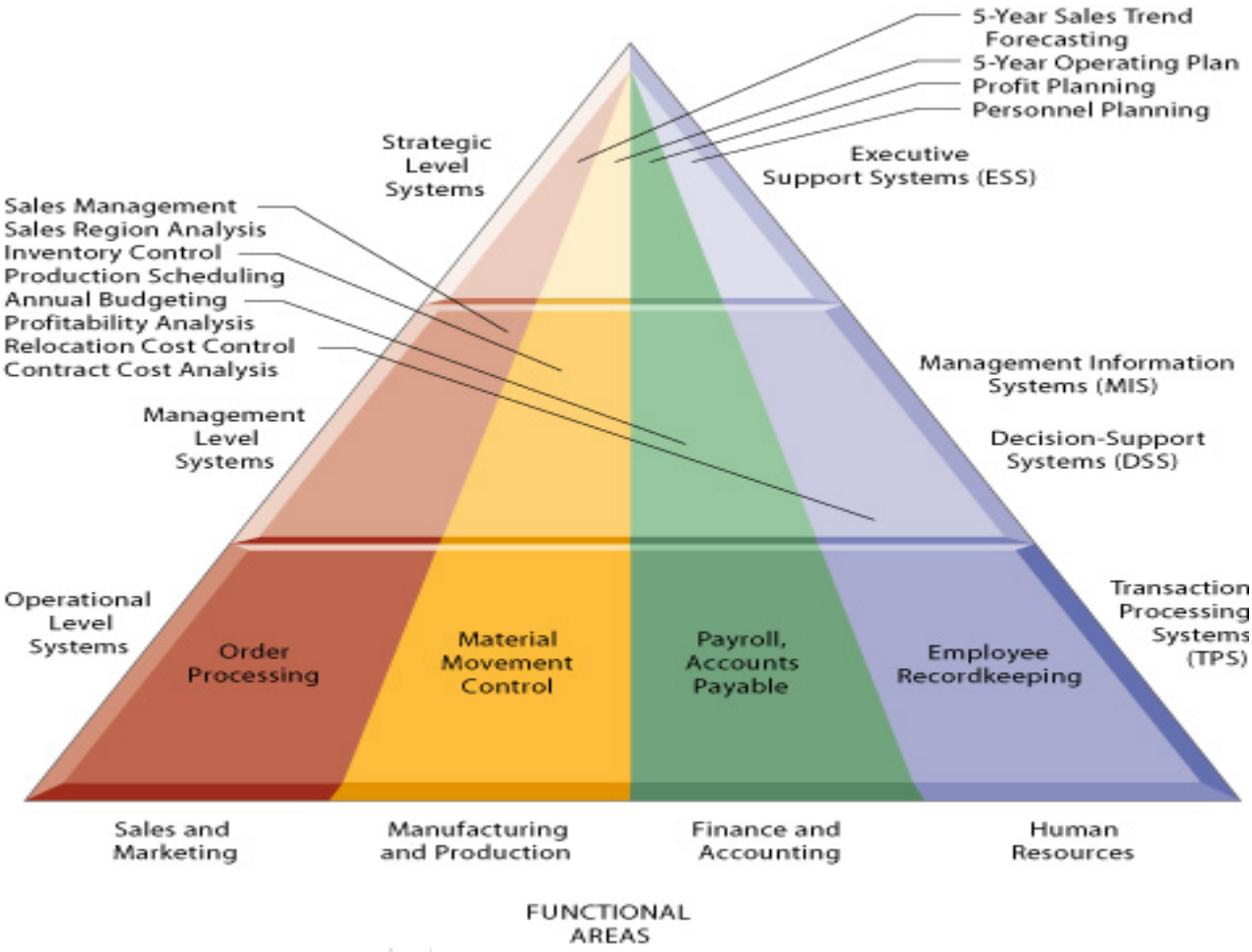
- To reduce costs or offload some of the information systems department's work
- When the firm's existing information system capabilities are limited, ineffective, or technically inferior.
- To improve the contribution of information technology to business performance
- To create new sources of revenue and profit from technology assets.

B) MAJOR TYPES OF INFORMATION SYSTEMS

After completing this sub- chapter on Major Types of Information Systems, you will be able to:

- Describe the specific categories of systems serving each organizational level
- Describe the value of different type of information systems to organization
- Describe the feature and characteristics of different information systems

There are four major types of systems : The organization has executive support systems (ESS) at the strategic level; management information systems (MIS) and decision-support systems (DSS) at the management level; and transaction processing systems (TPS) at the operational level. Systems at each level in turn are specialized to serve each of the major functional areas. The figure below shows levels of organization and corresponding information systems [figure Adopted from laudon and laudon]



Operational Level Information Systems

The information system that involved at operational level of an organization is Transaction Processing Systems. Transaction processing systems (TPS) are the basic business systems that serve the operational level of the system. A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to the conduct of the business. A TPS is any system that records transaction (a business event: a sale, a purchase, the hiring of a new employee). TPS is the entry point where data are entered at its source at the time of transactions take place. TPSs are interfaced with applications that provide clerical workers and operational managers with up-to-date information.

At the operational level, tasks, resources and goals are predefined and highly structured. The decision to grant credit to customer, for instance, is made by a lower-

level supervisor according to predefined criteria. All that must be determined is whether the customer meets the criteria.

The following table shows the specific types of application information systems that correspond to operation level:

Functional Area	**Systems**
Sales and Marketing	⇨ Order tracking ⇨ Order processing
Manufacturing	⇨ Machine control ⇨ Plant scheduling ⇨ Material movement control
Finance	⇨ Securities trading ⇨ Cash management
Accounting	⇨ Payroll ⇨ Accounts payable ⇨ Accounts receivable
Human Resources	⇨ Compensation ⇨ Training and development ⇨ Employee record keeping

The following description and diagram shows a payroll TPS, which is a typical accounting transaction processing system found in most firms.

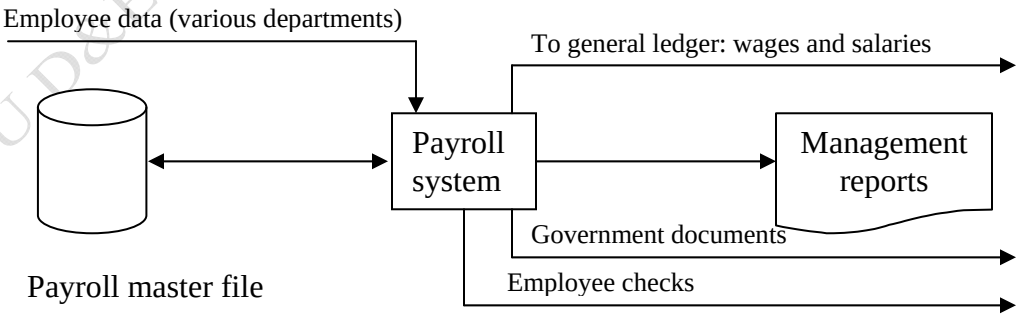


Figure 3-1

A payroll system keeps track of the money paid to employees. The master file is composed of discrete pieces of information (such as a name, address or employee

number) called data elements. Data are keyed into the system, updating the data elements. The elements on the master file are combined in different ways to make up reports of interest to management and government agencies and paychecks sent to employees. These TPS can generate other report combinations of existing data elements.

Other typical TPS applications are identified in the following table:

Types of TPS	Major functions of system	Major application systems
Sales and Marketing systems	⇨ Sales management ⇨ Market research ⇨ Promotion ⇨ Pricing ⇨ New products	⇨ Sales Order Information System ⇨ Market Research System ⇨ Pricing System
Manufacturing/Production systems	⇨ Scheduling ⇨ Purchasing ⇨ Shipping/receiving ⇨ Engineering ⇨ Operations	⇨ Materials Resource Planning Systems ⇨ Purchase Order Control Systems ⇨ Quality Control Systems
Finance/Accounting systems	⇨ Budgeting ⇨ General ledger ⇨ Billing ⇨ Cost accounting	⇨ General Ledger ⇨ Accounts Receivable/Payable ⇨ Budgeting ⇨ Funds Management Systems
Human Resource systems	⇨ Personnel records ⇨ Benefits ⇨ Compensation ⇨ Labor relations ⇨ Training	⇨ Payroll ⇨ Employee Records ⇨ Benefit Systems ⇨ Career Path Systems
Other types	⇨ Admissions ⇨ Grade records	⇨ Registration Systems ⇨ Student Transcript

	⇨ Course records ⇨ Alumni	System ⇨ Curriculum Class Control Systems ⇨ Alumni Benefactor System

The table above shows that there are five functional categories of TPS: sales/marketing, manufacturing/production, finance/accounting, human resources and other types of TPS that are unique to a particular industry. All organizations have these five kinds of TPS (even if the system is manual). TPS are often so central to a business that TPS failure for a few hours can spell the demise of a firm and perhaps other firms linked to it. Manager needs 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 types of systems. For example, the payroll system illustrated before will supplies data to the company's general ledger system, which is responsible for maintaining records of the firm's income and expenses and for producing reports such as income statements and balance statements.

Information inputs for TPS are normally transactions and events. The processing process for TPS is to sort, list, merge or update the data based on the transactions or events. Information output from TPS is detailed reports, lists or summaries.

Management Level Information Systems

For management level of an organization, two types of information systems involved, which is Management Information System (MIS) Management Information Systems (MIS, information system at the management level of an organization that serve the functions of planning, controlling and decision making by providing routine summary and exception reports) serves the management level of the organization, provides managers with reports and in some cases with on-line access to organization's current performance and historical records. Most of the systems oriented almost exclusively to internal, not environmental or external events. MIS primarily serve the functions of planning, controlling and decision making at the management level. Generally, they are

dependant on underlying TPS for their data. MIS summarize and report on the basic operations of the company. The basic data from TPS are compressed and are usually presented in long reports that are produced on a regular schedule. Figure 3.3 shows how a typical MIS transforms transactions level data from inventory, production and accounting into MIS files that are used to provide managers with reports.

MIS usually serve managers interested in weekly, monthly or yearly results – not day-today activities. MIS generally address structured questions that are known well in advance but the systems are not flexible and have little analytical capability. Most MIS uses simple routines such as summaries and comparisons as opposed to sophisticated mathematical models or statistical techniques.

Some of the characteristics of MIS are as follows:

- MIS support structured decisions at operational and management control levels. However, they are useful for planning purpose of senior management staff.
- MIS are generally reporting and control oriented. They are designed to report on existing operations and therefore to help provide day-to-day control of operations.
- MIS rely on existing corporate data and data flows.
- MIS have little analytical capability.
- MIS generally aid in decision making using past and present data.
- MIS are relatively inflexible.
- MIS have an internal rather than an external orientation.

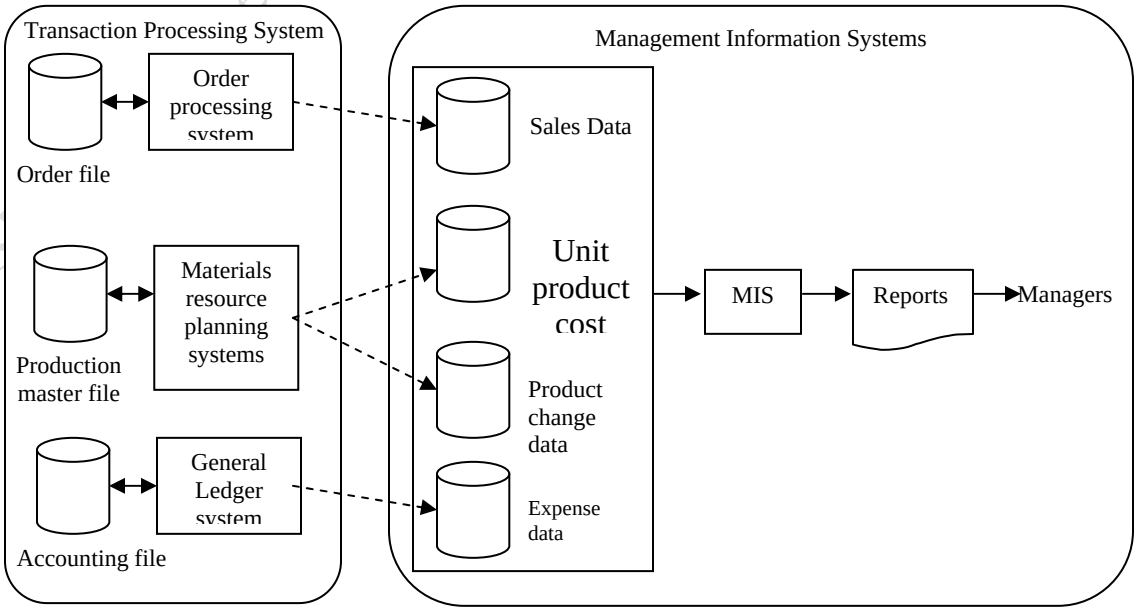


Figure 3-3

Strategic Level Information Systems

Senior managers use Executive Support System (ESS) to make decisions. ESS serve the strategic level of an organization and address unstructured decisions and create a generalized computing and communications environment rather than providing any fixed application or specific capability. ESSs are designed to incorporate data about external events but they also draw summarized information from MIS and DSS. They filter, compress and track critical data, emphasizing the reduction of time and effort required to obtain information useful to executives. ESSs employ the most advanced graphics software and can deliver graphs and data from many sources immediately to a senior executive's office or to a boardroom. Unlike other types of information systems, ESSs are not designed primarily to solve specific problems. Instead, ESSs provide a generalized computing and telecommunications capacity that can be applied to a changing array of problems. While many DSS are designed to be highly analytical, ESS comes with less analytical capabilities. Since ESSs are designed to be used by senior managers who often have little, is any, direct contact or experience with computer-based information systems, they incorporate easy-to-use graphic interfaces.

Figure 3.5 below shows an example of an ESS which consists of workstations with menus, interactive graphics and communication capabilities that can access historical and competitive data from internal corporate systems and external databases:

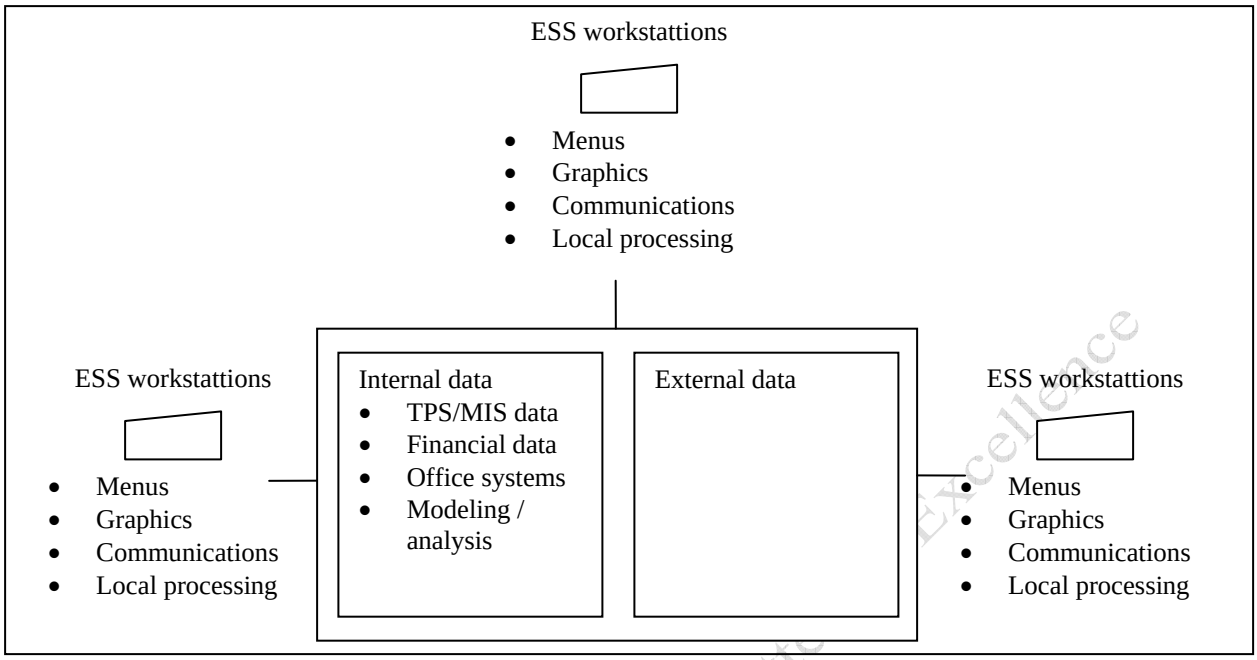
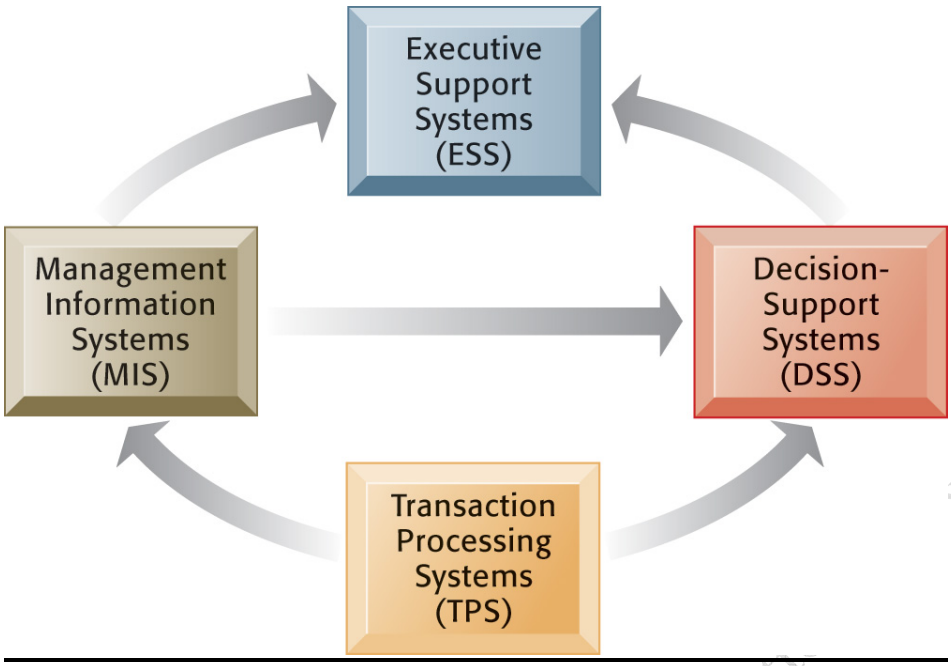


Figure 3.5

Information input for ESSs are aggregate data from external and internal sources. Processing for ESSs are graphics, simulations and interactive between user and the system. Information outputs for ESSs are projections, responses to queries.

