Modules 1

Introduction to MIS: Concepts, Roles, Impacts, MIS & its users, Components of an IS, Management as Control systems, MIS support to Organization Effectiveness, MIS for E- business Digital Firms – E-Commerce, E – Communication, E-Collaborations, Real Time Enterprise, MIS: Strategic Business Planning, concept of corporate planning, Essentiality of strategic Planning, Balance Score card, Score Card & Dash Board, Security Challenges in E- Enterprises, Impacts of Information Technology on society

The concept of MIS

The concept of MIS gives high regard to the individual and his ability to use the info; MIS gives info through data analysis; while analysing the data, it relies on many academic disciplines in the management area; these academic principles are used in the designing of the MIS, evolving the decision support tools for modelling & decision making.

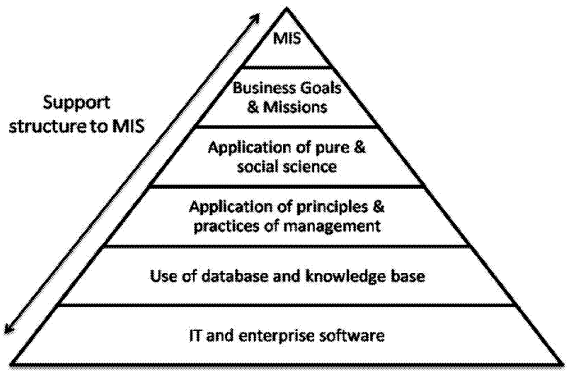
The foundation of MIS is the principles of management and its practices; it uses the concept of management control in its design and relies heavily on d fact that the decision maker s a human being and a human processor of information.

The physical view of MIS can be seen as an assembly of several subsystems based on databases in the org (either at functional or corporate level). MIS is evolved for a specific objective; it calls for an analysis of biz, policies, management culture. Style etc; thus, info is to be generated through the MIS in this setting and must be useful in managing the business.

Other points – MIS model may differ in two organizations involved in the same business

- it may generate different contents; it is a dynamic concept subject to change;
- it continuously reacts with internal and external environment of biz & provides a corrective mechanism in the system so that changed needs of the info are met effectively;
- primary objective therefore is to provide data for decision making.
- It will be designed giving due regard to people in org;
- the management functions and managerial control;
- thus, MIS model gives more info on the critical success factors for decision making.

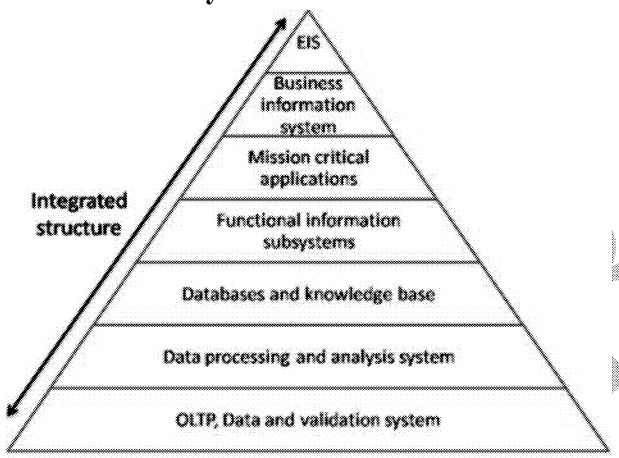
Conceptual view of MIS



The concept is a blend of principles, theories and practices of management, information and system giving rise to a single product called MANAGEMENT INFORMATION SYSTEM.

The concept of management gives high regard to the individual and his ability to use the information. MIS gives information through data analysis. While analysing the information, it relies on many academic disciplines like management science, OR, organization behaviour, psychology, etc.

Physical View of MIS



The physical view of MIS can be seen as assembly of several subsystems based on the databases in the organisation. These subsystems range from data collection, transaction processing and validating, processing, analysing and storing the information in databases. The subsystems could be at a functional level or a corporate level. The information is evolved through them for a functional or a departmental management and it provides the information for the management of business at the corporate level. All the systems shown in the above diagram together are MISs.

MIS: Definition

• MIS is been defined as a system which provides info support for decision making in the org.
• It can also be defined as integrated system of man and machine for providing information to support the operations, the management & decision-making functions in the org.
• The field of MIS is all about information: how it is collected, stored, and manipulated; MIS professionals make sure that information gets to the right humans at the right time so that they can do their jobs.

Characteristics: management oriented, biz driven, integrated system, avoids redundancy in data storage, enables proper planning, uses common database, it has flexibility & ease of use, the info serves a resource, it is distributed system
• In any organization, small or big, a major portion of time goes in data collection, processing, documenting and communicating to the people; hence more overheads go into this; every individual will be always looking for some info or other which is needed to perform his/her task; thus, information is people oriented.

• In order to get a grip on the activity of info processing, it is necessary to have a formal system which is to take care the following:

a. Handling of voluminous data.
b. Confirmation of validity of data & transaction.
c. Complex processing of data and multi-dimensional analysis.
d. Quick search and retrieval; mass storage.
e. Communication of information to the user on time.
f.Fulfilling the changing needs of the info.
Thus, the MIS uses computers and communication tech to deal with these points of supreme importance

What is an Information system?
The term Information System has been formally defined as an organized cooperative set of components i.e., people, hardware, software, communication networks and data resources that collect, transform, disseminate and store information in an organization.

The term **Information System** can therefore be validly used to refer to:

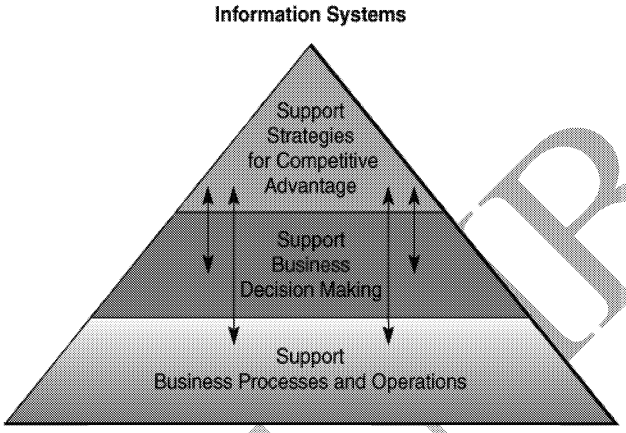
- Manual pen and paper) Information systems
- Informal (word-of-mouth) Information system
- Formal information systems (i.e., with written procedures)
- Computer based information systems.

The term 'information system' is used to refer to computer-based information systems. These are those that use computer hardware, software the internet, computer-based data resource management techniques and other information technologies to transform data into a variety of information products to support organizational or personal functions.

Role of Management Information System

- The role of MIS is an organization that can be compared to the roles of heart in the body
- The system ensures that an appropriate data is collected from various sources processed, and then further sent to individual, group of Individuals or the management functionaries: the managers and the top management
- It satisfies diverse needs through a variety of system such as Query system, Analysis system, modelling system, decision support system.
- MIS contribute to strategic planning, management control.
- (Management control can be defined as a systematic effort by business management to compare performance to predetermined standard, plans, or objective in order to determine whether performance is in the line with these standard and presumably in order to take any remedial action required)
- It helps Clerical personnel in the transaction processing and answers the queries on the data pertaining to the transaction, the status of a particular record and references on a variety of documents It helps Junior management personnel by providing the
- operational data for planning, scheduling and control, and helps in decision making at an operational level to correct an out-of-control situation.

- It helps Middle-Level management in short term planning, target setting and controlling the business functions.
- It helps Top management in goal setting, strategic planning and evolving the business plans and their implementation.
- It plays an important role in information generation, communication, problem identification and helps in the process of decision making
- Thus, MIS plays a vital(important) role in the management, administration and operations of an organization.



Impact of Management Information System

- Decision making: MIS can help businesses assess the impact of the market and competition.
- Competitive advantage: MIS can help businesses eliminate weaknesses and non-performing areas.
- Customer relationship management: MIS can help businesses store information about customers and businesses, including sales records and contact information.
- Improved employee productivity: MIS can improve the administration of a business by bringing discipline to operations.
- Decentralization: MIS can make routine business transactions faster and cheaper than manual methods.

MIS and the User

Every person in the organization is the user of MIS. people in the organization operate at al levels in the hierarchy. MIS caters to the needs of all.

Clerk

The main task of a clerk is to search the data, make a statement and submit it to the higher level. A clerk can use the MIS for quick search and reporting the same to the higher level.

Assistant

Assistant has the task of collecting and organizing data, and conducting a rudimentary(basic) analysis of it. MIS offers user tools to perform such tasks.

Officer

Officer has a role of integrating the data in different systems and disciplines to analyse it and make a critical comment if necessary

Executive

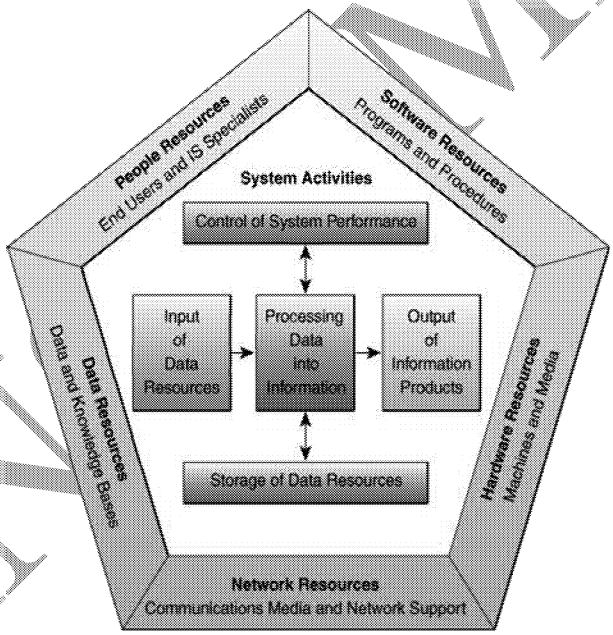
- Executive plays the role of decision maker and a planner. He is for achievement of targets and goals of an organization.
- MIS provides facility to analyse the data and offers the decision support system to perform the task of execution. MIS provides an action-oriented information.

Manager

- Manager has the responsibility and accountability for business results He/She is a strategist and a long-term planner, a person of foresight and analytical
- MIS provides information in a structured or unstructured format to take actions, MIS caters to his changing needs of information

Through MIS, the information can be implemented as a strategic weapon to ledge the threats to business, making business more competitive, bringing about the organizational transformation through integration. A good MIS also erects (putting up) an organization seamless by removing communication barriers.

Components of an IS



The information system model above summarizes the relationship among the components and activities of information systems.

As a system, the IS accepts inputs and produces outputs in an organized transformation process. It also includes additional concepts of feedback and control. Feedback refers to data about the performance of a system e.g. information about sales performance to sales manager. Control is about monitoring and evaluating feedback to determine whether or not the system is moving toward the achievement of its goals. It may as a result make adjustments to the system's input and processing components to ensure that it produces proper output.

Systems exist in environments containing other systems. The following are some important components related to this situation:

Subsystems: Systems that are components of a larger system. Almost all systems can be viewed as subsystems of some larger systems.
System Boundary: Demarcation between a system and its environment
Interface: An interconnection point between a system and other systems.
Open System: A system that impacts and is impact upon by its environment. A system that interacts with other systems. Almost all System interact with their environment hence are open systems.
Adaptive System: A system that has the ability to change itself or its environment in ensuring its survival.

Management as a control system

A definition of 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 deviation 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 predetermined standards To identify the deviations from the standards
- To measure its significance and to take corrective action in case of significant deviations.

This systematic effort is undertaken through the management control system.

MIS support to Organization Effectiveness

The management process is executed through a variety of decisions taken at each step of planning, organizing, staffing, directing coordinating and control. If the management is able to spell out the decisions required to be taken, the MIS can be designed suitably.

Decisions in Management

Steps in Management	Decision
Planning	A selection from various alternatives - strategies, resources, methods, etc.
Organization	A selection of a combination out of several combinations of the goals, people, resources, method and authority.
Staffing	Providing a proper manpower complement.
Directing	Choosing a method from the various methods of directing the efforts in the organization.
Coordinating	Choice of the tools and the techniques for coordinating the efforts for optimum results.
Controlling	A selection of the exceptional conditions and the decision guidelines

The objective of the MIS is to provide information for a decision support in the 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 Negandhi Estafen model is a model for analysing management effectiveness.
It was conceptualized in 1965 by Negandhi and Estafen. The model focuses on the following factors: Management philosophy, Environmental factors.

The model hypothesizes that management practices are a function of both environmental factors and the management philosophy of the firm.

The model incorporates the following:
• Management Philosophy of the Firm: (micro variables)
• Environmental Factors: (macro-variables)

The model can be used to:
• Determine system efficiency
• Determine firm efficiency

The model puts a lot of emphasis on the management philosophy and the environment factors on which the effectiveness is dependent. The environment factors provide the opportunities to survive and grow with certain constraints, Management philosophy sets the guidelines for deciding the management practices to run the enterprise

While the environment factors are difficult to control, it is left for the management to change its philosophy towards the various players in the business, viz., the employees, the consumers, the suppliers, the government, the community and the shareholders.

MIS for E- business

In order to operate, businesses must deal with many different pieces of information about suppliers, customers, employees, invoices and payments, and of course their products and services.
Due to Internet capabilities and web technology, traditional business organization definition has undergone a change where scope of the enterprise now includes other company locations, business partners, customers and vendors. It has no geographic boundaries as it can extend its operations where Internet works. All this is possible due to Internet and web moving traditional paper driven organization to information driven Internet enabled E-business enterprise. E-business enterprise is open twenty-four hours, and being independent, managers, vendors, customers transact business anytime from anywhere. Internet capabilities have given E-business enterprise a cutting-edge capability advantage to increase the business value. It has opened new channels of business as buying and selling can be done on Internet.

Management Information Systems (MIS) for E-business is different compared to conventional MIS design of an organization. The role of MIS in E-business organization is to deal with changes in global market and enterprises. MIS produces more knowledge-based products. Knowledge management system is formally recognized as a part of MIS. It is effectively used for strategic planning for survival and growth, increase in profit and productivity and so on. To achieve the said benefits of E-business organization, it is necessary to redesign the organization to realize the benefits of digital firm. The organization structure should be lean and flat. Get rid of rigid established infrastructure such as branch office or zonal office. Allow people to work from anywhere. Automate processes after reengineering the process to cut down process cycle time. Make use of groupware technology on Internet platform for faster response processing. Another challenge is to convert domestic process design to work for international process, where integration of multinational information systems using different communication standards, country-specific accounting practices, and laws of security are to be adhered strictly.

Internet and networking technology has thrown another challenge to enlarge the scope of organization where customers and vendors become part of the organization. This technology offers a solution to communicate, coordinate, and collaborate with customers, vendors and business partners. This is just not a technical change in business operations but a cultural change in the mindset of managers and workers to look beyond the conventional organization. It means changing the organization behaviour to take competitive advantage of the E-business technology.

The last but not the least important is the challenge to organize and implement information architecture and information technology platforms, considering multiple locations and multiple information needs arising due to global operations of the business into a comprehensive MIS.

Digital Firms- E Commerce

A digital firm is a company that has enabled core business relationships with customers, suppliers, and employees through digital networks. These digital networks are supported by technology platforms that enable seamless information exchange within the organization and with external partners.

A combination of information technology innovations and a changing domestic and global business environment makes the role of IT in business even more important for managers than just a few years ago. The Internet revolution is not something that happened and then burst, but instead has turned out to be an ongoing, powerful source of new technologies with significant business implications for much of this century.

There are five factors to consider when assessing the growing impact of IT in business firms both today and over the next ten years.

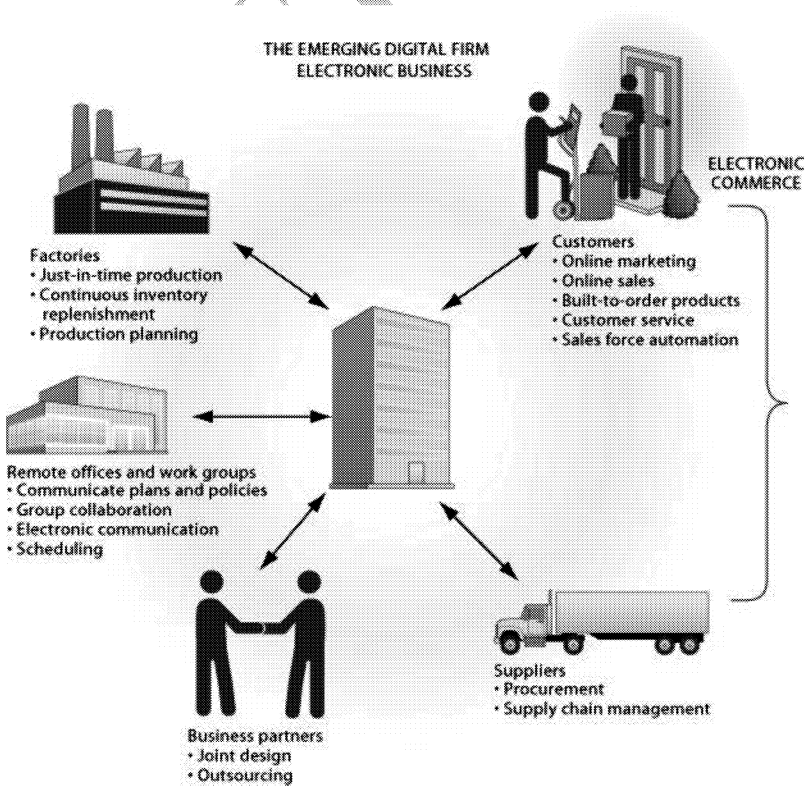
- Internet growth and technology convergence
- Transformation of the business enterprise
- Growth of a globally connected economy
- Growth of knowledge and information-based economies
- Emergence of the digital firm

A digital firm is one in which nearly all of the organization's significant business relationships with customers, suppliers, and employees are digitally enabled and mediated. Core business processes are accomplished through digital networks spanning the entire organization or linking multiple organizations.

Business processes refer to the set of logically related tasks and behaviors that organizations develop over time to produce specific business results and the unique manner in which these activities are organized and coordinated. Developing a new product, generating and fulfilling an order, creating a marketing plan, and hiring an employee are examples of business processes, and the ways organizations accomplish their business processes can be a source of competitive strength.

Key corporate assets—intellectual property, core competencies, and financial and human assets—are managed through digital means. In a digital firm, any piece of information required to support key business decisions is available at anytime and anywhere in the firm.

