Unit 1

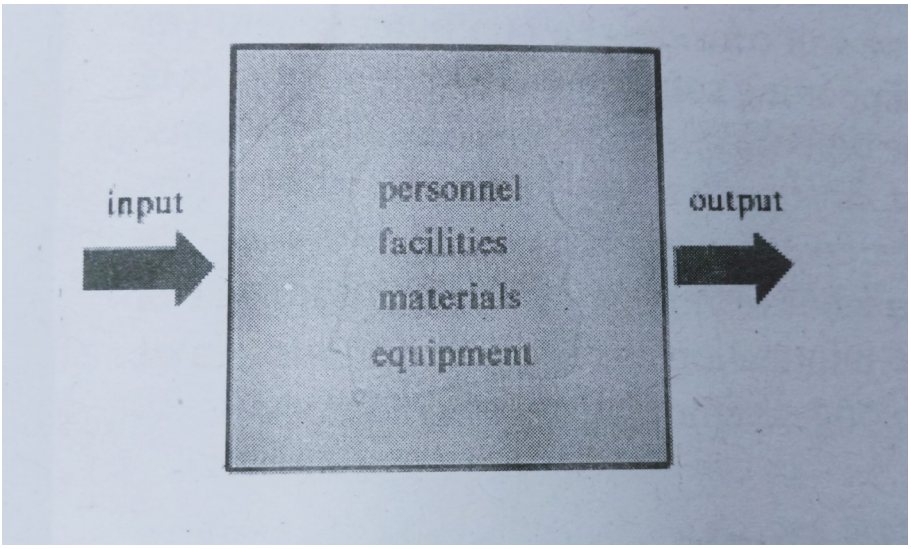
Computer Information Systems

Information Systems Concepts

A system is a combination of resources working together to convert inputs into outputs. Inputs to a system to be data, which are recordable facts. The outputs of a system are interpreted data, which are called information. Thus data is the unprocessed form of information.

Business Information System

A Business Information System uses resources to convert data into information needed to accomplish the purposes of the business. The resources may be personnel, facilities, materials, and equipment.



A business functions with a set of constraints. The transformation of inputs into outputs is affected by certain constraints which are external to the system. Some examples of constraints are federal laws, social environment, total market, raw material limitations, scientific principles etc.(Figure 2.1)

Example: Retail Store system that converts sales transaction data into information needed to prepare customer billings, manage inventory, and calculate profit and loss.

Example: A financial system helps the customers to enter personal details, making deposits, transfer funds, withdraw cash etc.

Subsystems

Components of a system are known as subsystems. Business information systems are made up of smaller components that are themselves systems. All the major systems are composed of subordinate systems, or subsystems, that perform specific functions.

Example: Marketing System contains sales and distribution subsystems. Here, an input to a sales system is typically a sales order, and outputs include a shipping order and a customer invoice. These “subsystems” are often referred to as “systems”.

Example: Finance System contains subsystems billing subsystem, collection subsystem, paying subsystem

Example: Product Development System contains purchasing subsystem, receiving subsystem, inventory subsystem, production subsystem

Example: Administration System contains personnel subsystem, contracts subsystem.

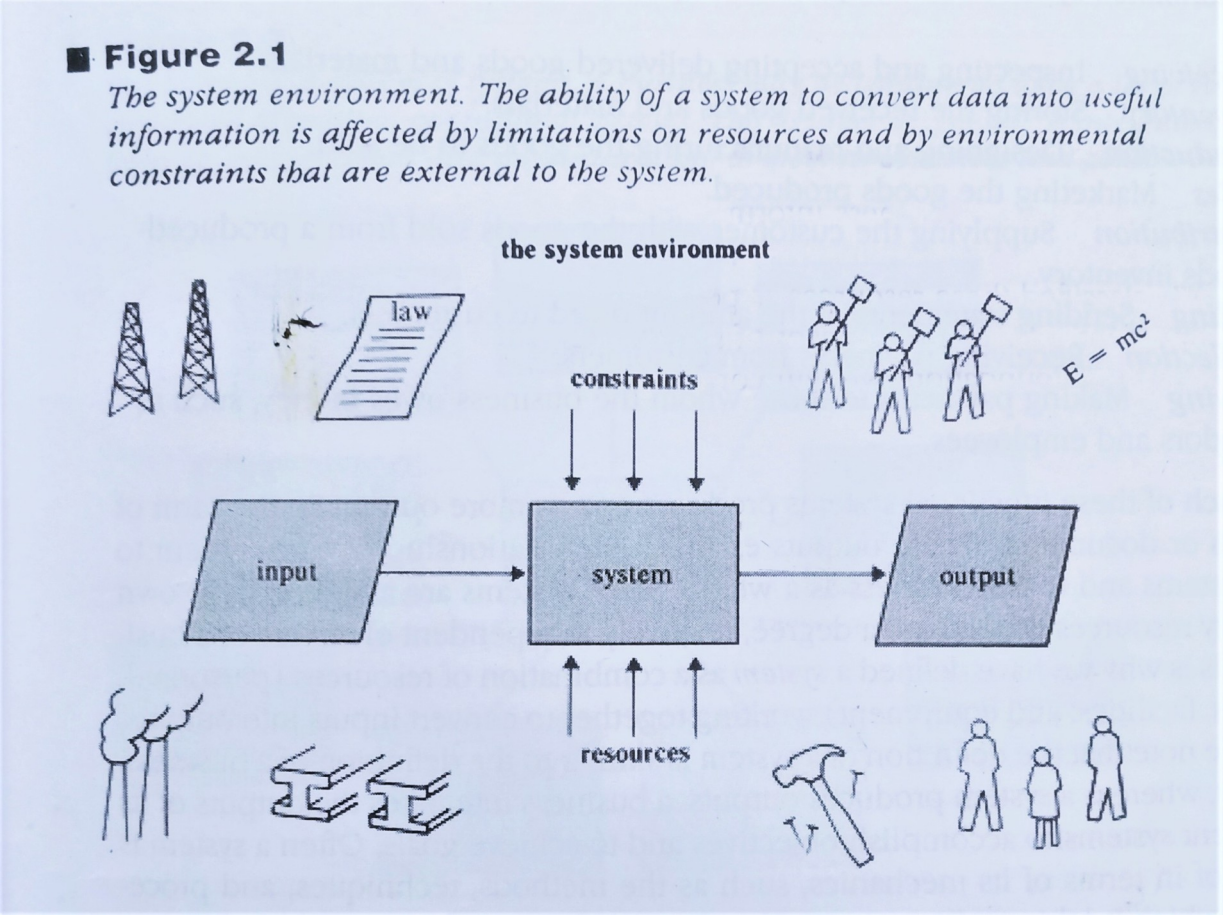
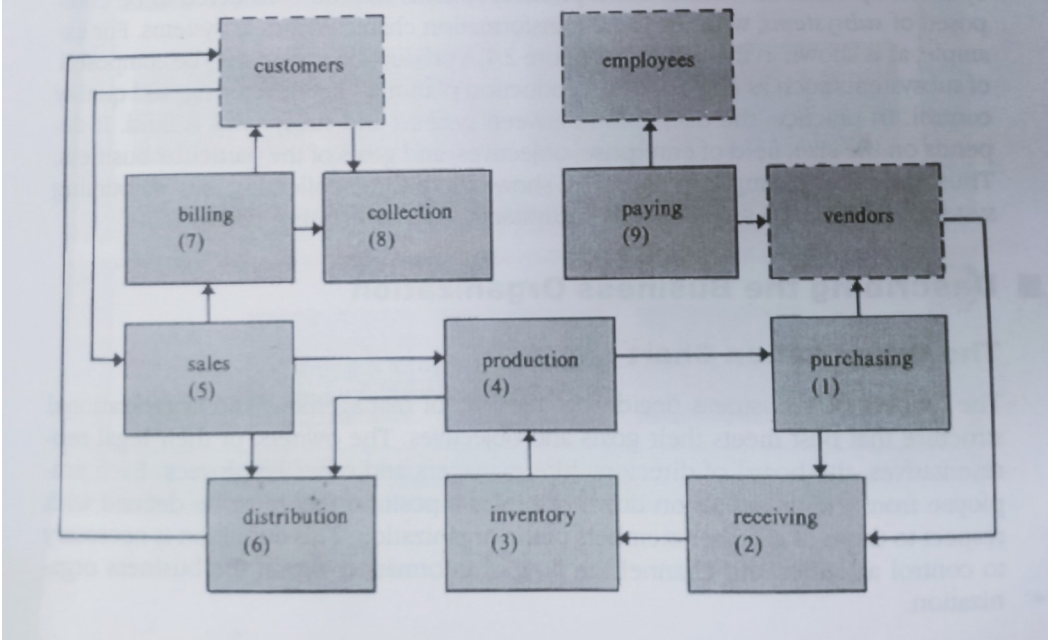