3.5 Relationship of Systems to One Another: Integration

The various types of systems in the organization exchange data with one another. TPS are a major source of data for other systems, especially for MIS and DSS. ESS is primarily a recipient of data from lower-level systems. The other types of systems may exchange data with each other as well. Data may also be exchanged among systems serving different functional areas. However, the different systems in an organization are only loosely integrated. The information needs of the various functional areas and organizational levels are too specialized to be served by a single system. Figure 3.6 below shows the relationship between the different systems:



CHAPTER 4: ENTERPRISE BUSINESS SYSTEMS

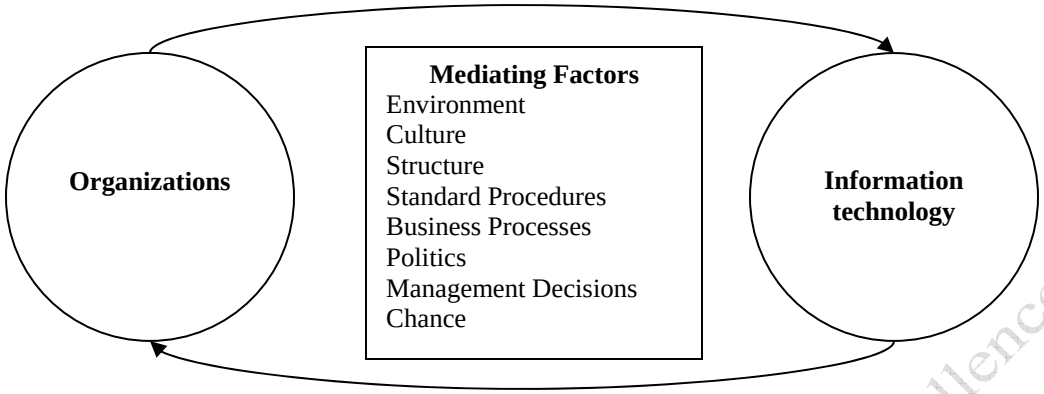
After completing this chapter, you will be able to:

- Identify the salient characteristics of organizations
- Analyze the relationship between information systems and organizations
- Contrasts the classical and contemporary models of managerial activities and roles
- Describe the role of various ***enterprise business systems***

4.1 Organization and Information Systems

Information systems and organizations have a mutual influence on each other. Information systems must be aligned with the organization to provide information needed by important groups within the organization. Meanwhile, organization must be aware of and open itself to the influences of information systems in order to benefit from new technologies. The interaction between information technology and organizations is very complex and is influenced by a great many mediating factors, including the organization's structure, standard operating procedures, politics, culture, surrounding environment and management decisions.

Figure 4.1 below illustrates the two-way relationship between organization and information technology.



Fiaure 4.1

4.1.1 What is an Organization

Organization is a stable, formal social structure that takes resources from the environment and processes them to produce outputs (technical definition). This technical definition focuses on three elements of an organization:

- Capital and labor are primarily production factors provided by the environment.
- The organization (the firm) transforms these inputs into products and services in a production function.
- The products and services are consumed by environments in return for supply inputs.

Figure 4.2 will shows the relation between these three elements. In the technical microeconomic definition of the organization, capitol and labor (the primary production factor provided by the environment) are transformed by the firm through the production process into products and services (output to the environment). The products and services are consumed by the environment, which supplies additional capital and labor as

inputs in the feedback loop.

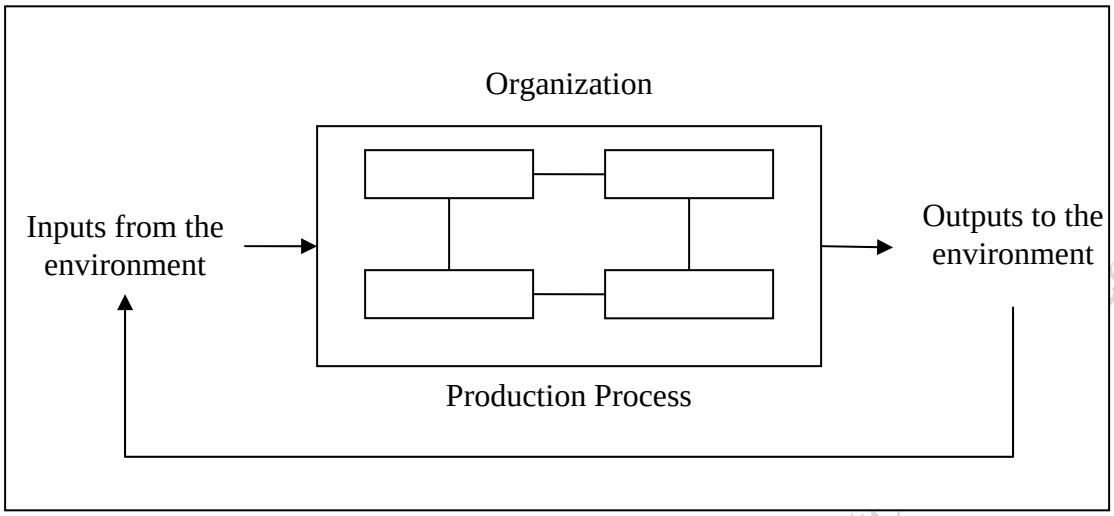


Figure 4.2

An organization is more stable than an informal group in terms of longevity and routine-ness. Organizations are formal legal entities, with internal rules and procedures, that must be abide by laws.

Organizations are also social structure because they are a collection of rights, privileges, obligations and responsibilities that are delicately balanced over a period of time through conflict and conflict resolution (behavioral definition).Figure 4.3 below shows the behavioral view of an organization that emphasizes group relationships, values and structures.

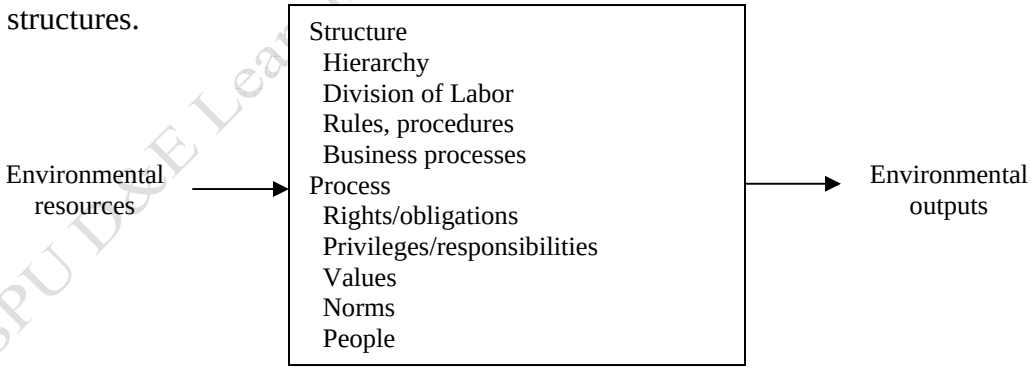


Figure 4.3

From the technical view of organization, it encourages organization to focus upon the way inputs are combined into outputs when technology changes are introduced into the company. The firm is seen as infinitely malleable, with capital and labor substituting for each other quite easily. Meanwhile, from the behavioral view of organization, it

suggests that building new information systems or rebuilding old ones involves much more than a technical rearrangement of machines or workers.

The technical and behavioral definitions of organizations are not contradictory but they complement each other. The technical definition tells us how many thousands of firms in competitive market combine capital, labor and information technology whereas the behavioral models takes us inside the individual firm to see how that technology affects the inner workings of the organization.

4.1.2 Why organizations are so much alike and why organizations are so different

According to Weber, all modern organizations (bureaucracies):

- Have a clear-cut *division of labor and specialization*;
- Arrange specialists in a *hierarchy* of authority;
- Limit authority and action by abstract *rules or procedures* (standard operating procedures, or SOPS);
- Create a system of *impartial and universalistic decision making*;
- Are devoted to the *principle of efficiency*: maximizing output using limited inputs.

Some supplements to Weber, identifies some additional features for organization as following:

- Have Standard Operating Procedures – a set of precise rules, procedures and practices developed by organization to cope with virtually all expected situations.
- Have Organizational Politics.
- Have Organizational Culture – the set fundamental assumptions about what products the organization produces, how and where it should produce them and for whom they should be produced.

Although all organizations do have common characteristics, no two organizations are identical. The differences of organizations are like:

- Structures.
- Goals.
- Constituencies.
- Leadership styles.
- Tasks

- Surrounding environments.
- Power.
- Function.
- Technology.
- Business processes.
- Levels

4.2 The Changing Role of Information Systems

The development of information architecture of organizations has change from:

- Electronic accounting machines (EAM) in 1950s with isolated "electronic accounting machines" with limited functions.
- Data processing departments in 1960s with large, centralized mainframe computers that served corporate headquarters and a few remote sites.
- Information systems in 1970s with midsized minicomputers located in individual departments or divisions of the organization that were networked to large, centralized computers.
- Information systems and services in 1980s with desktop PCs used dependently and linked to minicomputers and large computers.
- Enterprise-wide information utility from 1990 until recently with computers coordinated information flowing among desktops, between desktops, among minicomputers and mainframes and perhaps among hundreds of smaller local networks. These networks can be connected into a network linking the entire enterprise or linking to external networks, including Internet.

The position and role of information system specialists also have evolved over time. The formal organizational unit or function that has emerged is called information systems department. In the early years, the information systems group was composed mostly of programmers, highly trained technical specialists who wrote the software instructions for the computer. Today a growing proportion of staff members are system analysts, who constitute the principal liaison between the information systems group and the rest of the organization and the main job function of a system analyst is to translate

business problem and requirements into information requirements and systems. Information systems managers are leaders of teams of programmers and analysts, projects managers, physical facility managers, telecommunication managers and heads of office automation groups. They are also managers of computer operations and data entry staffs. End users are representatives of departments outside of the information systems group for whom applications are developed. In most organizations, the information systems department is headed by a chief information officer (CIO).

4.2.1 Why Organizations Build Information Systems

Some of the general benefits why organizations adopt information systems are as follow:

- More efficient.
- Save money.
- Reduce work force.
- Become vitally important simply to stay in business.
- A source of competitive advantage.
- More innovative than others.
- Satisfy the ambitious of various groups within an organization.

Figure 4.4 below shows the system development process that includes many considerations other than economic. The model divides the explanation for why organization adopts systems into two groups:

- *External environment factors* (constraints and opportunities) that influence the adoption and design of information systems. Examples of external constraints would be the rising costs of labor or other resources, the competitive actions of other organizations and changes in government regulations. Examples of external opportunities include new technologies, new sources of capital, the demise of a competitors or a new government program.
- *Institutional factors* are factors internal to the organization that influence the adoption and design of information systems. They may include values, norms and vital interests that govern matters of strategic importance to the organization.

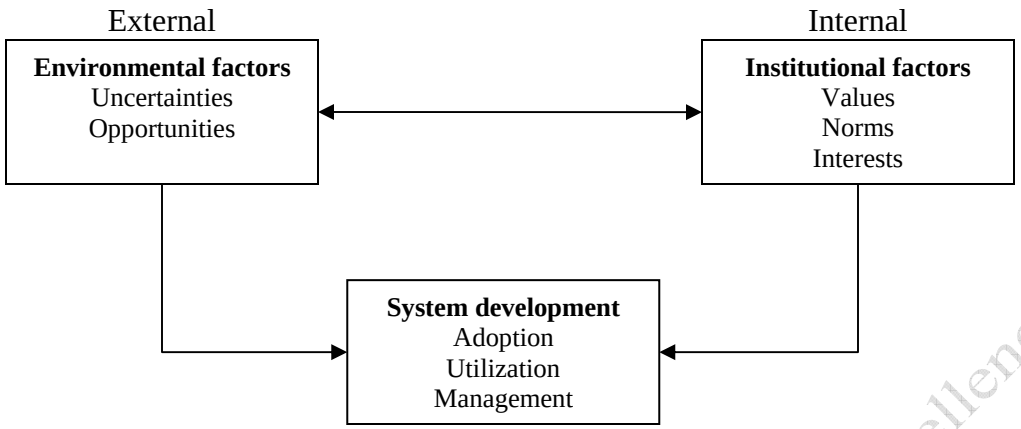


Figure 4.4

4.3 The Role of Managers in the Organization

Managerial roles are expectations of the activities that managers should perform in an organization. Their responsibilities range from making decisions to writing reports, to attend meetings. Behavioral model is used to describe the management based on behavioral scientists' observations of what managers actually do in their jobs. According to Mintzberg, these managerial roles fell into three categories:

- *Interpersonal roles*

Managers act as figureheads for the organization when they represent their companies to the outside world and perform symbolic duties. Managers act as leaders, attempting to motivate, counsel and support subordinates. Managers also act as a liaison between various levels of the organization; within each of these levels, they serve as a liaison among the members of the management team. Managers provide time and favors, which they expect to be returned.

- *Informational roles*

Managers act as the nerve centers of their organization, receiving the most concrete, up-to-date information and redistributing it to those who need to be aware of it. Managers are therefore information disseminators and spokesperson for their organization.

- *Decision roles*

Managers act as entrepreneurs by initiating new kinds of activities. They handle disturbances arising in the organization. They allocate resources to staff members who

need them. They negotiate conflicts and mediate between conflicting groups in the organization.

ENTERPRISE BUSINESS SYSTEMS

The enterprise applications are vital in any organization; they consist of enterprise systems, supply chain management systems, customer relationship management systems.. These enterprise applications span the entire firm, integrating information from multiple functions and business processes to enhance the performance of the organization as a whole.

1. Customer Relationship Management Systems (CRM)

The use of information technology to create a cross-functional enterprise system that integrates and automates many of the customer-serving processes in sales, marketing, and customer services that interact with a company's customers. It Coordinate all of the business processes that deal with customers to optimize revenue and customer satisfaction, and increase sales;Sales, marketing, and service record data from multiple communication channels can be combined

Some basic functions of CRM includes :

- **Contact and Account Management:** helps sales, marketing, and service professionals capture and track relevant data about every past and planned contact with prospects and customers, as well as other business and life cycle events of customers.
- **Sales:** provides sales reps with tools and company data sources needed to support and manage sales activities, and optimize cross-selling and up-selling
- **Customer Service and Support:** provides service reps with software tools and real-time access to the common customer database shared by sales and marketing professionals
- **Marketing Fulfillment:** help marketing professionals accomplish direct marketing campaigns by automating such tasks as qualifying leads for targeted marketing, and scheduling and tracking direct marketing mailings

- **Retention and Loyalty Programs:** help a company identify, reward, and market to their most loyal and profitable customers e.g Smart card for Supermarkets to track buyers spending habits

The *phases of CRM of process are summarised below in* *Figure 4.5*

:

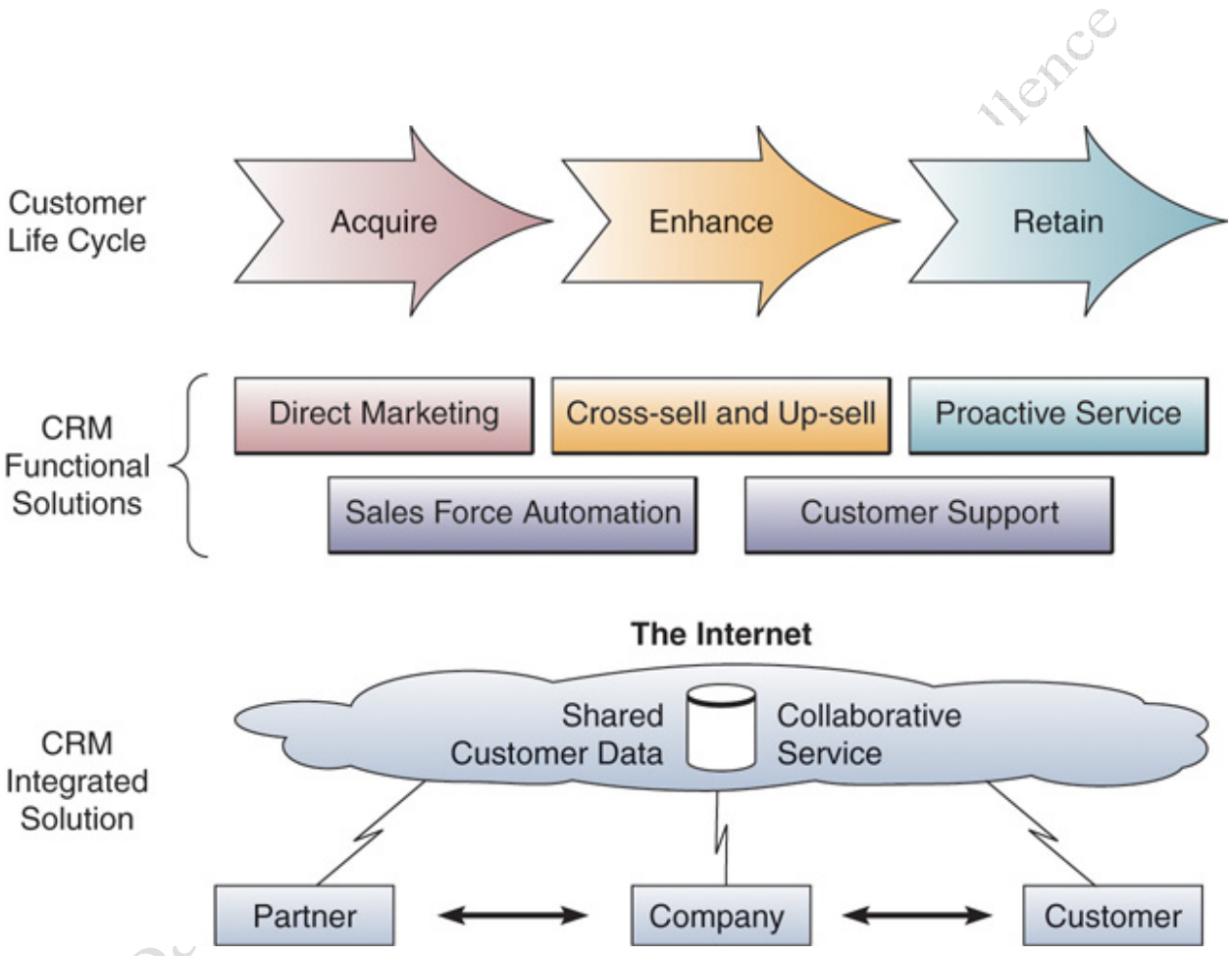


Figure 4.5

- **Acquire** new customers by doing a superior job of contact man-agement, sales prospecting, selling, direct marketing, and fulfillment
- **Enhance** relationship with customer by supporting superior service from a responsive networked team of sales and service specialists and business partners
- **Retain** and expand business with customers by proactively identifying and rewarding the most loyal and profitable customers

BENEFITS OF CRM

- CRM allows a business to identify and target their best customers so they can be retained as lifelong customers for greater and more profitable services
- CRM makes possible real-time customization and personalization of products and services based on customer wants, needs, buying habits, and life cycles.
- CRM can keep track of when a customer contacts the company, regardless of the contact point
- CRM systems can enable a company to provide a consistent customer experience and superior service and support across all the contact points a customer chooses

CHALLENGES OF CRM

- Lack of understanding and preparation
- Rely on CRM to solve business problem without first developing the business process changes and change management programs that are required
- CRM projects implemented without the participation of the business stakeholders involved.