Digital firms' sense and respond to their environments far more rapidly than traditional firms, giving them more flexibility to survive in turbulent times. Digital firms offer extraordinary opportunities for more global organization and management. By digitally enabling and streamlining their work, digital firms have the potential to achieve unprecedented levels of profitability and competitiveness. Electronically integrating key business processes with suppliers has made this company much more agile and adaptive to customer demands and changes in its supplier network.



The image illustrates a digital firm making intensive use of Internet and digital technology for electronic business. Information can flow seamlessly among different parts of the company and

between the company and external entities—its customers, suppliers, and business partners. More and more organizations are moving toward this digital firm vision.

E Communication

Electronic communication is any way to contact your team that can be viewed, shared, or stored electronically. It's sometimes called electric communication or e-communication. Using several e-communication channels together makes an electronic communication network.

Electronic communication mediums include email, instant messaging apps, video calls, phone calls, blogs, and text messages. Your electronic communication network can include any combination of these types of apps.

Different Types of Electronic Communication

Each electronic communication medium has its own strengths and weaknesses. Choosing the correct channels for your business or team's unique situation will depend on your business needs.

1. **Email-** Most businesses will be familiar with email as an electronic communication method. It is widely used in most businesses and is a reliable and effective method of sharing information.
2. **Messenger apps-** Instant messaging (IM) has become popular as an electronic communication method. It's a great way for your employees to connect with both team members and customers.
3. **Video calls and video sharing-** Sharing videos can also be a great way to communicate with both customers and employees. Many businesses are now using apps like TikTok to create short video content for colleagues and customers to keep younger employees engaged in communications.
4. **Blogs and websites** can be a great addition to your electronic communication network, especially when communicating with customers. Internally, a blog or website can be used to store internal communications and useful articles that employees can read.
5. **Phone calls and voicemails**- In modern workplaces, there is less emphasis on phone calls and voicemails as communication methods than there was in the past. However, this old-school system is still technically electronic communication, and it can still bring a personal touch that instant messaging or blogging platforms may lack.
6. **SMS/Text messages-** The main difference between SMS and other instant communication platforms is that SMS uses cellular towers to send messages, while IM uses the internet. The benefit of this is that if there is a problem with internet connectivity, SMS will still be available to the team.
7. **File Transfer Protocol (FTP)-** File Transfer Protocol (FTP) is an electronic communication method that transfers files between computers. While it's not the most widely known, FTP is one of the oldest methods of file sharing. It connects two computers over a network and allows them to exchange data. One significant security risk associated with FTP is that it does not encrypt data during transmission, meaning that any sensitive information sent via this protocol could be intercepted and read by malicious actors on the same network.

E- Collaboration

E-collaboration defined as "collaboration, which is conducted without face-to-face interaction among individuals or members of virtual teams engaged in a common task using information and communication technologies."

E-collaboration is a business management approach that involves using electronic technologies to help people work together to achieve a goal. It can also be described as the use of electronic communication to coordinate a group.

E-collaboration can include:
Communication, Coordination, Collaboration, Cooperation, Alliancing, Doing business together.

More specifically, the term E-Collaboration describes practices of communication, coordination and collaboration between people in distributed contexts, such as projects, (virtual) teams, or processes in and between organizations, which are enabled by Information and Collaboration Technology, in essence: E-Collaboration systems.

Real Time Enterprise

Real-Time Enterprise (RTE) is a business systems design concept that helps organizations automate processes across different media and systems. RTE systems are configurable information systems packages that integrate people, technology, and information processing.

RTE provides real-time information to employees, customers, suppliers, and other business partners. The goal of RTE is to ensure that all information is up-to-date and consistent throughout all systems.

It is also referred to as on-demand enterprise. Such an enterprise must be able to fulfil orders as soon as they are needed, and current information is available within a company at all times. This is achieved through the use of integrated systems including ERP, CRM and SCM.

Here are some different forms of real-time enterprise for managers in IT:

- **Supply chain management**: Monitors the flow of raw materials, money, and products throughout the production process.
- **HR recruiting:** Automates HR processes like recruiting, payroll, employee training, and performance management.
- **Content management**: Combines document capture, search, and networking with digital archiving, document management, and workflow.
- **Project management**: Tracks the progress of teams, individuals, or projects.
- **Analytics**: Centralizes data and provides actionable insights to teams.
- **Database management**: Promotes efficient use of data and allocation of resources.

- **Marketing automation**: Automates processes like cross-channel tracking and visitor behaviour analysis.
- **ERP Analytics**: Provides advanced capabilities like AI to automate manual processes, analytics to react to market shifts, and automatic updates.
- **Knowledge management**: Improves the quality and timeliness of information for decision-making and strategic planning.

Strategic planning for MIS is a managerial activity that enhances the working process and prospects of an organization.

The preparation of an organization's information system has traditionally been divorced from the overall strategic planning processes by which the organization plans for its future. The relation between the organization's "strategy set" and an MIS "strategy set" is conceptualized and illustrated as an M/S strategic planning mechanism.

For strategic planning and management, there are many structures and methodologies to choose from. Although there are no hard and fast rules when it comes to choosing the right system, the majorities of them follow a similar trend and share similar characteristics.

Many frameworks cycle through some variation on some very basic phases:

- Analysis or assessment, where current internal and external environments are analysed.
- Strategy formulation, strategy formulation process is developed and documented.
- Strategy execution is a phase of planning where the proposed plan is converted into operational planning.
- Evaluation or sustainment/management phase, where ongoing refinement and evaluation of performance, culture, communications, data reporting, and other strategic management issues occurs.

Concept of Corporate Planning

Corporate planning is a process that businesses use to create strategies to achieve their goals and objectives.

Corporate planning is the process of setting long-term goals and objectives for an organization. It includes:

- Defining strategies
- Decision-making
- Allocating resources
- Motivating people through the planning process
- Measuring performance
- Developing people through better decision-making

The stages of corporate planning are:

- Formulating the company's vision and mission statements
- Setting corporate goals and objectives
- Considering organizational strengths and weaknesses
- Integrating short-term and long-term plans
- Implementing the plan
- Evaluating performance

Corporate planning can lead to the formulation of corporate strategy. It can also help shape a plan to avoid costly mistakes by looking at the strengths and weaknesses of leading companies in the industry.

Essentiality of Strategic Planning

A strategic plan is a key component of planning for growth. It helps to prepare a realistic vision for the future of a business.

Essentialities:

- SWOT analysis: Evaluating the strengths, weaknesses, opportunities, and threats facing the organization
- Strategic objectives: Setting objectives that align with the organization's vision
- Goals and objectives: Specific targets that an organization aims to achieve
- Mission and values: Defining a clear mission and direction for the brand
- Engage your team: Developing a clear message that drives commitment and engagement among the workforce

Strategic planning for Management Information Systems (MIS) is the process of transforming an organization's strategy into a set of system objectives, constraints, and design principles. Strategic planning for MIS ensures that technology activities are properly aligned with the evolving needs and strategies of the organization.

The process involves:

- Analysis or assessment: Analysing the current internal and external environments
- Strategy formulation: Developing and documenting the strategy formulation process
- Strategy execution: Converting the proposed plan into operational planning

Strategic planning for MIS includes:

- Deciding on objectives for the MIS organization
- Deciding on changes to these objectives
- Deciding on the resources used to obtain these objectives
- Deciding on the policies that will govern the acquisition, use, and disposition

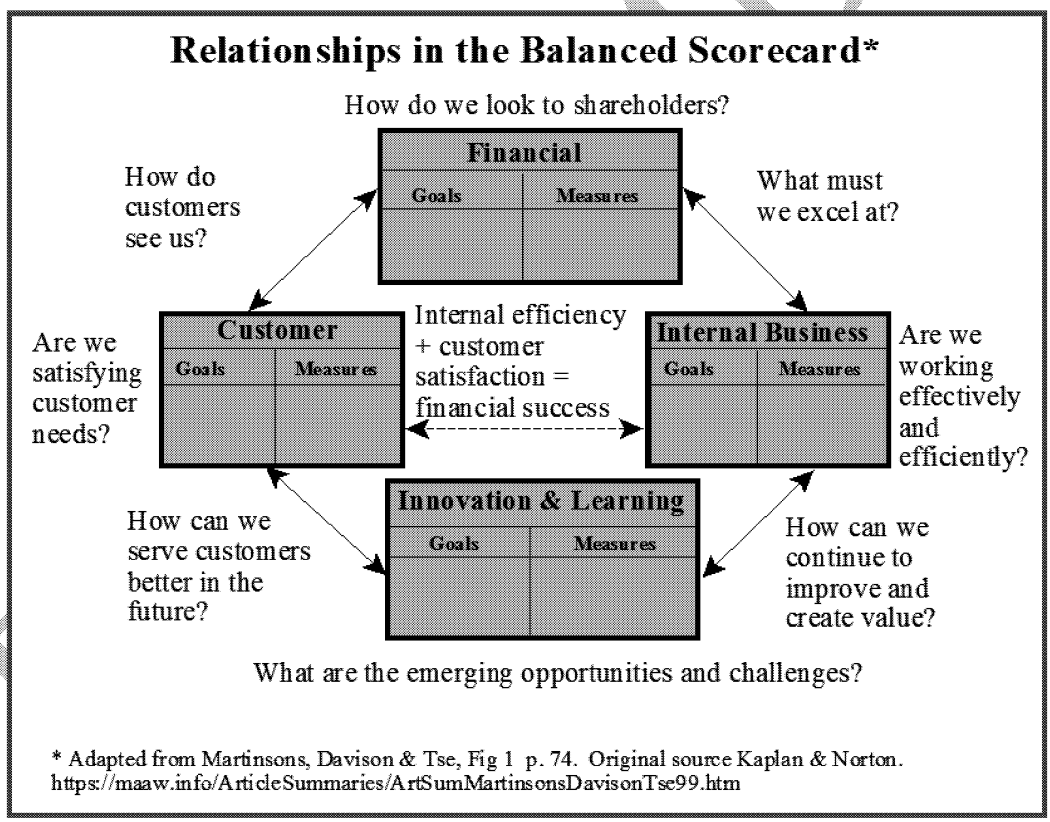
The appropriateness of strategic plans for MIS is determined by two factors:

- **Explicitness:** The degree to which the process is conscious, formal, and documented
- **Situational fit:** The degree to which the MIS is compatible with the specific organization and its members

Balance Score Card

The Balanced Scorecard is an approach to performance measurement that combines traditional financial measures with non-financial measures to provide managers with richer and more relevant information about activities they are managing.

The BSC is revolutionary tool that motivates staff to make the organization's vision happen. The balanced scorecard is a strategy performance management tool. The scorecard lists financials goals, customer goals, internal business goals, and innovation & learning goals. These four goals give a good overview of what the company tries to achieve, i.e., the company strategy.



The balanced scorecard approach is useful not only in accomplishing the objectives, measures and targets of the institutional strategy but also in the planning of the management information system.

The BSC concept can also be applied to measure, evaluate and guide activities that take place in specific functional areas of a business. It can even be used to shed greater light on performance at the individual project level.

The BSC-for-IS framework presented here is:

Measuring and evaluating business value

It is useful to distinguish between two categories of IT/IS performance evaluation: the short-term cost-benefit evaluation that is commonly applied to individual projects, and the longer-term perspective relevant to both IT applications and the IS department or function as a whole. Many of the business value measures fall into the latter category. For example, although `Cost control' and `Selling to third parties' may be evaluated in the short-term, many of the measures.

Measuring and evaluating user orientation

The end-user of an IS may be an internal customer or in another company that is utilizing an inter-organizational system. However, in contrast to the large potential market for the products and services of most companies, an IS department or function usually has limited opportunities to attract new customers, although we acknowledge that this may change in the expanding electronic marketplace. Given these circumstances, the satisfaction of existing customers will be much more important than

Measuring and evaluating internal processes

Internal operations may be assessed by measuring and evaluating three of the basic processes performed by the IS department:

(1) the planning and prioritization of IS projects;

(2) the development of new IT applications; and

(3) the operation and maintenance of current IT applications.

Other processes may also be considered, such as hardware and software supply and support, problem management, user education, the management of IS personnel, and their usage of efficient communication channels.

Measuring and evaluating future readiness

In addition to managing current performance, there is also a need to measure and evaluate the readiness of the IS department or function for the future. The future readiness perspective is concerned with:

(1) continually improving the skillset of IS specialists in order to prepare them for potential changes and challenges in the future;

(2) regularly updating the applications portfolio; and

(3) putting effort into researching emerging technologies and their potential value to the organization.

Balanced scorecards provide you with insightful snapshots of your company's activities, finances, and overall operations. A great balanced scorecard displays data of both external services and internal functions. They represent a variety of different insights from one central location.

Some of the most notable characteristics of balanced scorecards are that they include the most valuable KPIs, have precise goals, and display target values numerically to make the comparison process easier.

The main benefits of balanced scorecards are:

- **Better strategic planning** – Creating a strategy and figuring out the most likely outcomes is much easier with balanced scorecards.
- **Data-based management decisions** – Using balanced scorecards usually forces companies to outline the crucial metrics for their strategic objectives. This makes management consider the data that really matters and make more informed decisions based on that.
- **Robust performance reporting** – Balanced scorecards improve information transparency both internally and externally, which ultimately leads to more efficient KPI management and advanced performance reporting.
- **Tracking progress towards business objectives** – Scorecards are the easiest way to monitor how your company is progressing towards the set business goals.
- **Setting targets for employees** – You can use balanced scorecards to manage employee performance by their outputs and results.
- **Minimize the number of meetings** – If your whole company has access to the same scorecards, then you won't have to waste time organizing any unnecessary meetings.
- **Determine the most profitable marketing campaigns** – You can check out which marketing channels and campaigns generate the most profit.
- **Quickly identify important trends** – Scorecards allow you to stay up-to-date with all the latest trends.

To put it simply, balanced scorecards help you with strategic planning, improve communication, and allow management to make data-driven decisions.

Scorecard and Dashboard in MIS

A scorecard is a framework that compares current strategies to a company's overall goals. A dashboard is a business tool that provides a visual overview of a company's most important metrics and KPIs.

Scorecards

- Purpose: Measure progress towards a goal
- Focus: Long-term goals
- Use: Performance management

To better understand just how beneficial scorecards can be, here is a brief list of some of the main reasons why companies incorporate them:

- They can help you understand whether you are producing the right products, see how profitable they are, and check if they are in line with the current trends.
- They showcase which call centre scripts are functioning properly and whether there is any room for improvement in customer experience.
- They analyse the current safety standards and help you figure out ways to make the manufacturing environment more profitable.

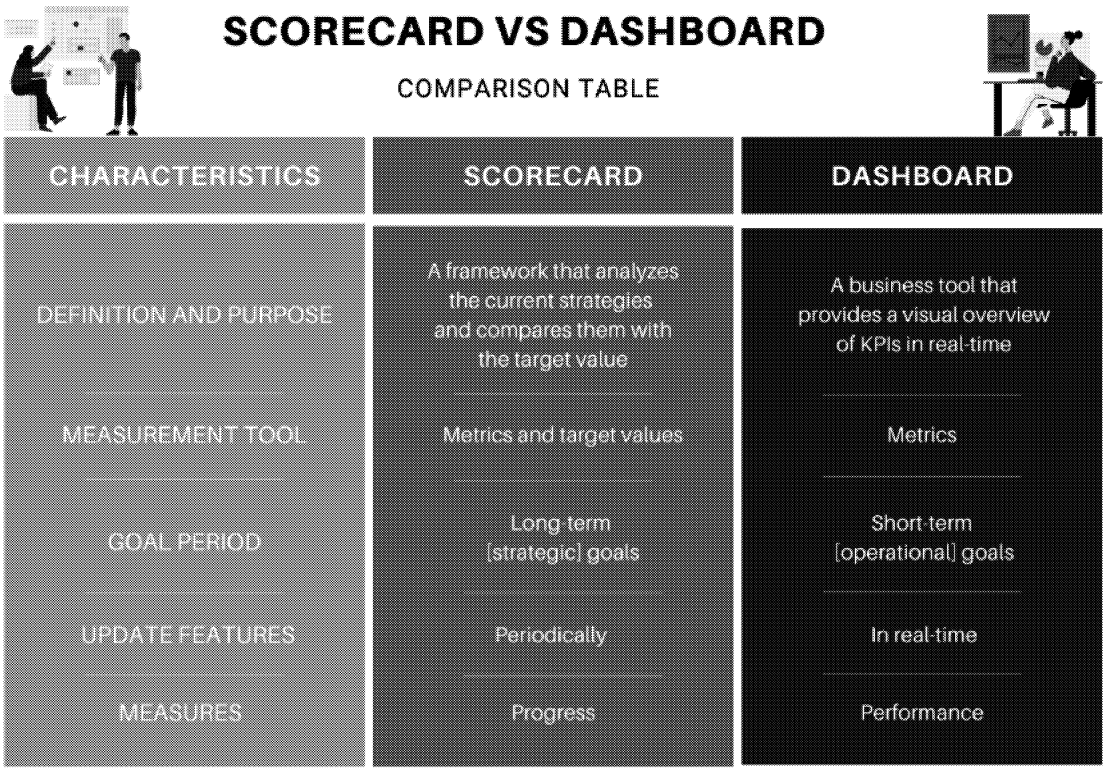
Dashboards

- Purpose: Measure performance
- Focus: Performance monitoring
- Use: Track strategic goals and overall efficiency
- Data: Real-time

Dashboards can be used to track ongoing campaigns or to get a snapshot of business performance. Information dashboards can be useful for formulating long-term plans.
Dashboards offer a broad way to track strategic goals and measure a company's overall efficiency. Scorecards, on the other hand, provide a quick and concise way to measure KPIs and give a clear indication of how well organizations are working to achieve their targets.

Depending on the purpose behind it, there are four types of data dashboards you can create:

- **Strategic dashboards** – Used for monitoring long-term company strategies by analysing trend-based metrics and KPIs.
- **Operational dashboards** – Tracking the operations that have a shorter time frame.
- **Analytical dashboards** – Used by analysts to extract valuable information from larger data sets.
- **Tactical dashboards** – Best suited for mid-level management. They can help you make better strategies based on the latest trends.



Security Challenges in E- Enterprises

1. Financial fraud

Financial fraud takes several forms. It involves hackers gaining access to your customer's personal information or payment information, then selling that information on the black market. It also involves fraudsters using stolen credit card information to make illegitimate purchases from your e-commerce store.

2. Phishing

Your customers are the target in a phishing scam, where a fraudster sends messages or emails pretending to be you with the goal of obtaining their private information. These messages may contain logos, URLs, and other information that appears to be legitimate, but it won't be you sending it. They'll ask customers to verify their account by logging in and then use the information to steal personal data.