Figure 2.1
The system environment. The ability of a system to convert data into useful information is affected by limitations on resources and by environmental constraints that are external to the system.

■ **Figure 2.2**

Functional business systems. Nine principal systems are associated with most product-oriented businesses: purchasing, receiving, inventory, production, sales, distribution, billing, collection, and paying. Persons who interact with these systems include customers, vendors, and employees.-



■ **Figure 2.3**

The business: A system of systems. A business may be considered to be a large system composed of smaller, operational systems. This "system of systems" is integrated, through management and administration, to meet its objectives and goals.

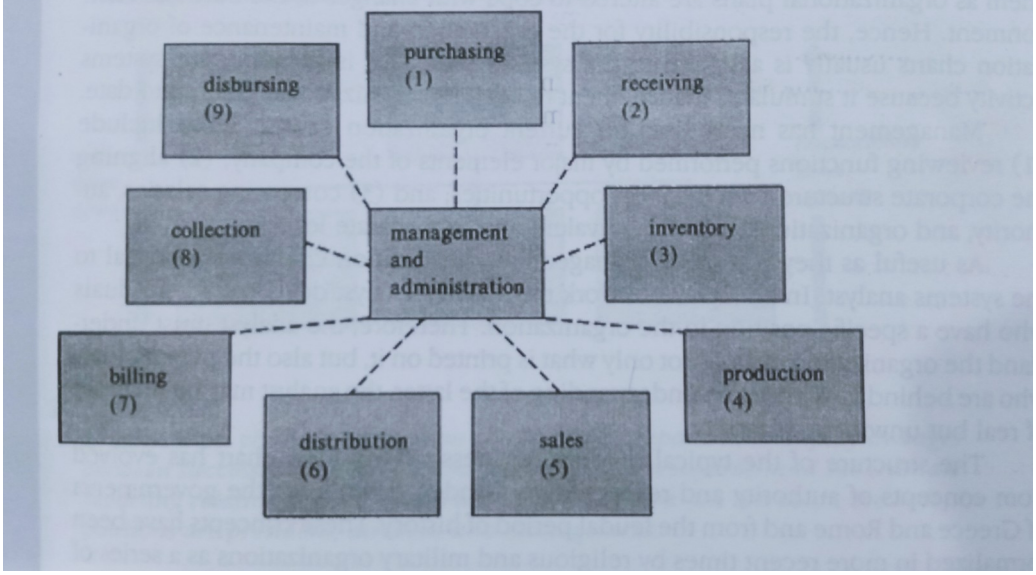
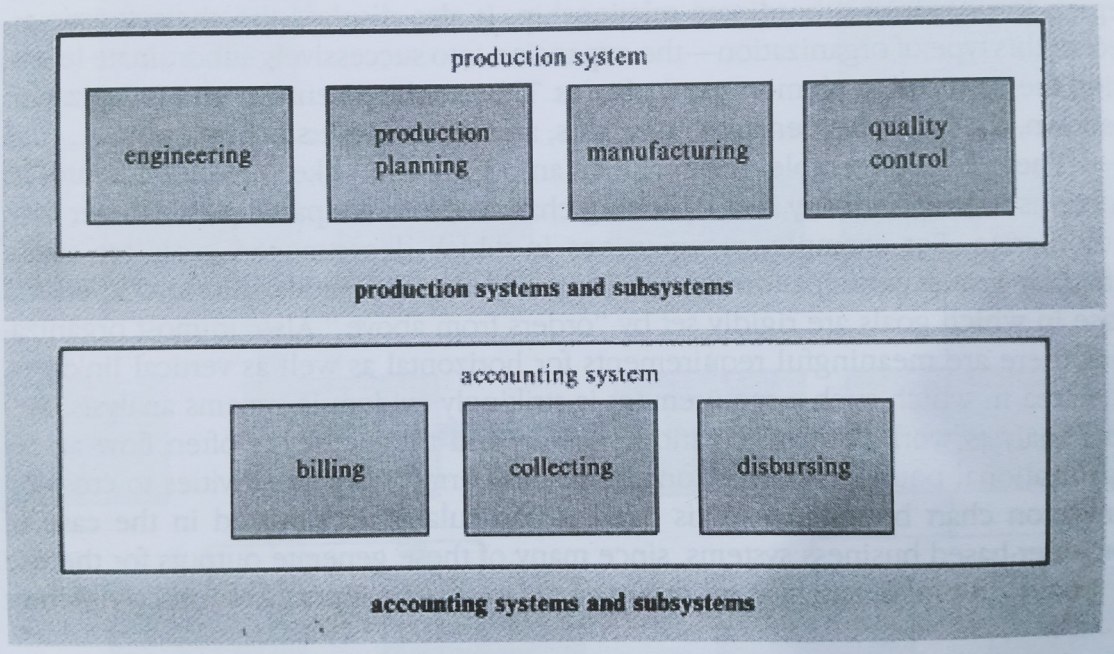


Figure 2.4
Systems and subsystems. Most large systems are made up of subsystems that also transform inputs into outputs. Two examples of such large systems are a production system and an accounting system.