2. Supply chain management

A supply chain or logistics network is the system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains as shown in (*Figure 4.6)*

Supply chain management (SCM) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by

end customers Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption (supply chain).*)*

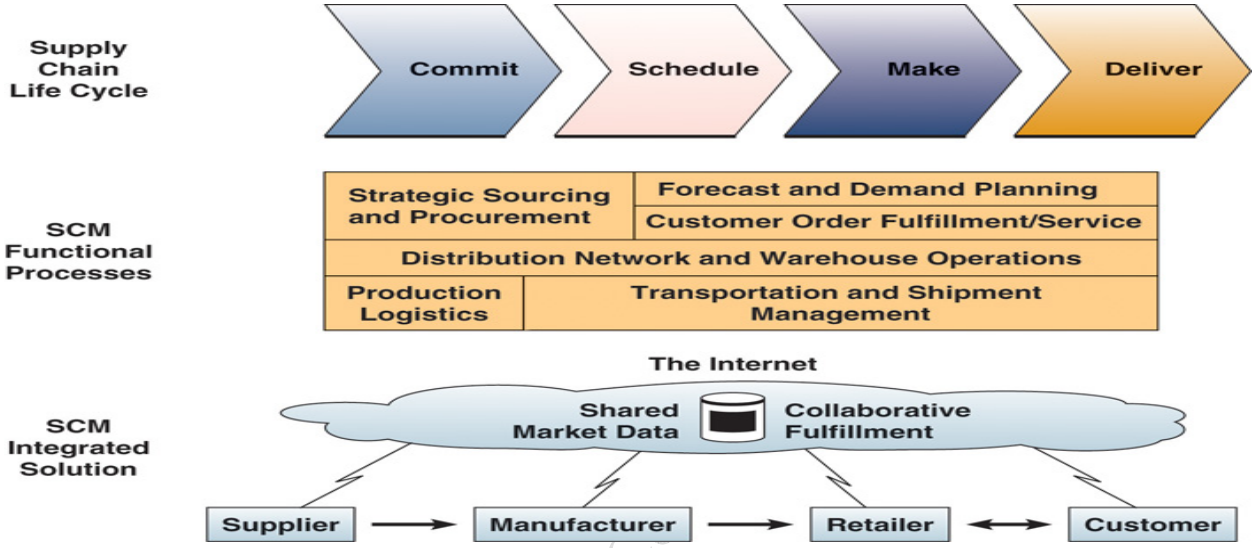


Figure 4.6

There are components of supply chain that are enhanced through internal departments that is the internal supply chain as shown in Figure 4.6 below

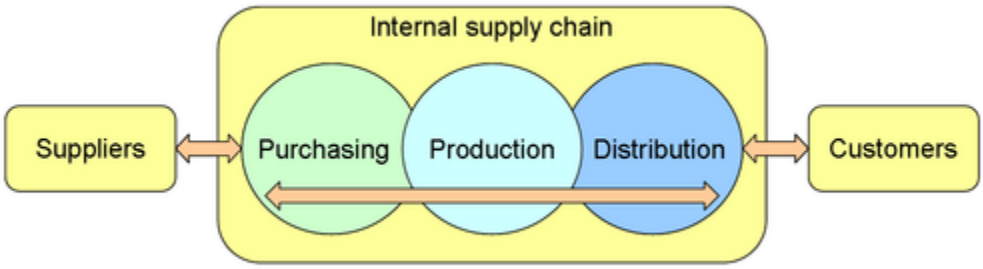


Figure 4.6

The objectives of an effective supply chain are summarised in figure 4.7 below

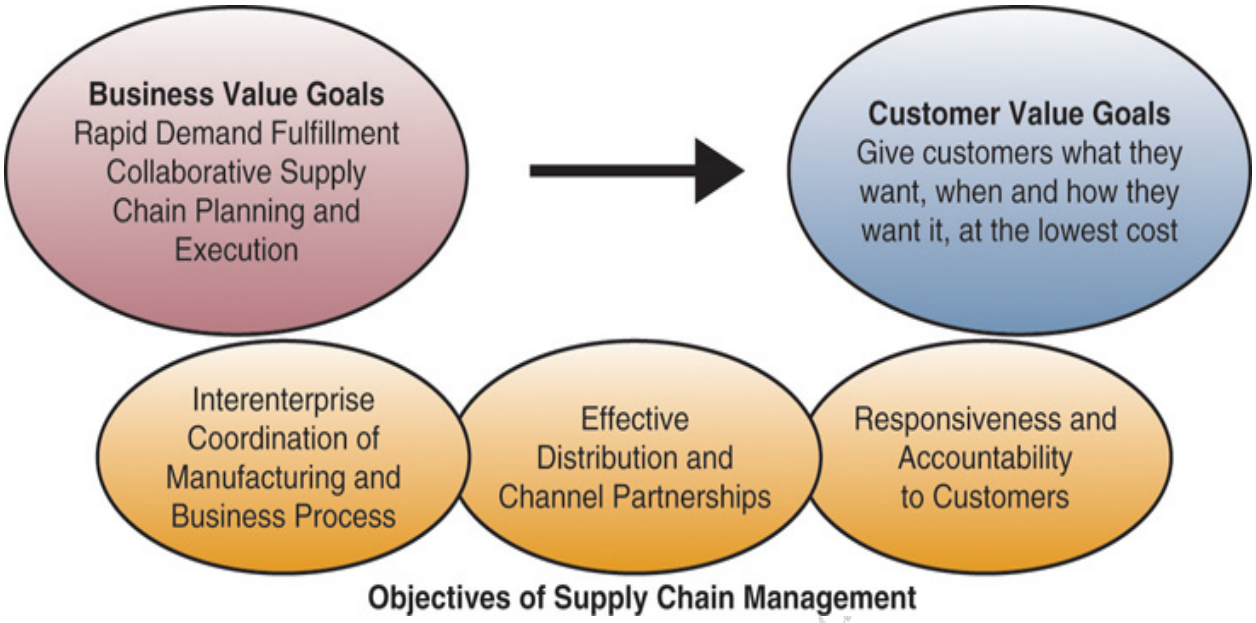


Figure 4.7

Some of the functions that can be achieved through the SCM system includes :

- **Materials Management:** share accurate inventory and procurement order information, ensure materials required for production are available in the right place at the right time, and reduce raw material spending, procurement costs, safety stocks, and raw material and finished goods inventory
- **Collaborative Manufacturing:** optimize plans and schedules while considering resource, material, and dependency constraints
- **Collaborative Fulfillment:** commit to delivery dates in real time, fulfill orders from all channels on time with order management, transportation planning, and vehicle scheduling, and support the entire logistics process, including picking, packing, shipping, and delivery in foreign countries
- **Supply Chain Event Management:** monitor every stage of the supply chain process, from price quotation to the moment the customer receives the product, and receive alerts when problems arise
- **Supply Chain Performance Management:** report key measurements in the supply chain, such as filling rates, order cycle times, and capacity utilization

BENEFITS OF SCM

- Faster, more accurate order processing
- Strategic relationship with suppliers.

- Lower transaction and material costs.
- Quicker times to market

Why SCM may fail.

- Lack of proper demand planning knowledge, tools and guidelines
- Inaccurate or overoptimistic demand forecasts
- Inaccurate production, inventory and other business data provided by a company's other information systems
- Lack of adequate collaboration among marketing, production, and inventory management departments within a company
- Immature, incomplete or hard to implement SCM software tools

3. Enterprise Planning systems

Also known as enterprise resource planning (ERP) systems. They Integrate key business processes of an entire firm into a single system enabling managers of large firms to assemble an overall view of operations.

It is A cross-functional enterprise system driven by an integrated suite of software modules that supports the basic internal business processes of a company

BENEFITS OF ERP

- **Quality and Efficiency:** ERP creates a framework for integrating and improving a company's internal business processes that results in significant improvements in the quality and efficiency of customer service, production, and distribution
- **Decreased Costs:** Significant reductions in transaction processing costs and hardware, software, and IT support staff

- **Decision Support:** Provides vital cross-functional information on business performance quickly to managers to significantly improve their ability to make better decisions in a timely manner
- **Enterprise Agility:** ERP breaks down many former departmental and functional walls of business processes, information systems, and information resources

WHY DO ERPS FAIL?

- Business mangers and IT professionals underestimate the complexity of the planning, development, and training needed
- Failure to involve affected employees in the planning and development phases
- Failure to do enough data conversion and testing

CHAPTER 5: DATA RESOURCE MANAGEMENT

After completing this chapter, you will be able to:

- Identify the salient characteristics of databases
- Analyze the relationship between database management and effective organizations
- Contrasts the database systems and contemporary file systems

The purpose of secondary storage, like a library, is to store information. This information could be stored in databases. We put a lot of effort in the design of databases so that we could retrieve information easily. Also, so that with little or no programming we can obtain the information that we need. To store and process information, data are organized into a hierarchy as follows:

Hierarchical organization of data

The way data are hierarchically organized is as follows:

Character: A character is a single letter, number, or special character such as a punctuation mark.

Field: A field contains a set of related characters. On a college registration form or a driver's license, a person's first name is a field. .Street address is another field.

Record: A record is a collection of related fields. Everything on a person's driver's license, including number and expiration date, is a record.

File: A file is a collection of related records. All the driver's licenses issued in one county could be a file.

Database: Files or records that are logically related.

To uniquely identify a record a key field is used. A key field may be social security number, employee identification number, or part number.

Batch Versus Real-Time Processing

Traditionally data is processed in two ways. These are (1) batch processing, what we might call "later," and (2) real-time processing, what we might call "right away." These two methods have been used to handle common record-keeping activities such as payroll and sales orders.

Batch processing: In batch processing, data is collected over several days or weeks. It is then processed all at once—as a "batch.".

Real-time processing: Real-time processing occurs when data are processed at the same time the transaction occurs.

Master Versus Transaction Files

Two types of files arc commonly used to update data—a master file and a transaction file.

The master file is a complete file containing all records current up to the last update. An example is the data file used to prepare your last month's telephone bill or bank statement.

The transaction file contains recent changes to records that will be used to update the master file. An example could be a temporary "holding" file that accumulates telephone charges or bank deposits and withdrawals through the present month.

FILE ORGANIZATION

The files are stored physically in secondary storage media. The way records are stored physically is known as file organization. File organization determined the manner of access to the records. File organization may be of three types: sequential, direct, and index sequential.

Sequential file organization: In a sequential file, records are physically stored one after another in some order. This order is determined by the key field on each record, such as the student identification number. In this arrangement, to find the record about a particular student, the registrar's office would sequentially search through the records. It would search them one at a time until the student's number was found. If your number is 8315, the computer will

start with record number 0000. It will go through 0001, 0002, and so on, until it reaches your number.

Sequential files are often stored on tape, although disk packs may also be used. They are appropriate for payroll processing.

Direct file organization: For direct file organization, records are not stored physically one after another. Rather, they are stored on a disk in a particular location that can be determined by their key field. Knowing the key field allows the computer to access the record directly; no sequential search is necessary. In direct tile organization, data must be stored on disks. Also, a method must exist for going directly to the key fields of all records. Direct file organization could be appropriate for seat reservation in passenger transport systems..

Index sequential file organization. Index sequential file organization is a compromise between sequential and direct file organizations. It stores records in a file in sequential order. However, an index sequential file also contains an index. The index lists the key to each group of records stored and the corresponding disk address for that group. When the user seeks a particular record, the computer starts searching sequentially by looking at the beginning of the group of records. .For example, the college registrar could index certain ranges of student identification numbers—0000 to 2000, 2001 to 4000, and so on. For the computer to find your number (e.g., 8315), it would first go to the index. The index would give the location of the range in which your number appears on the disk (e.g., 8001 to 10,000). The computer would then search sequentially (from 8001) to find your number. Index sequential file organization requires disks or other direct access storage device. Index sequential file organization could be appropriate bank applications.

All three kinds of file organization have their advantages and disadvantages.

Advantages and disadvantages of file organizations

The advantage of sequential files is that they are useful when all or a large part of the records need to be accessed—for example, when the next term's course offerings are being mailed out. They also have a cost advantage, since they can be stored on magnetic tape, which is less expensive

than disk. The disadvantage of sequential files is that records must be ordered in a certain way and be searched one at a time.

The advantage of direct file organization is that it is much faster than sequential for locating a specific record. For example, if your grades were stored in a direct file, the registrar could access them very quickly. They could be accessed just by your student identification number. The disadvantage of this form of organization is cost. It needs more storage on a hard disk. It also is not as good as sequential file organization for large numbers of updates or for listing large numbers of records.

Index sequential file organization is faster than sequential but not as fast as direct access. This kind is best used when large batches of transactions must occasionally be updated, yet users also want frequent, quick access to records. For example, every month a bank will update bank statements to send to its customers. However, customers and bank tellers need to be able to have up-to-the-minute information about checking accounts

Database is a shared collection of logically related data designed to meet the information needs of an organization. The need for database arises from the limitation of traditional file processing systems (file-based system or approach).

File-based system is a collection of application programs that perform services such as the production of reports for the end-users. In this system, each program defines and manages its own data and has several limitations.

Limitation of file-based systems

Separation and isolation of data

When data is isolated in separate files, it is more difficult to access data that should be available especially if we require data from more than two files.

Duplication of data

Given that each application has its own data file, there is duplication of data. This results in wastage of storage space, more efforts, money and time to enter the data more than once and update data file and loss of data integrity and consistency.

Data dependence

In file-based systems, the physical structure and storage of the data files and records arc defined in the application code. (This characteristic of file-based systems is known as program-data dependence.) This means that changes to an existing data file structures are more demanding to make. The reason is that when such changes are made, related changes would be made in the appropriate programs. This is time consuming and error prone.

Incompatible file formats

Because the structure of data files (in file-based systems) is embedded in the application programs, the structures are dependent on the application programming language. Thus structures in file-based systems of different data file are bound to be different hence incompatible. For example, the structure of a file generated by a COBOL program may be different from the structure of a file generated by a 'C' program. The direct incompatibility of such files makes them difficult to process jointly.

Fixed queries/proliferation of application programs

File-based systems are very dependent upon the application developer, who has to write any queries or reports that are required. As a result:

- In some organizations, the type of query or report that could be produced is fixed. There is no facility for asking unplanned (that is, spur-of-the-moment or ad hoc) queries either about the data itself or about which types of data are available.

- In other organizations, there has been a proliferation of files and application programs. Eventually, this reaches a point where the DP Department, with its current resources, cannot not handle all the work. This put tremendous pressure on the DP staff, resulting in programs that are inadequate or inefficient in meeting the demands of the users, documentation that is limited, and maintenance that is difficult. Often, certain types of functionality would be omitted including:
    - Lack of provision for security or integrity
    - Limited or non-existent recovery, in the event of a hardware or software failure;

File access

Access to the files is restricted to one user at a time - there is no provision for shared access by staff in the same department.

Characteristics of the Database Approach

In the database approach, a single repository of data is maintained that is defined once and then is accessed by various users. The main characteristics of the database approach are:

Self Describing Nature of a Database System

Database system contains not only the database itself but also a complete definition or description of the database structure and constraints. This definition is stored in the system catalog, which contains information such as the structure of each file, the type and storage format of each data item, and various constraints on the data. The information stored in the catalog is called metadata, and it describes the structure of the primary database. The catalog is used by the DBMS software and also by database users who need information about the database structure. A general purpose DBMS software package is not written for a specific database application, and hence it must refer to the catalog to know the structure of the files in a specific database, such as the type and format of data it will access.

Insulation between Programs and Data

in database systems, structure of data files is stored in the DBMS catalog separately from the access programs. This property is program-data independence. So when structure of the database is changed, we would just need to need te-change the description in the catalog to reflect the change; no programs are changed. The next time a DBMS program refers to the catalog, the new structure of records will be accessed and used.

Support of Multiple Views of the Data

A database typically has many users, each of whom may require a different perspective or view of the database. A view may be a subset of the database or it may contain virtual data that is derived from the database files but is not explicitly stored. A multi-user DBMS whose users have a variety of applications must provide facilities for defining multiple views.

Sharing of Data and Multiuser Transaction Processing

A multiuser DBMS, must allow multiple users to access the database at the same time. This is essential if data for multiple applications is to be integrated and maintained in a single database. The DBMS must include concurrency control software to ensure that several users trying to update the same data do so in a controlled manner so that the result of the updates is correct. For example, when several reservation clerks try to assign a seat on an airline flight, the DBMS should ensure that each seat can be accessed by only one clerk at a time for assignment to a passenger.

Components of the Database systems

Hardware

The DBMS and the applications require hardware to run. The hardware can range from a single personal computer, to a single mainframe, to a network of computers. The particular hardware depends on the organization's requirements and the DBMS used. Some DBMSs run only on particular hardware or operating systems, while others run on a wide variety of hardware and operating systems.

Software

The software component comprises the DBMS software itself and the application programs, together with the operating system, including network software if the DBMS is being used over a network. Typically, application programs are written in a third-generation programming language (3GL), such as C, C++, Java, Visual Basic, COBOL, Fortran, Ada, or Pascal, or using a fourth-generation language (4GL), such as SQL, embedded in a third-generation language. The target DBMS may have its own fourth-generation tools that allow rapid development of applications through the provision of non-procedural query languages, reports generators, forms generators, graphics generators, and application generators. The use of fourth-generation tools can improve productivity significantly and produce programs that are easier to maintain.

Data

The database contains both the operational data and the metadata, the 'data about data'. The structure of the database is called the schema.

Procedures

Procedures refer to the instructions and rules that govern the design and use of the database. The users of the system and the staff that manage the database require documented procedures on how to use or run the system. These may consist of instructions on how to: log on to the DBMS; use a particular DBMS facility or application program; start and stop the DBMS; make backup copies of the database; handle hardware or software failures.

Included also are the procedures on how to identify the failed component, how to fix the failed component; how to recover the database; change the structure of a table, reorganize the database across multiple disks, improve performance, or archive data to secondary storage.

People

We can identify four distinct types of people that participate in the Database environment: data and database administrators, database designers, application developers, and the end-users

- Data and Database Administrators The database and the DBMS are corporate resources that must be managed like any other resource. Data and database administration are the roles generally associated with the management and control of a DBMS and its data. The Data Administrator (DA) is responsible for the management of the data resource including database planning, development and maintenance of standards, policies and procedures, and conceptual/logical database design. The DA consults with and advises senior managers, ensuring that the direction of database development will ultimately support corporate objectives.

The Database Administrator (DBA) is responsible for the physical realization of the database, including physical database design and implementation, security and integrity control, maintenance of the operational system, and ensuring satisfactory performance of the applications for users. The role of the DBA is more technically oriented than the role of the DA, requiring detailed knowledge of the target DBMS and the system environment.

In some organizations there is no distinction between these two roles; in others, the importance of the corporate resources is reflected in the allocation of teams of staff dedicated to each of these roles.

- logical database designers and physical database designers

Found in large database design projects. The logical database designer is concerned with identifying the data (that is, the entities and attributes), the relationships between the data, and the constraints on the data that is to be stored in the database. The logical database designer must have a thorough and complete understanding of the organization's data and any constraints on this data (the constraints are sometimes called business rules).