3. Spamming

In an attempt to obtain personal information—or to affect your website's performance—spammers may leave infected links in their comments or messages on your website, such as on blog posts or contact forms. If you click on the links, they can take you to a spam website that exposes you to malware.

4. Malware

Malware refers to malicious programs such as spyware, viruses, trojan horses, and ransomware. Hackers install it on your computer system and spread it to your customers and administrators, where it might swipe sensitive data on their systems and from your website.

5. Bad bots

People are generally aware that bots are all over the Internet, obtaining information about our habits and behaviours. Your competition, however, could use bots to gather information about your inventory and prices. They then use that information to change their prices. Or hackers can send malicious bots to e-commerce checkout pages to buy large amounts of a product and scalp it for up to 10 times the list price.

6. Distributed denial of service (DDoS) attacks

Distributed denial of service attacks happens when your servers receive an overwhelming number of requests from various IP addresses—usually untraceable—that cause your server to crash. That means your e-commerce store isn't available to visitors, which disrupts your sales.

7. Fake return and refund fraud

Fraudsters can obtain money from you by committing fake returns and refund fraud in many ways. Some use a stolen credit card to purchase merchandise, then claim that the card is closed and request a refund to another card. Others use counterfeit receipts to request refunds for items they haven't purchased.

8. Man-in-the-middle attacks

With technology evolving, so are hackers' schemes. Man-in-the-middle attacks allow the hacker to listen in on the communications of e-commerce website users. These users are tricked into using a public wireless network, enabling hackers to access their devices and see their browsing history. They can also access credit card information, passwords, and usernames.

Impacts of Information Technology on Society.

- **Business Models, Commerce and Market Structure-**

One important way in which information technology is affecting work is by reducing the importance of distance. In many industries, the geographic distribution of work is changing significantly. For instance, some software firms have found that they can overcome the tight local market for software engineers by sending projects to India or other nations where the wages are much lower. Furthermore, such arrangements can take advantage of the time differences so that critical projects can be worked on nearly around the clock. Firms can outsource their manufacturing to other nations and rely on telecommunications to keep marketing, R&D, and distribution teams in close contact with the manufacturing groups.

- **Workplace and Labour Market-**

Computers and communication technologies allow individuals to communicate with one another in ways complementary to traditional face-to-face, telephonic, and written modes. They enable collaborative work involving distributed communities of actors who seldom, if ever, meet physically. These technologies utilize communication infrastructures that are both global and always up, thus enabling 24-hour activity and asynchronous as well as synchronous interactions among individuals, groups, and organizations.

Jobs are both created and destroyed by technology, trade, and organizational change. These processes also underlie changes in the skill composition of employment. Beyond the net employment gains or losses brought about by these factors, it is apparent that workers with different skill levels will be affected differently. E-commerce is certainly driving the demand for IT professionals but it also requires IT expertise to be coupled with strong business application skills, thereby generating demand for a flexible, multi-skilled work force. There is a growing need for increased integration of Internet front-end applications with enterprise operations, applications and back-end databases. Many of the IT skill requirements needed for Internet support can be met by low-paid IT workers who can deal with the organizational services needed for basic web page programming. However, wide area networks, competitive web sites, and complex network applications require much more skill than a platform-specific IT job. Since the skills required for e-commerce are rare and in high demand, e-commerce might accelerate the upskilling trend in many countries by requiring high-skilled computer scientists to replace low-skilled information clerks, cashiers and market salespersons.

- **Education-**

Advances in information technology will affect the craft of teaching by complementing rather than eliminating traditional classroom instruction. Indeed, the effective instructor acts in a mixture of roles. In one role the instructor is a supplier of services to the students, who might be regarded as its customers. But the effective instructor occupies another role as well, as a supervisor of students, and plays a role in motivating, encouraging, evaluating, and developing students. For any topic there will always be a small percentage of students with the necessary background, motivation, and self-discipline to learn from self-paced workbooks or computer assisted instruction. For the

majority of students, however, the presence of a live instructor will continue to be far more effective than a computer assisted counterpart in facilitating positive educational outcomes. The greatest potential for new information technology lies in improving the productivity of time spent outside the classroom. Making solutions to problem sets and assigned reading materials available on the Internet offers a lot of convenience. E-mail vastly simplifies communication between students and faculty and among students who may be engaged in group projects.

- **Private Life & Security-**

Increasing representation of a wide variety of content in digital form results in easier and cheaper duplication and distribution of information. This has a mixed effect on the provision of content. On the one hand, content can be distributed at a lower unit cost. On the other hand, distribution of content outside of channels that respect intellectual property rights can reduce the incentives of creators and distributors to produce and make content available in the first place. Information technology raises a host of questions about intellectual property protection and new tools and regulations have to be developed in order to solve this problem.

The rapid increase in computing and communications power has raised considerable concern about privacy both in the public and private sector. Decreases in the cost of data storage and information processing make it likely that it will become practicable for both government and private data-mining enterprises to collect detailed dossiers on all citizens. Nobody knows who currently collects data about individuals, how this data is used and shared or how this data might be misused.

Modules 2

Kinds of Information Systems: Transaction Processing System (TPS) - Office Automation System (OAS) - Management Information System (MIS) - Decision Support System (DSS) and Group Decision Support System (GDSS) - Expert System (ES) - Executive Support System (EIS or ESS), Ethical Issues in Information systems.

INTRODUCTION TO INFORMATION SYSTEMS

Information system refers to various information technology systems like computers, software, database, communication systems, the internet, devices, and others used by an organization to collect, transfer, organize, and store data. stuffed with changes. The current business background has helped companies to implement a varied set of advanced technologies into different processes. These IT applications have introduced automation, efficiency, and timeliness in various business activities.

The introduction of information systems into the business has evoked a chain reaction among different interrelated processes that have only benefited the companies by increasing profits and reducing costs and lead time, among other things. Therefore, it is imperative to understand the growing importance of information systems in companies.

Information Systems and its Importance

An information system is a group of data sets that ensures that business operates smoothly, embracing change, and helping companies achieve their goal. The dictionary defines an information system as a computer system or set of components for collecting, creating, storing, processing and distributing information. The information system is incomplete without the support of information technology (IT) systems.

An information system is not primarily associated with technology or IT system. Instead, it is related to how technology is used to fulfil the needs of- individuals, groups or organizations. In the digital era that we are in, the importance of information systems is increasing because it standardizes the process of passing, collecting, storing, and accessing information or data for individuals or businesses.

There are different types of information systems that help individuals and companies to use the information to their benefit. In the succeeding part of the article, we will discuss various types of information systems in detail.

TYPES OF INFORMATION SYSTEMS

1. **Knowledge Work System**

The enterprise-wide knowledge systems provide a wide range of capabilities that can be used by many if not all the workers and groups in an organization. Firms also have specialized systems for knowledge workers to help them create new knowledge and to ensure that this knowledge is properly integrated into the business. There are different knowledge management systems that an organization implements to ensure a continuous flow of new and updated knowledge into the company and its processes. A knowledge work system (KWS) is one of the knowledge management systems that ease the integration of new information or knowledge into the business process.

KWS also offers support and resources to various knowledge creation techniques, artificial intelligence applications, and group collaboration systems for knowledge sharing, among others. It also uses graphics, visuals, etc., to disseminate new information. Below are some of the applications that work on the core fundamentals of KWS.

- Designers often use computer-aided design systems (CAD) to automate their design process.
- Financial workstations are used to analyze huge amounts of financial data with the help of new technologies.
- Virtual reality systems are found in the scientific, education, and business fields for using graphics and different systems to present data.

EXAMPLES OF KNOWLEDGE WORK SYSTEMS

Major knowledge work applications include CAD systems, virtual reality systems for simulation and modeling, and financial workstations. Computer-aided design (CAD) automates the creation and revision of designs, using computers and sophisticated graphics software. Using a more traditional physical design methodology, each design modification requires a mold to be made and a prototype to be tested physically. That process must be repeated many times, which is a very expensive and time-consuming process. Using a CAD workstation, the designer need only make a physical prototype toward the end of the design process because the design can be easily tested and changed on the computer. The ability of CAD software to provide design specifications for the tooling and manufacturing processes also saves a great deal of time and money while producing a manufacturing process with far fewer problems. The Interactive Session on Technology illustrates some of these benefits, and shows how they can be a source of competitive advantage. CAD systems are able to supply data for 3-D printing, also know known as additive manufacturing, which uses machines to make solid objects, layer by layer, from specifications in a digital file. 3-D printing is currently being used for producing prototypes and small items, such as jewelry and hip implants, as well as aircraft parts. In the future, it may be used for custom-fabricating parts for autos and military equipment.

Virtual reality systems have visualization, rendering, and simulation capabilities that go far beyond those of conventional CAD systems. They use interactive graphics software to create computer-generated simulations that are so close to reality that users almost believe they are participating in a real-world situation. In many virtual reality systems, the user dons special clothing, headgear, and equipment, depending on the application. The clothing contains sensors that record the user's movements and immediately transmit.

REQUIREMENTS OF KNOWLEDGE WORK SYSTEMS

Most knowledge workers rely on office systems, such as word processors, voice mail, e-mail, videoconferencing, and scheduling systems, which are designed to increase worker productivity in the office. However, knowledge workers also require highly specialized knowledge work systems with powerful graphics, analytical tools, and communications and document management capabilities. These systems require sufficient computing power to handle the sophisticated graphics or complex calculations necessary for such knowledge workers as scientific researchers, product designers, and financial analysts. Because knowledge workers are so focused on knowledge in the external world, these systems also must give the worker quick and easy access to external databases. They typically feature user-friendly interfaces that enable users to perform needed tasks without having to spend a great deal of time learning how to use the system. Below figure summarizes the requirements of knowledge work systems. Knowledge workstations often are designed and optimized for the specific tasks to be performed; so, for example, a design engineer requires a different workstation setup than a financial analyst. Design engineers need graphics with enough power to handle three-dimensional (3-D) CAD systems. However, financial analysts are more interested in access to a myriad number of

external databases and large databases for efficiently storing and accessing massive amounts of financial data.

2. MANAGEMENT INFORMATION SYSTEM

The management information system provides aid to managers by automating different processes that were initially done manually. Business activities like business performance tracking and analysis, making business decisions, making a business plan, and defining workflow. It also provides feedback to the managers by analyzing the roles and responsibilities.

A management information system is considered a significant application that helps managers immensely.

ADVANTAGES OF MANAGEMENT INFORMATION SYSTEM

- It enhances the efficiency and productivity of the company
- It provides a clear picture of the organization's performance
- It adds value to the existing products, introduces innovation and improves product development
- It assists in communication and planning for business processes
- It helps the organization provide a competitive advantage

OFFICE AUTOMATION SYSTEM

An office automation system is an information system that automates different administrative processes like documenting, recording data, and office transactions, among others. The office automation system is divided into managerial and clerical activities.

BUSINESS ACTIVITIES DONE UNDER OFFICE AUTOMATION SYSTEM

- Email
- Voice mail
- Word processing

ASPECTS OF OFFICE AUTOMATION

- Information storage: This includes the recording of information, like forms, documents, files, images and spreadsheets. Information storage generally exists in formats of word processors or spreadsheets, but it can also be more sophisticated like records in a CMS or automation software tool like SolveXia.

- Data exchange: Systems allow for the real-time exchange of information, such as fax machines or emails. Automation software tools also fit into this category as you can easily share information and send reports between people.

- Data management: Office automation must also be easily manageable between different parties and relevant information. As such, office automation systems can handle short-term and long-term data, including financial plans, marketing expenditures, inventory management, etc.

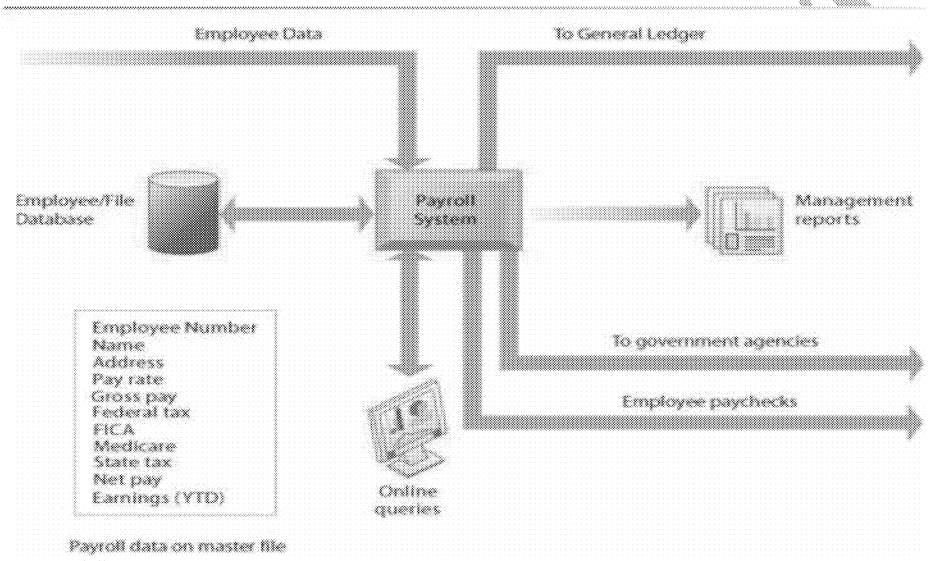
BENEFITS OF OFFICE AUTOMATION

- Reduction of manual effort to achieve tasks
- Minimization of human and manual errors
- Decreased processing time for task completion
- Enhanced transparency and process improvement abilities
- Better decision-making based on data and forecasts
- Enhanced metrics and KPI monitoring
- Increased employee satisfaction and communication
- Results in better customer service

TRANSACTION PROCESSING SYSTEM

A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to conduct business, such as sales order entry, hotel reservations, payroll, employee record keeping, and shipping. The principal purpose of systems at this level is to answer routine questions and to track the flow of transactions through the organization.

At the operational level, tasks, resources, and goals are predefined and highly structured.



PAYROLL SYSTEM

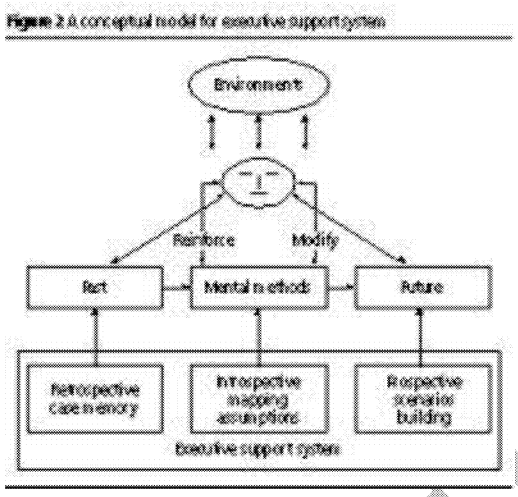
Payroll system keeps track of money paid to employees. An employee time sheet with the employee's name, social security number, and number of hours worked per week represents a single transaction for this system., the payroll system illustrated in Figure along with other accounting TPS, supplies data to the company's general ledger system, which is responsible for maintaining records of the firm's income and expenses and for producing reports such as income statements and balance sheets. It also supplies employee payment history data for insurance, pension, and other benefits calculations to the firm's human resource's function, and employee payment data to government agencies such as the U.S. Internal Revenue Service and Social Security Administration

EXECUTIVE SUPPORT SYSTEM

Executive support systems (ESS) help senior management make these decisions. They address non-routine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at a solution. ESS present graphs and data from many sources through an interface that is

easy for senior managers to use. Often the information is delivered to senior executives through a portal, which uses a Web interface to present integrated personalized business content. ESS is designed to incorporate data about external events, such as new tax laws or competitors, but they also draw summarized information from internal MIS and DSS. They filter, compress, and track critical data, displaying the data of greatest importance to senior managers. Increasingly, such systems include business intelligence analytics for analyzing trends, forecasting, and "drilling down" to data at greater levels of detail.

ESS provides the desktop a minute-to-minute view of the firm's financial performance as measured by working capital, accounts receivable, accounts payable, cash flow, and inventory. The information is presented in the form of a digital dashboard, which displays on a single screen graphs and charts of key performance indicators for managing a company. Digital dashboards are becoming an increasingly popular tool for management decision makers.



An Executive Support System or ESS helps top-level executives to plan and control workflow and make business decisions. It is very similar to Management Information System or MIS.

CHARACTERISTICS OF ESS

- It provides great telecommunication, better computing capabilities, and effective display options to executives.
- It enables them with information through static reports, graphs, and textual information on demand.
- It helps monitor performances, track competitors' strategies, and forecast future trends, among others.

GDSS (GROUP DECISION SUPPORT SYSTEMS)

GDSS is the abbreviation for Group Decision Support System. It is a system that supports decision-making and has been designed and structured in such a way so that the members constituting a group can interact with each other to arrive at a particular decision. It provides support for various group decision-making activities such as file sharing, integration of the individual opinions with that of the group, communication, modelling of group actions and any other action which requires interaction of the group members.

The decision support systems that have been mentioned till now facilitate a single person to take decisions by providing computerized support. These decisions fall into the unstructured or semi-

structured category. Most of the decisions that have to be taken in the organization are generally a group effort rather than taken by a single person.

THE CHARACTERISTICS OF THE GROUP DECISION SUPPORT SYSTEMS OR GDSS

- supports exchange and flow of information and ideas seamlessly between various members of the decision-making group.
- It also maintains the privacy of the members.
- helps in solving problems that are unstructured in nature when a group of decision makers are working in collaboration with each other.

POPULAR SYSTEMS THAT USE GDSS

Computer-Supported Co-operative Work (CSCW), computerized collaborative work support and Electronic Meeting System (EMS).

ADVANTAGES OF GDSS :

1) More Information in Less Time :

It is possible to gather huge amount of information in a very short time period as GDSS facilitates the members of the team to work parallel.

2) Greater Participation :

The risks associated with conformity pressure and groupthink is greatly decreased when the members of the group work in a GDSS because the members are able to express their thoughts freely. This is due to the anonymity feature extended by GDSS.

3) More Structure :

In a GDSS environment the discussions are much more concentrated and focused. Irrelevant degradations are greatly reduced.

4) Automated Documentation :

Comments are preserved forever and the system provides the result without any delay. Excellent graphics makes viewing more attractive.

DISADVANTAGES OF GDSS :

1) Cost :

A significant amount of cost may be associated with putting up the infrastructure consisting of the room, network connectivity and the software.

