Chapter Six
Supply Chain Information System

6.1.Fundamental concepts of information system

System concepts underline the field of information systems. Understanding system concepts will help you understand many other concepts in the technology, applications, development, and management of information systems.

A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process. A system (sometimes called a dynamic system) has three basic interacting components or functions. These include:

- ✓ **Input -** involves capturing and assembling elements that enter the system to be processed.
- ✓ **Processing -** involves transformation processes that convert input into output.
- ✓ **Output -** involves transferring elements that have been produced by a transformation process to their ultimate destination.

Two additional components of the system concept (input, processing, output) include feedback and control. A system with feedback and control, components is sometimes called a cybernetic system, that is, a self-monitoring, self-regulating system.

- ✓ **Feedback** - is data about the performance of a system.
- ✓ **Control -** - involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goals.
  - the control function then makes necessary adjustments to a system's input and processing components to ensure that it produces proper output.

6.1.1. **Components of An Information System**

An ***information system model*** expresses a fundamental conceptual framework for the major components and activities of information systems. An information system depends on the resources of people, hardware, and software to perform input, processing, output, storage, and control activities that convert data resources into information products.

Information systems model emphasizes four major concepts that can be applied to all types of information systems:

- ✓ People, hardware, software, and data are the four basic resources of information systems.
- ✓ People resources include end users and IS specialists, hardware resources consists of machines and media, software resources include both programs and procedures, and data resources can include data, model, and knowledge bases.
- ✓ Data resources are transformed by information processing activities into a variety of information products for end users.
- ✓ Information processing consists of input, processing, output, storage, and control activities.

A. Information System Resources

The basic IS model shows that an information system consists of five major resources:

i. ***People Resources*****:** People are required for the operation of all information systems. This people resource includes end users and IS specialists.

- ✓ ***End Users***: are people who use an information system or the information it produces.
- ✓ ***IS Specialists***: are people who develop and operate information systems.

ii. ***Hardware Resources:*** Hardware resources include all physical devices and materials used in information processing.

- ✓ ***Machines***: physical devices (computers, peripherals, telecommunications networks)
- ✓ ***Media***: all tangible objects on which data are recorded (paper, magnetic disks)

iii. ***Software Resources*****:** Software resources include all sets of information processing instructions.

- ✓ ***Program***: a set of instructions that cause a computer to perform a particular task.
- ✓ ***Procedures***: set of instructions used by people to complete a task.

iv. ***Data Resources*****:** Data constitutes a valuable organizational resource. Thus, ***data resources*** must be managed effectively to benefit all end users in an organization.

- ✓ ***Databases:*** is a collection of logically related records or files. A database consolidates many records previously stored in separate files so that a common pool of data records serves many applications.
- ✓ ***Knowledge Bases:*** which hold knowledge in a variety of forms such as facts and rules of inference about various subjects.

v. ***Network Resources:***

Telecommunications networks like the Internet, intranets, and extranets have become essential to the successful operations of all types of organizations and their computer-based information systems. Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by communications software. The concept of network resources emphasizes that communications networks are a fundamental resource component of all information systems. Network resources include:

- ✓ ***Communications media*** (twisted-pair wire, coaxial cable, fiber-optic cable, microwave systems, and communications satellite systems.

- ✓ ***Network support*** (people, hardware, software, and data resources that directly support the operation and use of a communications network).

B. Information System Activities:

Information processing (or data processing) activities that occur in information system include the following:

Input of Data Resources:

i. Data about business transactions and other events must be captured and prepared for processing by the ***input*** activity. Input typically takes the form of *data entry* activities such as recording and editing.
ii. Once entered, data may be transferred onto a machine-readable medium such as magnetic disk or type, until needed for processing.

Processing of Data into Information:

i. Data is typically subjected to ***processing*** activities such as calculating, comparing, sorting, classifying, and summarizing. These activities organize, analyse, and manipulate data, thus converting them into information for end users.

Output of Information Products:

i. Information in various forms is transmitted to end users and made available to them in the ***output*** activity. The goal of information systems is the production of appropriate ***information products*** for end users.