The physical database designer decides how the logical database design is to be physically realized. This involves:

• mapping the logical database design into a set of tables and integrity constraints;

• selecting specific storage structures and access methods for the data to achieve good performance;

• designing any security measures required on the data.

Application Developers

Once the database has been implemented, the application programs that provide the required functionality for the end-users must be implemented. This is the responsibility of the application developers. Typically, the application developers work from a specification produced by systems analysts. Each program contains statements that request the DBMS to perform some operation on the database. This includes retrieving data, inserting, updating, and deleting data. The programs may be written in a third-generation programming language or a fourth-generation language, as discussed in the previous section.

- End-Users

The end-users are the 'clients' for the database, which has been designed and implemented, and is being maintained to serve their information needs. End-users can be classified according to the way they use the system:

Naive users are typically unaware of the DBMS. They access the database through specially written application programs that attempt to make the operations as simple as possible. They invoke database operations by entering simple commands or choosing options from a menu. This means that they do not need to know anything about the database or the DBMS. For example, the checkout assistant at the local supermarket uses a bar code reader to find out the price of the item. However, there is an application program present that reads the bar code, looks up the price of the item in the database, reduces the database field containing the number of such items in stock, and displays the price on the till.

Sophisticated users. At the other end of the spectrum, the sophisticated end-user is familiar with the structure of the database and the facilities offered by the DBMS. Sophisticated end-users may use a high-level query language such as SQL to perform the required operations. Some sophisticated end-users may even write application programs for their own use.

Database management systems (DBMS)

DBMS is a software system that enables users to define, create, maintain database and control access to the database. The DBMS is the software that interacts with the users' application programs and the database. Typically, a DBMS provides the following facilities:

- It allows users to define the database, usually through a Data Definition Language (DDL). The DDL allows users to specify the data types and structures and the constraints on the data to be stored in the database.

- It allows users to insert, update, delete, and retrieve data from the database, usually through a Data Manipulation Language (DML). Having a central repository for all data and data descriptions allows the DML to provide a general inquiry facility to this data, called a query language. The provision of a query language alleviates the problems with file-based systems where the user has to work with a fixed set of queries or there is a proliferation of programs, giving major software management problems. The most common query language is the Structured Query Language (SQL, pronounced 'S-Q-L', or

sometimes 'See-Quel'), which is now both the formal and de facto standard language for relational DBMSs.

- It provides controlled access to the database.

-It may provide:

- a security system, which prevents unauthorized users from accessing the database;
- an integrity system, which maintains the consistency of stored data;
- a concurrency control system, which allows shared access and update of the database while maintaining data integrity;
- a recovery control system, which restores the database to a previous consistent state following a hardware or software failure;
- a user-accessible catalog, which contains descriptions of the data in the database this is the data dictionary (which keeps meta - data or data about data).

Basically the DBMS has the following major uses:

Database development. Define and organize the content, relationships, and structure of the data needed to build a database, including any hyperlinks to data on Web pages.

Database interrogation. Access the data in a database to display information in a variety of formats. End users can selectively retrieve and display information and produce forms, reports, and other documents, including Web pages.

Database maintenance. Add, delete, update, and correct the data in a database, including hyperlinked data on Web pages.

Application development. Develop prototypes of Web pages, queries, forms, reports, and labels for a proposed business application. Use a built-in 4GL or application generator to program the application.

Advantages of DBMSs

The advantages of database management systems include:

- **Control of data redundancy**

Database approach integrates data in such a way that redundancy in minimized. It does not eliminate redundancy entirely, but controls the amount of redundancy inherent in the database. Sometimes, it is necessary to duplicate key data items to model relationships. At other times, it is desirable to duplicate some data items to improve performance. The reasons for controlled duplication will become clearer as you read the next few chapters.

- **Data consistency**

By eliminating or controlling redundancy, we reduce the risk of inconsistencies occurring. If a data item is stored only once in the database, any update to its value has to be performed only once and the new value is available immediately to all users. If a data item is stored more than once it may not be updated consistently in all locations leading to inconsistencies.

- **More information from the same amount of data**

With the database approach, it may be possible for the organization to derive additional information from the same data. For example, average sales in respect of a salesperson could be determined from the salesperson's sales in a period.

- **Sharing of data**

The database belongs lo the entire organization and can be shared by all authorized users. In this way, more users share more of the data. Furthermore, new applications can build on the existing data in the database. The new applications can also rely on the functions provided by DBMS, such as data definition and manipulation, and concurrency and recover) control, rather than having to provide these functions themselves.

- **Improved data integrity**

Database integrity refers to the validity and consistency of stored data. Integrity is usually expressed in terms of constraints, which are consistency rules that the database is not permitted to violate. Constraints may apply to data items within a single record or they may apply to relationships between records.

- **Improved security**

Database security is the protection of the database from unauthorized users. Without suitable security measures, integration makes the data more vulnerable than file-based systems. However, with DBMS the DBA can define, and the DBMS would enforce, database security. This may take the form of user names and passwords to identify people authorized to use the database. The access that an authorized user is allowed on the data may be restricted.

- **Enforcement of standards**

With DBMS, the DBA can define and enforce the necessary standards. These may include departmental, organizational, national, or international standards for such things as data formats to facilitate exchange of data between systems, naming conventions, documentation standards, update procedures, and access rules.

- **Economy of scale**

Combining all the organization's operational data into one database, and creating a set of applications that work on this one source of data, can result in cost savings. In this case, the budget that would normally be allocated to each department for the development and maintenance of its file-based system can be combined, possibly resulting in a lower total cost, leading to an economy of scale.

- **Balance of conflicting requirements**

Each user or department has needs that may he in conflict with the needs of other users. Since the database is under the control of the DBA, the DBA can make decisions about the design and operational use of the database that provide the best use of resources for the organization as a whole. These decisions will provide optimal performance for important applications, possibly at the expense of less critical ones.

- **Improved data accessibility and responsiveness**

As a result of integration, data that crosses departmental boundaries are directly accessible to the end-users. This provides a system with potentially much more functionality that can, for example, be used to provide better services to the end-user or the organization's clients. Many DBMSs provide query languages or report writers that allow users to ask ad hoc questions and to obtain the required information almost immediately at their terminal, without requiring a programmer to write some software to extract this information from the database. SQL command could be used.

- **Increased productivity**

The DBMS provides many of the standard functions that the programmer would normally have to write in a file-based application. At a basic level, the DBMS provides all the low-level file-handling routines that are typical in application programs. The provision of these functions allows the programmer to concentrate on the specific functionality required by the users without having to worry about low-level implementation details. Many DBMSs also provide a fourth-generation environment consisting of tools to simplify the development of database applications. In addition should a database contain the data required by a new application being developed, new database need not be developed for the application.

Instead, the new application would use the existing database, thus saving on the database design time and cost. All these result in increased programmer productivity and reduced development time (with associated cost savings).

- **Improved maintenance through data independence**

In file-based systems, the descriptions of the data and the logic for accessing the data are built into each application program, making the programs dependent on the data. A change to the structure of the data file, for example making an address 41 characters instead of 40 characters, or a change to the way the data are stored on disk, can require substantial alterations to the programs that are affected by the change. In contrast, a DBMS separates the data descriptions from the applications, thereby making applications immune to changes in the data descriptions. This is known as data independence. The provision of data independence simplifies database application maintenance.

- **Increased concurrency**

In some tile-based systems, if two or more users are allowed to access the same file simultaneously, it is possible that the accesses will interfere with each other, resulting in loss of information or even loss of integrity. Many DBMSs manage concurrent database access and ensure such problems cannot occur.

- **Improved backup and recovery services**

Many file-based systems place the responsibility on the user to provide measures to protect the data from failures to the computer system or application program. This may involve taking a nightly backup of the data. In the event of a failure during the next day, the backup is restored and the work that has taken place since this backup and is lost has to be re-entered.

Disadvantages

The disadvantages of the database approach include:

- **Complexity**

The provision of the functionality we expect of a good DBMS makes the DBMS an extremely complex piece of software. Database designers and developers, the data and

database administrators, and end-users must understand this functionality to take full advantage of it.

- **Size**

The complexity and breadth of functionality makes the DBMS an extremely large piece of software, occupying many megabytes of disk space and requiring substantial amounts of memory to run efficiently.

- **Cost of DBMSs**

The cost of DBMSs varies significantly, depending on the environment and functionality provided. There is also the recurrent annual maintenance cost, which is typically a percentage of the list price.

- **Additional hardware costs**

The disk storage requirements for the DBMS and the database may necessitate the purchase of additional storage space. Furthermore, to achieve the required performance, it may be necessary to purchase a larger machine, perhaps even a machine dedicated to running the DBMS. The procurement of additional hardware results in further expenditure.

- **Cost of conversion**

The cost of DBMS, extra hardware, converting existing applications to run on the new DBMS and hardware, training staff to use these new systems, and possibly the employment of specialist staff to help with the conversion and running of the system is high. This cost is one of the main reasons why some organizations feel tied to their current (often legacy) systems and cannot switch to more modern database technology. The term legacy system is sometimes used to refer to an older, and usually inferior, system.

- **Performance**

Typically, a file-based system is written for a specific application, such as invoicing. As a result, performance is generally very good. However, the DBMS is written to be more

general, to cater for many applications rather than just one. The effect is that some applications may not run as fast as they could.

- **Higher impact of a failure**

The centralization of resources increases the vulnerability of the system. Since all users and applications rely on the availability of the DBMS, the failure of certain components can bring operations to a halt.

When to justify database approach

Despite the fact that databases are very convenient in information processing, their application need to be justified. Situations in which it is advantageous to apply database include when:

- Application needs are constantly changing
- Requirements to answer ad hoc questions are needed
- There is a need to reduce new application development time and costs
- Many data elements are shared by users throughout the organization
- There is a need to communicate and relate data cross functional and departmental boundaries
- There is a need to improve quality and consistency of data
- Substantially dedicated programming assistance is not normally available.

CHAPTER 6: TELECOMMUNICATION AND NETWORKS

After completing this chapter, you will be able to:

- Discuss key concepts of telecommunications
- Contrasts the various topologies
- Highlight the trends in Networked economy

Telecommunications is the communication of information any form (voice, data, text, images, audio, video) by electronic means, usually over some distance. Previously, telecommunications meant voice transmission over telephone lines. Today, a great deal of telecommunications transmission is digital data transmission in which computers transmit data from one location to another.

People wish to connect computers together for reasons which include:

- Users working at their own computers, often in different locations, have access to programs, files, data from a data base, documents, and the like that are stored elsewhere. The users can also communicate using e-mail or "talk" services, or they can use groupware to work together on documents.
- It is often desirable to share valuable resources such as printers, a large disk facility, programs, or a data base among two or more computers.
- Users may connect their computers to powerful computer resources, such as CompuServe, Dow Jones News, other on-line services, the Internet, or computer bulletin boards to access and retrieve information, obtain support services, conduct business, purchase goods, discuss common interests, play games, or simply socialize.
- Computers can be used together to increase system reliability by providing redundant processing. Two or more CPUs can be executing the same program, and the results can be compared by the computers continuously. Connecting computers together also makes it possible to switch

processing to a backup computer in the event of failure of a CPU. Such systems are called fault-tolerant systems. Fault-tolerant systems often provide redundancy on other devices, such as disks, as well.

- Computer power can be increased by combining multiple CPUs or computers to work together. Grouping multiple CPUs means that multiple processes can be executed simultaneously. As another approach, a program may be executed more rapidly by distributing its execution so that each connected CPU or computer may be executing different parts of the program.
- Actually, it is rare today to see a computer that operates totally independently of other computers.

Functions of telecommunications systems

In order to send and receive information from one place to another, a telecommunications system must perform a number of separate functions. The system transmits information, establishes the interface between the sender and the receiver, routes messages along the most efficient paths, performs elementary processing of the information to ensure that the right message gets to the right receiver, performs editorial tasks on the data (such as checking for transmission errors and rearranging the format), and converts messages from one speed (say, the speed of a computer) into the speed of a communications line or from one format to another. Finally, the telecommunications system controls the flow of information. Many of these tasks are accomplished by computer. Telecommunications systems have several components that make performance of the functions possible. These include: computers to process information; terminals or any input/output devices that send or receive data; communications channels; communications processors; communications software, which controls input and output activities and manages other functions of the communications network

Communications channels

Communications channels are the means by which data are transmitted from one device in a network to another. A communications channel is the path—the physical medium—over which information travels in a telecommunications system from its source to its destination. (Channels are also called links, lines, or media.)

The channels differ in terms of capacities, the total amount of information that can be transmitted through any telecommunications channel and which is measured in bits per second (BPS). The channels that can be used include the following:

Wired Communications Channels

Three types of wired channels are twisted-pair wire (conventional telephone lines), coaxial cable, and fiber-optic cable.

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Twisted-pair wire

Twisted-pair wire consists of two strands of insulated copper wire, twisted around each other. This twisted-pair configuration somewhat reduces interference from electrical fields. Twisted-pair is relatively slow. Moreover, it does not protect well against electrical interference. However, because so much of the world is already served by twisted-pair wire, it will no doubt be used for years to come, both for voice messages and for modem-transmitted computer data. Figure 6.1 shows the twisted pair

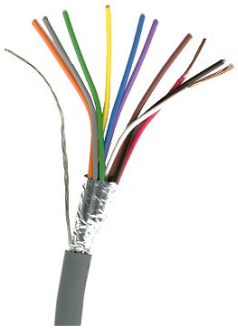


Figure 6.1

Coaxial cable

Coaxial cable, commonly called "coax," consists of insulated copper wire wrapped in a solid or braided metal shield, then in an external cover. Coax is widely used for cable television. Thanks to the extra insulation, coaxial cable is much better than twisted-pair wiring at resisting noise. Moreover, it can carry voice and data at a faster rate. Often many coaxial cables will be bundled together. Figure 6.2 shows the Coaxial cable

Figure 6.2

Fiber-optic cable

A fiber-optic cable consists of dozens or hundreds of thin strands of glass or plastic that transmit pulsating beams of light rather than electricity. Unlike electrical signals, light pulses are not affected by random electromagnetic interference in the environment. Thus, they have much lower error rates than normal telephone wire and cable. In addition, fiber-optic cable is lighter and more durable than twisted-pair and co-ax cable. Fiber-optic cables cannot easily be wiretapped, so transmissions are more secure. They also have greater capacity as light travels faster than electricity. Figure 6.3 shows the fiber-optic

figure 6.3: optic fibre

Wireless Communications Channels

Four types of wireless channels are infrared transmission, broadcast radio, microwave radio, and communications satellite.

Infrared transmission

Infrared wireless transmission sends data signals using infrared-light waves. The drawbacks are that line-of-sight communication is required—there must be an unobstructed view between transmitter and receiver—and transmission is confined to short range.

Broadcast radio

Broadcast radio, a wireless transmission medium that sends data over long distances—between regions, states, or countries. A transmitter is required to send messages and a receiver to receive them,- sometimes both sending and receiving functions are combined in a transceiver.

Microwave radio

Microwave radio transmits voice and data through the atmosphere as super-high-frequency radio waves called microwaves, which vibrate at 1 gigahertz (1 billion hertz) per second or higher. These frequencies are used not only to operate microwave ovens but also to transmit messages between ground-based stations and satellite communications systems.

Figure 6.4 : Terrestrial Microwave:

Communications satellites

To avoid some of the limitations of microwave earth stations, communications companies have added microwave "sky stations"—communications satellites. Communications satellites are microwave relay stations in orbit around the earth.

Communications processors and software

Communications processors

Communications processors include front-end processors, concentrators, controllers, multiplexers, and modems, support data transmission and reception in a telecommunications network. Their goal is to ensure that messages travel to the right destination at the right time with minimum possible cost and errors.

Front-end processor

Front-end processor is a special purpose computer dedicated to communications management and is attached to the main, or host, computer. The front-end processor performs communications processing such as error control, formatting, editing, controlling, routing, and speed and signal conversion.

Concentrator

A concentrator is a programmable telecommunications computer that collects and temporarily stores messages from terminals until enough messages are ready to be sent economically. The concentrator bursts signals to the host computer.

Controller

A controller is a specialized computer that supervises communications traffic between the CPU and peripheral devices such as terminals and printers. The controller manages messages from these devices and communicates them to the CPU. It also routes output from the CPU to the appropriate peripheral device.

Multiplexer

A multiplexer is a device that enables a single communications channel to carry data transmissions from multiple sources simultaneously. The multiplexer divides the communications channel so that it can be shared by multiple transmission devices. The multiplexer may divide a high-speed channel into multiple channels of slower speed or may assign each transmission source a very small slice of time for using the high-speed channel.

Modem

Information travels through a telecommunications system in the form of electromagnetic signals. Signals are represented in two ways: analog and digital signals. An analog signal is represented by a continuous waveform that passes through a communications medium. Analog signals are used to handle voice communications and to reflect variations in pitch.

A digital signal is a discrete, rather than a continuous, waveform. It transmits data coded into two discrete states: 1-bits and O-bits, which are represented as on-off electrical pulses. Most computers communicate with digital signals, as do many local telephone companies and some larger networks. However, if a traditional telephone network is set up to process analog signals, a digital signal cannot be processed without some alterations. All digital signals must be translated into analog signals before they can be transmitted in an analog system. The device that performs this translation is called a modem. (Modem is an abbreviation for MOdulation/DEModulation.)

A modem translates a computer's digital signals into analog form for transmission over ordinary telephone lines, or it translates analog signals back into digital form for reception by a computer. Modem is short for "modulate/demodulate"; a sending modem modulates digital signals into analog signals for transmission over phone lines. A receiving modem demodulates the analog signals back into digital signals. The modem provides a means for computers to communicate with one another using the standard copper-wire telephone network, an analog system that was built to transmit the human voice but not computer signals.

Telecommunications software

Special telecommunications software residing in the host computer, front-end processor, and other processors in the network is required to control and support network activities. This software is responsible for functions such as network control, access control, transmission control, error detection/correction, and security.

Telecommunication application and benefits

Videoconferencing, also called teleconferencing, is the use of television and sound technology as well as computers to enable people in different locations to see, hear, and talk with one another.

Workgroup computing, also called collaborative computing, enable teams of co-workers use networks of microcomputers to share information and to cooperate on projects. Workgroup computing is made possible not only by networks and microcomputers but also by groupware. Groupware is software that allows two or more people on a network to work on the same information at the same time.

Telecommuting: Working at home while in telecommunication with the office is called telecommuting. (A related term is telework, which includes not only those who work at least part time from home but also those who work at remote or satellite offices.).

Virtual offices: The virtual office is an often nonpermanent and mobile office run with computer and communications technology. Employees work from their homes, cars, and other new work sites. They use pocket pagers, portable computers, fax machines, and various phone and network services to conduct business. The rise in telecommuting and virtual offices is only part of a larger trend. "Powerful economic forces are turning the whole labor force into an army of freelancers and independent contractors and consultants.

Home Networks

Today many new buildings and even homes are built as "network enabled." The new home or small office is equipped with a local area network (LAN), which allows all the personal computers under the same roof to share peripherals (such as a printer or a fax machine) and a single modem and Internet service. The networking of home appliances, linking stereos, lights, heating systems, phones, and TV sets is also expected.