Business System Characteristics

Business Goals and Objectives

The purposes of a business can be defined in terms of goals and objectives. A **goal** is a very broadly stated purpose. Examples are the goal of making profit and the goal of educating students. **Objectives** are concrete and specific accomplishments necessary to the achievement of goals. For example, an automobile manufacturer must have as an objective the production of a competitive product in order to achieve a profit goal; a college must as an objective relevant curricula in order to achieve its educational goal. Major objectives are composed of lower-order objectives. Accordingly, before a car can be made, subassemblies must be produced and, before that, proper tools must be designed. Goals are relatively long term, and objectives are relatively short term.

Most business enterprises fall into one of two broad categories: production or service. Examples of production enterprises are manufacturing, farming, construction, and agriculture. Service enterprises include transportation, communications, medicine, and education. Each enterprise, whether production or service, has its particular goals and goal -supporting objectives.

A Business: A System of Systems

Business Systems are composed of smaller elements, which also are systems. These systems transform or convert inputs into outputs. Principal functional systems associated with most product-oriented enterprises are:

Purchasing, Receiving, Inventory, Production, Sales, Distribution, Billing, Collection, Paying

(Figure:2.2). Each of these functional systems produces one or more outputs in the form of products or documents. These outputs establish the relationship of each system to other systems and to the business as a whole.

A business may be considered to be a large system composed of smaller, operational systems. This “system of systems” is integrated, through management and administration, to meet its objectives and goals.(Figure 2.3). A system produces output, a business integrates the outputs of its component systems to accomplish objectives and achieve goals. Systems are the major elements of a business so a business can be considered as a system of systems.

Describing the Business Organization

The Organization Chart

The owners of a business decide on the type of management and organizational structure that best meets their goals and objectives. The owners, or their legal representatives, the board of directors, hire managers and other employees. Each employee from the president on down occupies a position that must be defined with respect to those of all other members of the organization. This definition is necessary to control activities and channel the flow of information within the business organization.

The organization chart is a flowchart that identifies the organizational elements of a business and displays areas of responsibility and lines of authority. It is the responsibility of top management to define and to update the organization chart. The designing of organization chart is an important systems activity because it stimulates management to keep its organizational plan up to date.

Management has many uses for current organization charts. These include:

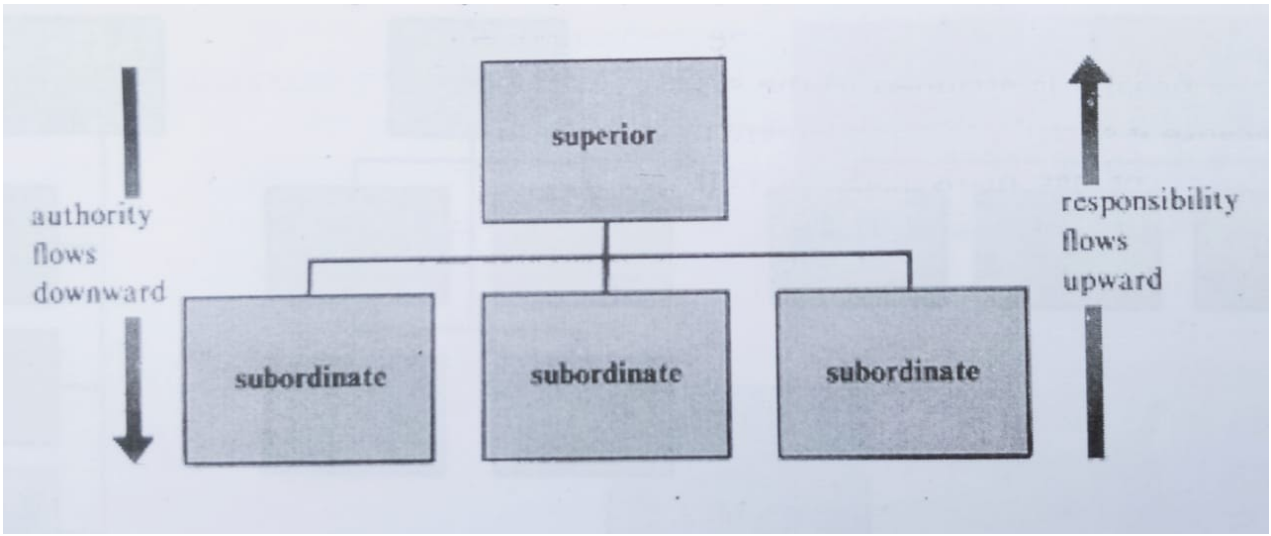
(1) Reviewing functions performed by major elements of the company

(2) Aligning the corporate structure with business opportunities

(3) Comparing salaries, authority, and organizational size at equivalent and subordinate levels!

Organization charts are essential to the systems analyst. In all aspects of the work system analyst deals with individuals who have a specific position in the organization. Therefore, the analyst must understand the organization chart - not only what is printed on it but also the personalities who are behind it.

Superior-subordinate relationship. Most business organization charts are structured as a series of superior-subordinate relationships. Rectangles identify positions and functions; lines and arrowheads indicate the downward flow of authority and the upward flow of responsibility.



Organization charts can be expanded to display linkages between successive levels. In most of the organization there is a horizontal linkage and vertical linkage. Vertical linkages are used for superior subordinate reporting. Positions for which both a superior and subordinate reporting relationship are shown are called link pins. On this chart(Figure 2.6), the link pin positions are vice-presidents, the directors, and the managers. Horizontal linkages are used to pass information to different functional areas in the same level of an organization.