Storage of Data Resources:

Storage is a basic system component of information systems. Storage is the information system activity in which data and information are retained in an organized manner for later use. This facilitates its later use in processing or its retrieval as output when needed by users of a system.

Control of System Performance:

An important information system activity is the ***control*** of its performance.

i. An information system should produce feedback about its input, processing, output, and storage activities.
ii. Feedback must be monitored and evaluated to determine if the system is meeting established performance standards.
iii. Feedback is used to make adjustments to system activities to correct deficiencies.

6.1.2. Types of Information Systems

Information Systems perform important operational and managerial support roles in businesses and other organizations. Therefore, several types of information systems can be classified conceptually as either Operations Information Systems or Management Information Systems.

A. **Operations Support Systems**

Information systems are needed to process data generated by and used in business operations. Such ***operations support systems*** (OSS) produce a variety of information products for internal and external use. However, they do not emphasize producing the specific information products that can best be used by managers. Further processing by management information systems is usually required. It may include:

- ✓ ***Transaction Processing Systems (TPS)***
- ✓ ***Process Control Systems (PCS)***
- ✓ ***Enterprise Collaboration Systems***

B. **Management Support Systems (MSS):**

Management support systems focus on providing information and support for effective decision making by managers. They support the decision making needs of strategic (top) management, tactical (middle) management, and operating (supervisory) management.

Providing information and support for management decision making by all types and levels of managers is a complex task. Conceptually, several major types of information systems are needed to support a variety of managerial end user responsibilities. Three major types of management information systems include:

- ✓ Management Information Systems (MIS)
- ✓ Decision Support Systems (DSS)
- ✓ Executive Information Systems (EIS)

6.2.Solving Business Problems with Information Systems

To solve a problem or pursue an opportunity requires a thorough understanding of the situation at hand. This requires separating problems from symptoms, determining objectives and constraints, and, more important, viewing the problem or opportunity in a systems context.

- ✓ *Problem*: is a basic condition that is causing undesirable results.
- ✓ *Opportunity*: is a basic condition that presents the potential for desirable results.
- ✓ *Symptoms*: are merely signals of an underlying cause or problem.

The problem solving process involves the following steps:

- ✓ Problem defining
- ✓ Developing Alternative Solutions
- ✓ Evaluating Alternative Solutions
- ✓ Selecting the Best Solution
- ✓ Designing and Implementing a Solution

6.2.1. Developing Information System Solution

Developing IS solutions to business problems is a major responsibility of any business professional today. As a business end user you will be responsible for; first proposing or developing new or improved information systems for your company and second managing the development efforts of IS specialists and other end users.

The systems approach can be applied to the solution of many types of problems. When this involves the development of information system solutions to business problems, it is called ***information systems development*** or *application development*. Most computer-based information systems are conceived, designed, and implemented using some form of systematic development process. In this process, end users and information specialists *design* information systems based on an analysis of the information requirements of an organization. Thus, a major part of this process is known as *systems analysis and design*.

When the systems approach is applied to the development of information system solutions, a multistep process or cycle emerges. This is frequently called the ***information systems development cycle,*** also known as the *systems development life cycle* (SDLC). The system development steps include:

i. ***Systems investigation stage:*** This step may involve consideration of proposals generated by an information systems planning process. The investigation stage also includes the preliminary study of proposed information system solutions to end user business problems. The three steps of the systems investigation stage involve:
   - ✓ Determine whether a business problem or opportunity exists.
   - ✓ Conduct a feasibility study to determine whether a new or improved information system is a feasible solution
   - ✓ Develop a project management plan and obtain management approval.

ii. ***Systems analysis*** is an in-depth study of end user information needs which produces *functional requirements* that are used as the basis for the design of a new information system. System analysis traditionally involves a detailed study of:
   - ✓ The information needs of the organization and the end users.
   - ✓ The activities, resources, and products of any present information systems
   - ✓ The information systems capabilities required to meet the information needs of end users.

iii. ***System analysis*** describes ***what*** a system should do to meet the information needs of users. System design specifies ***how*** the system will accomplish this objective. Systems design consists of design activities which produce systems specifications satisfying the functional requirements developed in the systems analysis stage. These specifications are used as the basis for:
   - ✓ Software development
   - ✓ Hardware acquisition
   - ✓ System testing
   - ✓ Other activities of the implementation stage.