2) Security:

This risk arises when the facility for setting up GDSS has been rented. There are chances that information gets leaked to the peers by a low level employee.

3) Technical Failure :

The system must be properly implemented to reduce the risk associated with loss of connectivity and power loss. It is highly dependent on LAN/WAN infrastructure and bandwidth.

4) Keyboarding Skills :

If the members get frustrated they might participate less.

5) Training :

There is variation in the learning curve of the user in various situations.

6) Perception of Messages :

MIS-interpretations may occur in case the members communicate less verbally.

FEATURES OF GROUP DECISION SUPPORT SYSTEM (GDSS)

1) Ease of Use :

It consists of an interactive interface that makes working with GDSS simple and easy.

2) Better Decision Making:

It provides the conference room setting and various software tools that facilitate users at different locations to make decisions as a group resulting in better decisions.

3) Emphasis on Semi-structured and Unstructured Decisions:

It provides important information that assists middle and higher level management in making semi-structured and unstructured decisions.

4) Specific and General Support :

The facilitator controls the different phases of the group decision support system meeting (idea generation, discussion, voting and vote counting, etc.) what is displayed on the central screen and the type of ranking and voting that takes place, etc. In addition, the facilitator also provides general support to the group and helps them to use the system.

5) Supports all Phases of the Decision Making:

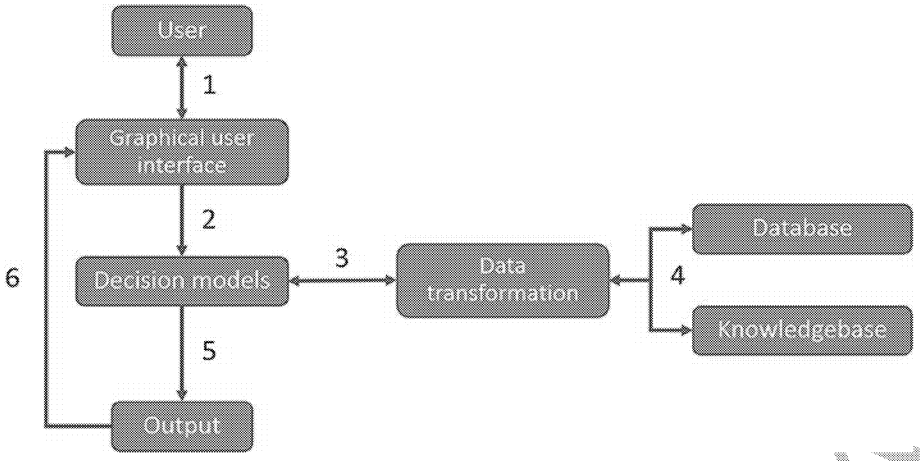
It can support all the four phases of decision making, viz intelligence, design, choice, and implementation.

6) Supports Positive Group Behavior : In a group meeting, as participants can share their ideas more openly without the fear of being criticized, they display more positive group behavior towards the subject matter of the meeting.

DSS

A decision support system (DSS) is an information system that supports business or organizational decision-making activities. DSSs serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e., unstructured and semi-structured decision problems. Decision support systems can be either fully computerized or human-powered, or a combination of both.

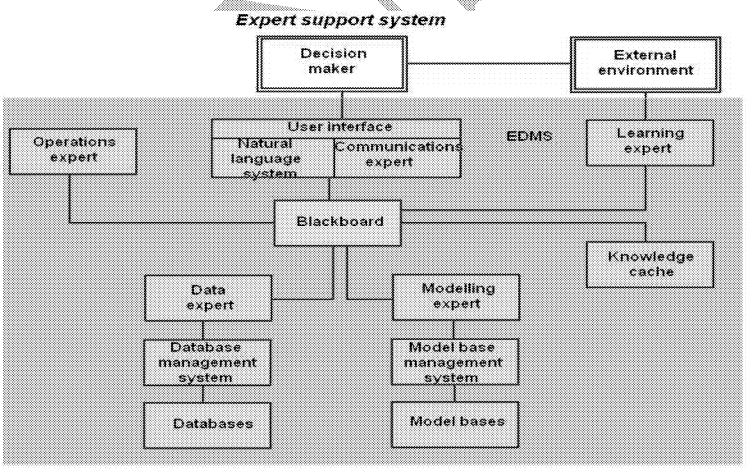
Decision support system (DSS) is an analytics software program used to gather and analyze data to inform decision making. There are many different types of decision support systems, from modern business intelligence which uses AI and machine learning to suggest insights and analyses for humans to perform, to model-based DSS systems which use predefined criteria to perform automated calculations and deliver best-case decisions. For all types, DSS is used in timely problem solving to improve efficiency and streamline operations, planning and company management.



DECISION SUPPORT SYSTEM TYPES

- Communication-Driven DSS: Helps companies manage data that requires more than one person to collaborate on a task.
- Model-Driven DSS: These DSS software solutions enable decision makers to access and manage statistical models used to run the business. The information is imported to a decision-making model that will then be used to analyze situations. These are the models mentioned above in the model management section.
- Knowledge-Driven DSS: Uses company data, facts, procedures, graphical displays, or pre-coded data rules to deliver informed solutions to specialized company scenarios.
- Document-Driven DSS: This type of DSS uses unstructured information available in various electronic formats in company systems, such as share drives, cloud storage, or other data asset management (DAM) solutions.
- Data-Driven DSS: Helps companies save, manage, and analyze a combination of data that's both internal to the company and external to the company.

EXPERT SYSTEM (ES)



Expert systems are an intelligent technique for capturing tacit knowledge in a very specific and limited domain of human expertise.

These systems capture the knowledge of skilled employees in the form of a set of rules in a software system that can be used by others in the organization. The set of rules in the expert system adds to the

memory, or stored learning, of the firm. Expert systems lack the breadth of knowledge and the understanding of fundamental principles of a human expert.

They typically perform very limited tasks that can be performed by professionals in a few minutes or hours, such as diagnosing a malfunctioning machine or determining whether to grant credit for a loan.

expert systems can provide benefits, helping organizations make high-quality decisions with fewer people. Today, expert systems are widely used in business in discrete, highly structured decision-making situations

MODULE 3

SYSTEM ANALYSIS AND DEVELOPMENT

System analysis – introduction

When you are asked to computerize a system, as a requirement of the data processing or the information need, it is necessary to analyze the system from different angles. While satisfying such a need, the analysis of the system is a basic necessity for an efficient system design.

The need for system analysis stems from the following points

Need for system analysis

1. **Systems objective** – it is necessary to define the system objective (s); many a times, it is observed that systems are historically in operation & have lost their main purpose of achievement of objective; hence in order to develop a computer based system, it is necessary to redefine or reset the objective as a reference point in context of current business requirement.
2. **System boundaries** – it is necessary to establish the system boundaries which would define the scope (coverage) of the system; this in turn helps to sort out & understand the functional boundaries of the system & people involved in it; it also helps to identify the inputs & outputs of various subsystems covering the entire system.
3. **System importance** – it is necessary to understand importance of the system in organization; this would throw more light on its utility & would help the designer to decide the design feature of the system; it would be possible then to position the system in relation to other systems for deciding design strategy & development.
4. **Understanding of resource needs** – the analysis of the system helps in defining the resource requirements in terms of hardware and software; hence if any additional resources are required, this would mean an investment, thus paving way for finding ROI etc; if its profitable, then it takes up the project or else drop it.
5. **Nature of the system** – analysis of the system will help the system designer to conclude whether the system is closed type or an open one; whether it is deterministic or probabilistic; such an understanding of the system is necessary prior to the design process to ensure the necessary design architecture.
6. **Role of the system as an interface** – the system many times acts as an interface (where to computers interact) to the other systems. Hence through such an interface, it activates or promotes some changes in other systems; it's necessary to understand the existing role of the system, as an interface to safeguard the interests of the other systems; - any modifications made is not to affect the functioning or objective of other systems.
7. **Participation of d users** – the strategic purpose of the analysis of the system is to seek acceptance of the people to a new development; system analysis process provides a sense of participation to the people; this helps in breaking resistance to the new development & it also ensures the commitment to the new system.

8. **Assessment of feasibility** – system analysis helps to establish feasibility from different angles; the system is to satisfy technical, economic and operational feasibility; the assessment of feasibility will save investment & the system designers' time.

Steps in system analysis and design

Steps	Elaboration	Explanation
1. Need for information	Define the nature of information; also who wants and who uses	Identify the users & application of information for achieving the objective
2. Define the system	Decide the nature, type of systems and its scope	Helps to determine the system ownership, its benefits and complexity
3. Feasibility	Technical success -------- Economic viability --------- Operational effectiveness-	H/w & S/w availability Study investment benefits and ROI See if system will perform as desired with respect to time/results
4. Detailing the requirements	Identify in operational terms, the strategic, functional & operational info needs	Study the sources of generating the info
5. Conceptual (basic) system design	Determine the inputs, process and outputs & design a conceptual model	It is necessary to understand the system process
6. Detailing the system design	Draw the document flow charts & DFD is data/system hierarchy diagrams, data info mapping table etc	Helps in bringing clarity in data flow; responsibility & process centers are identified.
7. Structuring the system design	Break the system into its hierarchical structure	Helps in understanding the dataflow from one level to other & process carried out at each level.
8. Conceptual model of computer system	Define step by step, the usage of files, processes and interface	Helps to put down the data processing flow in the computerized system
9. Break the system in program modules	Make physical conversion of system into program structure in a logical order.	Modules will be data entry/validation/processing/reporting and storing.
10. Develop the	Test the modules and integrity of system	Confirms whether the system design is

test data for checking the system ability	wrt input v/s output	satisfactory (suggests the modifications)
11. Install the system	Install the hardware	Install, test and run the system before the user is exposed in a live mode.
12. Implementation	Train the personnel; run the system in parallel; prepare the system manual	Helps to identify the problem and provides the solution
13. Review and maintenance	Review the system through audit trail & test data, also confirm whether the objective is fulfilled; carry out the modifications if any.	Helps to maintain system quality & quality of information.

System analysis of Existing System

When the objective of information system is finalized, it is necessary to analyze the existing system.

Such an analysis helps in achieving the following:

- Understanding the existing system.
- Understanding the objective achieved by the existing system.
- Evaluating the system for computerization & its placement in total MIS design.
- Knowing whether the system is feasible technically and operationally.
- Are the information needs fully justified?
- If so, is the cost of system design justified to increase the value of the information? Etc.

Procedure for analyzing existing system – the system analyst while analyzing existing system should:

1. Carry out system analysis at a place where the system is functioning.
2. Note down the key personnel in the system – who contribute toward the system operations.
3. Observe the system to understand details of system.
4. Define the scope of system & its objective.
5. Collect all documents which are raised in system.
6. Collect separately, the output statements such as reports, memos etc.
7. Make a list of rules, formulae, guidelines policies etc.
8. Note down the check points & the controls used in system to ensure that dataflow is complete.
9. Make a small system note – to discuss the system with each head of the department.
10. Study the flow of data in the system in unit's summary and aggregates from document to document and from one stage to another.
11. Examine whether the achievement of system objective is feasible in present system.

12. If there are problems, examine where system can be modified.
13. Draw a revised system flowchart to indicate how a system runs.
14. Discuss the flowchart with personnel operating the system, so that they understand the system.
15. Make a list of outputs – get approval from the head of the department.
16. Analyze the requirements of the information and report from the utility point of view.
17. Compare cost of old & new system.
18. Obtain approval of new system from users & top mgt
19. Write a system manual for use of the people in the dept.

System analysis of a new requirement

It is not always necessary that the analysts are required to conduct the analysis of the existing system. **In a number of cases where, the legacy systems have outlined their utility or a new businesses environment requires a totally radical approach, the analyst is called for redesigning the processes, practices and procedures.**

Today's business world of a company is beyond the 4 walls of the org; this change in mgt philosophy calls for a change in information management function in the org. The characteristic change in the org is that it's being looked as a process org as against a functional one. The work culture is changing from the single hierarchical command control principle to working through group's principle. In such a changed environment, the information system architecture, design & processes, the hardware, software configuration is to be restructured to meet this changed requirement of information. Thus the trend is toward building a system which is potentially flexible, adaptable to the new tech, easy to use and which enables the user to meet his own needs through his knowledge and expertise.

System analyst – roles, duties and responsibilities

In majority of the organization, systems analyst has the primary responsibility for system analysis and design.

A system analyst helps system users and other business managers in

(a) Defining their requirements for new/enhanced info services and

(b) Acting as an agent of change and innovation.

Duties of a system analyst:

- He should study the problems and needs of org.
- He should determine how people, methods and IT can best be combined for improving the org.
- He is to help system users and other system managers in defining the requirement for new and enhanced info services.

Responsibilities of system analyst:

He is responsible to bring about improvements in the org.

He is responsible to facilitate change in the org by motivating/training people.

He is to take responsibilities in:

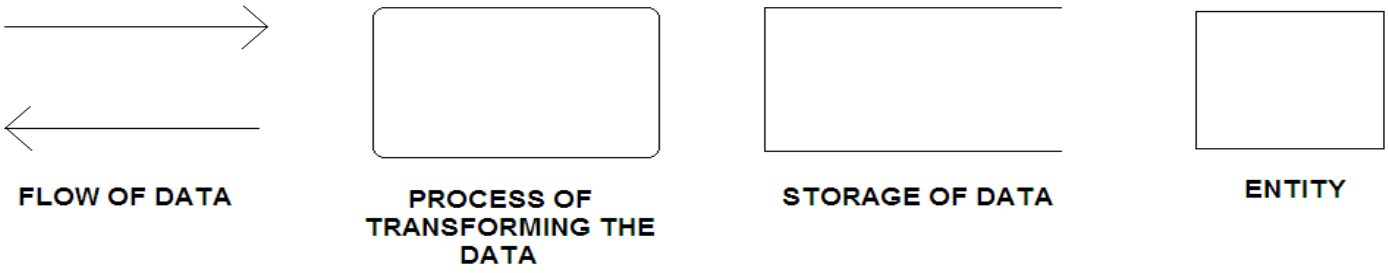
- Analysis of business needs & info systems.
- Programming of business application.
- Designing new information systems.
- Updating & maintaining of existing information systems
- Developing alternative systems
- Analyzing system requirements provided by users.
- Documenting system features.
- Providing adequate specifications for programmers to write code.

SSAD (structured systems analysis design)

The structured systems analysis develops a conceptual, logical and graphical model of the system, if it is developed with reference to the objective and taking into consideration the constraints under which the system operates.

The model is developed with for symbols

[For example, the logical model of customer order processing and issuing the order acceptance can be shown in the model using these symbols]



Basic 4 Symbols of SSAD

In the example of order processing, the processing is carried out in three stages – validating, commercial processing and decision making for acceptance.

SSAD has three steps:

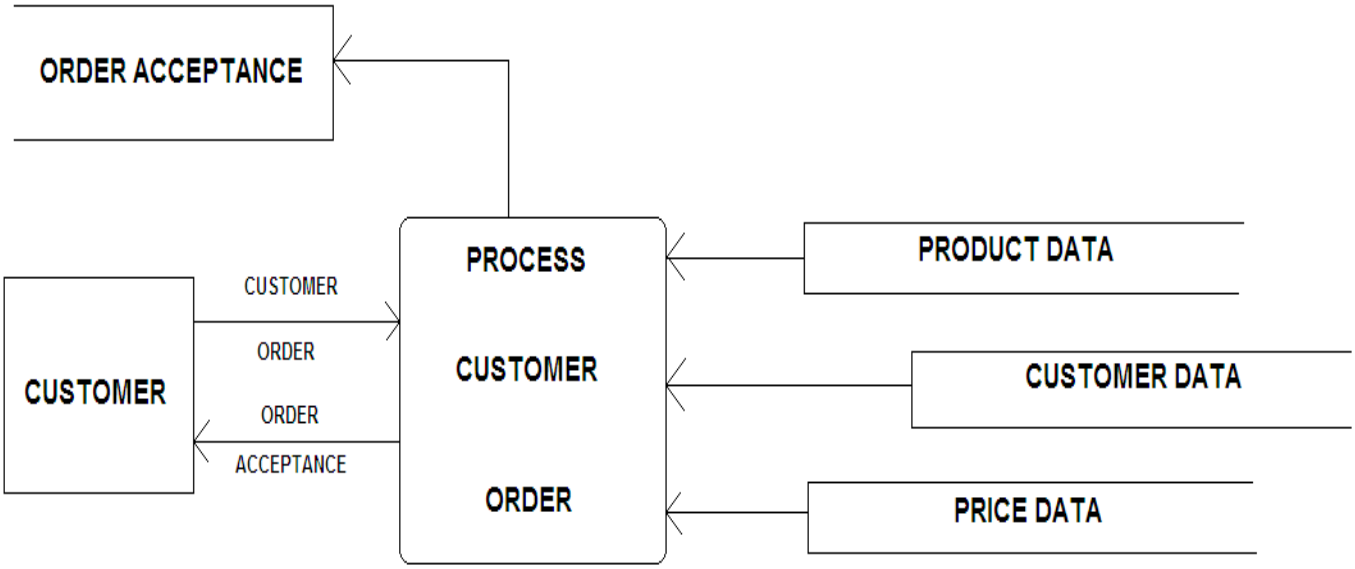
- Modeling of the system in the DFD.
- Constructing the data dictionary.
- Process Modeling.

1. The DFD provides clarity in terms of output, use of stored or master data already available in the organization or in the system.

2. After detailing the system in the DFD, the system designer has to define the data in the dictionary the data dictionary is an assembly of the data used in the system giving its picture definition and use (for e.g.: customer is data dictionary will be defined with specifications)
3. Process modeling: the 3rd task which the system designer undertakes is to define in detail, the process of transformation in its logical order this graphical model of validation process indicates that this process decides whether the customer order is to be accepted for commercial processing.

Thus SSAD provides a methodology to the system designer to analyze the existing system in an orderly manner and enables him to put the proposed system in a logical order. Since the entire system is presented in a graphical manner, the communication with the users becomes easy and effective. Any change in the post implementation phase is easy to implement as it is possible to know its implications on the other processes.

Logical Model of Customer Order Processing & Issuing the Order Acceptance



Data flow diagram

DFD

It is an important tool in system analysis. DFD represents the data flowing between processes, data stores and external entities. It is data in motion, moving from one place in system to another. DFD is a method to illustrate how data flows in a system they are versatile diagramming tools. Here only 4 symbols are used to represent both the physical and logical information flows.

