MAR GREGORIOS COLLEGE OF ARTS & SCIENCE

Block No.8, College Road, Mogappair West, Chennai – 37

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PG DEPARTMENT OF COMMERCE

SUBJECT NAME: MANAGEMENT INFORMATION SYSTEM

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PREPARED BY:PROF.C.SUJDHA/PROF.D.STEPHY JOY

Objective: To offer in depth knowledge on information systems in business and their management

Unit I Management Information System – Concept, Need, Strategic role – Evolution of Management Information System – Components of Management Information System – Information flow

Unit II Data base management systems – Objectives and Components – Database design – Creation and control – Recent trends in database

Unit III Developing information system – Planning, Designing and redesigning – Approaches for system development – System analysis and Design – system Implementation and Maintenance

Unit IV Transaction processing and Support system – Transaction processing system – Office automation systems – Decision support systems – Executive information systems – Artificial intelligence and Expert systems

Unit V Functional Information systems – Production, Finance, Human resource and Marketing – Managing information resources – Information Security – Control & Audit of Information Systems

UNIT - 1

MIS principal concerns

Facilitate decision making by supplying the information needed in an up-to-date and accurate form

· To the people who need it
· On time
· In a usable form

The objective of MIS is to provide information for a decision support process of management. It should help in such a way that the business goals are achieved in the most efficient manner. Since the decision-making is not restricted to a particular level, the MIS is expected to support all the levels of the management in conducting the business operations. Unless the MIS becomes a management aid, it is not useful to the organization.

The actual MIS process relates to:

1. Collection
2. Organization
3. Distribution
4. Storage of wide information
5. Managerial control and analysis of data

Characteristics of MIS:

1. MIS is a consciously developed master plan for information flow. It is an ongoing process. It operates continuously.

2. We have the best integration and coordination among functional departments, executives

and specialists such as systems analyst, programmer, and computer expert.

3. We have some kind of data processing equipment usually operated electronically. The computer is the modern equipment for MIS.

4. MIS is future oriented. It anticipates and prevents problems as well as it solves marketing problems. It is both a preventive as well as curative process in marketing.

5. The gathered data is processed with the help of management science or operations research techniques. Modern mathematical and statistical tools are available for problem solving in the field of marketing.

6. Systems analyst designs and operates MIS. It is operated through computers. Operations research analyst offers solutions to the marketing problem with the help of quantitative decision making tools.

7. Management gets a steady flow of information on a regular basis the right information, for the right people, at the right time and cost.

The following are the most important reasons to have a good management information system:

- **To control the creation and growth of records**

Despite decades of using various non-paper storage media, the amount of paper in our offices continues to escalate. An effective records information system addresses both creation control (limits the generation of records or copies not required to operate the business) and records retention (a system for destroying useless records or retiring inactive records), thus stabilizing the growth of records in all formats.

- **To reduce operating costs**

Recordkeeping requires administrative dollars for filing equipment, space in offices, and staffing to maintain an organized filing system (or to search for lost records when there is no organized system). It costs considerably less per linear foot of records to store inactive records in a Data Records Center versus in the office. [Multiply that by 30% to 50% of the records in an office that doesn't have a records management program in place], and there is an opportunity to effect some cost savings in space and equipment, and an opportunity to utilize staff more productively - just by implementing a records management program.

- **To improve efficiency and productivity**

Time spent searching for missing or misfiled record is non-productive. A good records management program (e.g. a document system) can help any organization upgrade its recordkeeping systems so that information retrieval is enhanced, with corresponding improvements in office efficiency and productivity. A well designed and operated filing system with an effective index can facilitate retrieval and deliver information to users as quickly as they need it.

Moreover, a well managed information system acting as a corporate asset enables organizations to objectively evaluate their use of information and accurately lay out a roadmap for improvements that optimize business returns.

- **To assimilate new records management technologies**

A good records management program provides an organization with the capability to assimilate new technologies and take advantage of their many benefits. Investments in new computer systems whether this is financial, business or otherwise, don't solve filing problems

unless current manual recordkeeping or bookkeeping systems are analyzed (and occasionally, overhauled) before automation is applied.

- **To ensure regulatory compliance**

In terms of recordkeeping requirements, China is a heavily regulated country. These laws can create major compliance problems for businesses and government agencies since they can be difficult to locate, interpret and apply. The only way an organization can be reasonably sure that it is in full compliance with laws and regulations is by operating a good management information system which takes responsibility for regulatory compliance, while working closely with the local authorities. Failure to comply with laws and regulations could result in severe fines, penalties or other legal consequences.

- **To minimize litigation risks**

Business organizations implement management information systems and programs in order to reduce the risks associated with litigation and potential penalties. This can be equally true in Government agencies. For example, a consistently applied records management program can reduce the liabilities associated with document disposal by providing for their systematic, routine disposal in the normal course of business.

- **To safeguard vital information**

Every organization, public or private, needs a comprehensive program for protecting its vital records and information from catastrophe or disaster, because every organization is vulnerable to loss. Operated as part of a good management information system, vital records programs preserve the integrity and confidentiality of the most important records and safeguard the vital information assets according to a "Plan" to protect the records. This is especially the case for financial information whereby ERP (Enterprise Resource Planning) systems are being deployed in large companies.

- **To support better management decision making**

In today's business environment, the manager that has the relevant data first often wins, either by making the decision ahead of the competition, or by making a better, more informed decision. A good management information system can help ensure that managers and executives have the information they need when they need it.

By implementing an enterprise-wide file organization, including indexing and retrieval capability, managers can obtain and assemble pertinent information quickly for current decisions and future business planning purposes. Likewise, implementing a good ERP

system to take account of all the business' processes both financial and operational will give an organization more advantages than one who was operating a manual based system.

- **To preserve the corporate memory**

An organization's files, records and financial data contain its institutional memory, an irreplaceable asset that is often overlooked. Every business day, you create the records, which could become background data for future management decisions and planning.

- **To foster professionalism in running the business**

A business office with files, documents and financial data askew, stacked on top of file cabinets and in boxes everywhere, creates a poor working environment. The perceptions of customers and the public, and "image" and "morale" of the staff, though hard to quantify in cost-benefit terms, may be among the best reasons to establish a good management information system.

ROLE OF MANAGEMENT INFORMATION SYSTEM

The role of the MIS in an organization can be compared to the role of heart in the body. The information is the blood and MIS is the heart. In the body the heart plays the role of supplying pure blood to all the elements of the body including the brain. The heart work faster and supplies more blood when needed. It regulates and controls the incoming impure blood, processed it and sends it to the destination in the quantity needed. It fulfills the needs of blood supply to human body in normal course and also in crisis.

The MIS plays exactly the same role in the organization. The system ensures that an appropriate data is collected from the various sources, processed and send further to all the needy destinations. The system is expected to fulfill the information needs of an individual, a group of individuals, the management functionaries: the managers and top management.

Here are some of the important roles of the MIS:

- The MIS satisfies the diverse needs through variety of systems such as query system, analysis system, modeling system and decision support system.
- The MIS helps in strategic planning, management control, operational control and transaction processing. The MIS helps in the clerical personal in the transaction processing and answers the queries on the data pertaining to the transaction, the status of a particular record and reference on a variety of documents.
- The MIS helps the junior management personnel by providing the operational data for planning, scheduling and control , and helps them further in decision-making at the operation level to correct an out of control situation.
- The MIS helps the middle management in short term planning, target setting and controlling the business functions. It is supported by the use of the management tools of planning and control.
- The MIS helps the top level management in goal setting, strategic planning and evolving the business plans and their implementation.

- The MIS plays the role of information generation, communication, problem identification and helps in the process of decision-making. The MIS, therefore, plays a vital role in the management, administration and operation of an organization.

The Evolution of Management Information Systems (MIS)

A management information system (MIS) is a computer system that gathers data from multiple business systems, analyzes the information, and provides reports that help guide management in decision-making.

MIS started as a data capturing and processing system and evolved into a more complex and intelligent system. Here's how MIS evolved through the years.

1950-1960: Electronic Data Processing (EDP)

Electronic Data Processing (EDP) systems, also called Transaction Processing Systems (TPS), were groundbreaking at the time. It was the first large-scale computer information system to centralize and process day-to-day transactions and activities such as cash deposits, ATM transactions, and payment orders. Shifting from manual to electronic made transaction processing and record-keeping a much faster process.

1960-1970: Management Information Systems (MIS)

It wasn't long before the EDP system was upgraded to a Management Information System (MIS) that was able to generate reports from the data it collected. MIS pulled reports from historical data to determine cost trends, do a sales analysis, keep track of inventory, and measure production performance.

When managers evaluated the information in these reports, they could see which areas of the business were underperforming and adjust decisions accordingly.

1970-1980: Decision Support Systems (DSS)

Decision Support System (DSS) provided historical and ad hoc reports on both internal and external information. For example, internal sales reports and external market pricing.

This advancement brought a new level of decision-making to businesses. Management could more accurately forecast sales, perform a risk analysis, and make bolder strategic decisions.

It was during this era that personal computers entered the workplace. PCs were connected to the main server so information became accessible to employees throughout the company. This led to a significant boost in productivity.

With this came the need for expert skills to manage these computer networks. Information technology (IT) soon became a burgeoning career and a degree in Management Information Systems became sought after.

1980-1990: Executive Information Systems (EIS)

As PCs put power in the hands of executives, they could purchase software tailored to their department's needs, such as accounting, project management, and HR systems. It resulted in multiple systems within an organization working independently.

This led to Executive Information Systems (EIS), a more refined version of the DSS system.

It allowed executives to analyze their department's output and how it impacted the business's overall performance.

1990-2000: Enterprise Resource Management (ERP) Systems

Multiple information systems that were not integrated resulted in employees wasting time duplicating information across systems. MIS had to become efficient.

It did that by creating Enterprise Resource Management (ERP) systems that integrated knowledge management systems and expert systems.

- Knowledge-based systems were used to organize and disseminate business knowledge within an organization. *Example:* placing a best practices resource on the intranet.
- Expert systems started to use artificial intelligence to provide advice and solutions. *Example:* proposing faster delivery routes or assessing risk profiles for credit applications.

Components of MIS

A management information system is made up of five major components namely people, business processes, data, hardware, and software. All of these components must work together to achieve business objects.

People – these are the users who use the information system to record the day to day business transactions. The users are usually qualified professionals such as accountants, human resource managers, etc. The ICT department usually has the support staff who ensure that the system is running properly.

Business Procedures – these are agreed upon best practices that guide the users and all other components on how to work efficiently. Business procedures are developed by the people i.e. users, consultants, etc.

Data – the recorded day to day business transactions. For a bank, data is collected from activities such as deposits, withdrawals, etc.

Hardware – hardware is made up of the computers, printers, networking devices, etc. The hardware provides the computing power for processing data. It also provides networking and printing capabilities. The hardware speeds up the processing of data into information.

Software – these are programs that run on the hardware. The software is broken down into two major categories namely system software and applications software. System software refers to the operating system i.e. Windows, Mac OS, and Ubuntu, etc. Applications software refers to specialized software for accomplishing business tasks such as a Payroll program, banking system, point of sale system, etc.

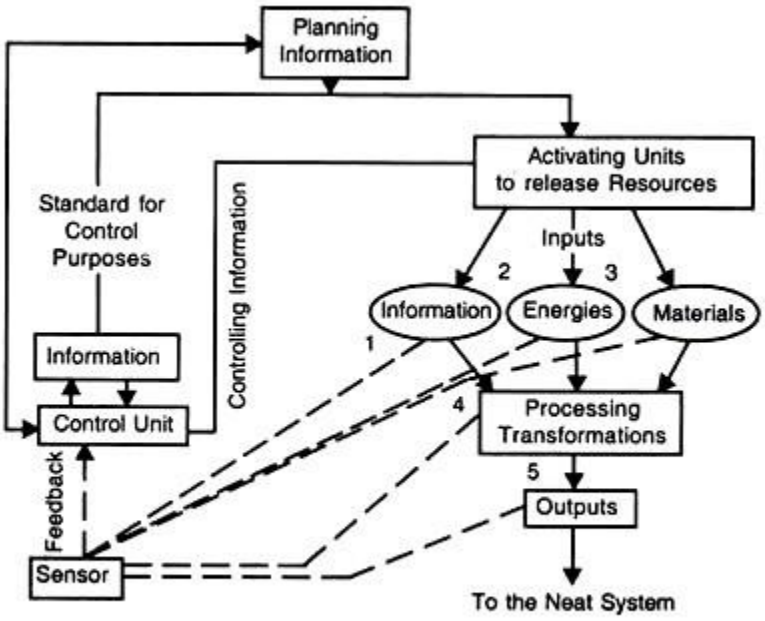


Fig. 4. Flow of Planning and Controlling

How Is MIS Changing?