The Information/Internet Appliance

An information appliance is a device merging computing capabilities with communications gadgets. Examples include TV set-top boxes, Internet phones, and personal digital assistants. Especially as cable and wireless channels become speedier, these devices will offer the ability to deliver all types of data—text, audio, video, film, still pictures—anywhere at any time.

People and organizations use computers in networks for reasons that include the following:

• *Sharing of peripheral devices*: Peripheral devices such as laser printers, disk drives, and scanners are often quite expensive. Consequently, to justify their purchase, management wants to maximize their use. Usually the best way to do this is to connect the peripheral to a network serving several computer users.

• *Sharing of programs and data*: This is cost-saving. For instance, it is less expensive for a company to buy a separate word processing program that will serve many employees than to buy a separate word processing program for each employee. Accessing the same data is also beneficial. For instance, updating information on a shared server is much easier than updating every user's individual system. Incidentally, in most organizations, people use the same software and need access to the same data/information.

• *Better communications*: Information can be transmitted to the intended recipients immediately it is produced.

• *Security of information*: Information can be made secure with network security systems. In addition, it could easily be backed up or duplicated on a networked storage device shared by others.

• *Access to databases*: Networks enable users to tap into numerous databases, whether private company databases or public databases available online through the Internet.

Summary of Internet benefits is depicted in pictorial nature below in Figure 6.5

Figure 6.5 : summary of business value of internet and networked economy

Factors affecting how data are transmitted

Serial and Parallel Transmission

Data are transmitted in two ways: serially and in parallel.

*Serial data transmission***:** In serial data transmission, bits are transmitted sequentially, one after the other. Serial transmission is the way most data flows over a twisted-pair telephone line. Serial transmission is found in communications lines and modems. A command send mouse typically would be conveyed by serial transmission. The plug-in board for a microcomputer modem usually has a serial port.

*Parallel data transmission***:** In parallel data transmission, bits are transmitted through separate lines simultaneously**.** Parallel lines move information faster than serial lines do, but they are efficient for up to only 15 feet. Thus, parallel lines are used, for example, to transmit data from a computer's CPU to a printer. Parallel transmission may also be used within a company's facility for transmitting data between terminals and the main computer.

Transmission Rate

Transmission rate is a function of two variables: frequency and bandwidth. The amount of data that can be transmitted on a channel depends on the wave frequency or the cycles of waves per second (expressed in hertz). The more the cycles per second, the more the data that can be sent through that channel. Also, the greater a channel's bandwidth—the difference (range) between the highest and lowest frequencies—the more frequencies it has available and hence the more data that can be sent through that channel (expressed in bits per second, or bps).

Line Configurations

There are two principal line configurations, or ways of connecting communications lines: point-to-point and multipoint.

*Point-to-point***:** A point-to-point line directly connects the sending and receiving devices**,** such as a terminal, with a central computer. This arrangement is appropriate for a private line whose sole purpose is to keep data secure by transmitting it from one device to another.

Multipoint: A multipoint line is a single line that interconnects several communications devices to one computer. Often on a multipoint line only one communications device, such as a terminal, can transmit at any given time.

Direction of Transmission

When two computers are in communication, data can flow in three ways: simplex, half-duplex, or full-duplex. These are fancy terms for easily understood

*Simplex transmission***:** In simplex transmission, data can travel in only one direction. An example is a traditional television broadcast, in which the signal is sent from the transmitter to your TV antenna. There is no return signal. Some computerized data collection devices also work this way, such as seismograph sensors that measure earthquakes.

*Half-duplex transmission***:** In half-duplex transmission, data travels in both directions but only in one direction at a time. Half-duplex transmission is seen with marine radios, in which both parties must take turns talking. This is the most common mode of data transmission used today.

*Full-duplex transmission***:** In full-duplex transmission, data is transmitted back and forth at the same time. An example is two people on the telephone talking and listening simultaneously. Full-duplex is sometimes used in large computer systems. It is also available in newer microcomputer modems to support truly interactive workgroup computing.

Transmission Mode

Asynchronous: This method, used with most microcomputers, is also called start-stop transmission. In asynchronous transmission, data is sent one byte (or character) at a time. Each string of bits making up the byte is bracketed, or marked off, with special control bits. That is, a "start" bit represents the beginning of a character, and a "stop" bit represents its end. Because only one byte is transmitted at a time, this method is relatively slow. As a result, asynchronous transmission is not used when great amounts of data must be sent rapidly. Its advantage is that the data can be transmitted whenever it is convenient for the sender.

*Synchronous transmission***:** Instead of using start and stop bits, synchronous transmission sends data in blocks. Start and stop bit patterns, called synch bytes, are transmitted at the beginning and end of the blocks. These start and end bit patterns synchronize internal clocks in the sending and receiving devices so that they are in time with each other.

This method is rarely used with microcomputers because it is more complicated and more expensive than asynchronous transmission. It also requires careful timing between sending and receiving equipment. It is appropriate for computer systems that need to transmit great quantities of data quickly.

Circuit Switching and Packet Switching

*Circuit switching—best for voice***:** Circuit switching is used by the telephone company for its voice networks to guarantee steady, consistent service for telephone conversations. In circuit switching, the transmitter has full use of the circuit until all the data has been transmitted and the circuit is terminated.

Packet switching—best for data: A packet is a fixed-length block of data for transmission. The packet also contains instructions about the destination of the packet. In packet switching, electronic messages are divided into packets for transmission over a wide area network to their destination, through the most expedient route. Here's how packet switching works: A sending computer breaks an electronic message apart into packets. The various packets are sent through a

communications network—often by different routes, at different speeds, and sandwiched in between packets from other messages. Once the packets arrive at their destination, the receiving computer reassembles them into proper sequence to complete the message.

The benefit of packet switching is that it can handle high-volume traffic in a network. It also allows more users to share a network, thereby offering cost savings.

Multiplexing

Communications lines nearly always have far greater capacity than a single microcomputer or terminal can use. Because operating such lines is expensive, it's more efficient if several communications devices can share a line at the same time. This is the rationale for multiplexing. Multiplexing is the transmission of multiple signals over a single communications channel. With multiplexing a large capacity in not wholly allocated to a single channel for all the time, hence reduced time for transmission. Also, it is possible that the whole channel may be divided into channels of lower speed thus, affecting transmissions accordingly.

Protocols

Different components in a network can communicate by adhering to a common set of rules that enable them to talk to each other. This set of rules and procedures governing transmission between two points in a network is called a protocol. A protocol, or communications protocol, is a set of conventions governing the exchange of data between hardware and/or software components in a communications network. Every device connected to a network (and, of course, the Internet is just one enormous network) have an Internet Protocol (IP) address so other computers on the network can properly route data to that address.

Types of networks

Networks may be divided into three main categories, differing primarily in their geographical range.

• *Wide area network*: A wide area network (WAN) is a communications network that covers a wide geographical area, such as a country or the world. A WAN may use a combination of satellites, fiber-optic cable, microwave, and copper wire connections and link a variety of computers, from mainframes to terminals.

• *Metropolitan area network***:** A metropolitan area network (MAN) is a communications network covering a city or a suburb. The purpose of a MAN is often to bypass local telephone companies when accessing long-distance services. Many cellular phone systems are MANs.

• *Local area network***:** A local area network (LAN) connects computers and devices in a limited geographical area, such as one office, one building, or a group of buildings close together (for instance, a college campus).

Local area networks consist of two principal types: client/server and peer-to-peer.

Client/server LANs: A client/server LAN consists of clients, which are microcomputers that request data, and servers, which are computers used to supply data. The server is a powerful microcomputer that manages shared devices, such as laser printers. It runs server software for applications such as e-mail and web browsing. Different servers may be used to manage different tasks. A file server is a computer that acts like a disk drive, storing the programs and data files shared by users on a LAN. A database server is a computer in a LAN that stores data but doesn't store programs. A print server controls one or more printers and stores the print-image output from all the microcomputers on the system. Web servers contain web pages that can be viewed using a browser. *Mail servers* manage e-mail.

Peer-to-peer LANs: The word peer denotes one who is equal in standing with another (as in the phrases "peer pressure" and "jury of one's peers"). In a peer-to-peer LAN, all microcomputers on the network communicate directly with one another without relying on a server. Peer-to-peer networks are less expensive than

client-server networks and work effectively for up to 25 computers. Beyond that, they slow down under heavy use. They are appropriate for small networks. Many LANs mix elements from both client server and peer-to-peer models.

Most large computer networks have at least one host computer, a mainframe or midsize central computer that controls the network. The other devices within the network are called nodes. A node is any device that is attached to a network—for example, a microcomputer, terminal, storage device, or printer.

Network designers determine the types of hardware and software necessary as interface to make connections among computers possible. Interfaces used in these instances are: routers, bridges and gateways. A router is a special computer that directs communicating messages when several networks are connected together. A bridge is an interface used to connect the same type of networks. A gateway is an interface permitting communication between dissimilar networks.

Networks may be connected together—LANs to MANs and MANs to WANs. A backbone is a high-speed network that connects LANs and MANs to the Internet**.**

Network topologies

One way of describing networks is by their shape, or topology. Networks can be laid out in different ways. The logical layout, or shape, of a network is called a topology. The three basic topologies are star, ring, and bus.

***Star network*:** A star network is one in which all microcomputers and other communications devices are connected to a central server. Electronic messages are routed through the central hub to their destinations. The central hub monitors the flow of traffic. The advantage of a star network is that the hub prevents collisions between messages. Moreover, if a connection is broken between any communications device

and the hub, the rest of the devices on the network will continue operating. However, if the hub goes down, the entire network will stop.

***Ring network*:** A ring network is one in which all microcomputers and other communications devices are connected in a continuous loop. Electronic messages are passed around the ring until they reach the right destination. There is no central server. The advantage of a ring network is that messages flow in only one direction. Thus, there is no danger of collisions. The disadvantage is that, if a connection is broken, the entire network stops working.

***Bus network*:** The bus network works like a bus system at rush hour, with various buses pausing in different bus zones to pick up passengers. In a bus network, all communications devices are connected to a common channel. There is no central server. Generally, each communications device transmits electronic messages to other devices when ready. If some of those messages collide, the device waits and tries to transmit again.

Networks are actually a combination of several network configurations so that in reality they are meshed.

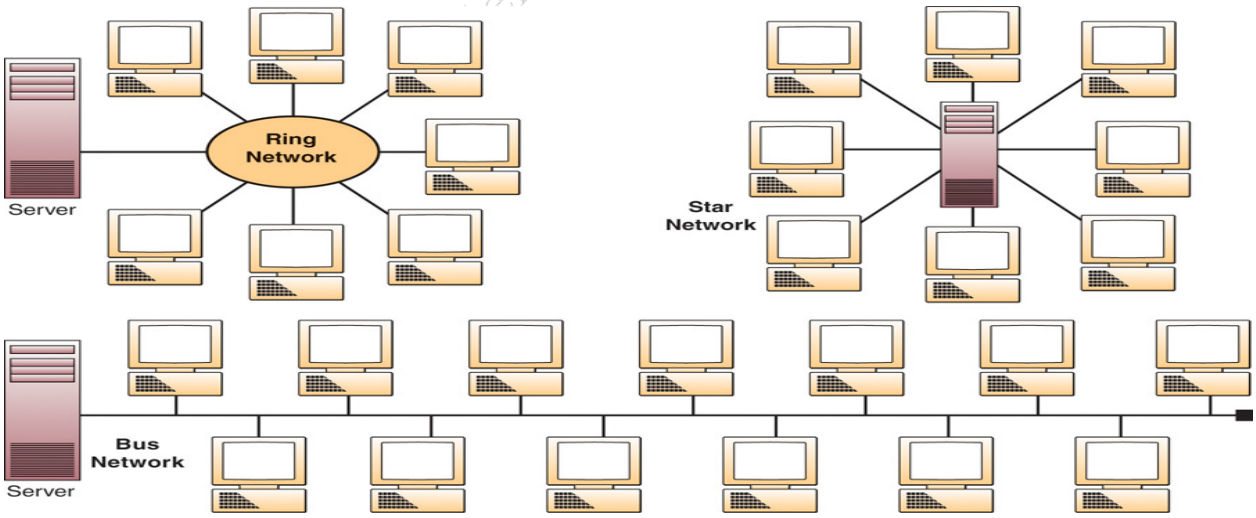


Figure 6.6 : topologies

Trends in telecommunications

Major trends occurring in the field of telecommunications have a significant impact on management decisions in this area. You should thus be aware of major trends in telecommunications industries, technologies, and applications that significantly increase the decision alternatives confronting business managers and professionals.

Industry trends: The competitive arena for telecommunications service has changed dramatically in many countries in recent years. The telecommunications industry has changed from government-regulated monopolies to a deregulated market with fiercely competitive suppliers of telecommunications services. Numerous companies now offer businesses and consumers a choice of everything from local and global telephone services to communications satellite channels, mobile radio, cable TV, cellular phone services, and Internet access.

The explosive growth of the Internet and the World Wide Web has spawned a host of new telecommunications products, services, and providers. Driving and responding to this growth, business firms have dramatically increased their use of the Internet and the Web for electronic commerce and collaboration. Thus, the service and vendor options available to meet a company's telecommunications needs have increased significantly, as have a business manager's decision-making alternatives.

Technology trends: Open systems with unrestricted connectivity, using Internet networking technologies as their technology platform, are today's primary telecommunications technology drivers. Web browser suites, HTML Web page editors, Internet and intranet servers and network management software, TCP/IP Internet networking products, and network security fire walls are just a few examples. These technologies are being applied in Internet, intranet, and extranet applications, especially those for electronic commerce and collaboration. This trend has reinforced previous industry and technical moves toward building client/server networks based on an open systems architecture.

Open systems are information systems that use common standards for hardware, software, applications, and networking. Open systems, like the Internet and corporate

intranets and extranets, create a computing environment that is open to easy access by end users and their networked computer systems. Open systems provide greater connectivity, that is, the ability of networked computers and other devices to easily access and communicate with each other and share information. Any open systems architecture also provides a high degree of network interoperability. That is, open systems enable the many different applications of lend users to be accomplished using the different varieties of computer systems, software packages, and databases provided by a variety of interconnected networks. Frequently, software known as *middleware* may be used to help diverse systems work together.

Telecommunications is also being revolutionized by the rapid change from analog to digital network technologies. Telecommunication systems have always depended on voice-oriented analog transmission systems designed to transmit the variable electrical frequencies generated by the sound waves of the human voice. However, local and global telecommunications networks are rapidly converting to digital transmission technologies that transmit information in the form of discrete pulses, as computers do. This provides (1) significantly higher transmission speeds, (2) the movement of larger amounts of information, (3) greater economy, and (4) much lower error rates than analog systems. In addition, digital technologies allow telecommunications networks to carry multiple types of communications (data, voice, video) on the same circuits.

Another major trend in telecommunications technology is a change from reliance on copper wire-based media and land-based microwave relay systems to fiber-optic lines and cellular, PCS, communications satellite, and other wireless technologies. Fiber-optic transmission, which uses pulses of laser-generated light, offers significant advantages in terms of reduced size and installation effort, vastly greater communication capacity, much faster transmission speeds, and freedom from electrical interference. Satellite transmission offers significant advantages for organizations that need to transmit massive quantities of data, audio, and video over global networks, especially to isolated areas. Cellular, PCS, mobile radio, and other wireless systems are connecting cellular and PCS phones, PDAs, and other wireless appliances to the Internet and corporate networks.

Business application trends: The changes in telecommunications industries and technologies just mentioned are causing a significant change in the business use of telecommunications. The trend toward more vendors, services, Internet technologies, and open systems, and the rapid growth of the Internet, the World Wide Web, and corporate intranets and extranets dramatically increase the number of feasible telecommunications applications. Thus, telecommunications networks are now playing vital and pervasive roles in electronic commerce, enterprise collaboration, and internal business applications that support the operations, management, and strategic objectives of both large and small companies. An organization's local and global computer networks can dramatically cut costs, shorten business lead times and response times, support electronic commerce, improve the collaboration of workgroups, develop online operational processes, share resources, lock in customers and suppliers, and develop new products and services. This makes telecommunications a more complex and important decision area for businesses that must increasingly find new ways to compete in both domestic and global markets.