DFD symbols – they use 4 kinds of symbols to represent four kinds of system components:

1. Processes.
2. Data stores.
3. Data flow.
4. External entities.

DFD (dataflow model)

This model illustrates the following

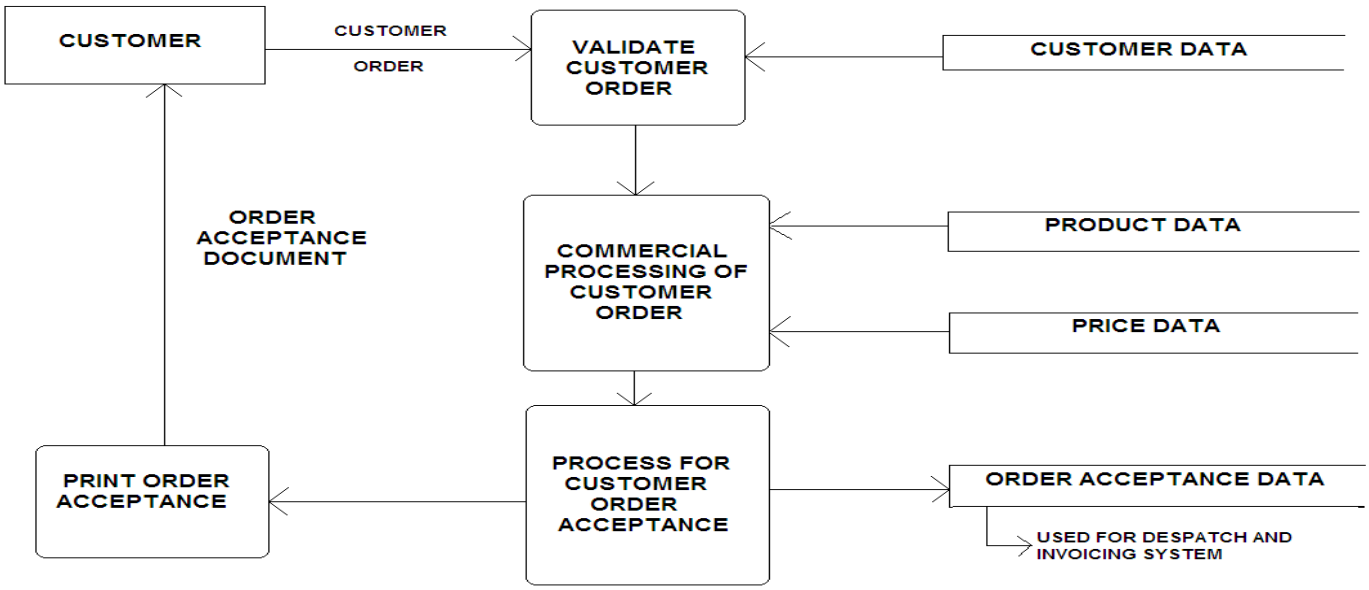
1. Documents in the system.
2. Sources of documents.
3. Process center for converting the customer order into the order acceptance.
4. Use of stored data in the process center.
5. Output or documents provided by the process center and its destination.

Such Dataflow Diagrams (DFDs) provide a logical clarity in terms of input, output, and use of stored data or master data already available in the organization/system. The use of DFDs can be made by detailing the system in a hierarchical manner. In this process, we are detailing the activities which are performed in the system in its logical order.

Here the processing is carried out in three stages

- Validating
- Commercial Processing
- Decision Making for Acceptance

DFD of Customer Order Processing

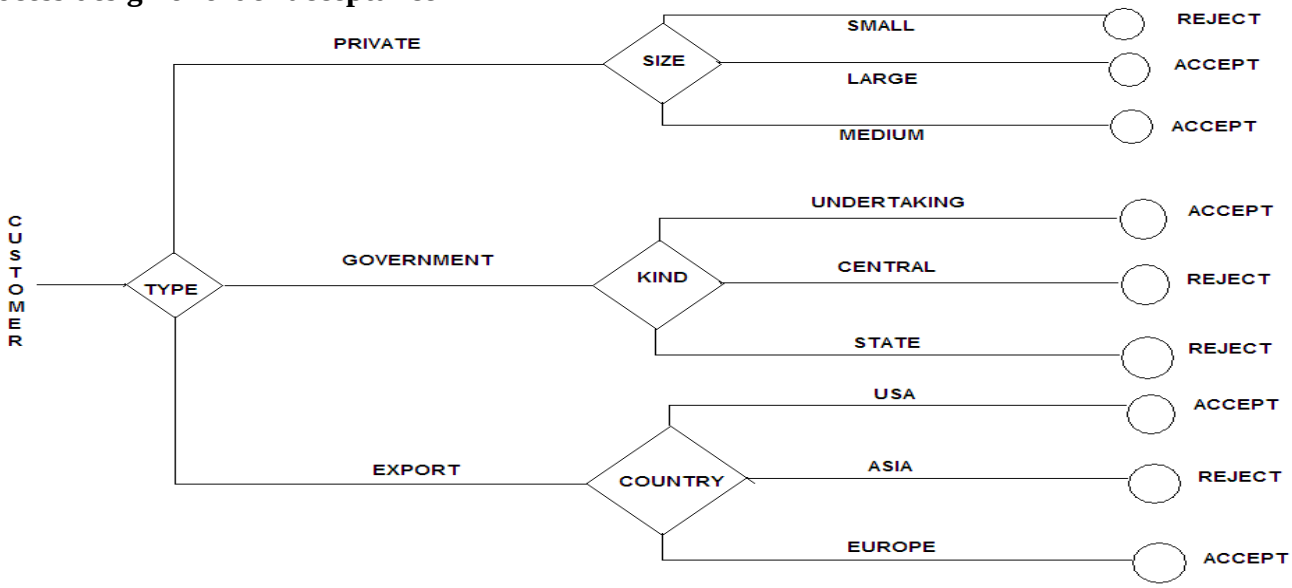


The main system is divided into three levels in its logical order. It says that unless the customer order is validated and commercially accepted, it will not be processed for an order acceptance decision**.** It also indicates that at each level, the stored data in the system is used. After detailing the system in the DFDs, the system designer has to define the data in the dictionary**.**

The **data dictionary** is an assembly of the data used in the system giving its picture definition and its use. For example, the customer is a data entity and its presentation in the dictionary will be defined with specifications. The customer name is defined of thirty character length and the pin code is defined of six character length. The data dictionary contains information about individual pieces of data & data groupings within a system. It defines the contents of data flows & data stores so that system builders understand exactly what pieces of data they contain.

The third task which the system designer undertakes is to define, in detail, the process of transformation in its logical order. For example, the process of the customer order acceptance validation will be graphically modeled. It shows the process design of the order acceptance decision. The graphical model shows that this process decides whether the customer order is to be accepted for commercial processing. The decision of acceptance is based on the type of customer and further on the specifications such as the size, the type and the zone.

Process design of order acceptance



Decision Tables

A decision table is a diagram of process logic where the logic is reasonably complicated; all of the possible choices and the conditions of the choices dependent on are represented in a tabular form. Thus decision tables are a tabular form of presentation that specifies a set of condition & their corresponding action. They are a tool of SSAD methodology. It consists of columns and rows. The decision table expresses a series of conditions;

when these conditions are fulfilled, then a rule associated with a condition is executed. It includes both quantitative and non quantitative basis for decision making. They are used to understand in case of structured decisions.

Context Diagram

Context Diagram is the highest level DFD. It defines the boundaries of the system by showing a single major process and the data and inputs and outputs and external entities involved. A common way to begin is to model the whole system by one process. The DFD that is involved in this case is called a context diagram. It is a diagram that shows the inputs and outputs of the system.

(For example of context diagram on:

- Admissions to college at VTU.
- Library book borrowing system

Computer system design for system analysis

After designing the system by the way of structured analysis, the next task of the designer is to designs computer system. The computer system design consists of five major steps:

1. Designing the output.
2. Designing the input.
3. Process design.
4. Data specifications.
5. The procedure specification.

Output Design

The output design should be able to communicate information to the users in the organization effectively. The information, as an output, can be printed, displayed or stored. If it is necessary to print the information, as a report, then the designer has to decide the format of the report & if it is to be displayed, then the designer has to provide a screen format. While designing a report and a screen format, the designer should pay attention to the concepts of information presentation so that the utility of the system is not reduced due to information overload, incomplete coverage, inadequate content, etc. The designer should decide an appropriate balance between the print reports & the display screens

Input design

In this phase, the designer's task is to identify those data items that will be an input to the system. The designer finds a linkage to the input data from the output. Once the data items are identified, it is necessary to find the documents from where these data will be taken. For example, if the sales information is an output of the system

then the path to find the documents and records. A document containing several data items will be treated as a record.

Process design

After the output & input design, the designer has to develop a process design which will specify the various steps that will convert input data into outputs. The process design deals with the following two types of processes, viz.,

- Computation process for the net value of invoice
- Decision making for choice of the invoice processing

Here, the designer, as a part of the process design, has to decide the source of the data items, viz., the documents & the files. The organization of the files is an important factor as the files will be used for storage of record and for retrieval. The designer classifies the files as master file(s) and transaction files and also decides their use in the system in a logical sequence. The files can be organized in a number of ways, like random ordered fashion/indexed sequential fashion. Each file organization has its own advantages related to access & processing.

Data Specifications

After selecting the data items and configuring them into a set to form a record of an input entity, it is necessary to design specifications for each data item. These specifications will be followed uniformly at all places wherever they are used. These specifications are expressed in terms of length of an item in terms of characters, its nature in terms of numeric/alpha/alpha numeric known as picture. For example, date is an item having eight characters, and its order of presentation is day, month & year. These specifications are used for error checking, control and processing. Any data item is checked against specifications before it is accepted as an input. If there is any problem/violation it is corrected through a formal process of editing before acceptance.

Procedure design

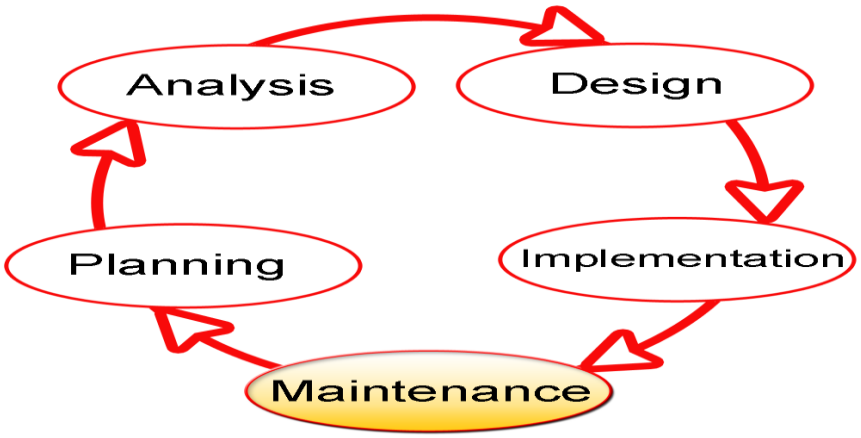
This phase specifies how the computer system will function from data entry to the output stage. It indicates the logic of data processing and the flow of system control from one step to the other. Since the process design is complete, each process will be a step in the procedure design of the computer system. The procedure design steps will be shown in the computer system flow chart.

Systems development life cycle (SDLC)

The five major stages are:

1) **Definition of system and its objective** (assures clarity to users of the system)
2) **Development of the system** (clear view of problems, design a computer system)
3) **Installations of the system** (modifications, controls etc are ensured)
4) **Operations of the system** (user confidence is built)

5) **Review and evaluation** (design audit for improvement)



Stages of SDLC explained

1. **Definition of system & its objective** – determine system boundaries and scope; set the objective of system in line with d biz obj.
2. **Development of the system:**

- Sys analysis of existing business system & changes there in (clear understanding of problems)
- Decision making needs are identified & corresponding information needs are defined.
- Feasibility of system is analyzed.
- Conceptual design of the system.
- An initial prototype of the system.
- Structured breakup of system in smaller sub systems.
- Computer system design.

3. **Installation of the system and testing**
4. **Operations of the system** (system is operated in full course and existing systems are discontinued)
5. **Review and evaluation** – a review is taken whether system objective are being met with & what are the problems in smooth running.

System development Models

- Waterfall model.
- Spiral model.

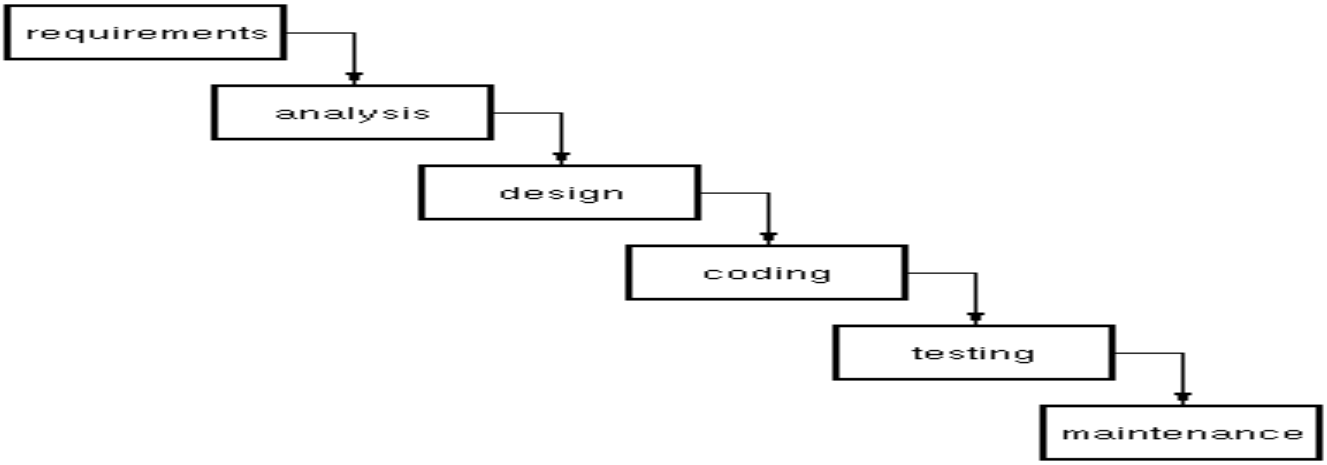
Waterfall model

In order to design a good system traditionally, the developers have used the waterfall model. The waterfall model is **a sequential software development model in which development is seen as flowing steadily**

downwards (like a waterfall) through the phases of requirement analysis, design, implementation, testing (validation), integration and maintenance. As water flows from top to bottom, the system model shows the development process from top to the bottom in steps. As water does not rise from a lower level to a higher level, it is presumed that once a step in the model is over, it is not required to go back. This model fits when the changes into the requirement specifications are not required frequently. However, the minor changes can be taken care of through a maintenance process. **The waterfall model applies well to the basic rule based data and info processing systems in accounting, materials, production and personnel.**

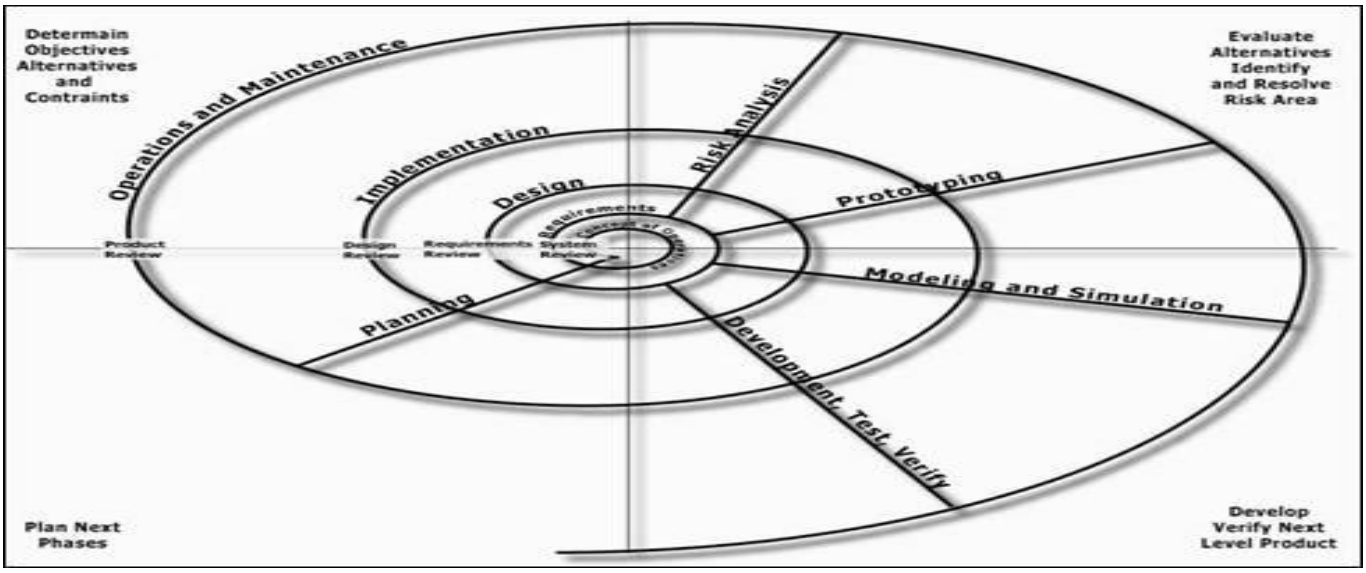
When to use the Waterfall Model

- Requirements are very well known
- Product definition is stable
- Technology is understood
- New version of an existing product
- Porting an existing product to a new platform.



Spiral model

The spiral model, **also known as spiral life cycle model, is a systems development method (SDM) used in IT.** This model of development combines the features of a prototyping model and the waterfall model. It is favored for large, expensive projects. **The systems which are more dynamic & require changes in specifications make use of this model.** A spiral model fits well when we are developing large systems, where the specifications cannot be ascertained in one stroke completely and correctly. **The continuous revision of these steps in the system development is very common & designers call them as versions.** The new version provides **an additional functionality, features and facilities to the users & addresses the issue of users of the system like performance, response**, security and so on which is allowed by d spiral model.



Steps in d spiral model

1. The new system requirements are defined in as much detail as possible (it involves interviewing a number of users…..)
2. A preliminary design is created for a new system
3. A first prototype of new system is constructed from the preliminary design (prototype represents an approximation of features of final product.
4. A second prototype is evolved after evaluating strengths, weaknesses and risks of first one.
5. At d customers' option, the entire project can be aborted if the risk is deemed too great (risk may include cost overruns, customer's judgment etc)
6. The existing prototype is evaluated in the same manner as the previous prototype and this follows again……..
7. The preceding steps are repeated until customer is satisfied with the new system prototype.
8. Thus the final system is constructed based on refined prototype.