MIS systems are becoming more intelligent. Most of the trends below are not new but they will continue to shape how management information systems function in the future.

1. Automation and cross-functional integration

Automation can be used for repetitive tasks and to cross-populate data with other systems. This frees up employees' time to focus on higher-value tasks. For example, automation can track inventory and alert you when stocks are low or automatically reorder stocks when needed without human intervention.

2. Big data analytics

Worldwide, around 2.5 quintillion bytes of data are being generated daily. That's a ton of data and a lot of it is harvested by businesses. From customers' buying habits to social media interactions, data is rolling in from everywhere.

Management information systems not only have to cope with the influx of data, but also analyze it. The information gleaned can be used to make operations more efficient, improve customer service, and create personalized marketing campaigns.

3. Artificial intelligence (AI)

Artificial intelligence is making waves across almost every sector. AI has been the biggest disruptor in business in recent years. From chatbots to self-driving cars, AI is already a part of our lives and will continue to become more entrenched.

AI technology is capable of learning patterns and identifying anomalies when processing big data. It can be used to detect fraud and determine the risk profile of applicants applying for credit.

4. Cyber security

Cybercrime is a threat every business faces. Most cyber attacks are financially motivated but some want to access or steal information to gain a competitive edge.

A cyber attack can be a fatal blow to a business. Research by Fundera shows that 60% of small businesses that experience a cyber attack go out of business within six months. Companies now invest heavily in protecting their data. As cybercriminals become more sophisticated, cyber security software will have to stay one step ahead.

UNIT – 2

Data Base Management System (DBMS): Meaning, Nature and Objectives

Data is nothing but facts and statistics stored or free flowing over a network, generally it's raw and unprocessed. For example: When you visit any website, they might store you IP address, that is data, in return they might add a cookie in your browser, marking you that you visited the website, that is data, your name, it's data, your age, it's data.

Data becomes information when it is processed, turning it into something meaningful. Like, based on the cookie data saved on user's browser, if a website can analyse that generally men of age 20-25 visit us more, that is information, derived from the data collected.

What is a Database?

A Database is a collection of related data organised in a way that data can be easily accessed, managed and updated. Database can be software based or hardware based, with one sole purpose, storing data.

What is DBMS?

A DBMS is a software that allows creation, definition and manipulation of database, allowing users to store, process and analyse data easily. DBMS provides us with an interface or a tool, to perform various operations like creating database, storing data in it, updating data, creating tables in the database and a lot more.

DBMS also provides protection and security to the databases. It also maintains data consistency in case of multiple users.

Here are some examples of popular DBMS used these days:

- MySql
- Oracle
- SQL Server
- IBM DB2
- PostgreSQL
- Amazon SimpleDB (cloud based) etc.

Characteristics of Database Management System

A database management system has following characteristics:

1. Data stored into Tables: Data is never directly stored into the database. Data is stored into tables, created inside the database. DBMS also allows to have relationships between tables which makes the data more meaningful and connected. You can easily understand what type of data is stored where by looking at all the tables created in a database.

2. Reduced Redundancy: In the modern world hard drives are very cheap, but earlier when hard drives were too expensive, unnecessary repetition of data in database was a big problem. But DBMS follows Normalisation which divides the data in such a way that repetition is minimum.

3. Data Consistency: On Live data, i.e. data that is being continuosly updated and added, maintaining the consistency of data can become a challenge. But DBMS handles it all by itself.

4. Support Multiple user and Concurrent Access: DBMS allows multiple users to work on it(update, insert, delete data) at the same time and still manages to maintain the data consistency.

5. Query Language: DBMS provides users with a simple Query language, using which data can be easily fetched, inserted, deleted and updated in a database.

6. Security: The DBMS also takes care of the security of data, protecting the data from un-authorised access. In a typical DBMS, we can create user accounts with different access permissions, using which we can easily secure our data by restricting user access.

7. DBMS supports transactions, which allows us to better handle and manage data integrity in real world applications where multi-threading is extensively used.

Advantages of DBMS

- Segregation of applicaion program.
- Minimal data duplicacy or data redundancy.
- Easy retrieval of data using the Query Language.
- Reduced development time and maintainance need.
- With Cloud Datacenters, we now have Database Management Systems capable of storing almost infinite data.
- Seamless integration into the application programming languages which makes it very easier to add a database to almost any application or website.

Disadvantages of DBMS

- It's Complexity
- Except MySQL, which is open source, licensed DBMSs are generally costly.
- They are large in size.

Objectives of Data Base Management System (DBMS):

The objectives of a data base management system are to facilitate the creation of data

structures and relieve the programmer of the problems of setting up complicated files.

The objectives of DBMS can be narrated as follows:

1. Eliminate redundant data.

2. Make access to the data easy for the user.

3. Provide for mass storage of relevant data.

4. rotect the data from physical harm and un-authorised systems.

5. Allow for growth in the data base system.

6. Make the latest modifications to the data base available immediately.

7. Allow for multiple users to be active at one time.

8. Provide prompt response to user requests for data.

Components of DBMS

The database management system can be divided into five major components, they are:

1. Hardware
2. Software
3. Data
4. Procedures
5. Database Access Language

DBMS Components: Hardware

When we say Hardware, we mean computer, hard disks, I/O channels for data, and any other physical component involved before any data is successfully stored into the memory.

When we run Oracle or MySQL on our personal computer, then our computer's Hard Disk, our Keyboard using which we type in all the commands, our computer's RAM, ROM all become a part of the DBMS hardware.

DBMS Components: Software

This is the main component, as this is the program which controls everything. The DBMS software is more like a wrapper around the physical database, which provides us with an easy-to-use interface to store, access and update data.

The DBMS software is capable of understanding the Database Access Language and intrepret it into actual database commands to execute them on the DB.

DBMS Components: Data

Data is that resource, for which DBMS was designed. The motive behind the creation of DBMS was to store and utilise data.

In a typical Database, the user saved Data is present and meta data is stored.

Metadata is data about the data. This is information stored by the DBMS to better understand the data stored in it.

For example: When I store my Name in a database, the DBMS will store when the name was stored in the database, what is the size of the name, is it stored as related data to some other data, or is it independent, all this information is metadata.

DBMS Components: Procedures

Procedures refer to general instructions to use a database management system. This includes procedures to setup and install a DBMS, To login and logout of DBMS software, to manage databases, to take backups, generating reports etc.

DBMS Components: Database Access Language

Database Access Language is a simple language designed to write commands to access, insert, update and delete data stored in any database.

A user can write commands in the Database Access Language and submit it to the DBMS for execution, which is then translated and executed by the DBMS.

User can create new databases, tables, insert data, fetch stored data, update data and delete the data using the access language.

Users

- Database Administrators: Database Administrator or DBA is the one who manages the complete database management system. DBA takes care of the security of the DBMS, it's availability, managing the license keys, managing user accounts and access etc.
- Application Programmer or Software Developer: This user group is involved in developing and desiging the parts of DBMS.
- End User: These days all the modern applications, web or mobile, store user data. How do you think they do it? Yes, applications are programmed in such a way that they collect user data and store the data on DBMS systems running on their server. End users are the one who store, retrieve, update and delete data.

Database design

What is Database Design?

Database design is defined as a collection of steps that help with designing, creating, implementing, and maintaining a business's data management systems. The main purpose of designing a database is to produce physical and logical models of designs for the proposed database system.

A well-designed database is the one that:

- Distributes your data into tables based on specific subject areas to decrease data redundancy
- Delivers the database the information needed to link the data in the tables

- Provides support, and guarantees the precision and reliability of data
- Caters to your information processing and reporting requirements
- Functions interactively with the database operators as much as possible

Database Development Life Cycle

There are various stages in database development. However, it is not necessary to follow each of the steps sequentially. The life cycle can be broadly divided into three steps: requirement analysis, database designing, and implementation.

1- Requirement Analysis

Requirement analysis requires two steps:

- Planning: In this stage, the plan of the entire Database Development Life Cycle is decided. It also requires an analysis of the organization's information systems strategy.
- Defining the system: This stage explains and lays out the proposed database system's scope.

2- Database designing

The actual database designing takes into account two key models:

- Logical model: It is concerned with using the given requirements to create a database model. The complete design is laid out on paper at this stage, without considering any specific DBMS requirement or physically implementing it.
- Physical model: This stage comes after the logical model and therefore involves physically implementing the logical model. It takes the DBMS and other physical implementation factors into consideration.

3- Implementation

The implementation stage of the database development life cycle is concerned with:

- Data conversion and loading: It comprises data importation and data conversion coming from the old system into the new database.
- Testing: Finally, this stage identifies errors in the new system and make sure if all the database requirement specification are met.

Database Designing Techniques

The two most common techniques used to design a database include:

- Normalization: Tables are organized in such a way that it decreases data redundancy and dependency. Larger tables are divided into smaller tables and are linked together using relationships.

- Entity-Relationship (ER) Modeling: It's a graphical database design approach that models entities, their attributes, and defines relationships among these entities to signify real-life objects. An entity is any real-world item that's different or unique from the surroundings.

How to Design Database: Steps of Designing Database

Database designing generally starts with identifying the purpose of your database. The relevant data is then collected and organized into tables. Next, you specify the primary keys and analyze relationships between different tables for an efficient data design. After refining the tables, the last step is to apply normalization rules for table standardization.

Let's look at these steps of database design in detail:

- Define the objective of your database

The first step is to determine the purpose of your database. For example, if you are a small home-based business, you could be designing a customer database that maintains a list of consumer info to generate emails and reports. Hence, understanding the importance of a database is vital.

At the end of this step, you'll have a strong mission statement that you can refer to throughout the database design process. It'll help you concentrate on your objectives when making important decisions.

- Locate and consolidate the necessary data

The next step is to collect all kinds of information that you might want to store in the database. Begin with the current information. Mull over the questions you want your database to answer, and it'll help you decide which data needs to be recorded.

- Distribute the data into tables

Once you've amassed all the necessary data items, the next step is to divide them into main entities or subject areas. For example, if you are a retailer, some of your main entities could be products, customers, suppliers, and orders. Each entity will then become a separate table.

- Change data items into columns

Data is segregated into tables, such that every data item becomes a field and is shown as a column. For instance, a Customer table might include fields like name, address, e-mail address, and city.

After determining the preliminary set of columns for every table, you can refine them. For instance, customer name can be recorded as two distinct columns: first name and last name. Likewise, you can store the address in five distinct columns based on address, town, state, zip code, and region. This will make it convenient for you to filter information.

- Identify primary keys

The next step to improve your database design is to select a primary key for every table. This primary key is a column or a set of column that's used to distinctively pinpoint each row. For instance, in your customer table, the primary key could be customer ID. This will allow you to uniquely identify each row based on the customer ID.

More than one primary key can also exist, called a composite key, including multiple columns. For example, in your Order Details table, primary keys could be order ID and product ID. The composite key can be made using fields with similar or varying data types.

Similarly, if you wish to get an idea of your product sales, you can identify the product ID from the Products table and the order number or ID from the Orders table.

- Determine how tables are related

After dividing data into tables, information needs to be brought together in a meaningful manner. So, explore each table and determine how the data in one table is linked with the data in another table. If needed, you can add fields or form new tables to simplify the relationship based on the types of information.

Below is an example of different entity types and relationship types.

In this step, you'll create one-to-one, one-to-many, and/or many-to-many relationships between different table entries.

When only one item from a table is associated with an item from another table, it's called a one-to-one (1:1) relationship. In a one-to-many (1:M) relationship, an item in one table is related to many items in the other table, such as one customer placing several orders. A many-to-many (M:N) relationship occurs if many items from one table are related to many items in other tables.

- Enhance your database design

Now that you have all the required tables, fields, and relationships, the next step is to refine your database design by creating and populating your tables with mockup information. Experiment with the sample data by creating queries or adding new items. This will help you analyze your design for faults and you'll be able to highlight possible errors. If needed, adjust your design to mitigate those problems.