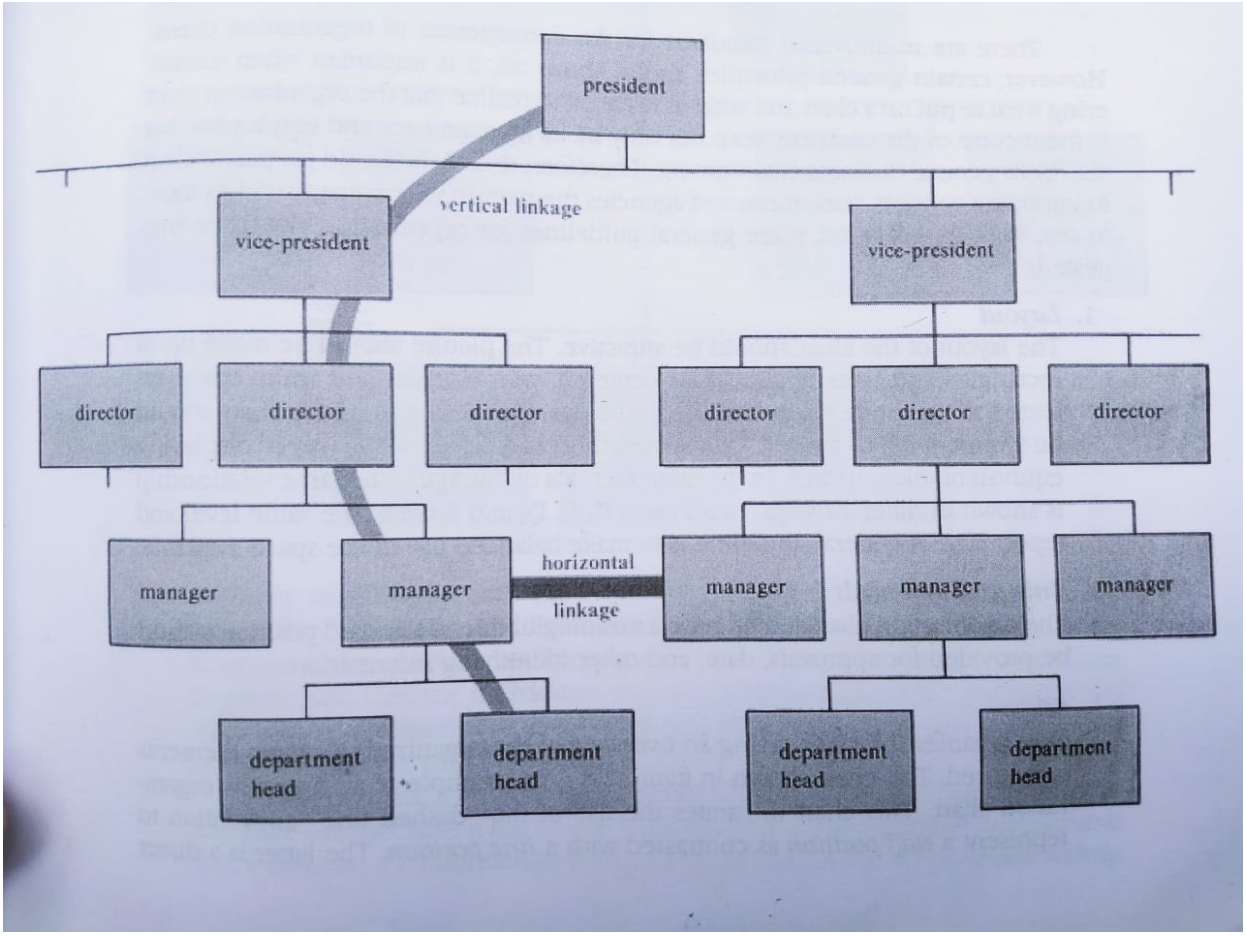


Figure 2.6

Organization chart symmetry: There are many ways of laying out symmetrical organization charts. The three methods shown are equivalent, since the superior-subordinate relationship are the same.

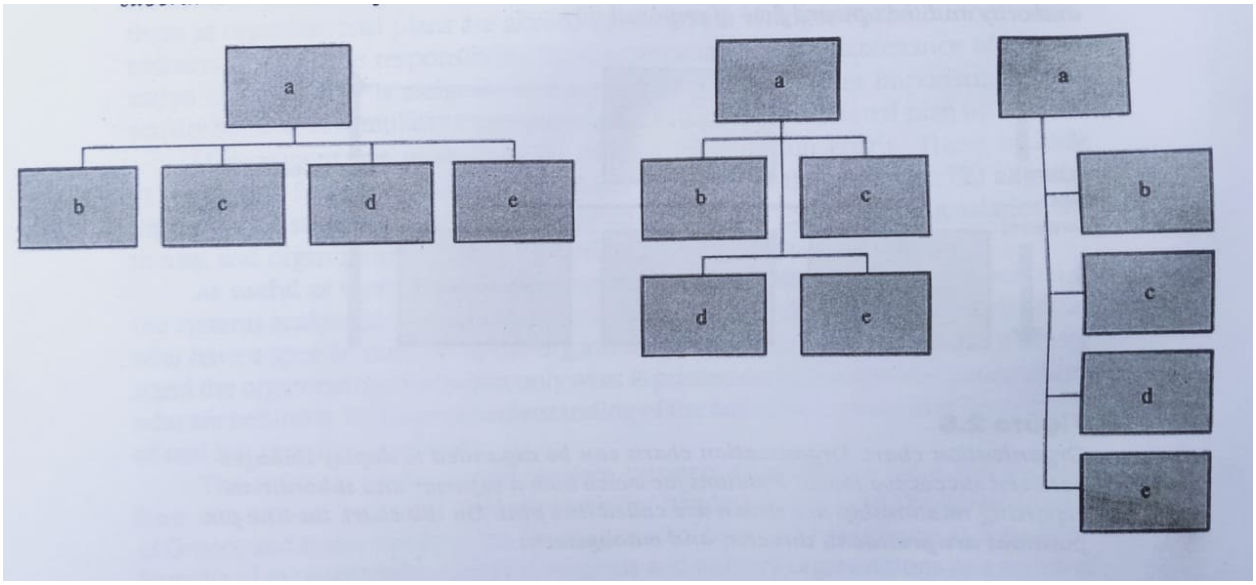


Figure 2.7

There are no universal standards for the construction of organization charts. However, certain general principles apply. Above all, it is important when considering what to put on a chart and what to leave off to realize that the organization chart is the picture of the company seen not only by its management and employees, but also by its general business environment. Therefore, this chart should properly reflect to important vendors, customers, and agencies the picture the company wishes them to see. some general guidelines for organization charts are :

1. Layout

The layout of the chart should be attractive. The picture should be made up of rectangles and lines. It should be centered, with margins and white space selected to make the chart pleasing to the eye. The structure of the chart should be symmetrical: As figure 2.7 illustrates, there is more than one way of displaying equivalent relationships. In the three sections of this figure the same relationship is shown in different ways. In all cases B, C, D, and E are at the same level and report to A. A general guideline is to make balanced use of the space available.