Advantages of waterfall model:

- It provides easy & clears to follow sequence of activities.
- It is simple without any complications.
- Particular issues on quality mgt r addressed through the justification & confirmation section that is being followed in each phase of the model.
- The model will facilitate project mgt and ctrl by the need to complete each stage before moving to the succeeding phase.

Disadvantages of waterfall model:

- It lacks prescribed technique of implementing mgt ctrl (risk mgt are not developed within the model itself)

- Forecasting the estimated time and cost are complicated for each stage.
- This model works best when any reworking of products is kept to a minimum & product remains unchanged.

Prototyping

It is the **process of rapid systems development** and testing of working models (prototypes) of a new application through an interactive, repeated process. **Prototype represents an approximation of features of final product.** Prototyping **consists of building an experimental system** rapidly and inexpensively for end users to evaluate. By **interacting with the prototype, users can get a better idea of their info requirements (**its design can be used create the final system) Such system prototypes a**re immediately passed on to the end users to run trials & identify deficiencies, if any after receiving feedback from the users, necessary modifications are made in the system and once again passed on to the end users. This process would continue** until an efficient, workable system is developed. Prototyping makes development process faster & easier for system analysts, especially for projects where end user requirements are difficult to define.

Steps in Prototyping

Four step approaches explained as under:

Step 1: Identify d users' basic requirement – system designer works with user only long enough to capture his basic information needs.

Step 2: Develop an initial prototype – designer creates initial base model using 4th gen S/w or computer aided S/w tools.

Step 3: Use the prototype – to see how well it works to meet d users' needs offer suggestions etc.

Step 4: Revise and enhance the prototype – d system builder notes all changes, the user requests & refines prototype accordingly after prototype is revised, the cycle returns to phase 3 (sometimes, prototype itself is adopted as production version of d system)

Advantages of prototyping:

- It requires intensive involvement by system users.
- A very short time period is required to develop & start experimenting with a prototype.
- This short time allows sys users to evaluate proposed system changes.
- Since sys users experiment with each version of d prototype through an interactive process, errors are detected and eliminated early in the development process.
- As a result, IS implemented is to be more reliable and less costly to develop.

Disadvantages of prototyping:

- It can click only if system users are willing to devote significant time in experimenting with prototype & provide change suggestions.

- ❖ Interactive process of prototyping causes the prototype to be experimented extensively so system developers are frequently tempted to minimize testing and documentation process.
- ❖ It causes behavioral problems with system users (dissatisfaction, impatience by users, too many interactions.)

Rapid Application Development (RAD)

The idea behind RAD is captured in its name, i.e., shortening the **time necessary for systems to be developed**

Complex business systems can take years to develop using SSAD processes but with an ever quickening pace of biz in a global economy, firms cannot wait for systems that no longer can be adequate models of the biz processes they are supposed to support. **RAD approach can result in a system in 6 months when following the traditional approach the have taken four times as long.**

RAD is not without its problems sometimes, due to the speed with which systems are developed, some of the basics of software development are overlooked. It is a process for developing systems in short time period. The system is segregated into smaller and relatively independent module which is sequential. Different teams work on these individual models simultaneously, thereby consuming less time in completing the task, where system development takes place either in top down approach or bottom up approach. It is a high speed adaptation of waterfall model

Advantages of RAD:

- ➢ Quick system development
- ➢ Supports reusability of components (user friendly)

Disadvantages of RAD:

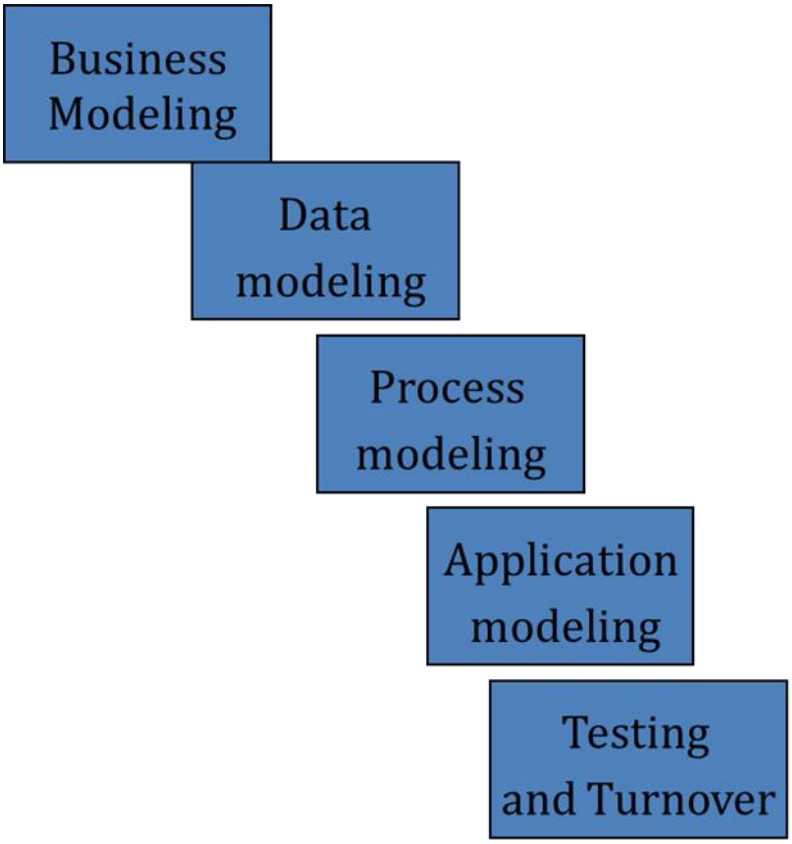
- ➢ Needs skilled human resource
- ➢ Any loose link may disrupt the entire software
- ➢ Not suitable for high risk and integrated projects

RAD model

The entire system development process follows 4 kinds of modeling-

- ➢ Business modeling:
- ➢ Data modeling
- ➢ Process modeling
- ➢ Application modeling

Testing and Turnover



Systems development and org change

New **info systems can be powerful instruments for org** change. **Concepts (types) that are noteworthy here are as under:**

- **Automation.**
- **Rationalization.**
- **Reengineering.**
- **Paradigm shifts.**

Roles and responsibilities of Database administrator (DBA)

A **database administrator** (**DBA**) is a person who is responsible for the environmental aspects of a database. In general, these include:

- Recoverability - Creating and testing Backups
- Integrity - Verifying or helping to verify data integrity
- Security - Defining and/or implementing access controls to the data
- Availability - Ensuring maximum uptime
- Performance - Ensuring maximum performance
- Development and testing support - Helping programmers and engineers to efficiently utilize the database.

The role of a database administrator has changed according to the technology of database management systems (DBMSs) as well as the needs of the owners of the databases. For example, although logical and physical database designs are traditionally the duties of a **database analyst** or **database designer**, a DBA may be tasked to perform those duties.

Roles and responsibilities of Database designer

Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a Data Definition Language, which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity.

The term database design can be used to describe many different parts of the design of an overall database system. Principally, and most correctly, it can be thought of as the logical design of the base data structures used to store the data. In the relational model these are the tables and views. In an Object database the entities and relationships map directly to object classes and named relationships. However, the term database design could also be used to apply to the overall process of designing, not just the base data structures, but also the forms and queries used as part of the overall database application within the Database Management System or DBMS.A person carrying out the activities of database design is known as database designer.

Modules 4

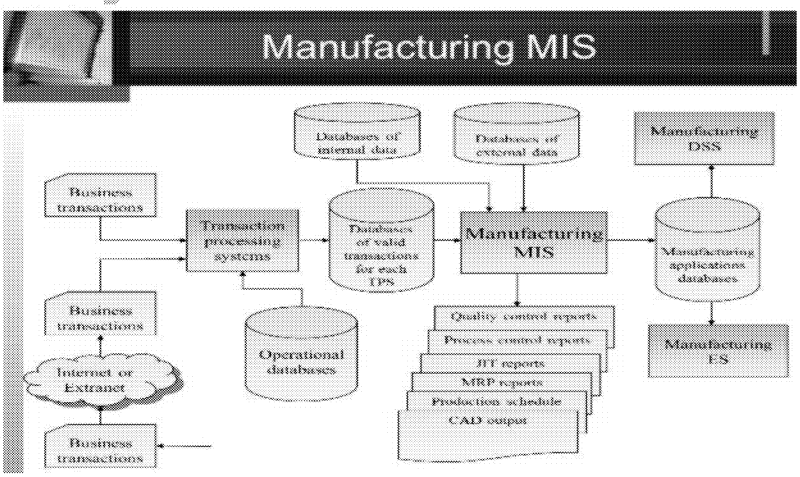
Application of MIS in Manufacturing and Service Sector: Introduction- Personnel Management, Financial Management, Production Management, Raw Materials Management, Marketing Management. Introduction to Service Sector, Creating a distinctive service, MIS Applications in Airlines, Hotel, Hospital, Banking, Insurance.

MIS in manufacturing and service sector/industries

Introduction – MIS in manufacturing sector

The information system developed for biz purposes should take into a/c all the conditions which affect the business transactions. Usually, the two major factors responsible for the biz changes are the environmental conditions (local & global) and the comparative factors. Successful development of information systems should have been based on the deep understanding of the organizational structure and dynamics of the enterprise also. For production department, the assignment of jobs to the machine or to operators in a production environment is very important. Some organizations which are goal oriented, the analyst must be clear as to what information is exactly needed to be collected, stored and analysed. Since every information have a context, only operational information that ultimately has some decision-making contribution must be collected. Secondly, the information collected & processed must be consistent to with the level of the org to which it is to be presented. Organizations have not only found out the immense utility of info system to better manage but are also feeling the potential of competitive advantage provided by information as a resource.

APPLICATION OF MIS IN MANUFACTURING SECTOR Management information systems are typically organized around the functional areas of an organization. MIS for manufacturing sector should have the following components



Total picture of manufacturing Management information system may look like as given fig. This starts from either forecasted demand or customer's order. Subsequent activities are interrelated and a comprehensive information system tries to help the manager keep a tab on each activity. This information system helps to follow up the order placed with vendors, proper receipt of materials from vendors" inspection and inward material quality control and finally its proper storage. Similarly on the production side, the production schedule is prepared based on the dispatch schedule. Production plan ensured that the material is issued timely from warehouse and any rejection must be properly salvaged. The produced material must go through quality control process and it goes to warehouse or customer only after it has passed quality assurance test.

Manufacturing information system is a complete set of tool for managing the flow of manufacturing production data throughout the enterprise. This IS was designed to provide tools for both IT and operations personnel who would deliver services to anyone in the plant.

Manufacturing consists of many different disciplinary areas including product engineering, facility design and scheduling, fabrications, and quality control management. Each of them can be dramatically improved by using information systems.

A manufacturing system takes material, equipment, data management and information systems technology as the input and uses manufacturing and information processes to generate better final product as output. The manufacturing designed around the transaction process of raw materials into usable components or materials. These systems are value added processes such as materials processing or support systems such as scheduling.

APPLICATION OF INFORMATION SYSTEM MODEL TO PERSONNEL MANAGEMENT

- Fast changing markets, industries, and services require organizational environments capable of constant adaptation with bright new ideas and reduced time-to-market.
- Under this competitive reality, HRM has a more critical role than ever because new forms of business require new ways of involving people.
- HR professionals must analyse social, economic, political-legal, and technological environment opportunities to redesign HRM processes and practices that are key success factors to the organization mission and objectives.
- In recent years, information technology has effects on almost every aspect of our society, as well on organizational processes, including HRM processes and practices.
- From a position associated with administrative management, it has managed to become a strategic partner of organizations, largely because of the use of technologies. Human resource information

system support activities such as identifying potential employees, maintaining complete records on existing employees and creating programs to develop employee's talent and skills.

• HR MIS sometimes called HRIS (Human Resource Information Systems), is an integrated system and has the following modules:

1. Recruitment Subsystem- A recruitment module should handle all your internal form-filling and authorization processes; allow managers or HR to post advertisements and supporting documentation online, offer applicant tracking and even initial sifting. There may also be functionality to build talent pools which can then be „trawled" for suitable candidates when a vacancy becomes available. Of all HR technology, its recruitment modules that have embraced social media to the greatest extent.

Common recruitment module features include:

- Customized pipelines for different roles
- One-click posting of jobs and job descriptions to a variety of jobs boards
- Automated assessment processes, inc. interview scheduling
- Applicant tracking
- Resume parsing
- Standard metrics and analytics for candidate profiles
- Mobile app
- Social media interface
- Digitized offer management

2. Training- Learning and development is a key element when it comes to employee management. This module allows HR to track qualification, certification, and skills of the employees, as well as an outline of available courses for company employees. This module is often referred to as an LMS, or Learning Management System, when it's a stand-alone. An LMS usually includes available e-learning and other courses to be followed by employees.

3. Benefits administration- Benefits management is all about providing timely information and aiding employees to make the right choice for their circumstances. This module should manage and monitor employee benefits, healthcare and pension/welfare packages, tracking enrolment options and any financial implications.

Common benefits administration module features include:

- Online open enrolment
- Automated communication of enrolment options and information

- Plan comparison tool to aid employee choices, inc. costs and contributions breakdowns
- Automatic event management of the benefits life cycle
- Legislative compliance for your territory

4. Performance management- Automating the appraisal process, recording and tracking objectives and targets, this module should incorporate your competence framework, job standards and/or other relevant systems.

Common performance management module features include:

- Setting and managing goals
- Links to competency framework
- Scheduling of appraisal meetings
- 360 performance feedback
- In the moment feedback tools
- Big Data gathering for a broader picture of individual performance
- Links to talent management and succession planning functions

5. Workforce management- Primarily a scheduling function, this module should link closely to (and is often combined with) time and attendance and leave management. Similarly, real-time functionality may involve linkages to other business intelligence systems such as ERP and CRM to match workforce deployment to shifting needs

Common workforce management module features include:

- Scheduling and shift management
- Workflow monitoring
- Management dashboard with real-time data and metrics

6. Time and attendance- Alongside payroll, this is probably one of the longest standing HR automations: the time clock. These days, such systems often incorporate biometric identification to avoid buddy punching" and will link directly to (or be an integral part of) the workforce management module, with information links to your payroll and accounting software.

Common time and attendance module features include:

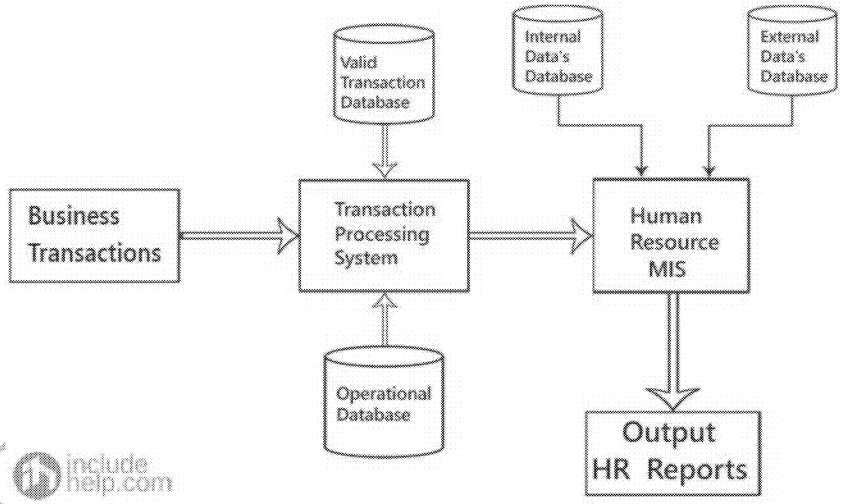
- Employment attendance tracking
- Time clock management
- Biometric systems

- Functionality for remote and mobile workers
- Legislative compliance (e.g. minimum mandated rest break

7. Absence and leave management- Again, often linked to the time and attendance and workforce management functions, your leave management module is an automated way to allocate, book, approve, track and monitor any absence from the workplace. It may be for vacations, compassionate reasons, illness, parental leave, even jury duty. Request and approval processes should be streamlined and the outcomes incorporated into team calendars where appropriate.

Common absence and leave management module features include:

- Self-service leave requests
- Integration with workforce management (scheduling) and time and attendance functions
- Account management, tracking accrued vacation time and usage.
- Metrics and analytics, including absence levels and trends



APPLICATION OF INFORMATION SYSTEM MODEL TO FINANCIAL MANAGEMENT

Management Information Systems (MIS) in Finance have been widely adopted both by corporations as well as governments. They are information systems with capacity to maintain large data bases enabling organizations to store organize and access financial information easily. These systems are primarily used for accounting operations and generation of financial reports. Increasingly they are also used to support budgetary, planning and decision-making processes. These systems are credited with increasing financial transparency, efficiency and accountability.

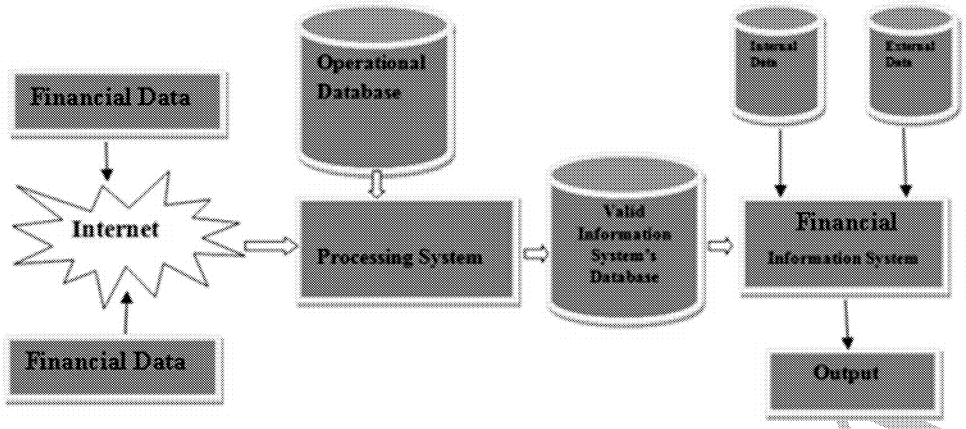
A financial MIS provides financial information for managers to make daily decisions on operations within the organization. Most systems provide these functions:

- Integrate financial information from multiple sources
- Provide easy access to financial information in summarized form
- Enable financial analysis using easy-to-use tools
- Compare historic and current financial activity

A financial MIS often has a number of subsystems, depending on the type of organization. These include systems to analyse revenues, costs and profits, auditing systems for both internal and external purposes and systems to manage funds. A financial MIS can also be used to prepare reports for third parties, such as external auditors or shareholders.