- Implement the normalization rules

The last step is to implement the normalization rules for your database design. It is a systematic approach that removes redundancy and unwanted characteristics, such as Insertion, Update, and Deletion irregularities.

Creation and control

This multi-step process stores data in a tabular form, eliminating redundant data from the relation tables.

- Data Manipulation Languages (DML) – This is a programming language used to insert or modify the data present in a database These are of two types: SQL and DDL.

- Structured Query Language (SQL) – A programming language generally used for the relational database management system, which comprises tables.

- Data Definition Language (DDL) – It is a syntax which helps in modifying data present in the form of tables or indexes

- Primary Key – Each file has a unique key. Using the Primary Key, a specific file can be identified
- Foreign Key – The relation between a field in one table and component identified by a primary key can be detected using a Foreign Key

How to Create a database?

We use the CREATE DATABASE statement to create a new database.

Syntax:

1 CREATE DATABASE databasename;

- Example:

1 CREATE DATABASE College

- So the database of name College will be created.
- This is how simple you can create a Database.

What are the Types of Databases

There are a few types that are very important and popular.

- Relational Database
- Object-Oriented Database
- Distributed Database
- NoSQL Database
- Graph Database
- Cloud Database
- Centralization Database
- Operational Database

Database control refers to the task of enforcing regulations so as to provide correct data to authentic users and applications of a database. In order that correct data is available to users, all data should conform to the integrity constraints defined in the database. Besides, data should be screened away from unauthorized users so as to maintain security and privacy of the database. Database control is one of the primary tasks of the database administrator (DBA).

The three dimensions of database control are −

- Authentication
- Access rights
- Integrity constraints

Authentication

In a distributed database system, authentication is the process through which only legitimate users can gain access to the data resources.

Authentication can be enforced in two levels −

- Controlling Access to Client Computer − At this level, user access is restricted while login to the client computer that provides user-interface to the database server. The most common method is a username/password combination. However, more sophisticated methods like biometric authentication may be used for high security data.
- Controlling Access to the Database Software − At this level, the database software/administrator assigns some credentials to the user. The user gains access to the database using these credentials. One of the methods is to create a login account within the database server.

Access Rights

A user's access rights refers to the privileges that the user is given regarding DBMS operations such as the rights to create a table, drop a table, add/delete/update tuples in a table or query upon the table.

In distributed environments, since there are large number of tables and yet larger number of users, it is not feasible to assign individual access rights to users. So, DDBMS defines certain roles. A role is a construct with certain privileges within a database system. Once the different roles are defined, the individual users are assigned one of these roles. Often a hierarchy of roles are defined according to the organization's hierarchy of authority and responsibility.

Semantic Integrity Control

Semantic integrity control defines and enforces the integrity constraints of the database system.

The integrity constraints are as follows −

- Data type integrity constraint
- Entity integrity constraint
- Referential integrity constraint

Data Type Integrity Constraint

A data type constraint restricts the range of values and the type of operations that can be applied to the field with the specified data type.

Entity Integrity Control

Entity integrity control enforces the rules so that each tuple can be uniquely identified from other tuples. For this a primary key is defined. A primary key is a set of minimal fields that can uniquely identify a tuple. Entity integrity constraint states that no two tuples in a table can have identical values for primary keys and that no field which is a part of the primary key can have NULL value.

Referential Integrity Constraint

Referential integrity constraint lays down the rules of foreign keys. A foreign key is a field in a data table that is the primary key of a related table. The referential integrity constraint lays down the rule that the value of the foreign key field should either be among the values of the primary key of the referenced table or be entirely NULL.

Recent trends in database

There are several trends in database management, and knowing how to take advantage of them will benefit your organization. Following are the some of the current trends:

1. Databases that bridge SQL/NoSQL

The latest trends in database products are those that don't simply embrace a single database structure. Instead, the databases bridge SQL and NoSQL, giving users the best capabilities offered by both. This includes products that allow users to access a NoSQL database in the same way as a relational database, for example.

2. Databases in the cloud/Platform as a Service

As developers continue pushing their enterprises to the cloud, organizations are carefully weighing the trade-offs associated with public versus private. Developers are also determining how to combine cloud services with existing applications and infrastructure. Providers of cloud service offer many options to database administrators. Making the move towards the cloud doesn't mean changing organizational priorities, but finding products and services that help your group meet its goals.

3. Automated management

Automating database management is another emerging trend. The set of such techniques and tools intend to simplify maintenance, patching, provisioning, updates and upgrades — even project workflow. However, the trend may have limited usefulness since database management frequently needs human intervention.

4. An increased focus on security

While not exactly a trend given the constant focus on data security, recent ongoing retail database breaches among US-based organizations show with ample clarity the importance for database administrators to work hand-in-hand with their IT security colleagues to ensure all enterprise data remains safe. Any organization that stores data is vulnerable.

Database administrators must also work with the security team to eliminate potential internal weaknesses that could make data vulnerable. These could include issues related to network privileges, even hardware or software misconfigurations that could be misused, resulting in data leaks.

5. In-memory databases

Within the data warehousing community there are similar questions about columnar versus row-based relational tables; the rise of in-memory databases, the use of flash or solid-state disks (which also applies within transaction processing), clustered versus no-clustered solutions and so on.

6. Big Data

To be clear, big data does not necessarily mean lots of data. What it really refers to is the ability to process any type of data: what is typically referred to as semi-structured and unstructured data as well as structured data. Current thinking is that these will typically live alongside conventional solutions as separate technologies, at least in large organisations, but this will not always be the case.

Integrating Trends

Projects involving databases should not be viewed and appreciated solely on how they adhere to these trends. Ideally, each tool or process available should merge in some meaningful way with existing operations. It is important to look of these trends as items that can coincide: enhancing security and moving to the cloud coexist.

UNIT-3

Developing information system

The software is one of the major components of a management information system. Some of the software used in a MIS system is off the shelf. These include packages such as spreadsheet programs, database applications, etc.

However, they are times when off the shelf, software does not meet the business requirements. The solution to this problem is custom made software.

Information Systems Development Stakeholder

A typical information systems development usually has three (3) stakeholders namely;

- **Users** – Users are the ones who use the system after it has been developed to perform their day to day tasks.
- **Project sponsors** - this category of the stakeholders is responsible for the financial aspect of the project and ensuring that the project is completed.
- **Developers** – this category is usually made up of systems analysts and programmers. The system analysts are responsible for collecting the user requirements and writing system requirements.

  The programmers develop the required system based on the system requirements that is developed by the system analysts.

The most important stakeholders in a project are users. For a project to be accepted as being completed, the users must accept it and use it. If the users do not accept the system, then the project is a failure.

MIS Systems Analysis and Design

Systems analysis and design refers to two closely related disciplines **system analysis** and **system design.**

- **System analysis** is concerned with understanding the business objectives, goals and developing business processes. The end product of systems analysis is systems specifications.

- **System design** uses the output from system analysis as its input. The main objective of system design is to interpret the system requirements into architectural, logical and physical designs of how the information system to be implemented.

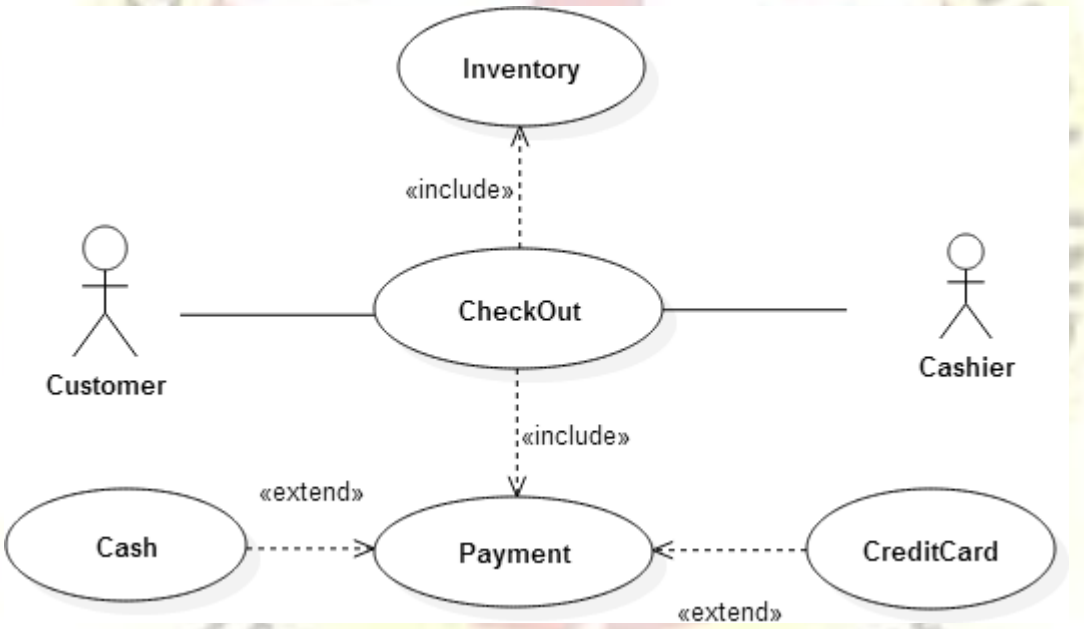
MIS Object oriented analysis and design

Object-oriented analysis and design (OOAD) is closely related to systems analysis and design. The main difference between object-oriented analysis and design (OOAD) and systems analysis and design is that OOAD uses objects to represent real-world entities.

Object oriented analysis and design uses visual modeling to improve communication among all stakeholders and produce high-quality products.

An object is a representation of a real-world entity such as a customer, a product, an employee, etc. Unified Modeling Language (UML) is a general-purpose language used to create visual designs for a system.

The following image shows a sample UML diagram that shows users interacting with a point of sale system



MIS Systems Development Life Cycle (SDLC)

The system development life cycle refers to the processing of planning, creating, testing, and deploying an information system. The main objective of system development life cycle is to produce high-quality information systems that meet or exceed the expectations of the users within the stipulated budget and time frame.

SDLC uses a number of development methodologies to achieve this objective. The next sections will discuss some of the most popular development methodologies.

Approaches for system Development

MIS development is a strategic process of developing an informative information system for a company. To do this, many experts from different levels of a system sit together and investigates and examine a feasible approach to MIS development. An approach is a method of developing a system in such a way so that it can be designed as per system needs and meet all the system objectives.

MIS (Management Information System) is an important source of information for an organization. An approach of MIS development offers some significant facts for the

organizations that influence each approach. MIS approaches to distinguish between each other; organizations are using an appropriate MIS development approach as per their need.

There are 3 different types of MIS –

1. Top-down approach
2. Bottom-up approach
3. Integrative approach

1) Top-down Approach

In this method, the entire system is partitioned into a hierarchy of subsystems. The overall system is divided into a number of subsystems, which are then divided into a number of other subsystems in a top-down approach.

A behavioral classification is used in the top-down approach of MIS development. This approach also defines the strategic and tactical decisions and the necessary decisions to operate the various key activities of MIS development. Many of them, strategies, goals, and plans are recognized by top management executives and conveyed to the administrative management levels.

The key objectives of the systems are established and ways to achieve them are decided in top-down design. They're gradually pushed down the organizational hierarchy to be created and defined well.

2) Bottom-up Approach

As its name implies, this approach mainly starts with the leaf-level or bottom-most management and proceeds progressively to the upper management levels. After recognizing the primary transactions, the needed file requirements and information processing programs are developed for each lifestream system which is then moved towards data integration that is stored in different files of the information system. A bottom-up approach is functional to identify the various factors and understand the difficult situations and formulate strategies to deal with them.

3) Integrative Approach

In the integrative approach subsystems of a system are integrated with each other in such a way so that the objective of the system can be fulfilled.

An integrative approach of a system development may consist of followings –

- Design a system that can be achieving the major objectives of the system using its subsystems.
- Designing a system that combines the various functions performed by its subsystems.
- Designing a system that is not very clear to the user but is concealed under the previously existing subsystems.

Managers at all levels can control the design using an integrated approach. Top management determines the structure and design of MIS that is appropriate for the business.

Implementation, Evaluation and Maintenance of Information System
Implementation
The design of a management information system may seem to management to be an expensive project, the cost of getting the MIS on line satisfactorily may often be comparable to that of its design, and the implementation has been accomplished when the outputs of the MIS are continuously utilized by decision makers.