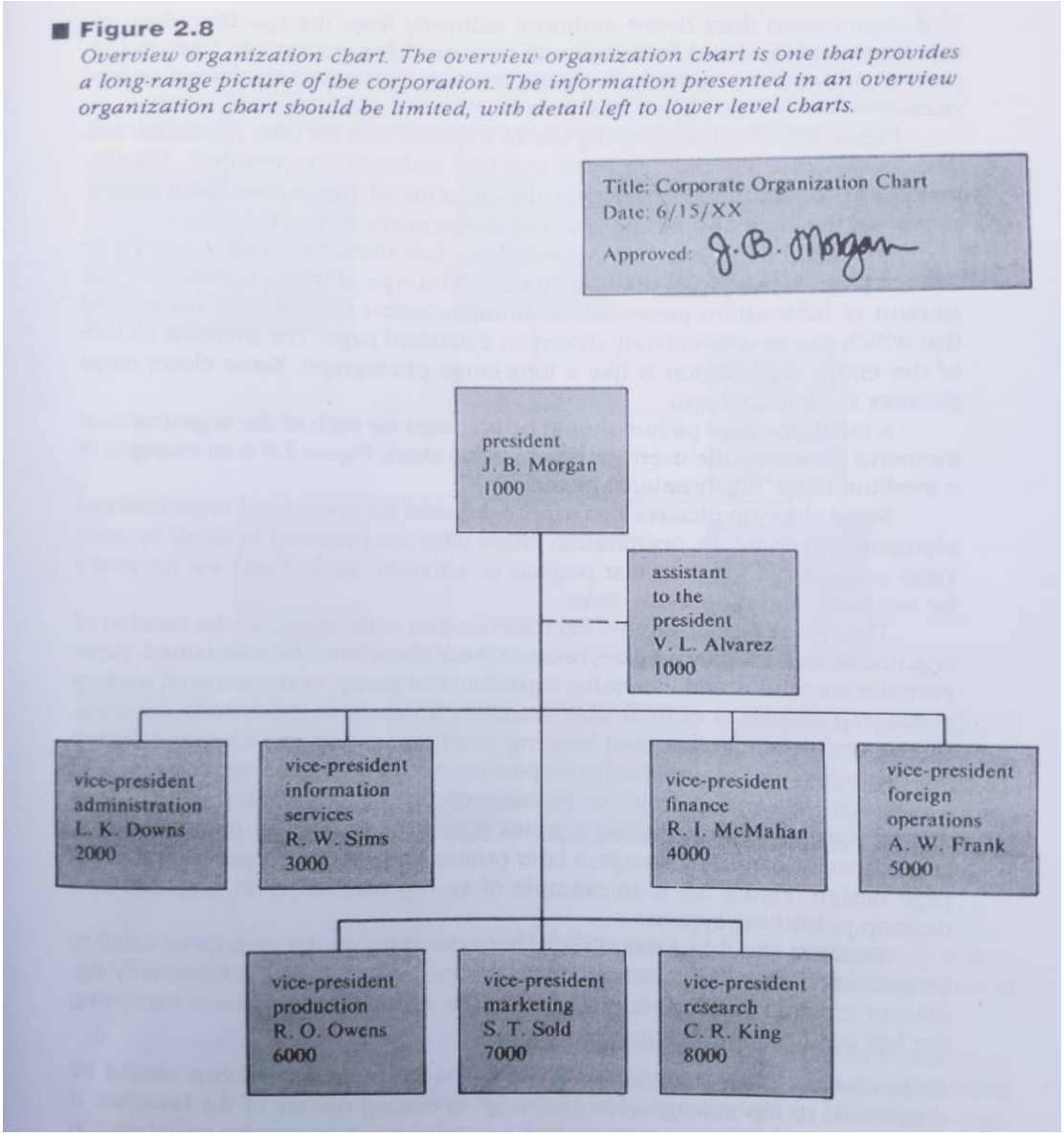
2. Title and approvals

The organization chart should have a meaningful title. A standard position should be provided for approvals, date, and other identifying information.

3. Scope

One organization chart giving an overview of the organization's main elements is required (Figure 2.8)

■ **Figure 2.8**
Overview organization chart. The overview organization chart is one that provides a long-range picture of the corporation. The information presented in an overview organization chart should be limited, with detail left to lower level charts.



4. Organization chart distribution

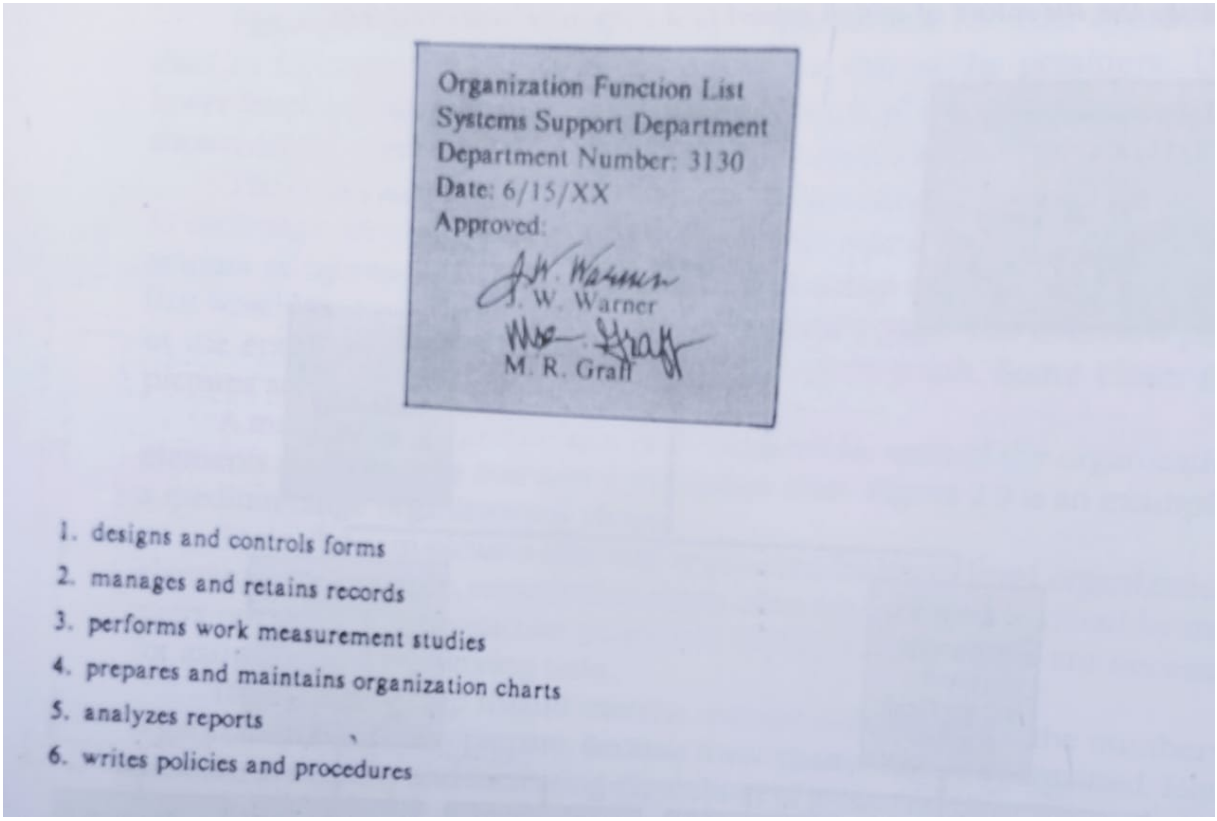
The overview organization chart should be distributed to top management and to all operating officers of the business. It should be available to customers and to employees who express an interest in the general organization of the company. Normally, new employees are provided with a copy of the top view organization chart as part of their indoctrination. Other organization charts should be distributed to individuals who have their responsibilities shown on the chart, to their superiors, and to any other persons, such as systems analysts, who have a legitimate need for the information.