Pictorial summary of Network and Telecommunication Trends below Figure 6.7

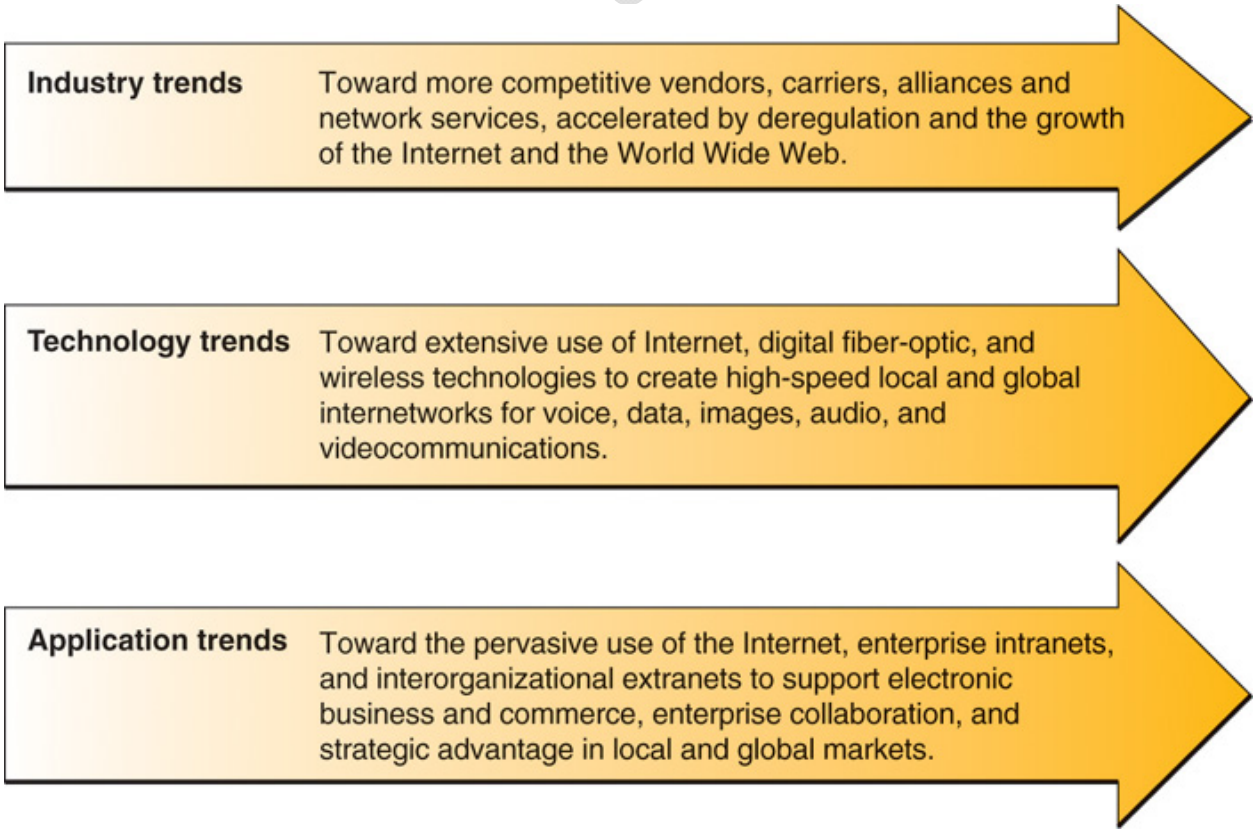
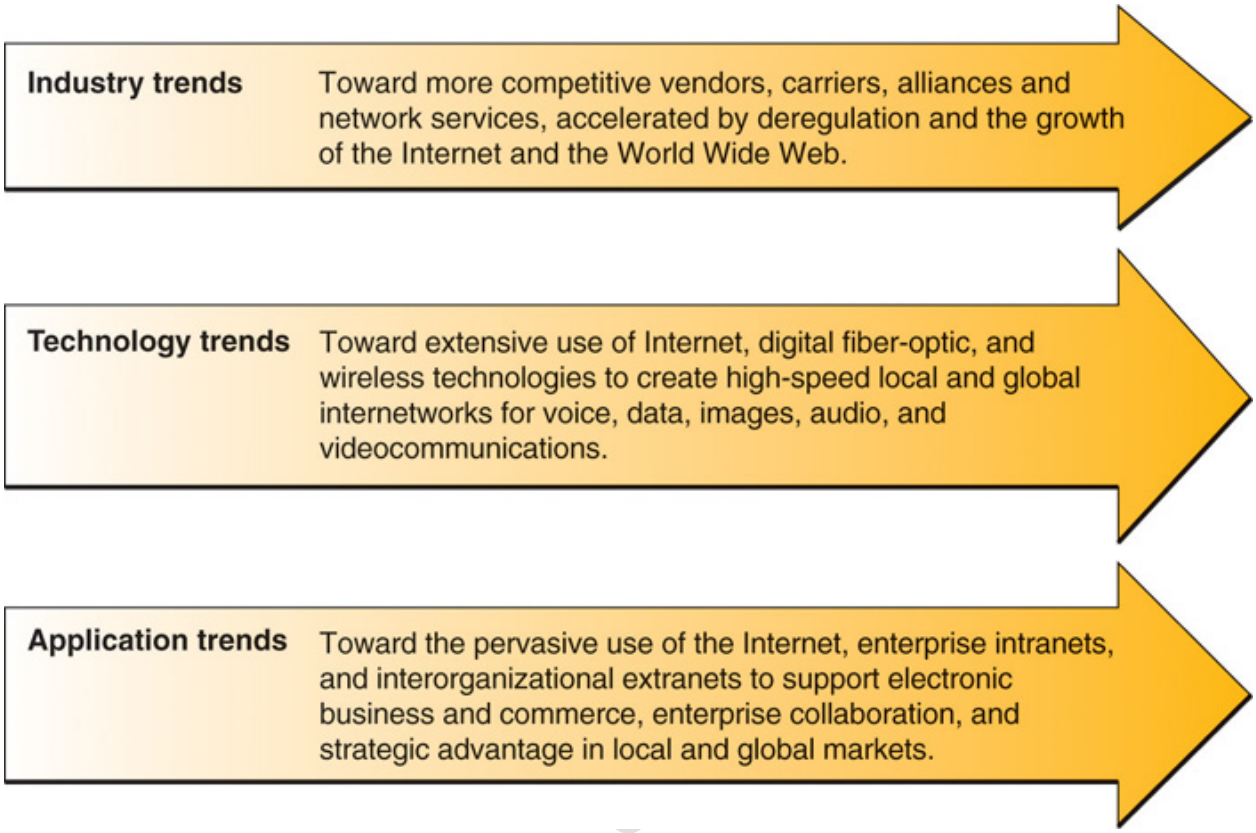


Figure 6.7: Network and Telecommunication Trends



New IT infrastructure

Communications technology, consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another. Computers and communications equipment can be connected in networks for sharing voice, data, images, sound, or even video. A network links two or more computers to share data or resources such as a printer.

All of these technologies represent resources that can be shared throughout the organization and constitute the firm's information technology (IT) infrastructure. The information technology (IT) infrastructure provides the foundation or platform on which the firm can build its specific information systems. Each organization must carefully design and manage its information technology infrastructure so that it has the set of technology services it needs for the work it wants to accomplish with information systems.

IT infrastructure is evolving into what is known as new IT infrastructure. The new IT infrastructure links desktop workstations, network computers, LANs, and server computers in an

enterprise network so that information can flow freely between different parts of the organization. The enterprise network may be linked to kiosks, point-of-sale (POS) terminals, PDAs and information appliances, digital cellular telephones and PCS, and mobile computing devices as well as to the Internet using public infrastructures. Customers, suppliers, and business partners may also be linked to the organization through this new IT infrastructure.

Pictorial summary of Business Value of Telecommunications below Figure 6.8

Strategic Capabilities	e-Business Examples	Business Value
Overcome geographic barriers: Capture information about business transactions from remote locations	Use the Internet and extranets to transmit customer orders from traveling salespeople to a corporate data center for order processing and inventory control	Provides better customer service by reducing delay in filling orders and improves cash flow by speeding up the billing of customers
Overcome time barriers: Provide information to remote locations immediately after it is requested	Credit authorization at the point of sale using online POS networks	Credit inquiries can be made and answered in seconds
Overcome cost barriers: Reduce the cost of more traditional means of communication	Desktop videoconferencing between a company and its business partners using the Internet, intranets, and extranets	Reduces expensive business trips; allows customers, suppliers, and employees to collaborate, thus improving the quality of decisions reached
Overcome structural barriers: Support linkages for competitive advantage	Business-to-business electronic commerce websites for transactions with suppliers and customers using the Internet and extranets	Fast, convenient services lock in customers and suppliers

Figure 6.8 : Business Value of Telecommunications

CHAPTER 7 : ELECTRONIC COMMERCE

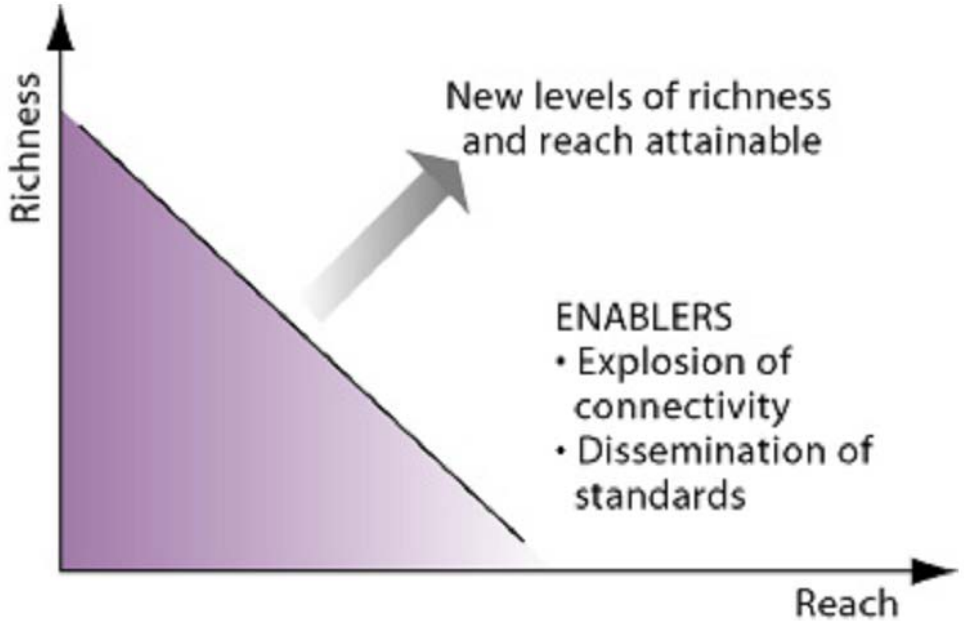
This chapter expects to introduce concepts that are emerging in the field of electronic commerce and demonstrate the potential of the Internet, World Wide Web, and related technologies for the marketing, selling, and distribution of goods and services.

INTERNET TECHNOLOGY AND THE INFLUENCE ON BUSINESS MODELS AND VALUE PROPOSITIONS

Internet and its effects on traditional business models

One of the aims of any IT/IS component in a firm is creating an information technology infrastructure in which information flows seamlessly from one part of the organization to another and from the organization to its customers, suppliers, and business partners. The Internet is rapidly becoming the infrastructure of choice for electronic commerce because it offers businesses an even easier way to link with other businesses and individuals at a very low cost compared to proprietary networks. Internet technology is helping companies radically reduce their transaction costs this includes the costs of searching for buyers and sellers, collecting information on products, negotiating terms, writing and enforcing contracts, and transporting merchandise. The Internet has introduced major changes in the way companies conduct business. It has created a dramatic decline in the cost of developing, sending, and storing information while making that information more widely available. Millions of people are able to exchange massive amounts of information directly, instantly, and for free. The Internet has changed that relationship. Once everyone is connected electronically, information about products and services flows on its own directly and instantly to consumers. The traditional link between the flow of the product and the flow of product-related information is broken. Information is not limited to traditional physical methods of delivery. Customers can find out about products on their own on the Web and buy directly from product suppliers instead of using intermediaries, such as retail stores.

Before the Internet, businesses had to make trade-offs between **the richness and reach** of their information. **Richness** refers to the depth and detail of information—the amount of information the business can supply to the customer, as well as information the business collects about the customer. **Reach** refers to how many people a business can connect with and how many products it can offer those people. Rich communication occurs, for example, when a sales representative meets with a customer, sharing information that is very specific to that interaction. Such an interaction is very expensive for a business because it can take place only with a small audience. The figure below adopted from laudon and laudon book shows the changing economics of information



INTERNET BUSINESS MODELS

Below are some emerged business models that provide value added services to the customer

1. **Virtual store front**- sells physical products directly to consumers or to individual businesses. Examples include Amazon.com and EPM.com.
2. **Information brokers** – provides product pricing and availability information to individuals and businesses. They generate income from advertising or from directing

buyers to sellers. Example include Edmund.com, kbb.com,insweb.com and realtor.com

3. **Transaction broker** - saves users money and time by processing online transactions, generating a fee each time a transaction occur .They also provides information on rates and terms. Examples include E*trade.com and Expedia.com.
4. **Online market places-** provides digital environmental where buyers and sellers can meet , search products and establish prices for those products. They also provide online auction or reverse auctions where buyers can place bids (**dynamic Pricing)** on multiple sellers to purchase at buyer specified pricing or negotiated prices. They can serve consumers or businesses and they generate income from transaction fees .Examples include ebay.com, priceline.com, chemconnect.com and pantellos.com
5. **Content provider-** generates revenue from selling digital content such as digital news, music, photos or videos e.t.c over the web. Customers can pay to access the content or they can buy advertising space. Examples include CNN.com, Gettyimages.com, MP3.com, Thestreet.com.
6. **Online service providers-** provides online services to customers, they generate income through advertising , subscription and transaction fees or by collecting marketing information from users. Examples include @backup.com, Xdrive.com,Employease.com, Salesforce.com
7. **Virtual Communities-** provides online meeting place where people with similar interest can communicate and find use information . Examples include motorcross.com, fixya.com, sailnet.com.
8. **Portal –** provides intial point of entry to the web along with specialized content and other services. Examples include Yahoo.com, Msn.com , startmedia.com.

CATEGORIES OF E-COMMERCE

Introduction

E commerce –refers to trading online i.e. sale of products and services using web technology. The use of computer networks, primarily the web technologies (**internet, intranet or extranet**), to buy and sell products, services, and information.

- Intranet is an internal network within logical organizational boundaries e.g a branch and head office or agent trading
- Extranet spans beyond organization boundaries and includes trading partners such as wholesalers can have a network to communicate with retailers
- Internet – is a public network utilised by organisations for trade

The term "**e-Business**" therefore refers to the integration, within the company, of tools based on information and communication technologies (generally referred to as **business software**) to improve their functioning in order to create value for the enterprise, its clients, and its partners. **M-commerce** or mobile commerce involves the use of wireless technology, e.g. mobile phones or PDA/Blackberry devices to conduct business.

Below are categories of e-commerce .
E-commerce can be further broken down into B2C, B2B and C2C e-commerce

- **Business to Consumer (B2C)** e-commerce involves retailing products and/or services directly to the consumer. BarnesandNoble.com, which sells books, software, and music to individual consumers, is an example of B2C e-commerce.
- **Business to Business (B2B)** e-commerce involves the electronic sale of goods and/or services amongst businesses e.g. E-procurement, Value-chain service provider(provides services like secure card payments and logistics), Value chain integrators, Collaboration platforms. **(**company provides a sets of tools, expertise, and an information environment for collaboration between enterprises**).** Another example is Milacron's Web site for selling machinery, mold bases, and related tooling, supplies, and services to companies engaged in plastics processing.

- **Consumer to Consumer (C2C)** e-commerce involves consumers selling goods and services to other consumers e.g eBay, the giant Web auction site, enables people to sell their goods to other consumers by auctioning the merchandise off to the highest bidder.

Customer-Centered Retailing and the web

The Internet provides companies with new channels of communication and interaction that can create closer yet more cost- effective relationships with customers in sales, marketing, and customer support. Companies can use the Web to provide ongoing information, service, and support, creating positive interactions with customers that can serve as the foundations for long-term relationships and repeat purchases.

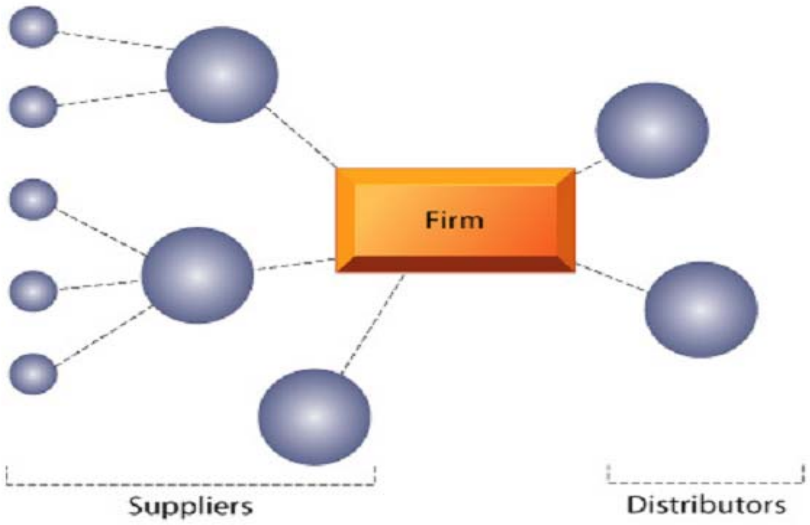
- Companies cans sell their products directly to the customer without intermediaries this is called **disintermediation of the customer** e.g an airline can sell tickets through its website to customers and leads to reduction in costs both for the seller and the buyer.
- Interactive marketing and personalization- Communications and product offerings can be tailored precisely to individual customers. Firms can create unique personalized Web pages that display content or ads for products or services of special interest to each user, improving the customer's experience and creating additional value.
- Customer self service – its cost saving and creates a passionate relationship between sellers and buyers.

Business-to-Business Electronic Commerce: New Efficiencies and Relationships

Its mainly based on proprietary EDI (Electronic Data Interchange) system. Electronic data interchange (EDI) enables the computer-to-computer exchange between two organizations of standard transactions, such as invoices, bills of lading, shipment

schedules, or purchase orders. Transactions are automatically transmitted from one information system to another through a network, eliminating the printing and handling of paper at one end and the inputting of data at the other. This can be illustrated with the diagram below adopted from laudons' book based on shipping scenario where the Suppliers can automatically send data about shipments to purchasing firms and the Purchasing firms can use EDI to provide production and inventory requirements and payment data to suppliers.

Private exchanges (private industrial networks) are currently the fastest-growing type of B2B commerce. They provide links a firm to its suppliers, distributors, and other key business partners for efficient supply chain management and other collaborative activities. They can illustrated using the figure below.



Net marketplaces (also called e-hubs) is another type of b2b commerce, they 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 are more transaction oriented (and less relationship oriented) than private industrial networks, generating revenue from purchase and sale transactions and other services provided to clients. Participants in Net marketplaces can establish prices through online negotiations, auctions, or requests for quotations, or they can use fixed prices. Customers benefit from lower search costs, lower transaction costs, and wider selection. The example below shows a e-hub.

Some Net marketplaces sell direct goods and some sell indirect goods. Direct

goods are goods used in a production process, such as sheet steel for auto body production. Indirect goods are all other goods not directly involved in the production process, such as office supplies or products for maintenance and repair. Exostar is an example. This aerospace and defense industry-sponsored Net marketplace was founded jointly by BAE Systems, Boeing, Lockheed Martin, Raytheon, and Rolls-Royce PLC to connect these companies to their suppliers and facilitate collaboration on major projects. More than 16,000 trading partners in the commercial, military, and government sectors use Exostar's sourcing, e- procurement, and collaboration tools for both direct and indirect goods. Exostar includes capabilities for auctioning, purchase forecasting, issuing electronic payments and receipts, and linking to participants' internal corporate systems. Also featured are capabilities for collaboration on joint development projects and sharing engineering product data.

Electronic Commerce Payment Systems

Electronic payment systems have been developed to pay for goods electronically on the Internet. Electronic payment systems for the Internet include systems for credit card payments, digital cash, digital wallets, accumulated balance digital payment systems, stored value payment systems, peer-to-peer payment systems, electronic checks, and electronic billing presentment and payment systems.

Examples of E-commerce payment systems

Payment System	Description	Commercial Example
Digital credit card payment systems	Secure services for credit card payments on the Internet that protect information transmitted among users, merchant sites, and processing banks	eCharge
Digital wallet	Software that stores credit card and other information to facilitate payment for goods on the Web	MSN Wallet MasterCard Wallet AOL Quick Checkout
Accumulated balance payment systems	Accumulates micropayment purchases as a debit balance that must be paid periodically on credit card or telephone bills	Trivnet PaymentOne
Stored value payment systems	Enables consumers to make instant payments to merchants based on value stored in a digital account	Ecount American Express Blue smart card
Digital cash	Digital currency that can be used for micropayments or larger purchases	eCoin.net
Peer-to-peer payment systems	Sends money using the Web to individuals or vendors who are not set up to accept credit card payments	PayPal Yahoo PayDirect
Digital checking	Electronic check with a secure digital signature	Western Union MoneyZap ECheck
Electronic billing presentment and payment systems	Supports electronic payment for online and physical store purchases of goods or services after the purchase has taken place	CheckFree Yahoo Bill Pay, MSN Bill Pay

Threats to data security

A threat is any situation whether intentional or accidental that will affect the system or the organization.

Threats may include:

- Phishing which is an attempt to acquire information by means of fraud, e.g. a customers account details, credit card numbers, usernames and password, etc. It can be done through techniques, such as fake websites or fake but authentic-looking websites which appear very much like the genuine site. One example to reduce the risk is to use antiphishing software or training users to look for https

before sensitive webpages or SSL protection when divulging (financial) information, etc.