iv. ***Prototyping*** is the rapid development and testing of working models, or ***prototypes***, of new applications in an interactive, iterative process involving both systems analysts and end users. Prototyping makes the development process faster and easier for systems analysts, especially for projects where end user requirements are hard to define. Thus, prototyping is sometimes called *rapid application design* (RAD). Prototyping has also opened up the application development process to end users because it simplifies and accelerates systems design. These developments are changing the roles of end users and information systems specialists in systems development.

v. ***Systems maintenance*** is the final stage of the systems development cycle. It involves the monitoring, evaluating, and modifying of a system to make desirable or necessary improvements. This may include:
   - ✓ ***Post implementation review*** process to ensure that the new system meets the objectives established for it.
   - ✓ Error detected in the development or uses of the system are corrected.
   - ✓ Later modifications to a system may also become necessary due to changes within the business or the business environment.

6.3. Data base Management

A hierarchy of several levels of data has been devised that differentiates between different groupings, or elements, of data. Data are logically organized into:

- ***Character*** - A ***character*** is the most basic logical data element. It consists of a single alphabetic, numeric, or other symbol.
- ***Field*** - A ***field*** consists of a grouping of characters. A data field represents an ***attribute*** (a characteristic or quality) of some ***entity*** (object, person, place, or event).
- ***Record*** - Related fields of data are grouped to form a ***record.*** Thus, a record represents a collection of *attributes* that describe an *entity*. *Fixed-length* records contain a fixed number of fixed-length data fields. *Variable-length* records contain a variable number of fields and field lengths.
- ***File*** - A group of related records is known as a data ***file***, or *table*. Files are frequently classified by the application for which they are primarily used, such as a *payroll file* or an *inventory file*, or the type of data they contain, such as a *document file* or a *graphical image file*. Files are also classified by their permanence, for example, a *master file* versus a *transaction file.* A transaction file would contain records of all transactions occurring during a period, whereas a *master file* contains all the permanent records. A *history file* is an obsolete transaction or master file retained for backup purposes or for long-term historical storage called *archival storage*.
- ***Database*** - A database is an integrated collection of logically related records or *objects*. A ***database*** consolidates records previously stored in separate files into a common pool of data records that provides data for many applications. The data stored in a database is independent of the application programs using it and of the type of secondary storage devices on which it is stored.

A ***database management system*** (DBMS) is a set of computer programs that controls the creation, maintenance, and use of the databases of an organization and its end users. The four major uses of a DBMS include:

- ***Database Development*** - Database management packages allow end users to develop their own databases. Large organizations with client/server or mainframe-based systems usually place control of enterprise database development with ***database administrators*** (DBAs). This improves the integrity and security of organizational databases. In database development a *data definition language* (DDL) is used to develop and specify the data contents, relationships, and structures of each database, and to modify these database specifications when necessary. Such information is catalogued and stored in a database of data definitions and specifications called a *data dictionary*, which is maintained by the DBA.

- ***The Data Dictionary*** - A ***data dictionary*** is a computer-based catalogue or directory containing *metadata;* that is, data about data. A data dictionary includes a software component to manage a database of data definitions about the structure, data elements, and other characteristics of an organization's databases. Data dictionaries can be queried by the database administrator to report the status of any aspect of a firm's metadata. The administrator can then make changes to the definitions of selected data elements. Some *active (*versus *passive)* data dictionaries automatically enforce standard data element definitions whenever end users and application programs use a DBMS to access an organization's database.

- ***Database Interrogation*** - The ***database interrogation*** capability is a major benefit of a database management system. End users can use a DBMS by asking for information from a database using a ***query language*** or a ***report generator***.

- ***Database Maintenance*** - Managers need accurate information in order to make effective decisions. The more accurate, relevant, and timely the information, the better informed management will be when making decisions. Thus, the databases of an organization need to be updated continually to reflect new business transactions and other events. This ***database maintenance*** process is accomplished by transaction processing programs and other end user application packages with the support of the DBMS.