5. Information provided

Each organizational rectangle on the chart should contain a title with functional significance (for example, vice-president, information services), the name of the individual in that position, and an identifying organization number. Figures 2.8 illustrate a typical format.

The Organization Function List

An organization function list provides information about the major activities performed by an organization. A separate organization function list is prepared for each element shown on an organization chart. It is keyed to the organization chart by use of the organizational titles and numbers shown on the organization chart.



Organization Function List
Systems Support Department
Department Number: 3130
Date: 6/15/XX
Approved:
J. W. Warner
M. R. Graff

1. designs and controls forms
2. manages and retains records
3. performs work measurement studies
4. prepares and maintains organization charts
5. analyzes reports
6. writes policies and procedures

Systems analysts who understand the organization chart and its associated function list are better equipped to improve the efficiency of business systems for which they are responsible. Analysts can use the organization chart as a means of increasing their knowledge of operational processes, job responsibilities, and information flow.

Management Uses of Information

Information System Levels

Four levels of information systems that exist in a typical business of moderate to large size. These are (1) operational; (2) lower management; (3) middle management; and (4) top management. (Figure 2.14)

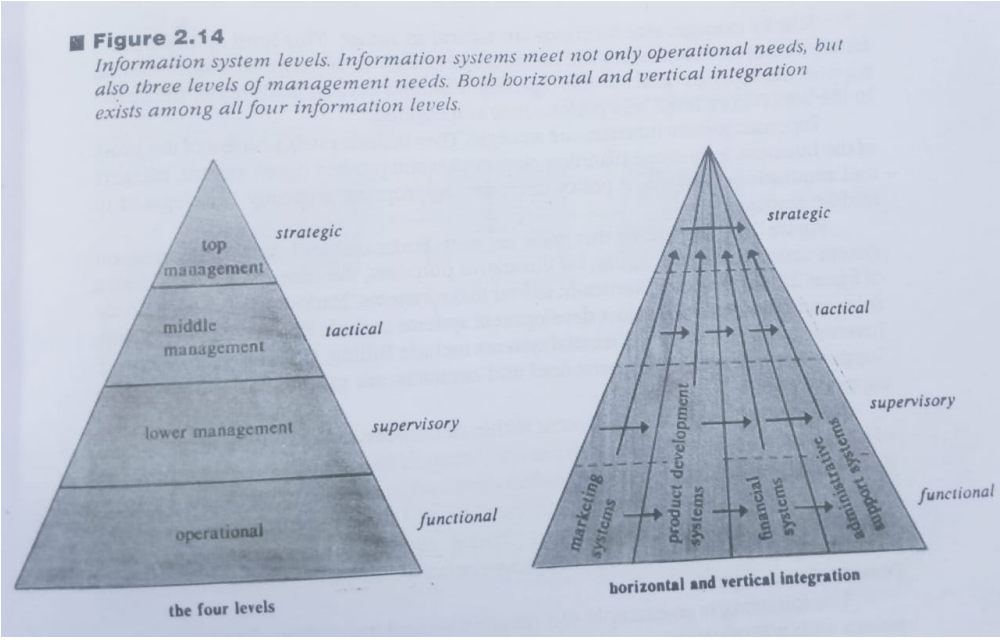


Figure 2.14
Information system levels. Information systems meet not only operational needs, but also three levels of management needs. Both horizontal and vertical integration exists among all four information levels.

At the operational level, routine production or clerical operations are per. formed. Operational systems provide little feedback directly to the employee. For example, the materials clerk receives a material requisition, fills the requisition, and files a report of action taken. A supervisor evaluates the employee's performance. However, records of transactions occurring at the operational level constitute data that, when collected, organized, and processed, becomes information that is the basis for higher level management actions.

Lower management performs supervisory functions that are short term relative to the higher levels of management. They deal with day-to-day job scheduling, checking the results of operations, and taking the necessary corrective actions.

Middle management functions are tactical in nature. This level is responsible for allocating and controlling the resources necessary to accomplish objectives that support the strategic goals of the business. Planning occurs; authority is delegated to the supervisory level; and performance is measured.

Top management functions are strategic. They include establishment of the goals of the business, long-range planning, new market and product development, mergers and acquisitions, and major policy decisions. Appropriate authority is delegated to middle management.

The different uses and requirements for information at each management decision level are summarized in figure 2.16.

Figure 2.16

Management decision levels: Information use and requirements. Information uses and, therefore, information requirements differ at each management decision level. At the higher decision levels more emphasis is placed upon external information, long-term trends, and "what if" considerations.

MANAGEMENT LEVEL	INFORMATION USE	INFORMATION REQUIREMENTS
TOP MANAGEMENT	1. GOAL SETTING 2. LONG-RANGE PLANS 3. STRATEGY 4. RETURN ON INVESTMENT	1. EXTERNAL INFORMATION, e.g. Competitor actions Government actions New markets Resource availability 2. INTERNAL INFORMATION, e.g. Financial reports Key exception reports 3. LONG-TERM TRENDS 4. "WHAT IF" INFORMATION
MIDDLE MANAGEMENT	1. OBJECTIVES DEFINITION 2. MEDIUM-RANGE PLANS 3. TACTICS	1. INTERNAL INFORMATION, e.g. Financial reports Exception reports 2. SHORT-TERM TRENDS 3. SOME "WHAT IF" INFORMATION
LOWER MANAGEMENT	1. OBJECTIVES ATTAINMENT 2. SHORT-RANGE PLANS 3. SUPERVISION	INTERNAL INFORMATION, e.g. Recent historical information Detailed operational reports Appropriate exception reports

1. The higher the decision level, the greater the reliance on externally generated information and the less the reliance on internally generated information.

2. The higher the decision level, the greater the emphasis upon planning and the use of longer term trend information.

3. The higher the decision level, the greater the necessity to ask "what if" questions as part of the decision process.

At the higher decision levels in a company, information needs and uses are future-oriented and depend to a greater extent upon external sources of information. This type of information is difficult to quantify and must be coupled with the experience and judgment of the decision maker. At these levels, computer-based information systems often are referred to as decision support systems (DSS) because they provide information to support the particular decision processes practised by senior managers. Increasingly, personal computers supported by productivity software, such as electronic

spreadsheets and database managers, are adding flexibility to decision making at all managerial levels.

Feedback and Control

Feedback and control are essential to the design of any management system. Feed back is the process of comparing an actual output with a desired output for the purpose of improving the performance of a system. Control is the action taken to bring the difference between an actual output and a desired output within an acceptable range. These concepts are illustrated in figure 2.15. Part A depicts a system in which there is no feedback and control. This system does transform an input into an output; however, because it lacks feedback, it is called an open loop system.