Once the design has been completed, there are four basic methods for implementing the MIS. These ares-
1. Install the system in a new operation or organization.
2. Cut off the old system and install the new
This produces a time gap during which no system is in operation. Practically, installation requires one or two days for small companies or small systems.
3. Cut over by segments
This method is also referred as" phasing in" the new system. Small parts or subsystems are substituted for the old. In the case of upgrading old systems, this may be a very desirable method.
4. Operate in parallel and cut over.

The new system is installed and operated in parallel with the current system until it has been checked out, then only the current system is cut out. This method is expensive because of personal and related costs. Its big advantages are that the system is fairly well debugged when it becomes the essential information system.

Plan the implementation
The three main phases in implementation take place in series.
These are
1. The initial installation
2. The test of the system as a whole
3. The evaluation, maintenance and control of the system.

Many implementation activities should be undertaken in parallel to reduce implementation time. Training of personnel and preparation of software may be in parallel with each other and with other implementation activities.

The first step in the implementation procedure is to plan the implementation. Some analyst includes the planning of the implementation with the design of the system, the planning and the action to implement the plan should be bound closely together. Planning is the first step of management, not the last. The MIS design and the urgent need for the system at the time the design is completed will weigh heavily on the plan for implementation.

Implementation Tasks

The major implementation tasks consists of-

1. Planning the implementation activities
2. Acquiring and laying out facilities and offices
3. Organizing the personnel for implementation
4. Developing procedures for installation and testing
5. Developing the training program for operating personnel.
6. Completing the system's software
7. Acquiring required hardware
8. Generating files
9. Designing forms
10. Testing the entire system
11. Completing cutover to the new system
12. Documenting the system
13. Evaluating the MIS
14. Providing system maintenance(debugging and improving)

1. Planning the implementation activities

Establish Relationships among tasks

For small projects, the order of performance may simply be described in text form. A Gantt chart or network diagram makes visualization of the plan and schedule much clearer.

For large projects, many concurrent and sequential activities are interrelated so that a network diagram must be employed in any good plan.

Establish a Schedule

Schedule is prepared by having the system designers estimate the times between the events in the program network. The critical path (longest time through the network) can be calculated. After specifying the starting date, the end date is established.

Cost Schedule to Tasks and Time

The cost for completing each task required to complete is established as part of the plan; then the rate of expenditures should be budgeted.

Reporting and control of the work in progress may be obtained by weekly meetings. The financial personnel must make certain that report formats allow them to show cost and technical progress relationship as well as cost and time.

2. Acquiring and laying out facilities and offices

For the installation of a new system to replace a current one may require a major revision of facilities as well as completely new office, computer room etc.

The MIS project manager must prepare rough layouts and estimates of particular floor areas that feel to be needed. The manager then prepares cost estimates.

Space planning must be done by the space to be occupied by people, the space occupied by equipment and the movement of people and equipment in the work progress. A large investment in good working conditions will repay its cost many times.

3. Organizing the personnel for implementation

As the implementation tasks have been defined, management usually assigns a project manager to guide the implementation.

The purpose of the MIS is to increase the amount and quality of their contributions, the system is their system.

Top management must make the middle managers for their involvement in implementation, besides these, systems specialists, computer programmer; top management should make sure that each people who will operate the system should have active parts in the implementation.

4. Developing procedures for installation and testing

After organizing the personnel for implementation the next task is to develop or prepare the procedures for implementation. As the project leader has the network plan for proceeding with the implementation, this leader calls the key people in the project to prepare more detailed procedures for system installation.

Procedures for evaluating and selecting hardware must be spelled out. Procedures for phasing in parts of the MIS or operating the MIS in parallel must be developed.

The major part of implementing the MIS is the testing of each segment of total system as it is installed.

5. Developing the training program for operating personnel

A program is developed keeping in mind to impress management and support. After developing the program, it is necessary to train operating personnel in their new duties. They must have a thorough understanding of what the new MIS is like and what it is supposed to do. They must learn how it will operate. They are faced with many changes in their work and have to obtain acceptance of changes.

As there are various levels of personnel and these people will be working with only a small part of the MIS, the seminars should be designed to provide them with an understanding of the complete system.

6. Completing the system's software

As the software is developed internally or under contract, in both cases, the software development must take in mind the nature of the hardware required.

As the system designers and programmers provide the flow diagrams and the block diagrams

during the detailed design state. Some modification may be required, as the implementation stage progresses.

7. Acquiring required hardware

This acquisition is usually the limiting factor in getting am MIS implementation. These tasks should be started during the design stage.

The decision is to be needed, whether to buy or lease the hardware. Capital expenditure analysis is only one of many factors involved in this decision. Others are prestige, usage etc.

8. Generating files

In the implementation stage, the actual data must be obtained and recorded for the initial testing and operation of the system. This requires format of the data, storage form and format and remarks to indicate when the data have been stored.

The collection of data used in routine operations is often called the master file. Responsibility for file maintenance for each file item should also be assigned. The development of files or databases belongs to information system designers and storage and retrieval experts.

The translation of specifications for files into computer programs is a function of computer specialists.

9. Designing forms

For controlling the marketing, a salesperson has to fill out the forms summarizing the day's activities. The form ensures the right information to be supplied for computer storage.

Forms are required not just for input and output but also for transmitting data at intermediate stages.

10. Testing the entire system

As the total system is installed, tests should be performed with the test specifications and procedure. A test during installation stage consists of component tests, subsystem tests and total system acceptance tests.

Components may be equipment (that can be new or old), new software programs, new data collection methods, work procedures, reporting formats. Difficulties that occur during component tests may lead t design changes.

As more components are installed, subsystems may be tested. There is a difference between the testing of component and the testing of a system.

System tests require verification of multiple inputs, complex logic systems, and timing aspects of many parts.

11. completing cutover to the new system

Cutover is a point at which the new component replaces the old component to the new system replaces the old system. This involves old forms, old files and old equipment being retried. The debugging proves associated with the cutover to the new system may extend for several months.

12. Documenting the system

Documentation of the MIS means preparation of written descriptions of the scope, purpose, information flow components, and operating procedures of the system.

Documentation is a necessity for troubleshooting, for replacement of subsystems, for interfacing with other systems, for training new operating personnel and also for evaluating and upgrading the system.

13. Evaluating the system

After the MIS has been operating smoothly for a short period of time, an evaluation of each step in the design and of the final system performance should be made.

Evaluation should not be delayed beyond the time when the system's analysts have completed most of the debugging. The longer the delay, the more difficult it will be for designer to remember important details.

The evaluation should be made by the customer as well as by the designers.

14. Providing system maintenance

Control and maintenance of the system are the responsibilities of the line managers. Control of the systems means the operation of the system as it was designed to operate. Sometimes, well-intentioned people or operators may make unauthorized changes to improve the system, changes that are not approved or documented.

Maintenance is closely related to control. Maintenance is that ongoing activity that keeps the MIS at the highest levels of effectiveness and efficiency within cost constraints.

Maintenance is directed towards reducing errors due to design, reducing errors due to environmental changes and improving the system's scope and services.

UNIT - 4

Transaction Processing System

Definition: A Transaction Processing System (TPS) is a type of information system that collects, stores, modifies and retrieves the data transactions of an enterprise. e.g.; airline reservation systems, electronic transfer of funds, bank account processing systems. • Designed to process routine business transactions • Seeks time and cost efficiency by automating repetitive operations in large volumes.

Transaction

A business activity between seller and buy to exchange an asset for payment. •Basic business operations such as customer orders, purchase orders, receipts, time cards, invoices, and payroll checks in an organization.

Types of Transactions:

Internal Transactions: Those transactions, which are internal to the company and are related with the internal working of any organization. For example Recruitment Policy, Promotion Policy, Production policy etc

External Transactions: Those transactions, which are external to the organization and are related with the external sources, are regarded as External Transaction. For example sales, purchase etc.

HISTORY OF TPS

One of the first transaction processing systems was American Airline SABRE system, which became operational in 1960. Designed to process up to 83,000 transactions a day, the system ran on two IBM 7090 computers. SABRE was migrated to IBM System/360 computers in 1972, and became an IBM product first as Airline control Program (ACP) and later as Transaction Processing Facility (TPF). In addition to airlines TPF is used by large banks, credit card companies, and hotel chains.

Qualifiers

In order to qualify as a TPS, transactions made by the system must pass the ACID test. The ACID tests refers to the following four pre-requisites

Atomicity

Atomicity means that a transaction is either completed in full or not at all. For example, if funds are transferred from one account to another, this only counts as a bone fide transaction if both the withdrawal and deposit take place. If one account is debited and the other is not credited, it does not qualify as a transaction. TPS systems ensure that transactions take place in their entirety

Consistency

TPS systems exist within a set of operating rules (or integrity constraints). If an integrity constraint states that all transactions in a database must have a positive value, any transaction with a negative value would be refused.

Isolation

Transactions must appear to take place in isolation. For example, when a fund transfer is made between two accounts the debiting of one and the crediting of another must appear to take place simultaneously. The funds cannot be credited to an account before they are debited from another.

Durability

Once transactions are completed they cannot be undone. To ensure that this is the case even if the TPS suffers failure, a log will be created to document all completed transactions. These four conditions ensure that TPS systems carry out their transactions in a methodical, standardized and reliable manner.

Features of Transaction Processing Systems

Rapid response

Fast performance with a rapid response time is critical. Transaction processing systems are usually measured by the number of transactions they can process in a given period of time.

Continuous Availability

The system must be available during the time period when the users are entering transactions. Many organizations rely heavily on their TPS. A breakdown will disrupt operations or even stop the business.

Data Integrity

The system must be able to handle hardware or software problems without corrupting data. Multiple users must be protected from attempting to change the same piece of data at the same time, for example two operators cannot sell the same seat on an airplane.

Ease Of Use

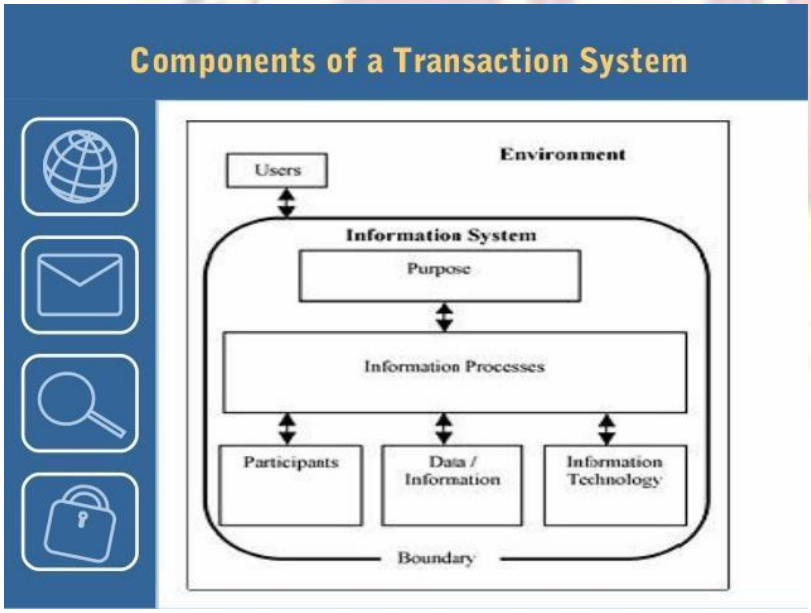
Often users of transaction processing systems are casual users. The system should be simple for them to understand, protect them from data-entry errors as much as possible, and allow them to easily correct their errors.

Components of a Transaction System

The user of the information system is the person belonging to the organization that owns the transaction system.

Participants are the people who conduct the information processing.

People from the environment become participants of the system as they directly enter transactions and perform validation.

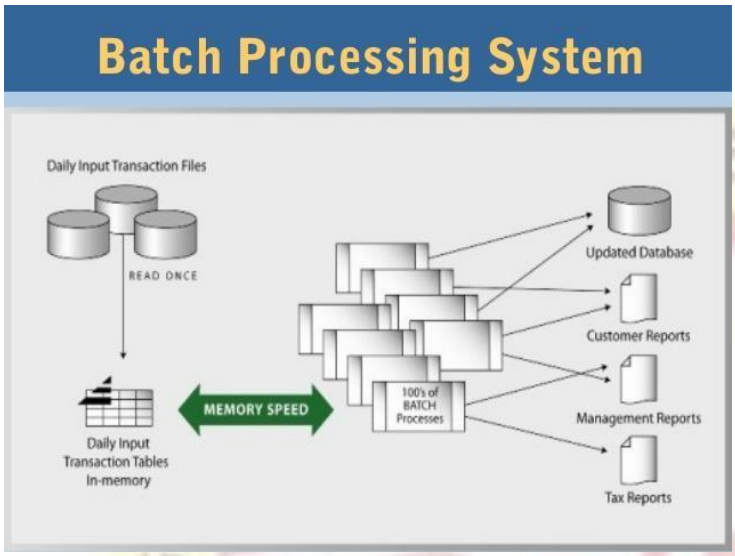


Types of TPS

Batch Processing

- Batch processing is where the information is collected and stored as a batch but not processed immediately
- Batch processing is useful for enterprises that need to process large amounts of data using limited resources.