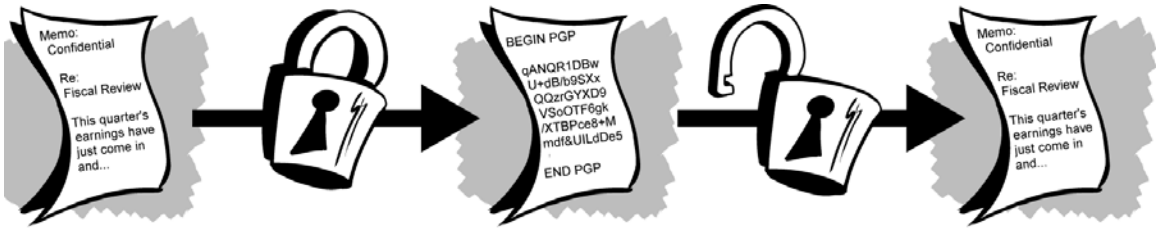
- Un athorised copying
- Program alteration
- Illegal access by hackers
- Theft of data and program (piracy)
- Tapping of data(eavesdropping)..
- Malware or malicious softwares like viruses, worms, Trojan horses and spywares (A program that monitors your actions. While they are sometimes like a remote control program used by a hacker, software companies to gather data about customers) etc

Note cyber threats are also called cyber Vandalism

Ways of preventing and minimizing these threats

- Authentication and Authorization of users – authentication involves verification of users to ensure they are known people and not malicious softwares . Authorisation involves

  control the data access by various users in an organizations.
- Data encryption –this is method of disguising plaintext in such a way as to hide its substance. Encrypting plaintext results in unreadable gibberish called ciphertext. You use encryption to make sure that information is hidden from anyone for whom it is not intended, even those who can see the encrypted data. The process of reverting ciphertext to its original plaintext is called decryption.



Plain text encryption cipher text decryption plain text

(Adopted from An introduction to Cryptography by PGP corporation version 8.0. Released Oct. 2002)

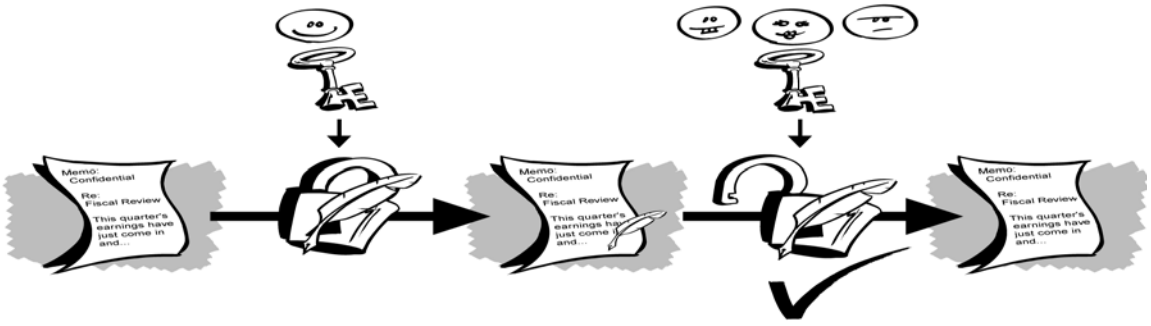
- Use of Effective and updated anti malwares eg anti viruses , anti spam and antispywares.

The three ways below are used specifically for minimizing cyber threats

- Use of proxy servers- This is a computer placed between the web browser and web server to validate all requests to the webserver. It can improve performance and prevent accessibility by certain users.
- Use of firewalls- to block unathorised access

Digital signatures- which is a string of bits that is computed from data being signed along with private key of an organization to verify data as genuine. A digital signature also gives **non-repudiation**, this means that it prevents the sender from claiming that he or she did not actually send the information (***this is equally important in business transactions as privacy is)*** . The basic manner in which digital signatures are made is illustrated in the figure below .Each party in the transaction has two keys used for verifying data that is private key and public key. Instead of signing information using someone else's public key, you encrypt it with your private key. If the information can be decrypted with your public key, then it must have originated with you.

Private key **public key**



Original text signing signed text Verifying verified text

(Adopted from An introduction to Cryptography by PGP corporation version 8.0. Released Oct. 2002)

Benefits of Electronic Commerce

- Improved, lower cost information
- Lower entry costs…cheap to start an online business
- Available 24/7, virtually anywhere in the world
- Availability expands markets for both buyers and sellers
- Decreases the cost of paper-based information
- Reduces the cost of communication
- Provides richer communication than traditional means
- Fast delivery of digitized products
- Increased flexibility of location

Challenges of E-commerce

- Lack of system security, reliability and standards Insufficient bandwidth and infrastructure
- Integrating e-commerce software with existing software is still a challenge
- Lack of trust in (1) unknowns on the other end of the transaction, (2) integrity of the transaction itself, and(3) electronic money that is only bits and bytes
- Ethical issues, professional issues and legal issues

CHAPTER 8 : DEVELOPING BUSINESS/IT STRATEGIES

After completing this chapter, you will be able to:

- Evaluate the strategic options available to different business entities and the ways in which the business and information systems strategies can be aligned and integrated.
- Evaluate a range of information systems solutions.
- Examine the options for establishing and maintaining information systems integrity.

Information technology has created a seismic shift in the way companies do business. Just knowing the importance and structure of e-business is not enough. You need to create and implement an action plan that allows you to make the transition from an old business design to a new e-business design

Organizational Planning Process

It involves the following tasks : -

- Team building, modeling and consensus
- Evaluating what an organization has accomplished and the resources they have acquired
- Analyzing their business, economic, political and societal environments
- Anticipating and evaluating the impact of future developments
- Building a shared vision and deciding on what goals they want to achieve
- Deciding what actions to take to achieve their goals

This tasks/steps can be summarised in the Figure 8.1 below

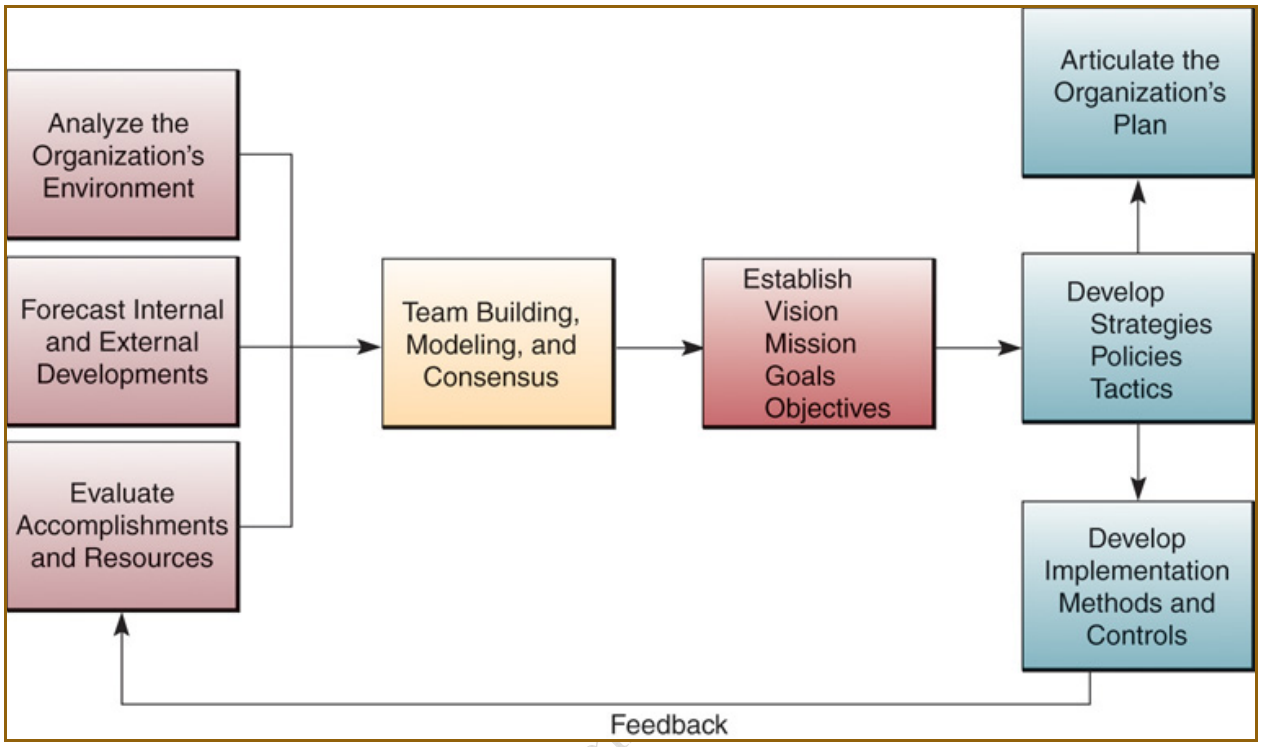


Figure 8.1 : Organizational Planning Process

Strategic Planning is defined as Development of an organization's mission, goals, strategies, and policies *whereas* Organizational planning is Planning done on a short-term basis to implement and control day-to-day operations

Below are the trends shaping Technology Strategic planning

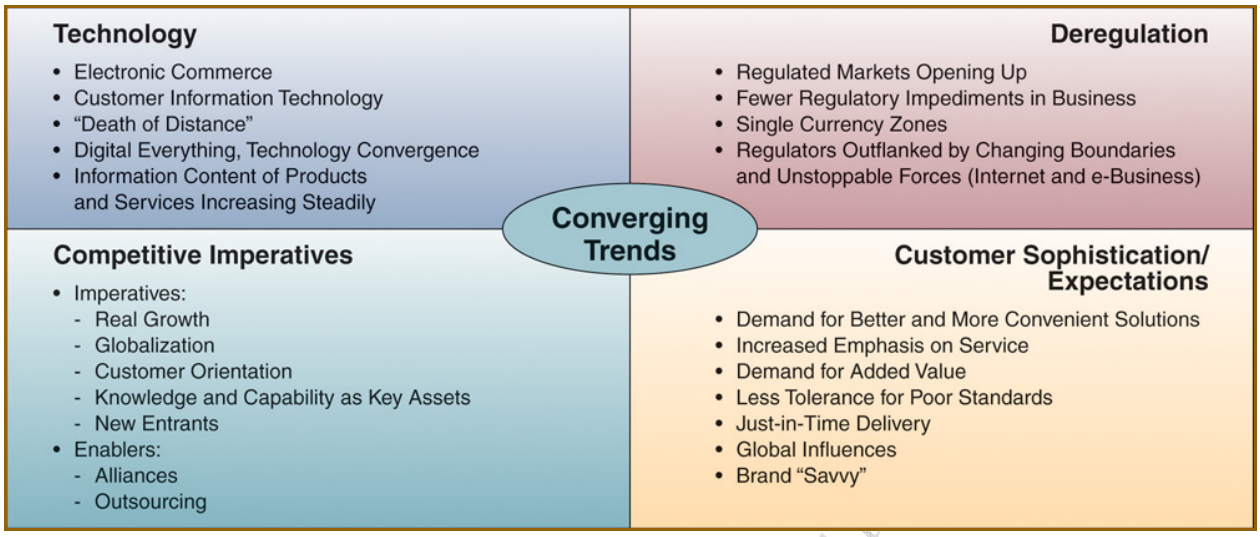


Figure 8.2: Trends shaping Technology Strategic planning

Business Model

Its defined as A conceptual framework that expresses the underlying economic logic and system that prove how a business can deliver value to customers at an appropriate cost and make money

Business Model Components includes :

- **Customer Value** – Is the firm offering its customers something distinctive or at a lower cost than its competitors?
- **Scope** – To which customers is the firm offering this value? What is the range of products/services offered that embody this value?
- **Pricing** – How does the firm price the value?
- **Revenue Source** – Where do the dollars come from? Who pays for what value and when? What are the margins in each market and what drives them? What drives value in each source?
- **Connected Activities** – What set of activities does the firm have to perform to offer this value and when? How connected are these activities?
- **Implementation-** What organizational structure, systems, people, and environment does the firm need to carry out these activities? What is the fit between them?
- **Capabilities** – What are the firm's capabilities and capabilities gaps that need to be filled? How does a firm fill these capabilities gaps? Is there something distinctive about

these capabilities that allows the firm to offer the value better than other firms and that makes them difficult to imitate? What are the sources of these capabilities?

- **Sustainability** – What is it about the firm that makes it difficult for other firms to imitate it? How does the firm keep making money? How does the firm sustain its competitive advantage?

Business/IT Planning Process can be summarised as shown in figure 8.3

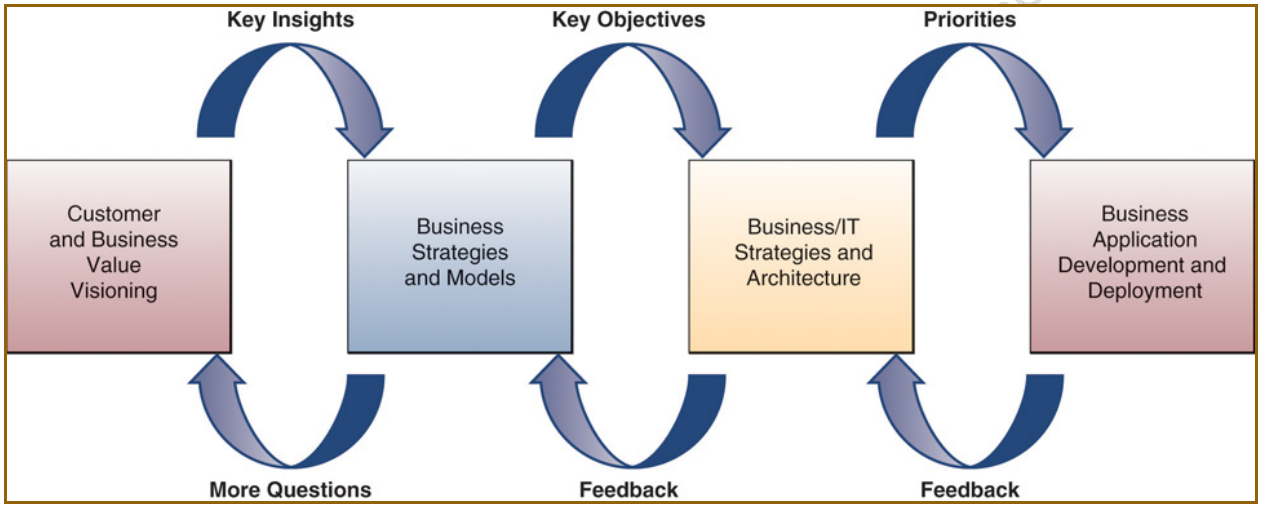


Figure 8.3: Business/IT Planning Process

Business/IT Planning Process Components are :

- **Strategy Development –** developing business strategies that support a company's business vision
- **Resource Management –** developing strategic plans for managing or out-sourcing a company's IT resources
- **Technology Architecture –** making strategic IT choices that reflect an information technology architecture designed to support a company's e-business and other business/IT initiatives

IT Architecture is A conceptual design that includes:

- **Technology Platform –** networks, computer systems, system software and integrated enterprise application software
- **Data Resources –** databases
- **Applications Architecture –** business applications

- **IT Organization –** organizational structure of the IS function and distribution of IS specialists

Some Business/IT Strategies includes :

- **Cost and Efficiency Improvements –** use Internet as a fast, low-cost way to communicate and interact with customers, suppliers, and business partners
- **Performance Improvement in Business Effectiveness –** widespread internal use of Internet-based technologies to improve information sharing and collaboration within the business and with trading partners
- **Global Market Penetration** – build e-commerce websites with value-added information services and extensive online customer support
- **Product and Service Transformation** – use the Internet for electronic commerce transaction processing with customers at company websites, and e-commerce auctions and exchanges for suppliers

These strategies can be represnted using a strategic positioning matrix shown below on **Figure 8.4**

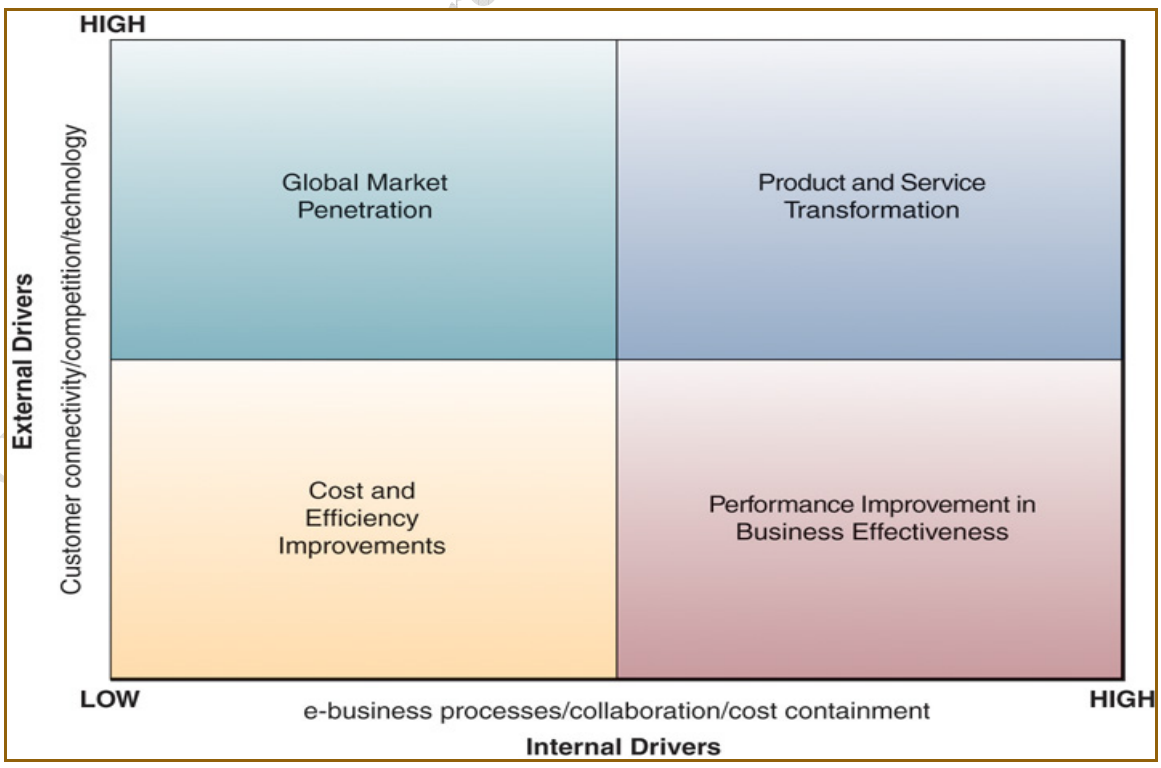


Figure 8.4 : strategic positioning matrix

Business Application Planning is the evaluation of proposals made by the IT management of a company for using information technology to accomplish the strategic business priorities developed earlier in the planning process as shown below in **figure 8.5**