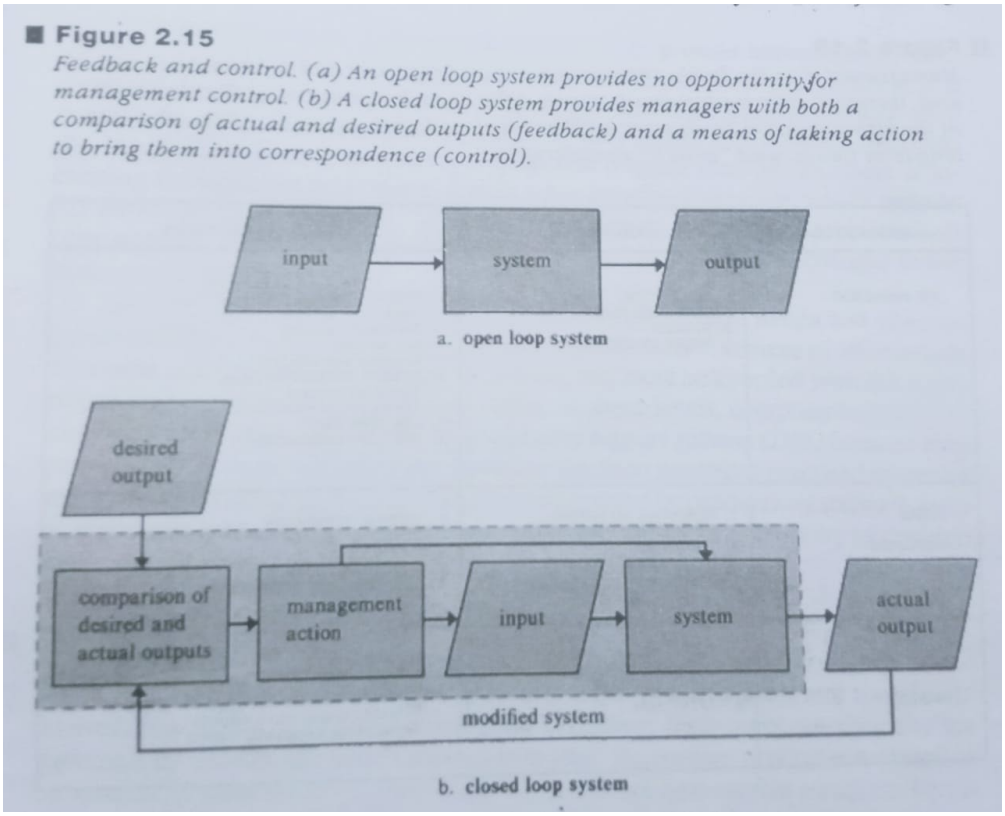


Figure 2.15
Feedback and control. (a) An open loop system provides no opportunity for management control. (b) A closed loop system provides managers with both a comparison of actual and desired outputs (feedback) and a means of taking action to bring them into correspondence (control).

From part A of figure 2.15, it is evident that the output depends solely on the characteristics of the input and of the system. If the output is not satisfactory, there is no provision for modifying either the input or the system. In a closed loop system, there is feedback and control. The elements of a closed loop system are shown in part B of figure 2.15. This flowchart demonstrates that the comparison of desired and actual outputs results in management action, which may modify the inputs, the system, or both. The result is a modified system that will produce altered outputs. Many operational systems are open loop systems. All true management systems are closed loop systems.

Hardware and Software End Products

The hardware end products are described primarily by their physical, for example, electrical or mechanical, attributes, which can be observed and measured as the hardware moves through the several stages of its development. Examples of complex systems that have been developed by the application of life-cycle techniques are rockets, communications networks, computer systems, and spacecraft.

Software may be defined as a collection of programs or routines that facilitates the use of a computer. This definition includes operating systems, which facilitate the general use of computers, and application programs, which are written to solve specific problems. Software, in contrast with hardware, does not possess attributes that can readily be observed and measured from concept to end product. The software end product is information.

System Analysis and the Systems Analyst

System Analysis

System Analysis is a structured process for identifying and solving problems. Analysis implies the process of breaking something down into its parts so that the whole may be understood. The definition of systems analysis includes not only the process of analysis, but also that of synthesis, which is the process of putting parts together to form a new whole.

Systems Analyst

A System analyst is an individual who performs systems analysis during any, or all, of the life-cycle phases of a business information system. The system analyst not only analyzes business information system problems, but also synthesizes new systems to solve those problems or to meet other information needs. In doing so, the systems analyst works not only with computers, but also must often manage other information resources available to a business.

The Systems Development Life-Cycle Concept

The Life-Cycle Concept

Systems are created by a dynamic process that moves through a series of stages, or phases. The concept of a life cycle has evolved to describe the relationship between these phases. This concept includes not only forward (in time) motion, but also the possibility of having to return, that is, cycle back to an activity previously considered completed. This cycling back, or feedback, is an iterative process that may occur as the result of the failure of the system to meet a performance objective or as the result of changes in or redefinition of system objectives. Thus, we refer to the information systems development process that follows the life cycle concept as the systems development life cycle or SDLC.

The Life-Cycle Activities

The Life-Cycle Flowchart (Figure 3.2)

The systems development life cycle of a computer information system can be described as an orderly sequence of significant steps. The four major phases of SDLC are:

1. The study phase
2. The design phase
3. The development phase
4. The operation phase

All of the activities associated with each life-cycle phase must be performed, managed, and documented. Hence, we can now define systems analysis as the performance, management, and documentation of the activities related to the four life-cycle phases of a business information system.