Example: Payment by cheque, Credit card transactions, etc. Batch Processing system



On-line transaction processing (OLTP)

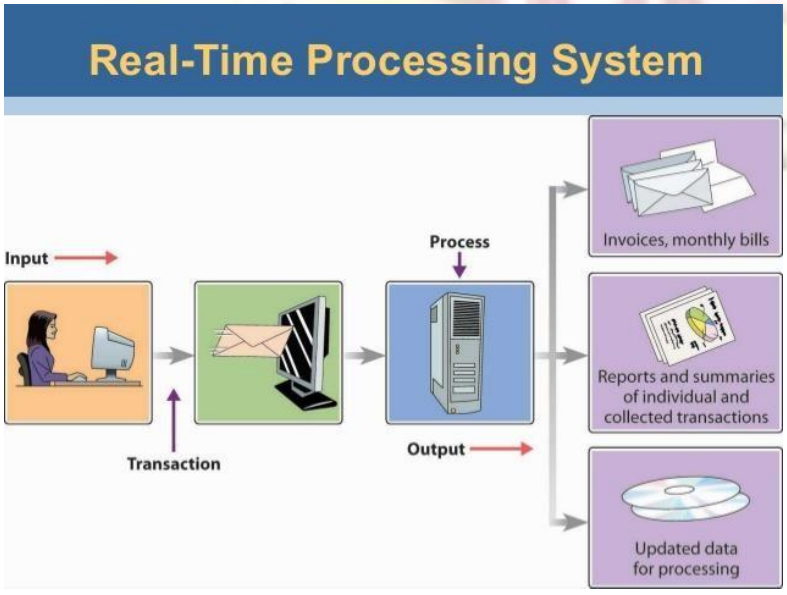
A system whereby each transaction is processed immediately, without the delay of accumulating transactions into a batch.

Real-time transaction

–Mostly in Online shopping

–Uses PCI cards (Payment Card Industry):

–PayPal or World Pay, We Pay, e-Way, ICEPAY, ATM's.



Data Processing Cycle

Data Entry

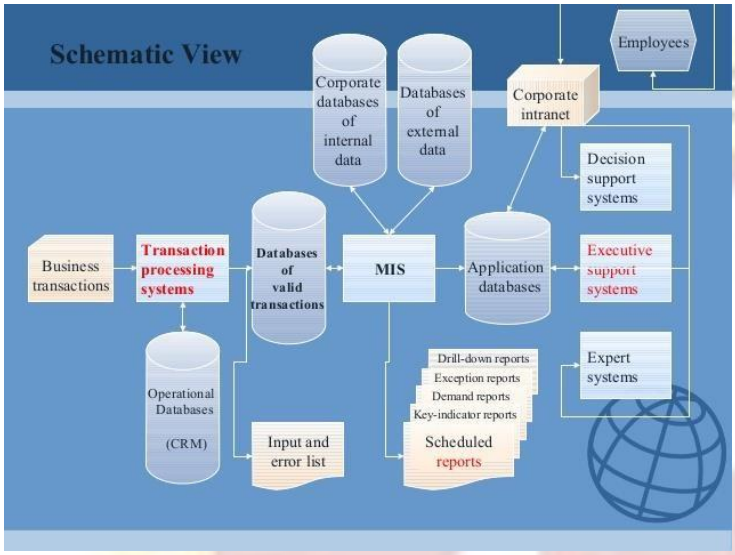
• Collecting and capturing transactions

• No longer manual:

– Old technologies : Bar Codes, Magnetic Strips (credit cards)

– New technologies : RFID, Smart Cards,

Semantic View



Database Maintenance

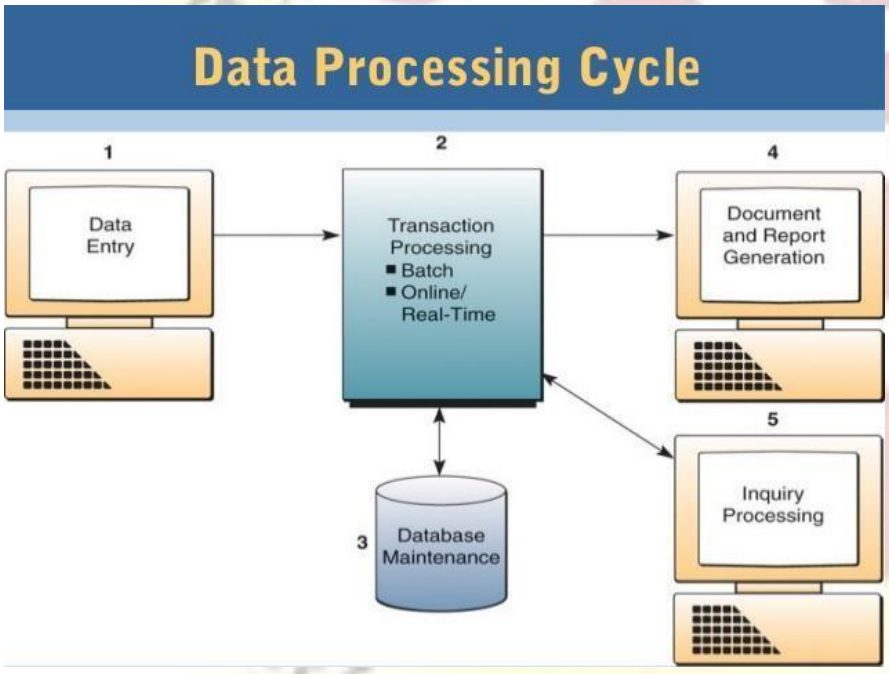
• TPS helps ensure the databases are up-to-date and correct
. • Multiple databases (internal & external)

Document/Report Generation

• Examples
– purchase orders
– pay checks
– sales receipts
– invoices
– bank statements

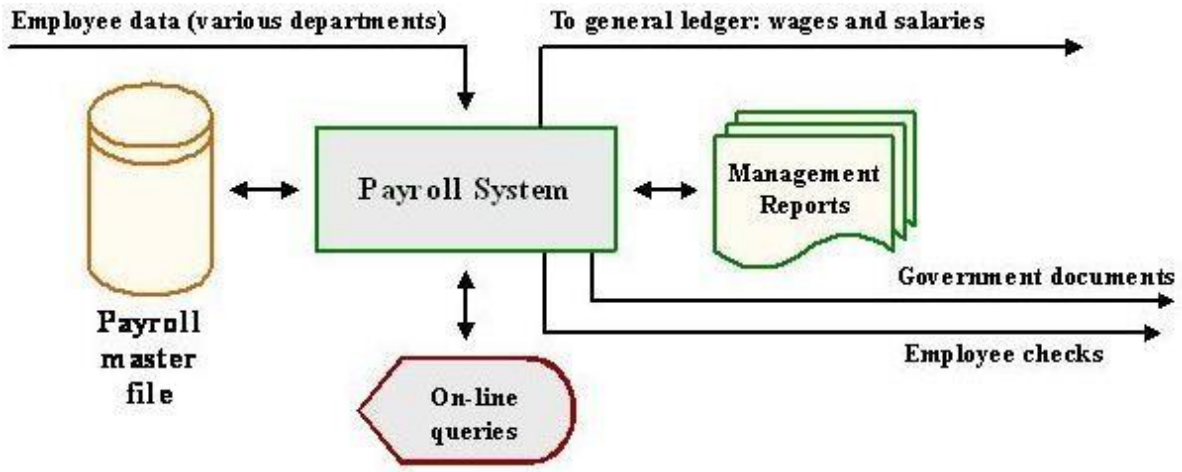
Inquiry Processing:

• Examples
– when was a purchase made
– does a customer have any credits on their account
– was an item scheduled for delivery
– was a package signed for



MIS Office Automation

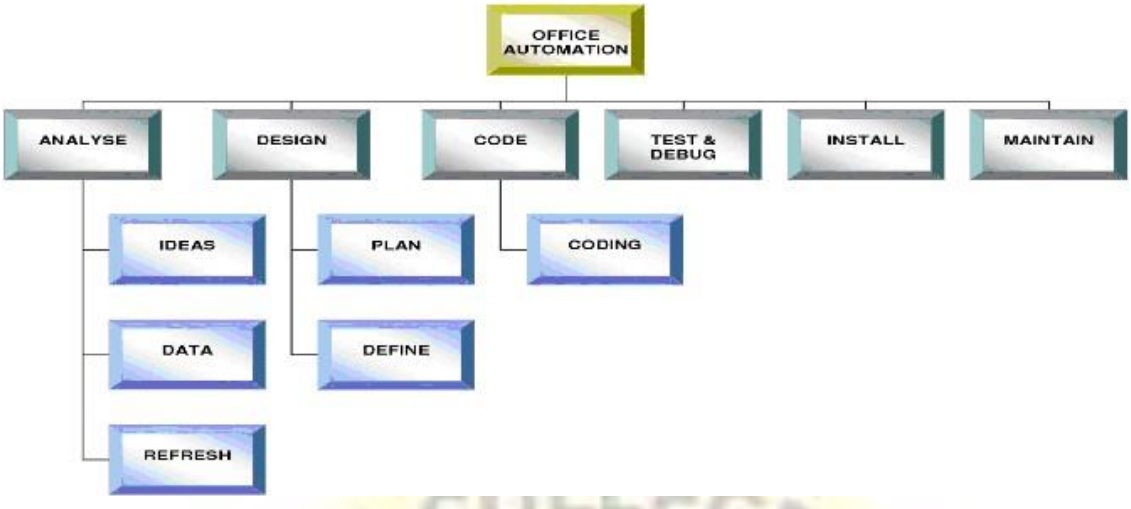
The use of computer is to execute a variety of office operations, such as word processing, accounting, and e-mail. Office automation almost always implies a network of computers with a variety of available program



Office automation refers to the varied Computer machinery and Software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures. The backbone of office automation is a LAN, which allows users to transfer data, mail and even voice across the network. All office functions, including dictation, typing, filing, copying, fax, Telex, microfilm and records management, telephone and telephone switchboard operations, fall into this category. Office automation was a popular term in the 1970s and 1980s as the desktop computer exploded onto the scene.

Advantages are:

1. Office automation can get many tasks accomplished faster.
2. It eliminates the need for a large staff.
3. Less storage is required to store data.
4. Multiple people can update data simultaneously in the event of changes in schedule
5. Businesses can easily purchase and stock their wares with the aid of technology. Many of the manual tasks that used to be done by hand can now be done through hand held devices and UPC and SKU coding. In the retail setting, automation also increases choice. Customers can easily process their payments through automated credit card machines and no longer have to wait in line for an employee to process and manually type in the credit card numbers.
6. Office payrolls have been automated which means no one has to manually cut checks, and those checks that are cut can be printed through computer programs. Direct deposit can be automatically set up and this further reduces the manual process and most employees who participate in direct deposit often find their paychecks come earlier than if they'd have to wait for their checks to be written and then cleared by the bank.
7. Other ways automation has reduced employee manpower on tasks is automated voice direction. Through the use of prom
pts, automated phone menus and directed calls, the need for employees to be dedicated to answer the phones has been reduced, and in some cases, eliminated.