Financial MIS has the following subsystems:

1. **Working capital management subsystem-** It manages the working capital finances of the organization. Working capital, I the capital required for an organization to operate. It is use to pay for salaries and materials. Normally it is in the form of short-term debt. This subsystem provides information about the requirement for working capital and the ideal method of financing it.
2. **Receivable and payable Management-** it is that module of the financial MIS in which the receivables and payables of a company is managed. This module manages debtors and creditors by maintaining key information about them and their commercial terms and reference with organization.
3. **Budgeting-** It is a strategic function of finance. The budgeting module has tools for making projections of the future needs of resources, so that the budgeting can be performed well. The budgeting module helps the finance department to take decisions on the quantum of money spent on each activity of the organization.
4. **Funds management module-** This module helps the finance department to take better capital expenditure decisions by providing the relevant information. The module helps the decision makers in the finance department by giving them information about fund utilization, cost of funds, the most suitable fund management options etc.
5. **Financial Control System-** It helps the finance department to exercise a control over finances by giving control related information to the department.



APPLICATION OF INFORMATION SYSTEM MODEL TO PRODUCTION MANAGEMENT

Enterprises generate a vast amount of data daily in their manufacturing operations that need to be processed so that important decisions are made faster, and the manufacturing flow remains free from bottlenecks. To manage the massive amounts of data, organizations need a set of tools that can help them manage the manufacturing/production data throughout the enterprise. Manufacturing is not a single area. It is instead a multidisciplinary area that includes several functions from product engineering to facility design and scheduling as well as fabrications and quality control management. Each of these functions can see dramatic improvements through the use of an information system. It is also why Manufacturing Information Systems seem to be complicated since they address several interacting domains. The Manufacturing information systems provide accurate and timely data that can be used in manufacturing to make critical decisions

Production information system performs an integrating role within the production system of any organization. Management of activities/operations in a production system is concerned with decision making related to different components of the system so as to accomplish the desired output. These decisions can be divided as periodic-decisions viz. selection, design and updating of resources, transformation process and methods, and continual decisions about day-to-day operation and control of various activities/operations in the system.

These decisions can also be divided in planning, implementation and control categories. Production information system is a network to generate necessary information and process it to make various decisions related to some production system. It consists of communication channels and information processing centres collecting information from its sources of origin, storing, updating, collating and processing it and then supplying the processed information to the various users of the system.

A production information system can be viewed as an independent group of sub systems each related to its successor, each performing a different function though yet united with others for achievement of the overall objective. It interacts with both its internal and external environments.

The system has the following subsystem:

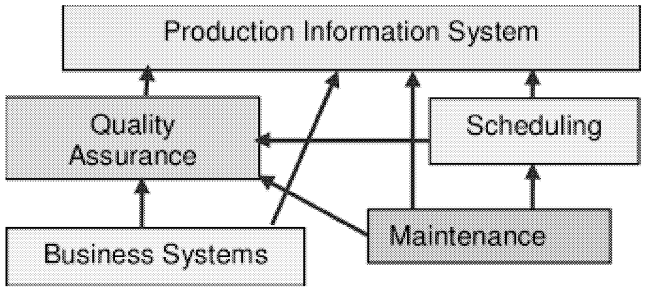
1. **Production management subsystem-** It provides information for managing the production process of a firm. It provides information about production in different periods, the planning of capacities and monitoring of the production process so that control can be exercised over the production process. Capacity planning and production scheduling related information is also provided so that the operations manager can use this information for better decision making.

2. Maintenance management subsystem- It helps in managing the maintenance of machine in a firm. Different companies have different maintenance policies and the system must give the necessary information regarding such policies. This system also provides the information regarding performance of machine and their period of maintenance free life.

3. **Quality management Subsystem-** It helps the quality team take quality related decisions in a better manner. Quality checked data are analysed in this module and information is passed on to the department for decision making.

4. Project management subsystem- It provides information about project. This module has a facility for PERT/CPM type analysis and crashing activities to fit the entire project within the cover cost and time schedule. This is a complex and advance subsystem

5. Inventory management subsystem- An inventory management system (or inventory system) is the process by which you track your goods throughout your entire supply chain, from purchasing to production to end sales. It governs how you approach inventory management for your business. Inventory systems tell you the number of components or ingredients you need to create or assemble your final product. Without this information you may end up with excess stock, eroding your bottom line, or with insufficient stock to meet customer demand.



APPLICATION OF INFORMATION SYSTEM MODEL TO RAW MATERIALS MANAGEMENT

A Materials Management Information System (MMIS) can be used for human resource and materials management. It can help businesses integrate their staffing and material needs.

Here are some applications of MIS in raw material management:

- Centralized platform: Provides a centralized platform for handling procurement, inventory management, logistics, and other related processes.
- Streamlined filing: Simplifies the entire filing procedure of the Bureau of Materials.
- Automated functions: Can be used to automate functions such as purchasing and accounting.
- Inventory management: Facilitates inventory management, and patient supply charges.
- Improved efficiency: Can increase the efficiency of a business by helping it integrate its staffing and material needs.

A manufacturing MIS is used at every stage of the manufacturing process. Some of the common subsystems in a manufacturing MIS include: Design and engineering, Production scheduling, Inventory control, Process control, Quality control.

APPLICATION OF INFORMATION SYSTEM MODEL TO MARKETING MANAGEMENT

The Marketing Information System refers to the systematic collection, analysis, interpretation, storage and dissemination of the market information, from both the internal and external sources, to the marketers on a regular, continuous basis. The marketing information system distributes the relevant information to the marketers who can make the efficient decisions related to the marketing operations viz. pricing, packaging, new product development, distribution, media, promotion, etc.

Every marketing operation works in unison with the conditions prevailing both inside and outside the organization, and, therefore, there are several sources (viz. Internal, Marketing Intelligence, Marketing Research) through which the relevant information about the market can be obtained Marketing information system is a set of procedures and methods for regular and planned collection, analysis and presentation of information in making marketing decisions. It is an interacting, continuing, future-

oriented structure of persons, machines and procedures designed to generate an orderly flow of information collected from internal and external sources of information.

MIS helps in product launches, authorizes the co-ordination of marketing strategies, and is an integral part of Sales Force Automation (SFA), Customer Relationship Management (CRM), and customer service systems implementations. It permits decision makers to more effectively manage the sales force as well as customer relationships.

It supports strategy development for new products, product positioning, marketing communications (advertising, public relations, and sales promotion), pricing, personal selling, distribution, customer service and partnerships and alliances. MIS gives the foundation for the development of information system-dependent e commerce strategies.

The system has the following subsystem:

1. **Point of sale system** – This system is another fact of the order entry system. It captures data about the order at the point of sale and frequently found in fast food centers chain marketing, department store. The information obtained from point of sale becomes input to the FAIS and also to the marketing information system. Point of sale updates immediately inventory and sales levels. Through point of sales can be monitored minute and inventory also can be monitored closely.

2. Market intelligence system – This system refers to an information system regarding the strategies of the competitors. Most of the intelligence system of market obtained in an unstructured manner will be through the word of mouth or through observing statistics available through the media as well as commercial data base services. Nowadays due to heavy increase of competition there is a heavy need for the data of market intelligence to have appropriate decisions in marketing.

3. Market research system – This system provides details on particular problem of marketing. It gathers consumer related data that can be utilized to support decisions of marketing. Through marketing research useful information as to promotion, sales and product can be obtained. Marketing research can be through phone interview, personal interview and mail services etc.

4. Forecasting system – Market forecasting system is essential system. It refers to estimating the future demand for the services or products. This system normally takes input from the existing information systems and allows the organization to forecast the future. By utilizing various techniques of predicting the demand of the products can be ascertained that serves as basis for all the functional area.

Appropriate predicting technique should be utilized based on the information. The forecasting helps for planning as well as useful for controlling also.

5. Direct mail advertising system – In this system, the company mails, brochures and sends the information directly to the target customers. For this reason company Keeps Company's mailing address. The data may be drawn from the files of customers, account receivable files and prospect files as well as other data purchased from outside. This is quite opposite to mass advertising that reaches an unspecified number of people that may purchase the product or not. This direct mail advertising system permits high target market selectivity, flexibility, personalization, early testing of the product or services as well as measurement of the results.

6. Delivery rooting and tracking system – This system tracks the goods vehicles position and calculates the status of delivery. Delivery tracking system employs satellite dishes on the delivery vans in order to monitor the movement and location of vehicles and goods. Delivery routing systems help to route the vehicles efficiently in order to deliver the goods to the customers at lesser cost. The routing software works on geographical maps as well as identifies the best routes for the sake of vehicles that would expedite delivery and reduce the cost.

7. Marketing Decision Support System: It includes several software programs that can be used by the marketers to analyse the data, collected so far, to take better marketing decisions. With the use of computers, the marking managers can save the huge data in a tabular form and can apply statistical programs to analyse the data and make the decisions in line with the findings.

Applications of Management Information System in Service Sectors

Customer satisfaction is the main goal of the service industry while this is not true for the manufacturing industry and varies from industry to industry. To maintain its position in the market and remain ahead of others the industry must provide services that are distinct in nature. The service industry must know the services that are required, perceptions and expectations. It must also perform customer and market research to identify the segments that it is going to serve. It is also necessary to carry out the research on perceptions, requirements and expectations on a regular basis for enhancing and upgrading the facilities provided by the services because the demands for services are dynamic in nature as compare to products.

The service sectors are more susceptible to change as compared to the manufacturing sectors. The service sectors get returns much faster compared to the manufacturing sectors. In order to stay in the competition, the managers in a service sector give maximum efforts to provide distinctive services.

In the service industries, Management Information System (MIS) gives its prime focus on the services that are needed to the people. Hence, a continuous monitoring should be done in order to understand the changes occurring to the services demand on the basis of level and scope.

A regular scrutiny should be done to understand what the customer perceives by good service. After that a strategy should be adopted that will address the perception of good service to a customer. With the help of the MIS, the management is able to provide services. of the highest level by understanding the needs that enhances the communication, physical and human related processes to maintain this level.

Five principles of distinctive service:

- Listen, Understand and Respond to the customers
- Define a Superior Service and establish a Service Strategy
- Set standards and measure the performance
- Select, Train and Empower the employees to work for the customers
- Recognize and reward the accomplishments.

Major Service Management Systems

Information systems are also used in the service sector for process automation in order to take competitive advantages over the others. The information system that is being used differs from service to service. Some of these services are listed below:

MIS Application in Airlines

- **Introduction** – the operative function of airlines is to move people & goods from one place to another safely on time. The perceptions about good service are schedule, convenience, prices, seats, comfort, meal quality, treatment by the crew etc.
- **The MIS applications** in airlines would be towards supporting all decisions which affects the objective of offering a distinctive service to the customers.
- **Thus, MIS will have to** concentrate on the following managerial and operational decisions to achieve service goals.
- **Passenger information** – MIS should focus on collecting info like type/class/purpose of travel; socio-economic group; duration of stay, food habits, language and communication needs etc. This would help to service the schedule to suit passenger needs, service package can be developed out of this profile information on type/class of passengers will help to design different fares affordable to them.
- **Information on aviation industry** – it is necessary to have a MIS to manage the aspect of airlines where decisions about new purchases, planned replacement, infrastructural facilities, spares in inventory, manpower training are taken with confidence. The MIS in this area will heavily rely on business/operations research models to solve complex problems of planning and control.

Here Management Information Systems depends largely on the business and the operations research models and helps in solving the complex problem of the planning and control. The Management Information Systems helps in the perspective planning and the strategy formulations and hence ultimately supports the implementation of the plan framed for offering a distinct service.

MANAGEMENT INFORMATION SYSTEM FOR AIRLINE SERVICE

Passengers Database

- Airline service MIS must be designed so that it supports for collecting all types of information.
- They may want to revise the schedules of the flight, which suits the passenger's needs.
- Some-times it needs to discover service package for particular group of passengers. It requires passengers' profile to be built up.

Benefits of MIS Implementation

- Online/immediate/24-hour availability, directly connect buyers and sellers
- Can be updated in real-time, therefore always up-to-date

- Reduce costs
- Increase productivity
- Improve level of customer service
- Strengthen customer relationships
- Enhance business intelligence
- Increase direct sales of products or services

MANAGEMENT INFORMATION SYSTEM FOR HOTELS

People generally take the service of the hotels when they are visiting some other place and don't have a place to stay there. It is considered to be a place where a person can stay conveniently. However, in the recent times there have been a number of changes in the concept of hotel due to a number of causes. People always search for differentiated services in a hotel.

There has been a remarkable transition from convenience to comfort, from comfort to enjoyment and finally from enjoyment to total service. This has happened because a large number of people are taking the service of the hotels.

The profile of the customers has also undergone drastic changes. Initially the hotels were designed to suit the individuals. Later they had to carry out modifications to accommodate tourist groups, family and business executives. Each time changes must be carried out in the design of the hotel to accommodate the changes in the customer demands. Depending on the budget of the customers the concept of star hotels has come up so that various segments of customers can be served.
The MIS that is used in the hotels helps in understanding the expectations and perceptions of the customers. The hotel is then able to fulfil these expectations in the best way.

Types of Hotel IS Reports

The various reports generated by the hotel information system are as follows:

1) Scheduled Reports:

These reports are generated periodically according to a defined schedule such as daily, weekly or monthly.

2) Demand Reports:

These reports are generated to satisfy any specific query that has been made by the manager. These reports are not generated on routine basis for example, when the manger wants to know the revenue

generated by a particular item during a specific time, he will see the information provided by the demand report.

3) Exception Reports:

Such reports are generated when a certain situation has gone out of control and the manager is required to take immediate action.

Benefits of Hotel Information Management

1) Higher Degree of Accuracy:

In case of manual systems, the reports produced might have some fault because multiple employees are responsible for maintaining accuracy. Faults might creep in during cross-checking. In case of computerized systems, the accuracy of the report is assured by both the employees and the computer system.

2) Timeliness of Documentation and Reporting:

To produce the routine reports the manual systems sometimes take a significant amount of time. This time can be notably reduced with the help of the computerized systems. Such a facility can greatly help in the preparation of reports relating to nutrient analysis of menus and payroll.

3) Labour Efficiency:

A lot of labour is required to run manual systems. This labour is reduced by using the computerized system.

4) Data and Information Integrity:

For carrying out an operation only accurate and relevant current information is used. This is not possible with the manual systems because manual systems lack the information discrimination capability. Such problems absent in are automated systems because they have in-built check-and-error prompts.

MANAGEMENT INFORMATION SYSTEMS IN HOSPITALS

Hospital's management has to provide distinctive services to a wide variety of customers having different perceptions and expectations regarding the services. Discrimination can be easily carried out by the customers regarding various aspects such as personal and medical treatment (quality of caring and quality of care), effective and efficient service and service provided at minimum cost. Customer mainly focuses on the end result of the service and appraises the management on the performance of service process.

So, we can say that, "Hospital Information System (HIS) is a computerized system that regulates all the medical and administrative information processing activities in order to achieve an efficient and effective work performance by health professionals of a hospital."

The hospital information system is also known as **Integrated Hospital Information Processing System (IHIPS)** because it integrates various components like Clinical Information System (CIS), Financial Information System (FIS), Laboratory Information System (LIS), Nursing Information System (NIS), Pharmacy Information System (PIS), etc.

Components of Hospital Information System

1) Clinical Information System (CIS):

With the help of the Clinical Information System (CIS) it is possible to collect, store, manipulate and make the clinical information available that is required for the healthcare delivery process. The Clinical Information Systems serves as a store house of the information related to the illness history of a patient and detail of the care providers who have interacted with the patient.

2) Financial Information Systems (FIS):

FIS manages the financial activities of the hospital. The FIS have the following characteristics:

i) Payroll:

Various kinds of payments and deductions of the employees are managed using this system. The payments are of two types. The recurring ones are generated in an automated manner when the payroll is prepared and the non-recurring ones like overtime are added to the payment once they have been approved.

ii) Patient Accounting:

This module keeps the track of the financial transactions that have been carried out when the patient visited to the hospital. The various records that are kept such as doctor's fees, charges of operations, medications and procedures and the fees collected from both inpatient and outpatient.

iii) Accounts Payable:

The payments and invoices generated within the hospital are managed by using this module.

iv) Accounts Receivable:

Using this module the records related to the clients, payments and invoices are managed.

v) General Ledger:

The financial data generated from all the transactions are collected, processed and reported using this module. It helps to obtain the financial status of the hospital at any point of view in an accurate manner.

vi) Fixed Asset Management:

This provides support for retaining asset data and forecasting the depreciation.

vii) Claims Management:

It deals with the claims that are made to the insurance companies.

viii) Contract Management:

It handles all the ongoing projects and contracts.

3) Laboratory Information Systems (LIS):

Laboratory Information System (LIS) is a specialized computer information system that provides support for various activities related to the laboratory. This includes haematology, clinical chemistry and microbiology, etc. These laboratory disciplines are used by laboratory officers.

Features of Laboratory Information System:

i) Patient Management:

This system keeps the details of the patient such as admission number, admission date and admitting doctor.

ii) Decision Support:

Classification codes like LONIC and ICD-9 can be also used to cross reference the lab orders. This will help in verifying the correctness of the test conducted.

iii) Patient Tracking:

The various tests of the patients are listed in catalogue. This is referenced when it is required to review them in future.

iv) Quality Assurance:

This ensures that the current standards have been followed while tests are carrying out.

v) Management Reporting

vi) Workload Recording

4) Nursing Information System (NIS):

A Nursing Information System helps the nurses to improve patient care by using clinical data related to different healthcare scenarios. NIS maintains this data and also makes the information available to the nurses in time and in order.

Features of Nurse Information System:

i) Patient Charting:

The system keeps the data related to the vital signs of a patient, care plan, nursing assessment and nursing notes in the form of free or structured text.

ii) Staff Schedules:

By following the scheduling rules given in the shift modules, the nurses can prepare their own schedule. After that the scheduling manager or coordinator confirms or changes their shifts.

iii) Clinical Data Integration:

The nursing staff can retrieve, view and analyse all the clinical information from here. After that they integrate all these to design a care plan for the particular patient.

iv) Decision Support:

The system can provide guidance related to disease such as symptoms/signs, patient populations, related factors/etiologist and reminders and also prompts regarding new updates.

5) Pharmacy Information Systems:

These are complex systems that provide support to the pharmacy department of a hospital. It makes able the pharmacists to supervise and understand the use of medications in a hospital.