- ***Application Development*** - DBMS packages play a major role in ***application development***. Application development is made easier by *data manipulation language* (DML) statements which can be included in application programs to let the DBMS perform the necessary data handling activities. Programmers can also use the internal programming language provided by many DBMS packages or a built-in application generator to develop complex application programs.

Types of Databases

Continuing developments in information technology and its business applications have resulted in the evolution of several major types of databases. Six major conceptual categories of databases that may be found in computer-using organizations include:

i. **Operational Databases** - These databases store detailed data needed to support the operations of the entire organization. They are also called subject area databases (SADB), transaction databases, and production databases. Examples are customer databases, personnel databases, inventory databases, and other databases containing data generated by business operations.

ii. **Analytical Databases** - These databases store data and information extracted from selected operational and external databases. They consist of summarized data and information most needed by the organization's managers and other end users. Analytical databases are also called management databases or information databases. They may also be called multidimensional databases, since they frequently use a multidimensional database structure to organize data. These are the databases accessed by the online analytical processing (OLAP) systems, decision support systems, and executive information systems in order to support managerial decision making.

iii. **Data Warehouse Databases** - A data warehouse stores data from current and previous years that has been extracted from the various operational and management databases of an organization. It is a central source of data that has been screened, edited, standardized, and integrated so it can be used by managers and other end user professionals from throughout an organization. Data warehouses may be subdivided into data marts which hold specific subsets of data from the warehouse. A major use of data warehouse databases is data mining. In data mining, the data in a data warehouse are processed to identify key factors and trends in historical patterns of business activity can be used to help managers make decisions about strategic changes in business operations to gain competitive advantages in the marketplace.

iv. **Distributed Databases** - Many organizations replicate and distribute copies or parts of databases to network servers at a variety of sites. These distributed databases can reside on network servers on the World Wide Web, on corporate intranets or extranets, or on other company networks. Distributed databases may be copies of operational or analytical databases, hypermedia or discussion databases, or any other type of database. Replication and distribution of databases is done to improve database performance and security.

v. **End User Databases** - These databases consist of a variety of data files developed by end users at their workstations. End users may have their own electronic copies of documents they downloaded from the WEB, generated themselves, or received by electronic mail.

vi. **External Databases** - Access to external, privately owned online databases or data banks is available for a fee to end users and organizations from commercial online services, and with or without charge from many sources on the Internet, especially the WEB.

6.4.Planning and Implementing Information systems

Once a proposed information system has been designed, it must be implemented. The ***systems implementation*** stage involves:

- ✓ Hardware and software acquisition
- ✓ Software development
- ✓ Testing of programs and procedures
- ✓ Development of documentation
- ✓ Installation activities
- ✓ Education and training of end users and specialists who will operate the new system.
- ✓ *Converting* from the use of the present system to the operation of a new or improved system.

Converting to a new system may involve:

- ✓ **Parallel System:** Operating both a new system and an old system at the same time for a trial period.
- ✓ **Pilot System:** Operate a pilot system on a trial basis at one location.
- ✓ **Phasing**: Phasing in the new system one application or location at a time.
- ✓ **Plunge (Cutover)**: Converting immediately to the new system.

6.5.Controlling Information Systems

Information technology presents managers with a major managerial challenge. The competitive pressures of the business and technology environment of the late 1990s are forcing major firms to rethink their use and management of information technology. Many business executives now see information technology as an enabling technology for managing the cross-functional and inter-organizational processes that business unit must have to successfully confront the competitive measures they face.

The information systems function has performance problems in many organizations. For example, information technology is not being used effectively, efficiently, or economically by many organizations. Information technology is not being used:

- **Effectively** - if it is used primarily to computerize traditional business processes, instead of using it for decision support and innovative processes and products to gain competitive advantages.
- **Efficiently** - by information services groups that provide poor response times, frequent downtime, incompatible systems, unintegrated data, and applications development backlogs.
- **Economically -** if information technology costs rise faster than other costs, even though the cost of processing each unit of data has decreased due to dramatic price reductions and improvements in hardware and software technology.