The term **office automation** refers to all tools and methods that are applied to *office* activities which make it possible to process written, visual, and sound data in a computer-aided manner. Office automation is intended to provide elements which make it possible to simplify, improve, and automate the organization of the activities of a company or a group of people (management of administrative data, synchronization of meetings, etc.). Considering that company organizations require increased communication, today, office automation is no longer limited to simply capturing handwritten notes. In particular, it also includes the following activities:

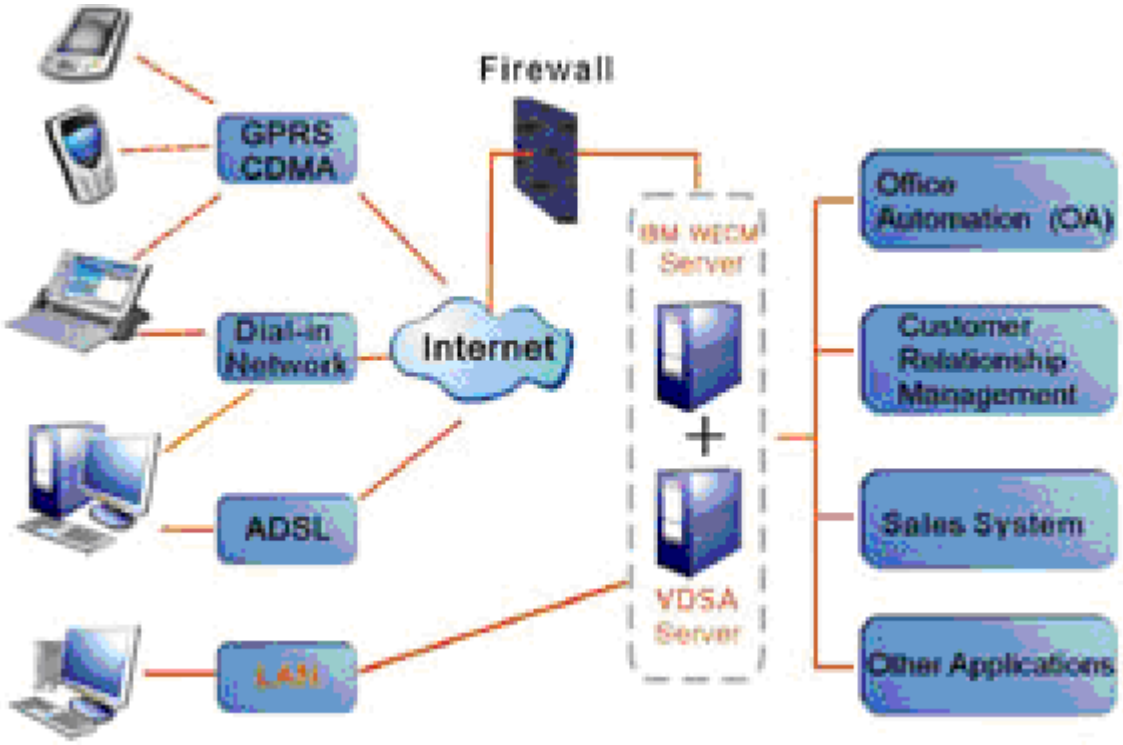
- exchange of information
- management of administrative documents
- handling of numerical data
- meeting planning and management of work schedules

The term "**office suite**" refers to all software programs which make it possible to meet office needs. In particular, an office suite therefore includes the following software programs:

- word processing
- a Spread sheet
- a presentation tool
- a Database
- a scheduler

The main office suites are:

- Open Office (freeware)
- Apple Works
- Corel word Perfect
- IBM/Lotus Smart Suite
- Microsoft Office
- Sun Star Office



Products:

- Currency counting machine
- Bar code printer
- Paper shredder
- Electronic safe
- Laminating machine
- Binding machine
- Bar code scanner

Types

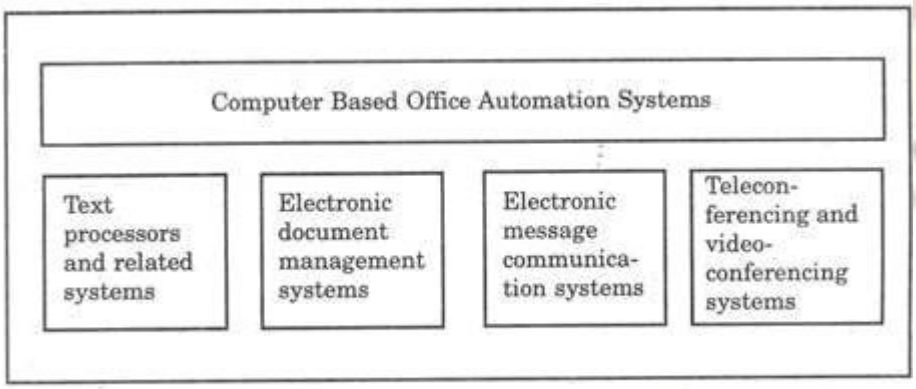


Fig. 10.7 Building blocks of office automation systems

Types of function integrated by office automation system includes

- Electronic publishing

- Electronic communication
- Electronic collaboration
- Image processing
- Office management

EDMS - Electronic Document Management System

EDMS - electronic document management system is a software program that manages the creation, storage and control of documents electronically. The primary function of an EDMS is to manage electronic information within an organization workflow. A basic EDMS should include document management, workflow, text retrieval, and imaging. An EDMS must be capable of providing secure access, maintaining the context, and executing disposition instructions for all records in the system.

One should always look for an EDMS that provides:

Security control: This function controls which users have access to which information. Any system that you use must be able to protect not-public records as defined by the MGDPA.

Version Control: The EDMS should allow users to add documents to the system and designate a document as an official record. It should also automatically assign the correct version designation.

Metadata Capture: The EDMS should allow you to capture and use the metadata appropriate for your agency.

Decision Support System

Decision support systems (DSS) are interactive software-based systems intended to help managers in decision-making by accessing large volumes of information generated from various related information systems involved in organizational business processes, such as office automation system, transaction processing system, etc.

DSS uses the summary information, exceptions, patterns, and trends using the analytical models. A decision support system helps in decision-making but does not necessarily give a decision itself. The decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions.

Programmed and Non-programmed Decisions

There are two types of decisions - programmed and non-programmed decisions.

Programmed decisions are basically automated processes, general routine work, where −

- These decisions have been taken several times.
- These decisions follow some guidelines or rules.

For example, selecting a reorder level for inventories, is a programmed decision.

Non-programmed decisions occur in unusual and non-addressed situations, so −

- It would be a new decision.
- There will not be any rules to follow.
- These decisions are made based on the available information.
- These decisions are based on the manger's discretion, instinct, perception and judgment.

For example, investing in a new technology is a non-programmed decision.

Decision support systems generally involve non-programmed decisions. Therefore, there will be no exact report, content, or format for these systems. Reports are generated on the fly.

Attributes of a DSS

- Adaptability and flexibility
- High level of Interactivity
- Ease of use
- Efficiency and effectiveness
- Complete control by decision-makers
- Ease of development
- Extendibility
- Support for modeling and analysis
- Support for data access
- Standalone, integrated, and Web-based

Characteristics of a DSS

- Support for decision-makers in semi-structured and unstructured problems.
- Support for managers at various managerial levels, ranging from top executive to line managers.
- Support for individuals and groups. Less structured problems often requires the involvement of several individuals from different departments and organization level.
- Support for interdependent or sequential decisions.
- Support for intelligence, design, choice, and implementation.
- Support for variety of decision processes and styles.
- DSSs are adaptive over time.

Benefits of DSS

- Improves efficiency and speed of decision-making activities.
- Increases the control, competitiveness and capability of futuristic decision-making of the organization.
- Facilitates interpersonal communication.
- Encourages learning or training.
- Since it is mostly used in non-programmed decisions, it reveals new approaches and sets up new evidences for an unusual decision.
- Helps automate managerial processes.

Components of a DSS

Following are the components of the Decision Support System −

- **Database Management System (DBMS)** − To solve a problem the necessary data may come from internal or external database. In an organization, internal data are generated by a system such as TPS and MIS. External data come from a variety of sources such as newspapers, online data services, databases (financial, marketing, human resources).
- **Model Management System** − It stores and accesses models that managers use to make decisions. Such models are used for designing manufacturing facility, analyzing the financial health of an organization, forecasting demand of a product or service, etc.

  Support Tools − Support tools like online help; pulls down menus, user interfaces, graphical analysis, error correction mechanism, facilitates the user interactions with the system.

Classification of DSS

There are several ways to classify DSS. Hoi Apple and Whinstone classifies DSS as follows

- **Text Oriented DSS** − It contains textually represented information that could have a bearing on decision. It allows documents to be electronically created, revised and viewed as needed.
- **Database Oriented DSS** − Database plays a major role here; it contains organized and highly structured data.
- **Spreadsheet Oriented DSS** − It contains information in spread sheets that allows create, view, modify procedural knowledge and also instructs the system to execute self-contained instructions. The most popular tool is Excel and Lotus 1-2-3.
- **Solver Oriented DSS** − It is based on a solver, which is an algorithm or procedure written for performing certain calculations and particular program type.
- **Rules Oriented DSS** − It follows certain procedures adopted as rules.
- **Rules Oriented DSS** − Procedures are adopted in rules oriented DSS. Export system is the example.
- **Compound DSS** − It is built by using two or more of the five structures explained above.

Types of DSS

Following are some typical DSSs −

- **Status Inquiry System** − It helps in taking operational, management level, or middle level management decisions, for example daily schedules of jobs to machines or machines to operators.
- **Data Analysis System** − It needs comparative analysis and makes use of formula or an algorithm, for example cash flow analysis, inventory analysis etc.
- **Information Analysis System** − In this system data is analyzed and the information report is generated. For example, sales analysis, accounts receivable systems, market analysis etc.
- **Accounting System** − It keeps track of accounting and finance related information, for example, final account, accounts receivables, accounts payables, etc. that keep track of the major aspects of the business.
- **Model Based System** − Simulation models or optimization models used for decision-making are used infrequently and creates general guidelines for operation or management.

Executive Support System

Executive support systems are intended to be used by the senior managers directly to provide support to non-programmed decisions in strategic management.

These information are often external, unstructured and even uncertain. Exact scope and context of such information is often not known beforehand.

This information is intelligence based −

- Market intelligence
- Investment intelligence

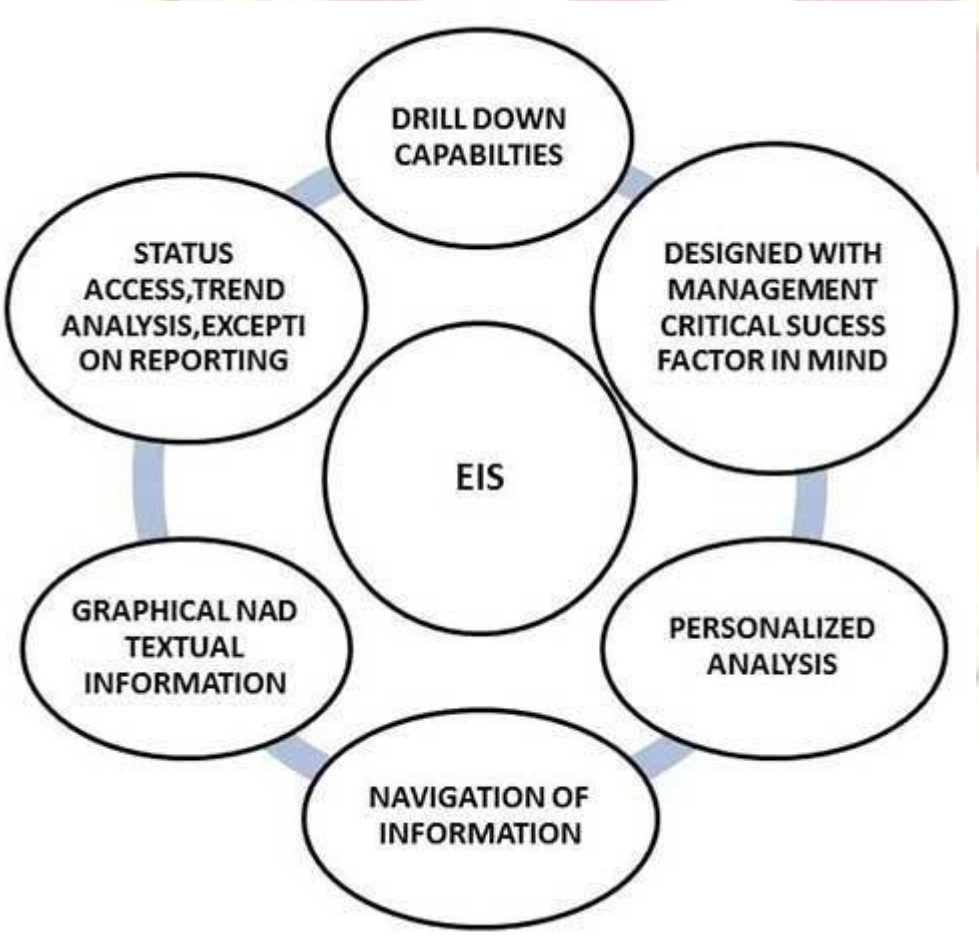
- Technology intelligence

Examples of Intelligent Information

Following are some examples of intelligent information, which is often the source of an ESS –

- External databases
- Technology reports like patent records etc.
- Technical reports from consultants
- Market reports
- Confidential information about competitors
- Speculative information like market conditions
- Government policies
- Financial reports and information

Features of Executive Information System



Advantages of ESS

- Easy for upper level executive to use

- Ability to analyze trends
- Augmentation of managers' leadership capabilities
- Enhance personal thinking and decision-making
- Contribution to strategic control flexibility
- Enhance organizational competitiveness in the market place
- Instruments of change
- Increased executive time horizons.
- Better reporting system
- Improved mental model of business executive
- Help improve consensus building and communication
- Improve office automation
- Reduce time for finding information
- Early identification of company performance
- Detail examination of critical success factor
- Better understanding
- Time management
- Increased communication capacity and quality

Disadvantage of ESS

- Functions are limited
- Hard to quantify benefits
- Executive may encounter information overload
- System may become slow
- Difficult to keep current data
- May lead to less reliable and insecure data
- Excessive cost for small company

Artificial Intelligence - Expert Systems

Expert systems (ES) are one of the prominent research domains of AI. It is introduced by the researchers at Stanford University, Computer Science Department.