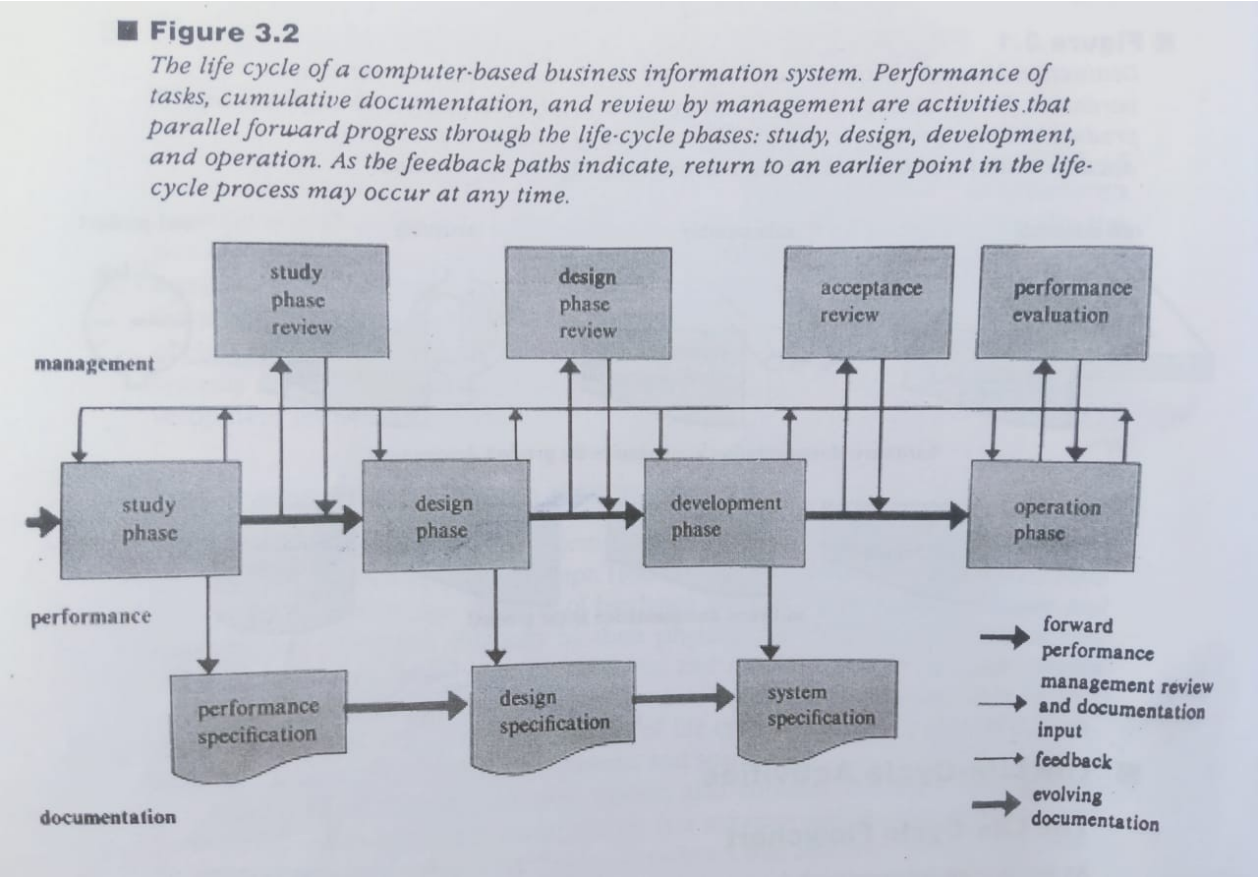


Figure 3.2
The life cycle of a computer-based business information system. Performance of tasks, cumulative documentation, and review by management are activities that parallel forward progress through the life-cycle phases: study, design, development, and operation. As the feedback paths indicate, return to an earlier point in the life-cycle process may occur at any time.

Performance of the Life-Cycle Tasks

The life-cycle method for developing complex systems is a modular, top-down procedure. In the study phase, modules that describe the major functions to be performed by the system are developed. The procedure is called top-down because in successive phases the major modules are

expanded into additional, Increasingly detailed, modules. Powerful graphic tools have been developed to structure the top-down design and development of systems.

The Study Phase

This is the phase in which a problem is identified and analyzed, alternate solutions studied, and a system recommendation made at a general design level. The recommendation involves the commitment of the resources needed to complete the detailed design and the development of the computer information system.

The Design Phase

In this phase the detailed design of the system selected in the study phase is accomplished. In the case of a computer-based business system, design phase activities include the allocation of resources to equipment tasks, personnel tasks, and computer program tasks. In the design phase, the technical specifications are prepared for the performance of all allocated tasks.

The Development Phase

This is the phase in which the computer-based system is constructed from the specifications prepared in the design phase. Equipment is acquired and installed during the development phase. Computer programs are written. All necessary procedures, manuals, software specifications, and other documentation are completed. The staff is trained, and the complete system is tested for operational readiness.

The Operation Phase

In this phase, the new system is installed or there is a changeover from the old system to the new system. The new system is operated and maintained. Its performance is reviewed, and changes in it are managed.

Management Review of the Life-Cycle Activities

Management review of the life-cycle activities may occur at any time. However, the conclusion of each phase is a natural time for a major management review.. These are formal scheduled reviews that must occur before a phase can be considered complete. They are essential to a structured interaction between the systems analyst and the user, ensuring user involvement at critical decision points. Three types of decisions can be forthcoming at each review:

(1) proceed to the next phase;

(2) cancel the project;

(3) redo certain parts of a previous phase.

Activities that are redone must be reviewed before the project can proceed to a subsequent phase. Management review often is the mechanism that triggers "cycling back” (feedback) to an earlier state in the life cycle, to remedy performance deficiencies, or to respond to changes in requirements. Each successful review is a renewal of management commitment to the project.

Documenting the Computer-Based Business Information System

The accumulation of documentation parallels the life cycle performance and management review activities. Documentation is not a task accomplished as a "wind-up" activity; rather, it is continuous and cumulative. The most essential documents are called baseline specifications (that is, specifications to which changes can be referred). **Baseline specification is a reference document for system maintenance and change. There are three baseline specifications**:

1. Performance specification

Completed at the conclusion of the study phase, and describing in the language of the user exactly what the system is to do. It is a general "design to" specification.

2. Design specification

Completed at the conclusion of the design phase, and describing in the language of the programmer how to develop the system. It is a detailed "build to" specification.

3. System specification

Completed at the conclusion of the development phase and containing all of the critical system documentation. It is the basis for all manuals and procedures, and it is a complete "as built" specification.

The design specification evolves from the performance specification, and the system specification evolves from the design specification. And, since these documents are the only measurable evidence that progress is being made toward the creation of a useful software end product, it is not possible to manage the life-cycle process without them. Thus, documentation is not only the "visible" software end product, but also the key to the successful management of the life cycle of computer based business systems.

The Role of the Systems Analyst

Characteristics of Computer Information Systems

1. Accuracy

There is a greater potential for accuracy. Once the data are entered correctly into the system in a machine-readable format, it is not necessary to reenter them. This reduces the chances for error by reducing the number of times humans are involved.

2. Data collection and communication

Methods for collecting and communicating data are faster and more efficient, Modern computers allow data communication networks to be established to collect data and to respond to inquiries. An airline reservation system is an example of a network of data communication sites tied into a central data processing center. A reservation clerk may inquire about space availability on any flight and receive an almost immediate response. Seat reservations can be made and confirmed while the customer waits.

3. Data storage

Another way in which manual and human-machine systems differ is in the quantities of data that can be stored and accessed. In computer-oriented systems, data are kept in files, in a machine-readable format. A collection of related files forms a database. Databases allow for the centralized storage of data, thereby eliminating the need for multiplicity of redundant files. Database systems require special measures to prevent their contamination by bad data.

4. Speed of response

The time required for information to become available-can be greatly improved by use of computers.

The Functions of Systems Analysis

Most of the basic functions performed by systems analysts have not changed as a result of the changes in technology and in business information needs. These functions are:

1. To analyze business systems with problems and to design new or modified systems to solve those problems

2. To develop business systems to meet new information or operational needs

3. To prepare and maintain manuals to communicate company policies and

procedures

4. To design the various business forms used to collect data and to distribute information

5. To perform records management, including the distribution and use of reports

6. To participate in the selection of information processing equipment and to establish standards for equipment selection

7. To prepare and maintain business organization charts