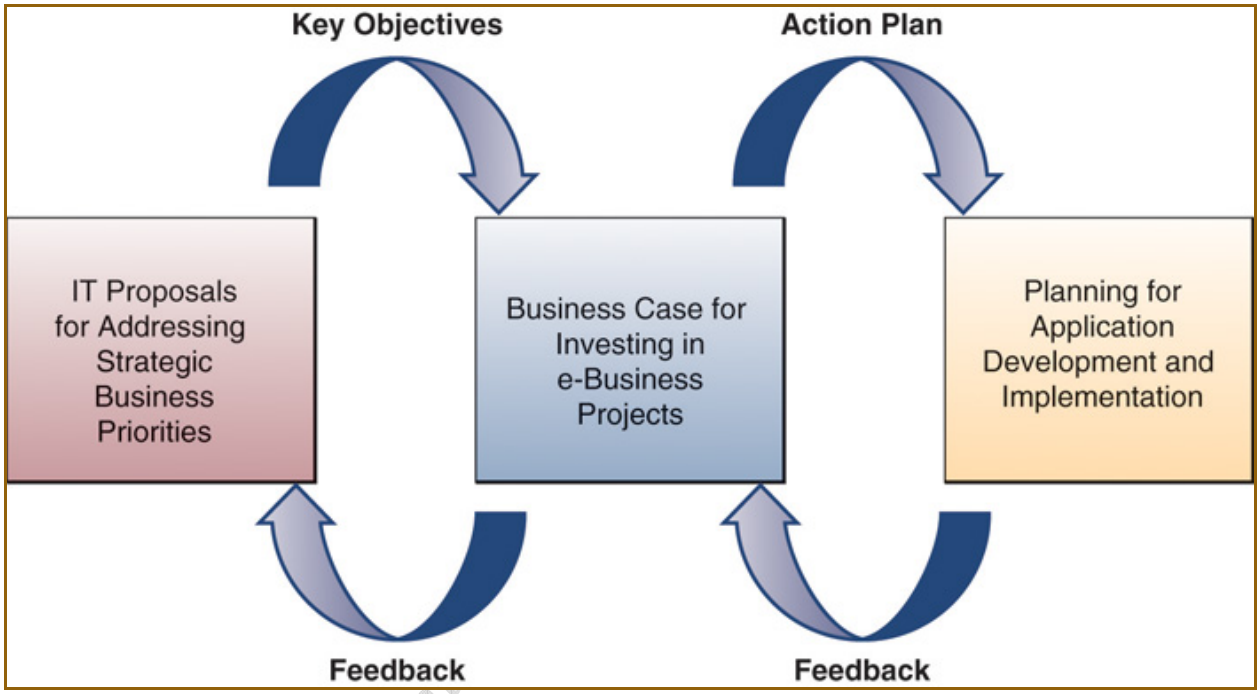


Figure 8.5: Business Application Planning

Global IT Management Challenges

Political Challenges :

- Rules regulating or prohibiting transfer of data across national boundaries
- Severely restricted, taxed, or prohibited imports of hardware and software
- Local content laws that specify the portion of the value of a product that must be added in that country if it is to be sold there
- Reciprocal trade agreements that require a business to spend part of the revenue they earn in a country in that nation's economy

Geoeconomic Challenges

- Sheer physical distances
- Difficult to get good-quality telephone and telecommunications services
- Differences in the cost of living and labor costs

Cultural Differences

- Languages
- Cultural Interests
- Religions
- Customs
- Social Attitudes
- Political Philosophies

Global IT Platform – is defined as Managing the hardware, software, data resources, telecommunications networks, and computing facilities that support global business operations:

- Internet as a Global IT Platform The Internet provides an interactive channel for direct communication and data exchange with customers, suppliers, distributors, manufacturers, product developers, financial backers, information providers – in fact, with all parties involved in a given business venture.

REVISION QUESTIONS

SET 1

QUESTION 1

(a) Describe how each of following four major categories of electronic communication facilities contribute to business efficiency and effectiveness: [20 Marks]
(i) Electronic mail
(ii) teleconfrencing
(iii) Short message service (SMS)
(iv) Web Site/web portal

QUESTION 2

a) Explain what is meant by the terms 'internal' and 'external' data (information) with regard to a business organisation, giving an example of each. [6 Marks]
(b) Describe and distinguish between a transaction data processing system and a management information system. [5 Marks]
(c) Explain what is meant by each of the following information types and give an example of the type of staff member who would use each type;
(i) Operational Information
(ii) Tactical Information
(iii) Strategic Information [9 Marks]

QUESTION 3

a) The systems development life cycle (SDLC) is a sequence of steps, or activities, followed by the project team developing a new information technology application. Using a diagram of the "waterfall model", explain the relevance of these steps. [10 Marks]
b) Discuss the Five key reasons why Information systems projects *fail* and advice on what can be done to make them successful. [10 Marks]

QUESTION 4

a) Describe Three ways that information technology is used to help managers make decisions more effectively [9 Marks]
b) Computer systems have traditionally helped businesses in terms of higher speed of working, improved accuracy, reduced costs,..The Internet has offered further benefits both to the business and its customers. However, Internet use has its risks and problems.

With examples, describe one business activities which can be helped by the use of the Internet; mention any risks or problems for the business which may arise from Internet use.

[3 Marks]

c) Describe four different input devices. For each one, provide an example of a different application that is best suited to it, giving reasons for your choice. [8marks each]

d)

QUESTION 5

a) The use of software and information systems in an organization is not automatic. Discuss reasons why managers must plan how information technology will be used within the context of the overall mission and goals of their organization. [10 Marks]

b) State THREE advantages and TWO limitations of Database Management systems in comparison with Flat (traditional) File systems [10 Marks]

QUESTION 6

In a devolved government for efficient provision of services there is need for automation. Using the Kenya National Examination Council as a case scenario, answer the following questions.

a) State FOUR reasons for using a computer-based registration in preference to a manual system. [8 Marks]

b) Suggest TWO challenges in submitting Candidates Exam details over the Internet.

[4 Marks]

c) Describe briefly FOUR main tasks of an automated Exams registration may perform .

[8 Marks]

SET 2

QUESTION 1

Explain the terms 'bespoke development (tailor made softwares)'and 'off-the-shelf package'. Illustrate your answer with some of the **FIVE** reasons cited in favor of **each** of these methods of application software acquisition using relevant examples.

QUESTION 2

Computers supplied to businesses are generally fitted with Optical Disks . Many systems have 'writeable' or 'recordable' compact discs - the 'CD-RW' or 'CD-R'.
a. Describe briefly FOUR business uses for Optical disks in a Hospital Environment.
b. Describe THREE uses for a CD-ROM in business.
c. Suggest ONE limitation or disadvantage of the CD-ROM.
d. Differentiate between DVD-R and DVD-RW

QUESTION 3

Computer systems have traditionally helped businesses in terms of higher speed of working, improved accuracy, reduced costs,... The Internet has offered further benefits both to the business and its customers. However, Internet use has its risks and problems.
a. With examples, describe THREE business activities which can be helped by the use of the Internet; mention any risks or problems for the business which may arise from Internet use.
b. Suggest TWO benefits of doing business on the internet to the customer.
c. Discuss THREE potential problems for the customer of purchasing through the Internet.

QUESTION 4

(a) What is the difference between a file manager and a database management system
(b) Describe the structure of a simple database.
(c) What makes a database relational

QUESTION 5

Identify some of the economic, social and ethical concerns that have resulted from the development and use of information technology

QUESTION 6

With the use of a diagram, identify the 4 basic hardware components of every computer system?

QUESTION 7

The success of an organization depends on the knowledge of its staff.
a) Explain clearly the difference between knowledge, information and data.

b) A large engineering business such as shipbuilding or aircraft building requires the skills of a large number of trades-people such as toolmakers, welders, etc. In your opinion, are these skills knowledge that could be made explicit by providing manuals so that long apprenticeships could be dispensed with? Give reasons to support your answer.

QUESTION 8

a) A study of information systems needs to address not just technological issues but should also include the social aspects of the impact of technology on a business. What are some of these social aspects?

b) Explain how trends in technology have the potential to increase the concern about ethical issues relating to the use of information systems.

QUESTION 9

Portable or laptop computers are becoming more widely accepted as a tool for the sales force. Outline the specification of a portable computer that would be suitable for such use, giving details of the features (a) to (d) listed below. For each feature, use common abbreviations that include performance and/or capacity, and explain what they mean.

(a) its Processing speed.
(b) its primary Memory.
(c) its monitor.
(d) its Secondary Memory Capacity

QUESTION 10

a) Give **two** reasons why computers users need secondary storage.

(b) Describe the secondary memory devices most suited to the following situations:
(i) backing up a large collection of .doc files and .xls files.
(ii) a place to keep working copies of MS Office 2003 programs.
(iii) an album of .jpg, or .tif files.

QUESTION 11

(1) Draft some guidelines to your boss explaining the **general** advantages and disadvantages of Automatic Data Collection [Input Devices]. *(Do not go into details of any specific devices.)*

(2) Which input device is best suited to each of the computerized tasks below.Briefly describe a **different** input device for **each** task and give reasons for your choice.
(a) Entering a new medical record into the PC at the doctor's surgery.
(b) Entering many old student records from previously typed case notes.
(c) Processing credit card purchases from a supermarket.
(d) Processing voting slips in a general election.
(e) Entering the text of your first novel into a PC word processor.

QUESTION 12

Read the following mini-case study on Stpauls'sMart Easi-Order system before attempting the questions. Ms Ouma likes to keep her house well stocked with groceries, but she no longer has to go out pushing a trolley down supermarket aisles. Ms Ouma does not have to spend time deciding what she wants. Using a Laptop connected to her telephone, she can submit her order to a computer at the headquarters of Stpauls'sMart in Church house Nairobi, and have the goods packaged and waiting for her to pick up at her convenience. A Custom written
software examines the details of Ms Ouma previous orders stored in Stpauls'sMart database and creates a personalised shopping list based on her buying patterns. The software also suggests other items she might like to try. If Ms Ouma wants to purchase something she hasn't ordered from Stpauls'sMart through this system before and has an empty box or wrapper lying around, she can swipe its bar code into a scanner built into the laptop for Stpauls'sMart and add the item to her order. If the item is not on hand or lacks a bar code – an apple, for instance – she can describe the item in a freeformat field that is transmitted to Stpauls'sMart as an e-mail: "Five apples." After the order, with an attached note indicating a pick up time, is transmitted to Stpauls'sMart and prints out the Easi-Order picking list scheduled for pick up that day. The
member of staff in the Stpauls'sMart store then picks the goods from the store aisles and logs each item by scanning its bar code. After completing each order, the staff worker brings it
to a holding area in front of the store, plugs the scanner into a docking station that reads the order, and holds the information until Ms Ouma arrives. When Ms Ouma picks up her order, she swipes her Stpauls'sMart account card at the same station. The system matches the order data with her customer data and sends both back to the server for transmittal to the Stpauls'sMart Database to update the database. About eight stores in the Stpauls'sMart group are now using the Easi-Order system, and offering their customers free laptops equipped with customised scanners. There are even plans to enhance the system to include automated
recipes so that customers clicking on a specific recipe would have all the required ingredients automatically added to their shopping trolley.

Required:
(a) Identify the critical components of the Easi-Order system distinguishing between Hardware, Software, and Information Resource components.
(b) Identify the main functional areas of StpaulMart's business that interface with, or collect data from, the Easi-Order system.

(c) Critically discuss the strategic benefits to Safeway from introducing the Easi-Order system.

QUESTION 13

An office has an old printer which needs to be replaced.

(i) Construct a suitable specification for a typical new office printer in terms of required speed of operation, type of printer, stationery, paper handling and resolution of output. Use and explain abbreviations normally employed in printer specifications.

(ii) Discuss the reasons why a laser printer may be better suited to the office environment than an inkjet printer.

QUESTION 14

The Central Processing Unit (CPU) performs the calculations within a computer, using the binary system. The CPU is made up of two major parts, the Control Unit (CU) and the Arithmetic/Logic Unit (ALU).

(i) Explain the functions of the Control Unit (CU).

(ii) Explain the functions of the Arithmetic/Logic Unit (ALU).

(iii) Discuss the interaction of the Control Unit (CU) and the Arithmetic/Logic Unit (ALU) within the Central Processing Unit (CPU).

QUESTION 14

(a) Describe how the following **four** major categories of electronic communication facilities

contribute to business efficiency and effectiveness:

(i) Electronic mail

(ii) Internet phone and fax

(iii) Short message service (SMS)

(iv) Web Site

QUESTION 15

The following is an extract from a news item in the spu*Computing* magazine of 14th February 2011:

Disease alert service for farmers New County government system will help stop the spread of animal infections like foot and mouth

The government agency responsible for animal welfare, Animal Health, has developed a system to automatically alert farmers to outbreaks of disease. Animal Health hopes the system will help prevent the rapid spread of infections like foot and mouth or blue tongue. "The key is getting people to subscribe to the service," said Animal Health communications manager, Wafula Kamau. "We expect thousands of farmers and vets totake advantage of this new flexible service so that all can become proactive in limiting the cost of animal disease," he said. The early-warning subscription service will be freely available to anyone. Users can choose between email, fax, and either voice mail or SMS messaging to their mobile or landline.

Required:

Discuss the business value of electronic communication facilities and describe **four** main advantages of using these facilities for alerting farmers about an outbreak of disease.

QUESTION 16

The word "multimedia" is frequently used today. Explain the meaning of "multimedia", and how use of multimedia has influenced businesses today .Use real life business examples.

QUESTION 17

Call centre mini case.

A call centre provides the public with a point of contact to an organisation. Telephone calls are routed to a department, often located away from the organization itself, which acts as a first-stage filter for calls. Simple enquiries can either be dealt with automatically, using computer-generated messages, or can be fielded by operators who have a basic understanding of the business and are aware of frequently asked questions. They may also place an order or make reservations for customers. Call centres were traditionally operated by companies in
the financial sectors and offered products such as insurance and mortgage services. Now it is becoming increasingly common for many large companies, including cinemas, travel operators and local authorities, to use a call centre to handle first-line inquiries. Call centres would not be possible without the technological advances of the last few decades. Developments in information and communications technology, especially advances in telephony, have seen
telephone switchboards being replaced by much smaller and less expensive computerised systems. These systems are easily tailored to suit the organisation's requirements and require much less human supervision and intervention. As well as computerised speech output,
many systems also employ voice recognition software. The immediate effect of establishing a call centre is for the organisation to gain a competitive advantage over its rivals. The cost of dealing with customer inquiries falls, and, if set up with care, the quality of customer service
and satisfaction is raised. The workflow through the call centre is largely controlled by the system itself. The customer service operators who take the calls are allocated tasks and their daily activity is closely monitored by the system. A number of indicators can be generated to
help monitor the performance of call centre operators in this way. The statistics can be used to ensure that the quality of service is maintained. The operators are clearly pivotal in the call centre as they are the customer's first point of contact. To gain any competitive advantage it is
important they are effective in their work. The automated distribution of work tasks leads to a very intense working atmosphere, and rates of pay are relatively low. Call centres have historically demonstrated low staff retention rates and high levels of absenteeism. The careful
management of operators is thus important.

Using a relevant business example, discuss and explain the following:

(a) How can the strategic decision-making process be supported by the data collected both automatically and by customer service operators at the call centre

b) various input and output devices that the business may need and why.

QUESTION 18

(a) Explain what is meant by the terms 'internal' and 'external' data (information) with regard to a business organisation, giving an example of each.
(b) Describe and distinguish between a transaction data processing system and a management information system.
(c) Explain what is meant by each of the following information types and give an example of the type of staff member who would use each type;
(i) Operational Information
(ii) Tactical Information
(iii) Strategic Information

QUESTION 19

(a) List **three** fundamental characteristics of all computers.
(b) Give **three** examples of ways in which these fundamental characteristics are used in everyday business and commerce.
(c) Give **two** examples of what you use a computer for.
(d) For each of the following types of computer, comment on their speed of operation, size (including portability) and give an example of their application or use.
(i) personal computer
(ii) notebook
(iii) mainframe
(iv) supercomputer

QUESTION 20

XYZ Banking Corporation is the oldest bank in Money land. The bank gradually developed in
Money city and is now a market leader in the country. It has over sixty branches offering banking and financial services to customers in normal working hours. Automatic teller machines (ATM) provide a cash withdrawal facility and other limited services to customers
outside the banking hours. The banking environment and services have changed considerably since the bank started its operations. Customer expectations of service and
availability are continually increasing. Additionally, as most of the rival banks have kept pace
with technology, XYZ feels the need to catch up in order to meet future customer expectations. In view of these developments, the directors of XYZ have been considering

offering Internet Banking services to their customers in order to compete with the rival banks.
As a Chief Information Officer of the bank, you have been asked to write a report to the
directors on the feasibility of introducing Internet Banking into XYZ Banking Corporation.
Highlight the information for the report under the three numbered headings below:
(i) the **potential benefits** from such a scheme
(ii) the **types of costs** there might be
(iii) any wider **operational issues** that would need to be addressed.

SET 3

QUESTION 22.
Explain FIVE challenges a firm may experience while using Decision Support systems (DSS) to support its operations

QUESTION 23.

A successful sole trader will develop a relationship with each of his/her customers. To do this the trader must remember many details about each customer; likes, dislikes, purchasing pattern, brief personal details to initiate a conversation, etc. Large organisations may have many casual or semi-casual staff who will not develop any relationship with customers. In an attempt to avoid price being the only determinant of customer choice such firms may use a Customer Relations Management (CRM) system.
a) Explain what a CRM system is.
b) How might an organisation gain a competitive advantage by using a CRM system

QUESTION 24.
Explain how information systems can give a firm a competitive advantage when used for the following purposes:-
i) Supply Chain Management.
ii) Enterprise Resource Planning.

QUESTION 25.

There are four kinds of Management Information System:-
- Operational-level.
- Management/ tactical-level.
- Strategic-level.

Choose THREE of the above and for EACH:-
i) Give a brief definition of this type of MIS.
ii) State the level of staff that will use it. Explain why this MIS is appropriate for staff at this level. Your answer MUST include a 'real life' example that clearly illustrates the points

QUESTION 26.

Define a DSS and describe its components, distinguishing between a model-driven and a data-driven DSS, and giving examples of typical applications. What additional software tools might be found in a Group DSS (GDSS).
b) The development of the internet presents new opportunities for both businesses and their customers as they engage in the selling/purchasing process. Explain:
(i) how a business might use a DSS for its Customer Relationship Management
(ii) how consumers might use a web-based DSS environment to support their purchasing decision-making

QUESTION 27

a) Explain how Information systems has changed the following business parameters
   (i) Capital Management
   (ii) Foundations of Doing Business
   (iii) Peoples' productivity
   (iv) Strategic Opportunity and advantage

QUESTION 28

(a) Describe how the following FOUR interrelated factors contribute to the establishment of an effective information systems strategy in an enterprise:
   (i) Strategic thinking.
   (ii) Strategic planning
   (iii) Opportunistic decision making
   (iv) Mission and vision statements

(b) Describe Four strategic benefits an organization may gain from office automation and systems in its operations