What are Expert Systems?

The expert systems are the computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise.

Characteristics of Expert Systems

- High performance
- Understandable
- Reliable
- Highly responsive

Capabilities of Expert Systems

The expert systems are capable of −

- Advising
- Instructing and assisting human in decision making
- Demonstrating
- Deriving a solution
- Diagnosing
- Explaining
- Interpreting input
- Predicting results
- Justifying the conclusion
- Suggesting alternative options to a problem

They are incapable of −

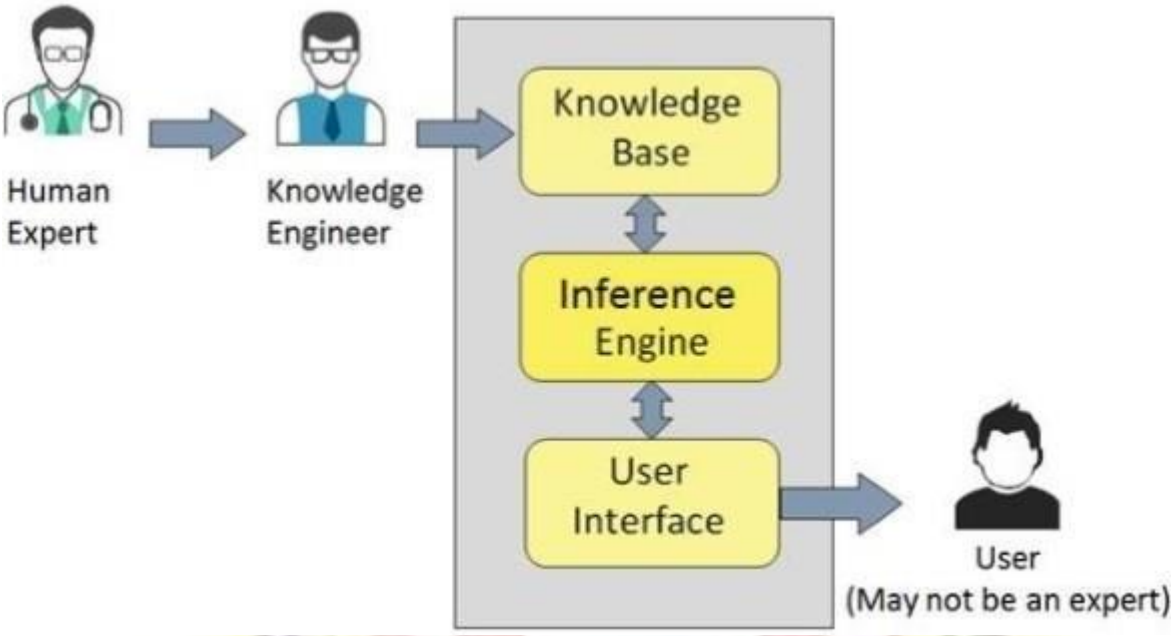
- Substituting human decision makers
- Possessing human capabilities
- Producing accurate output for inadequate knowledge base
- Refining their own knowledge

Components of Expert Systems

The components of ES include −

- Knowledge Base
- Inference Engine
- User Interface

Let us see them one by one briefly −



Knowledge Base

It contains domain-specific and high-quality knowledge.

Knowledge is required to exhibit intelligence. The success of any ES majorly depends upon the collection of highly accurate and precise knowledge.

What is Knowledge?

The data is collection of facts. The information is organized as data and facts about the task domain. **Data, information,** and **past experience** combined together are termed as knowledge.

Components of Knowledge Base

The knowledge base of an ES is a store of both, factual and heuristic knowledge.

- **Factual Knowledge** − It is the information widely accepted by the Knowledge Engineers and scholars in the task domain.
- **Heuristic Knowledge** − It is about practice, accurate judgement, one's ability of evaluation, and guessing.

Knowledge representation

It is the method used to organize and formalize the knowledge in the knowledge base. It is in the form of IF-THEN-ELSE rules.

Knowledge Acquisition

The success of any expert system majorly depends on the quality, completeness, and accuracy of the information stored in the knowledge base.

The knowledge base is formed by readings from various experts, scholars, and the **Knowledge Engineers**. The knowledge engineer is a person with the qualities of empathy, quick learning, and case analyzing skills.

He acquires information from subject expert by recording, interviewing, and observing him at work, etc. He then categorizes and organizes the information in a meaningful way, in the form of IF-THEN-ELSE rules, to be used by interference machine. The knowledge engineer also monitors the development of the ES.

Inference Engine

Use of efficient procedures and rules by the Inference Engine is essential in deducting a correct, flawless solution.

In case of knowledge-based ES, the Inference Engine acquires and manipulates the knowledge from the knowledge base to arrive at a particular solution.

In case of rule based ES, it −

- Applies rules repeatedly to the facts, which are obtained from earlier rule application.
- Adds new knowledge into the knowledge base if required.
- Resolves rules conflict when multiple rules are applicable to a particular case.

To recommend a solution, the Inference Engine uses the following strategies −

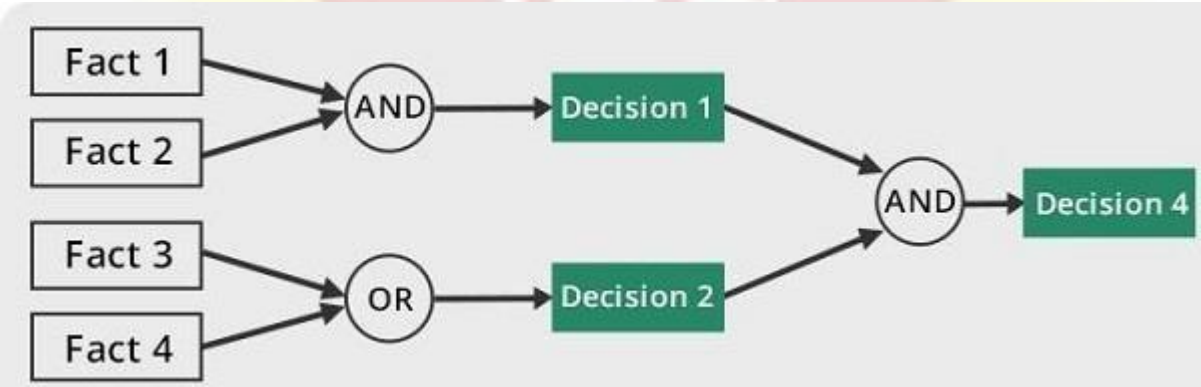
- Forward Chaining
- Backward Chaining

Forward Chaining

It is a strategy of an expert system to answer the question, **"What can happen next?"**

Here, the Inference Engine follows the chain of conditions and derivations and finally deduces the outcome. It considers all the facts and rules, and sorts them before concluding to a solution.

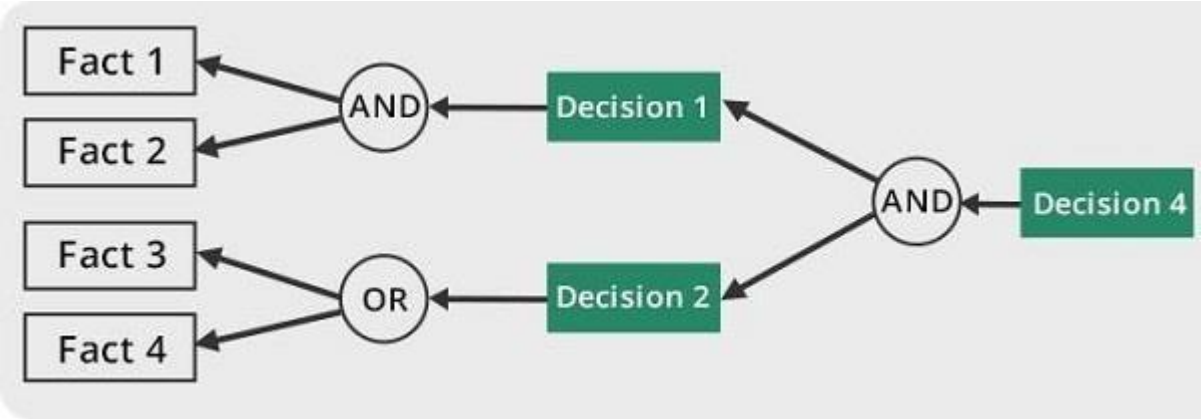
This strategy is followed for working on conclusion, result, or effect. For example, prediction of share market status as an effect of changes in interest rates.



Backward Chaining

With this strategy, an expert system finds out the answer to the question, **"Why this happened?"**

On the basis of what has already happened, the Inference Engine tries to find out which conditions could have happened in the past for this result. This strategy is followed for finding out cause or reason. For example, diagnosis of blood cancer in humans.



User Interface

User interface provides interaction between user of the ES and the ES itself. It is generally Natural Language Processing so as to be used by the user who is well-versed in the task domain. The user of the ES need not be necessarily an expert in Artificial Intelligence.

It explains how the ES has arrived at a particular recommendation. The explanation may appear in the following forms −

- Natural language displayed on screen.
- Verbal narrations in natural language.
- Listing of rule numbers displayed on the screen.

The user interface makes it easy to trace the credibility of the deductions.

Requirements of Efficient ES User Interface

- It should help users to accomplish their goals in shortest possible way.
- It should be designed to work for user's existing or desired work practices.
- Its technology should be adaptable to user's requirements; not the other way round.
- It should make efficient use of user input.

Expert Systems Limitations

No technology can offer easy and complete solution. Large systems are costly, require significant development time, and computer resources. ESs have their limitations which include −

- Limitations of the technology
- Difficult knowledge acquisition
- ES are difficult to maintain
- High development costs

Applications of Expert System

The following table shows where ES can be applied.

Application	Description
Design Domain	Camera lens design, automobile design.
Medical Domain	Diagnosis Systems to deduce cause of disease from observed data, conduction medical operations on humans.
Monitoring Systems	Comparing data continuously with observed system or with prescribed behavior such as leakage monitoring in long petroleum pipeline.
Process Control Systems	Controlling a physical process based on monitoring.
Knowledge Domain	Finding out faults in vehicles, computers.
Finance/Commerce	Detection of possible fraud, suspicious transactions, stock market trading, Airline scheduling, cargo scheduling.

Expert System Technology

There are several levels of ES technologies available. Expert systems technologies include −

- **Expert System Development Environment** − The ES development environment includes hardware and tools. They are −
    - Workstations, minicomputers, mainframes.
    - High level Symbolic Programming Languages such as **LIS**t **P**rogramming (LISP) and **PRO**grammation en **LOG**ique (PROLOG).
    - Large databases.
- **Tools** − They reduce the effort and cost involved in developing an expert system to large extent.
    - Powerful editors and debugging tools with multi-windows.
    - They provide rapid prototyping
    - Have Inbuilt definitions of model, knowledge representation, and inference design.

- **Shells** − A shell is nothing but an expert system without knowledge base. A shell provides the developers with knowledge acquisition, inference engine, user interface, and explanation facility. For example, few shells are given below −
    - Java Expert System Shell (JESS) that provides fully developed Java API for creating an expert system.
    - *Vidwan*, a shell developed at the National Centre for Software Technology, Mumbai in 1993. It enables knowledge encoding in the form of IF-THEN rules.

Development of Expert Systems: General Steps

The process of ES development is iterative. Steps in developing the ES include −

Identify Problem Domain

- The problem must be suitable for an expert system to solve it.
- Find the experts in task domain for the ES project.
- Establish cost-effectiveness of the system.

Design the System

- Identify the ES Technology
- Know and establish the degree of integration with the other systems and databases.
- Realize how the concepts can represent the domain knowledge best.

Develop the Prototype

From Knowledge Base: The knowledge engineer works to −

- Acquire domain knowledge from the expert.
- Represent it in the form of If-THEN-ELSE rules.

Test and Refine the Prototype

- The knowledge engineer uses sample cases to test the prototype for any deficiencies in performance.
- End users test the prototypes of the ES.

Develop and Complete the ES

- Test and ensure the interaction of the ES with all elements of its environment, including end users, databases, and other information systems.
- Document the ES project well.
- Train the user to use ES.

Maintain the System

- Keep the knowledge base up-to-date by regular review and update.
- Cater for new interfaces with other information systems, as those systems evolve.

Benefits of Expert Systems

- **Availability** − They are easily available due to mass production of software.
- **Less Production Cost** − Production cost is reasonable. This makes them affordable.nit
- **Speed** − They offer great speed. They reduce the amount of work an individual puts in.
- **Less Error Rate** − Error rate is low as compared to human errors.
- **Reducing Risk** − They can work in the environment dangerous to humans.
- **Steady response** − They work steadily without getting motional, tensed or fatigued.

Functional information system

UNIT – V

Functional Information System is based on the various business functions such as Production, Marketing, Finance and Personnel etc. These departments or functions are known as functional areas of business. Each functional area requires applications to perform all information processing related to the function. The popular functional areas of the business organization are:

• Financial Information System

• Marketing Information System

• Production/Marketing Information System

• Human Resource Information System

Financial Information System

Financial information system is a sub-system of organizational management information system. This sub-system supports the decision-making process of financial functions at the level of an organization.

Marketing Information System

This sub-system of management information system provides information about various functions of the marketing system of an organization. Marketing is another functional area of the business organization, which is engaged in marketing (selling) of its products to its customers.

Important functions of the marketing process include the following.

• The marketing identification function

• The purchase motivation function.

• The product adjustment function

• The physical distribution function

• The communication function

• The transaction function

• The post-transaction function

Production /manufacturing Information System

Manufacturing or production information system provides information on production /operation activities of an organization and thus facilitates the decision-making process of production managers of an organization. The main decisions to be taken in manufacturing system are:

• Product Design

Human Resources Information System

This functional information system supports the functions of human resource management of an organization. The human resource management function, in its narrow sense, it also known as personnel management .The function involves:

• Manpower planning.

• Staffing

• Training and development

• Performance evaluation, and

• Separation activities

Managing information resources

Information Resources Management (IRM) is the process of managing information resources to accomplish agency missions and to improve agency performance, including the reduction of information collection burdens on the public. When standardized and controlled, these resources can be shared and reused throughout an agency, not just by a single user or application.

There are three (3) classes of information resources:

1. **Business Resources**: Enterprises, Business Functions, Positions (Jobs), Human/Machine Resources, Skills, Business Objectives, Projects, and Information Requirements.
2. **System Resources**: Systems, Sub-Systems (business processes), Administrative Procedures (manual procedures and office automation related), Computer Procedures, Programs, Operational Steps, Modules, and Subroutines.
3. **Data Resources**: Data Elements, Storage Records, Files (computer and manual), Views, Objects, Inputs, Outputs, Panels, Maps, Call Parameters, and Data Bases.

The concept of RM is actually no different in intent than Materials Resource Planning (MRP) as used in manufacturing. Both are concerned with the efficient and cost-effective use of resources. The classification and control of resources are the main objectives. Resources are classified to prove their uniqueness so that redundancy is not introduced and to promote sharing. Control is required to collect, inventory, and retrieve resources as required by the business.

Whereas MRP is concerned with managing products and the parts required to produce them, IRM is concerned with managing information and the resources required to produce it.

One of the important by-products of cataloging and cross-referencing information resources is a model of the enterprise, including how it is organized and how it operates. Other benefits include:

- All information resources are controllable, permitting the ability to design integrated systems and perform an “impact analysis” of a proposed resource change.
- The simplified search of information resources for reuse. The redundancy of resource definition is eliminated.
- Complete and current documentation of all information resources, in an organized and meaningful way.
- Communications within the organization are improved since developers and users would use standard and common definitions for information resources, all of which would be in standard business terminology.

Information system Security

MIS security refers to measures put in place to protect information system resources from unauthorized access or being compromised. Security vulnerabilities are weaknesses in a computer system, software, or hardware that can be exploited by the attacker to gain unauthorized access or compromise a system.

People as part of the information system components can also be exploited using social engineering techniques. The goal of social engineering is to gain the trust of the users of the system.

Let's now look at some of the threats that information system face and what can be done to eliminate or minimize the damage if the threat were to materialize.

Computer viruses – these are malicious programs as described in the above section. The threats posed by viruses can be eliminated or the impact minimized by using Anti-Virus software and following laid down security best practices of an organization.

Unauthorized access – the standard convention is to use a combination of a username and a password. Hackers have learnt how to circumvent these controls if the user does not follow security best practices. Most organizations have added the use of mobile devices such as phones to provide an extra layer of security.

Let's take Gmail as an example, if Google is suspicious of the login on an account, they will ask the person about to login to confirm their identity using their android powered mobile devices or send an SMS with a PIN number which should supplement the username and password.

If the company does not have enough resources to implement extra security like Google, they can use other techniques. These techniques can include asking questions to users during signup such as what town they grew up in, the name of their first pet, etc. If the person provides accurate answers to these question, access is granted into the system.

Data loss – if the data center caught fire or was flooded, the hardware with the data can be damaged, and the data on it will be lost. As a standard security best practice, most organizations keep backups of the data at remote places. The backups are made periodically and are usually put in more than one remote area.

Biometric Identification – this is now becoming very common especially with mobile devices such as smartphones. The phone can record the user fingerprint and use it for authentication purposes. This makes it harder for attackers to gain unauthorized access to the mobile device. Such technology can also be used to stop unauthorized people from getting access to your devices.

Information system Ethics

Ethics refers to rules of right and wrong that people use to make choices to guide their behaviors. Ethics in MIS seek to protect and safeguard individuals and society by using information systems responsibly. Most professions usually have defined a code of ethics or code of conduct guidelines that all professionals affiliated with the profession must adhere to.

In a nutshell, a code of ethics makes individuals acting on their free will responsible and accountable for their actions. An example of a Code of Ethics for MIS professionals can be found on the British Computer Society (BCS) website.

Information Communication Technology (ICT) policy

An ICT policy is a set of guidelines that defines how an organization should use information technology and information systems responsibly. ICT policies usually include guidelines on;

- Purchase and usage of hardware equipment and how to safely dispose them
- Use of licensed software only and ensuring that all software is up to date with latest patches for security reasons
- Rules on how to create passwords (complexity enforcement), changing passwords, etc.
- Acceptable use of information technology and information systems
- Training of all users involved in using ICT and MIS

MIS & CONTROL

Information is required at every level either to set up standards, to know the actual performance, to compare the results , to find out deviations and to take corrective action, hence there ia a need of a management information system.

It also involves interactive control i.e. communicating with the employees directly and hence information system play a significant role.

NEED OF CONTROL IN INFORMATION SYSTEM:

- Information systems handle massive amounts of data –accidents such as not including some data can cause serious damage.
- Incorrect data entry can lead to high monetary losses.
- Credibility in the information system may be lost if errors are found in operational systems.

OBJECTIVES OF CONTROL IN INFORMATION SYSTEM:

1. To make sure data entering the computer are correct.
2. Check clerical handling of data before it is input to a computer.
3. Provide means of detecting and tracing errors which occur due to bad data.
4. Ensure legal requirements are met.
5. To guard against frauds.

CONTROL TECHNIQUES:

ORGANIZATIONAL MEASURES

Well defined responsibility for input preparation, delivery output use, operation and maintenance

-Changes in program and data (if any) should be documented

-Performance of task and recording must be by different persons to prevent frauds.

INPUT PREPARATION CONTROL

-Sequence numbering

-Batch controls

-Data entry and verification

-Record totals

-Self checking digits

Management As a control system.

Planning, organizing, staffing, directing and controlling are the various steps in the management process. All steps prior to a control are necessary but are not necessarily self assuring the results unless it is followed by a strong control mechanism. Management experts have viewed these steps as management control system.

Control, is the process through which managers assure that actual activities conform to the planned activities, leading to the achievement of the stated common goals. The control process measures a progress towards those goals, and enables the manager to detect, the deviations from the original plan in time to take corrective actions before it is too late.

The management is a systematic effort to set the performance standards in line with the performance objectives, to design the information feedback systems, to compare the actual performance with these predetermined standards, to identify the deviations from the standards, to measure its significance and to take corrective actions in case of significant

deviations. This systematic effort is undertaken through the management control system.

A reliable and effective control system has the following features :

- Early warning mechanism: This is a mechanism of predicting the possibility of achieving the goals and standards before it is too late and allowing the manager to take corrective actions.
- Performance Standard: The performance standard must be measurable and acceptable to all the organizations. The system should have meaningful standards relating to the work areas, responsibility, managerial functions and so on.
- Strategic controls: In every business, there are strategic areas of control known as the critical success factors. The system should recognize them and have controls instituted on them.
- Feedback: The control system would be effective, if it continuously monitors the performance and sends the information to the controls for action. It should not only highlight the progress but also the deviations.
- Accurate and timely: The feedback should be accurate in terms of results and should be communicated in time for corrective action.
- Realistic: The system should be realistic so that the cost of control is far less than the benefits. The standards are realistic and are believed as achievable. Sufficient incentive and rewards are to be provided to motivate the people.
- Information flow: The system should have the information flow aligned with the organization structure and the decision makers ensure that the right people get the right information for action and decision making.
- Exception Principle: The system should selectively approve some significant deviations from the performance standards on the principle of management by exception.

INFORMATION SYSTEMS AUDIT

The effectiveness of an information system's controls is evaluated through an information systems audit. An audit aims to establish whether information systems are safeguarding corporate assets, maintaining the integrity of stored and communicated data, supporting corporate objectives effectively, and operating efficiently. It is a part of a more general financial audit that verifies an organization's accounting records and financial statements. Information systems are designed so that every financial transaction can be traced. In other words, an audit trail must exist that can establish where each transaction originated and how it was processed.

Aside from financial audits, operational audits are used to evaluate the effectiveness and efficiency of information systems operations, and technological audits verify that information technologies are appropriately chosen, configured, and implemented.

AUDIT

A planned and documented activity performed by qualified personnel to determine by investigation, examination, or evaluation of objective evidence, the adequacy and compliance with established procedures, or applicable documents and the effectiveness of implication.

MIS audit

Examines firm's overall security environment as well as controls governing individual information systems. It identifies all controls that govern individual information systems and assesses their effectiveness.

INFORMATION SYSTEM AUDITING

Information system auditing is the process of collecting and evaluating evidence to determine whether a computer system safeguards assets, maintains data integrity, allows organizational goals to be achieved effectively, and users resources effectively (Weber, 2000).

IS Audit refers to audit systems (especially computer based) which provided information (like Accounts, Payroll, MIS etc) to assure the management that the information generated from these systems are reliable.

-Manager depends on information to take decision (reliability of information).

-Internet failure affecting not only business but every field (dependent).

-Control over system and IT Environment.

-Company wants assurance that system is reliable.

Objectives of auditing of Information System

- Ensure computer based financial and other information reliable.
- Ensure all records included while processing.
- Ensure protection from frauds.

Audit methods:

Auditing around computer

Take sample inputs and manually apply processing rules and compare outputs with computer outputs.

Auditing through the computer

-Establish audit trail which allows examining selected intermediate results.

-Control totals provide intermediate checks.

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