Features of Pharmacy Information Systems:

i) Clinical Screening:

Such system provides patient care support to the pharmacists regarding interactions of drugs, drug allergies and other complications related to medication.

ii) Prescription Management:

Such systems also provide management support to prescriptions for both outpatients and inpatients.

iii) Inventory Management:

Pharmacy Information System also provides an internal inventory of the pharmaceutical products. The systems generate alerts whenever the quantity of a particular item goes below a defined value. It also contains an electronic ordering system and sends requisition to the approved suppliers.

iv) Patient Drug Profiles:

Pharmacy Information System also manages drug profiles of patients that contain details about the past and current medicines that have been provided to the patients. The physiological parameters and known allergies of the patient. are also noted. Whenever a prescription is generated for a patient, a clinical screening is carried out using the profiles.

v) Report Generation:

PIS also generates the various types of reports like the reports related to the price of medicines dispensed and purchased and the pattern of medicine use.

vi) Interactivity with other Systems:

The Pharmacy Information System must be able to communicate with other systems such as the financial information system to get the information related to charge and bill for medications and clinical information systems to get the information related to the prescriptions.

6) PACS (Picture Archiving Communication System):

The PACS helps in archiving. viewing and processing of radiological images that have been recorded digitally. It also manages the information related to the images.

The greatest facility provided by PACS is that one can access the images efficiently within a time. So the related information can be interpreted easily in a hospital. A number of doctors can access the same images with the help of network. This helps in making the process of diagnosis better and efficient.

7) Radiology Information System:

This is a specialized computer system that helps in providing radiology services. The user can store, manipulate and retrieve information.

Features of Radiology Information Systems:

- Registering Patient
- Scanning of Request and document
- Entries of Result(s)
- Reporting
- Result(s) Delivery including faxing and e mailing of clinical reports
- Tracking of Patient
- Interactive Documents
- electronic Medical Record (EMR) is a medical record in digital format

Front-End and Back-End Applications of Hospital IS

Following are the front-end applications of HIS:

1) Patient Database:

It handles the queries regarding patients who are currently being treated and also who have been already discharged. These queries are made by any patient, staff or doctor of the hospital.

2) Medical Server Database:

It handles the information regarding name, telephone no. address, holidays, locations, work times of all the hospital staff including doctors, technician and nurses. It also provide important support service centres that provide services during emergency including blood banks, laboratories, special clinics and other special facility centres.

3) Resource Planning and Control:

Online queries regarding the scheduling, rescheduling and availability of facilities and resources are answered by this module. The facilities are used in a proper way after determining their usage.

4) Medical Case History Database:

It contains the knowledge database which includes the case history that facilitates research and provides guidance. It also supervises the drug's effect to measure its adequacy by recognizing the patient's feedback's. It plans the health service strategy after analysing the demand for health care services.

MANAGEMENT INFORMATION SYSTEM IN BANKS

Banks are organisations that provide various types of financial services such as savings, clearing checks. and providing loans to the account holders. The function of the bank in today's world has increased as they are offering financial assistance to the customers by offering various policies. The bank also has to meet various socio-economic obligations.

The banks handle a large number of transactions which are different from each other in terms of complexity and length. Like the customer of any other service, the customer of the bank also expects to get the end results as fast as possible. The prime service that is offered in the banking industry is to solve the financial problems that the customers of the bank are facing. The time elapsed for executing a transaction is the most widely used measurement for performing a service. The MIS in a bank must be designed in such a manner that it is able to provide differentiated services to the varied service requests of the customers.

Factors and Requirements Affecting Bank IS Design

1) Customer Database:

There are some factors that determine the perceptions and expectations of the customers regarding the service. These factors are as follows:

i) Customer:

They can be any company. institution, individuals, etc.

ii) Operator:

They can be any employee. officer, worker of an organisation, a housewife, etc.

iii) Range of Service:

These services may be any type of savings, account checking, payments or any other types of financial services.

iv) Class of Customers:

The class of customers may be any income groups, corporate bodies etc.

v) Working Hours:

It may be any time or any second of a day.

The bank management maintains a database of the customers. They use this database to analyse the customer's needs on a regular basis to design the package that is most suitable and appropriate to provide the required services.

2) Service to the Account Holders:

The account holders of the bank seek continuous information on the status of their accounts. The balance of the account is continuously changed as most of the customers carry out routine payments. Sometimes there may be a lot of balance in the account and no transaction has been carried out. The management must get the following reports from the MIS:

- The non-moving account or dormant account.
- The account having balance more than say Rs.50,000.
- The account going down below minimum balance.
- Not making routine payments.
- Not getting the routine credits.
- The defaults on loan repayment.
- The delays on crediting cheque amounts.
- Rise and fall in the transactions of accounts suddenly.
- There are about 80 percent account holders from whom the bank gets business to take personal care of the perceptions and expectations related to the service.

3) Service for Business Promotions:

The operations of the bank can be increased in a number of ways by giving the finances of the bank to the prospective customers. To make this successful the bank has to attract customers from the growing and upcoming businesses. This can be only done by a thorough study of the latest trends in the business sector. The bank can take the help of MIS to collect relevant data from different sources and then analyse it to formulate future strategies. Using this information, the bank's employees can communicate with the customers and bring business to the bank. It also helps to eliminate the risk of bad debts to a great extent.

4) Index Monitoring System:

Another prime characteristic of MIS should be to analyse the ratios and indices related to the operations that are carried out internally in the banks. The ratios are used for various needs; some of them meet the policy needs, while others meet the statutory needs. The MIS must be built in such a manner that it assists the manager in keeping the different ratios, norms and indexes within desirable limits.

5) Human Resource Upgrade:

The banking operations take into consideration various human aspects. The only way to improve the financial services of the business is by offering differentiated services. In order to serve the customer specific problems, the services must be more aggressive in nature. The needs of the customer must be identified by the MIS. So that the training must be imparted to the employees to enhance their knowledge about the financial and banking sector.

MANAGENENT INFORMATION SYSTEMS IN INSURANCE

Insurance businesses today are much more concerned about the effect of competition than they were a few years ago. They must react to the competitive threats not only from local sources but also from regional, national and international sources, likewise, they must seek to explore all opportunities that are available in the immediate, national and Global environment. MIS plays a crucial role in achieving success in the business as well as providing customer support that is up to mark and up to date.

MIS handles three major areas of an insurance company:

- **Development of New Policies**
  - Finding out the risk incident cost of risk management, identifying the conditions for giving the insurance offer
  - Assessment of insurance premium
  - It is focused on trend in the business and industry
  - They must identify the risk possibilities and covering them by appropriate insurance policy

- **Settlement of Claims**
  - This is a very critical function of MIS for the insurance industry and it needs effective design to help managers take decisions easily
  - Reports generated by MIS should bring out exception reports on the pending claims, disputes, unsettled and rejected claims

- **Administration and Management**

  Management of policy includes generating automatic reminders for beneficiaries

- MIS provides information in the form of reports and displays to insurance managers and many businesses professionals
- MIS considers integrative nature of information flow as well as the structuring of the organization around decision centres
- MIS has changed the physical layout of offices to accommodate local networks and departmental integrated systems
- The role of information in decision-making among insurance practitioners cannot be overemphasized, an effective decision-making demands accurate, timely and relevant information. MIS enables the managers to take informed decisions that are instrumental to the success of the organization.

Module – 5

INFORMATION TECHNOLOGY INFRASTRUCTURE

Introduction, data processing, transaction processing, application Processing, information system processing, TQM of IS, introduction network, network topology, data communication, Data & Clint Service Architecture RDBMS, Data Ware House, Introduction to E-business, models of E-business, internet and World Wide Web (WWW), Intranet and extranet, Security in E-business, electronic payment system, Impact of web on strategic management, web enabled business management, MIS in web environment.

INTRODUCTION

The development of modern information system is a complex process. It needs knowledge, know-how, skills and technology in almost all the disciplines. The developer, the designer and the user must be knowledgeable in their respective area of functions and responsibilities. As information systems are being demanded for on-line real time usage in business management, its development requires thorough understanding of the business and the manner in which it is executed. Further, different technologies, other than the Information Technology, are used in the business which are used for providing input to the information systems. As the business processes are getting automated, the information systems are undergoing cultural changes making them more sensitive to the business needs. It demands a flexibility in design and reliability in its use

DATA PROCESSING

In any information system application, the method generally followed is to design modular and hierarchical steps of processing leading to an output in a report form or information having certain—value specific or perceived—as seen by the user.

The steps involved are *data processing, transaction processing, application processing and system processing.*

Data processing is handling raw data in a systematic manner to confirm to the data quality standards and determined by the designer of the information system.

Example:

The specification of data means determining its manner of presentation (DD-MM-YY),its value, specific or in limits, its validity whenever possible.

DD-MM-YY or MM-DD-YY or YY-MM-DD. So the data ‘date’ has a specific orderof positioning and presenting.

Hence, ***data processing means*** following steps or stages to be implemented before the data is accepted in the system for usage.

• Confirming the character, structure and presentation vis-à-vis data design.

• Checking the value of the data vis-à-vis data value specification such as single specific value, range of value, and limit value ranges.

• If a nonconformance is seen, point out the error and seek corrective response before the processing control shifts to a new field.

Transaction processing

After the data has been processed, the next step is to process transaction itself on certain lines.

A transaction is processed with reference to business rules, i.e., a transaction is scrutinised for conformance to the rules, policy or guidelines before it is taken up for further processing. The rules may be directly related to the transaction or it may have some relation and association with other transactions.

Example

Let us take an example of the goods receipt as a transaction. Having checked the individual data entities, the goods receipt transaction is subjected to further checks for acceptance and execution. The business rules in case of this transaction are:

1. The purchase order must be present and open and the item received should be present on Purchase Order. Further, the receipt is as per the scheduled date.

2. The supplier has sent the necessary supporting documents such as Excise Gate Pass, Octroi Challan, Sales Tax Form, Certification by Third Party, etc.

3. Such other conditions that may be applicable.

APPLICATION PROCESSING

After data and transaction processing, the data finalised in these stages gets posted on the affected files.

Application processing is designed to process more than one type of transactions to bring out the specific business results in one or more business functions. This processing is carried out

once the transaction is processed for its validity.

Let us take an inventory application which require the receipt and issue transactions duly validated for inventory processing. When these two transactions are processed, the inventory is updated for receipts and issues giving the net balance at the end of the processing for each items in the inventory.

INFORMATION SYSTEM PROCESSING

The system processing is at a higher level, over the application processing. The system is defined as a product made up of several applications set in orderly manner to produce a higher level information output different than the output of the application processing.

For example, the financial system is a product of finance, sales and purchase accounting applications. Normally the system processing addresses the management issues of the business. In the financial system, processing is done for cash management, asset and liability management, working capital management, etc.

OLAP FOR ANALYTICAL INFORMATION

Information processing management has five basic systems

Data Processing:

Data Processing focuses on data acquisition, verification, validation, computing, summarising and so on. Then store the processed data results at designated storage and in medium.

Transaction Processing:

In transaction processing, the business transaction such as ordering, payment, delivery etc are processed at unit level using stored master data and data generated through a decision or event.

Application Processing:

In application processing, several transactions may come together to complete an event. For example, order processing and delivery processing are two transactions, two processing systems. We use transaction data of these two systems to process a bill. So customer billing is an application.

System Processing:

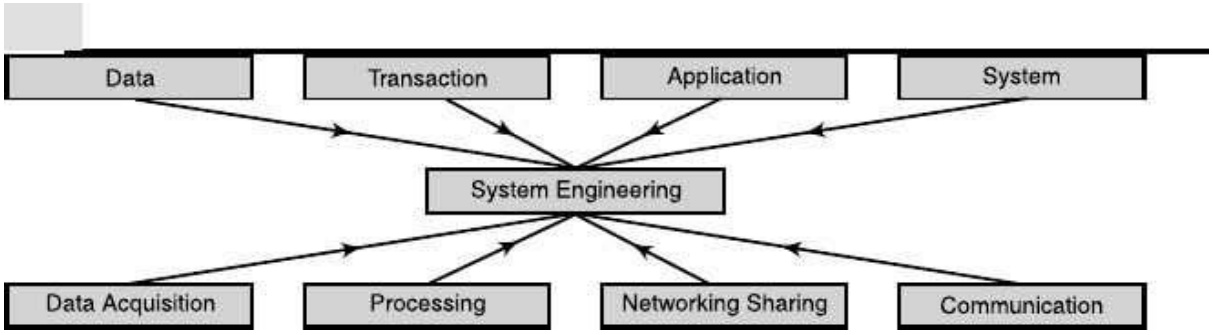
Customer billing data when processed for financial accounting and for credit rating of the customer, it is a commercial system. In system processing two or more applications are

processed together to achieve functional results.

Integrated Processing at Enterprise Level:

In integrated system several systems are processed together to produce organisation's results.

System Engineering Scope



TQM OF INFORMATION SYSTEM

The objective of the Total Quality Management (TQM) in the information systems design is to assure the quality of information. This is done by ensuring, verifying, and maintaining software integrity through an appropriate methodology choice amongst the technology, design and architecture. It institutes appropriate procedures with checks and controls in all the processes of information systems development.

The quality of information is governed by the quality of the information processing system design.

The quality of the information and the systems which generate that information will berated high provided it assures:

•A precise and an accurate information,

• A high level response in an interactive processing

• User friendly operations,

• Reliability of information, and

• An ease of maintenance.

The software quality assurance is an essential activity to ensure the attainment of quality goals. The activity comprises:

1. Application of the proven methods and tools for requirement analysis.
2. Technical review to detect errors in the functionality and its logic.
3. Testing to detect errors at the data level.
4. Version changes control to ensure that the change does not alter the original assured q uality.
5. Record keeping to establish knowledge and know-
   how on reviews, audits, changes, testing for fu-ture reference and use in bug fixing.

IT: A Strategic Decision

EVALUATION AND FEASIBILITY OF IT SOLUTIONS

Technical Evaluation

Technical evaluation deals with the testing parameters, such as data transfer needs, the response level, the successful connectivity of the different hardware platforms, and the degree of meeting the overall system performance standards. Technical evaluations can be carried out first by studying the literature of the product in detail and then by conducting brain storming sessions with the vendors' specialists. In this phase a number of doubts are clarified and the vendors' claim in the areas of the system performance are confirmed. Technical evaluation can then be planned by scheduling the activities such as the bench marking for a couple of key parameters.

Operational Feasibility

- The options approved after the technical evaluation are tested for the operational feasibility. What the technology offers may not be possible to operate at the practical level and at a scale to obtain full benefits of the various inherent features. The operational feasibility evaluation considers the people-related issues and whether the systems and the procedures of the organisation are complementary and conducive.
- the choice of technology determines automatically the calibre, the competence, the knowledge of the people in the organisation. It is also observed that the organisation does not provide people support to implement technology successfully. The shortcomings on peoples' side would be the lack of requisite qualification and the subject knowledge, the ability to absorb the technology, and use it efficiently and effectively. Many a times, the organisation would require to appoint a new set of personnel to fulfil these needs.

Financial Evaluation

- All the options can be evaluated in terms of the investment it calls for. It is always possible to rank the options on the basis of the investment. All business investments are evaluated in terms of return on the investment (ROI) or certain payback period. They are also judged from budget considerations.
- The information technology investments are difficult to judge on the ROI basis as some aspects of the investments are intangible and are difficult to quantify in monetary terms. The best approach in such cases is to judge the investment in terms of the value of information it gives on an incremental scale. If the value of information in relation to its investment is not significant, then it could advisable to consider the next best lower investment option.

INTRODUCTION TO NETWORK

More and more technologies are supporting basic networking technology, making net-work approach to information management most stable, efficient and effective.

The network essentially serves some important features like:

- It allows the users/departments/divisions to share the hardware resources like the laser printers, the plotter and any other storage media like the disk drives.
- It allows the information to share across the company.
- It enables the electronic transfer of mail, document, or data to the addressed locations

with a confirmation.

- It provides an access to the data file on other computer systems in the network for the local processing need.
- With a wide area network, different computer systems can talk to each other for the purpose of processing, sharing and communicating.
- It enables seamless integration of the business functions and operating divisions.

NETWORK TOPOLOGY

A network topology is the physical and logical arrangement of nodes and connections in a network. Nodes usually include devices such as switches, routers and software with switch and router features. Network topologies are often represented as a graph.

Types of Network Topology

Bus Network Topology -- Also known as *Backbone Network Topology*, this configuration connects all devices to a main cable via drop lines. The advantages of bus network topology lie in its simplicity, as there is less cable required than in alternative topologies, which makes for easy installation.

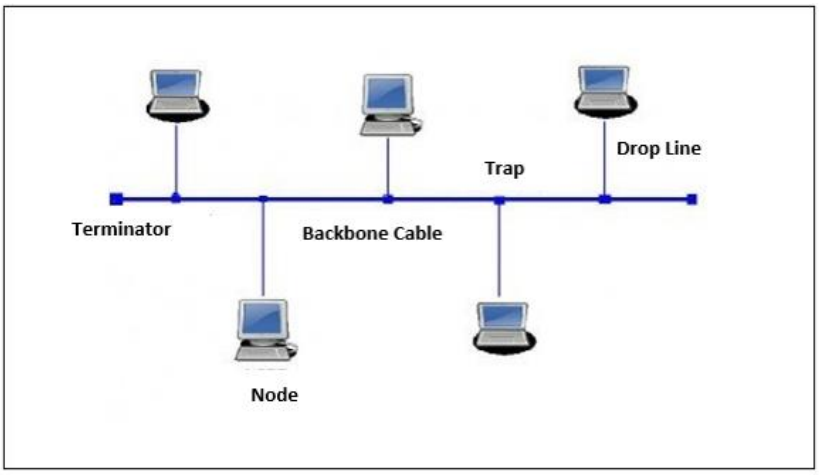
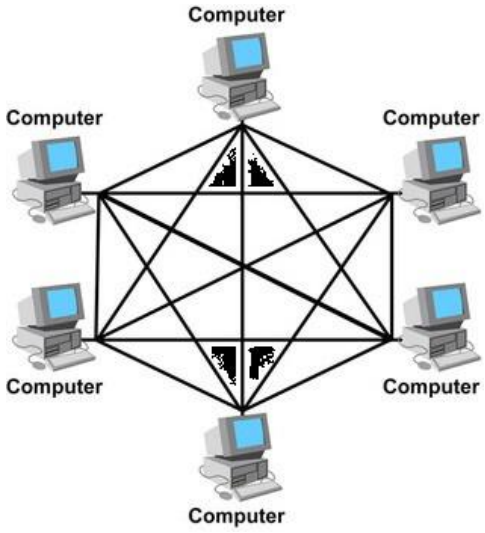


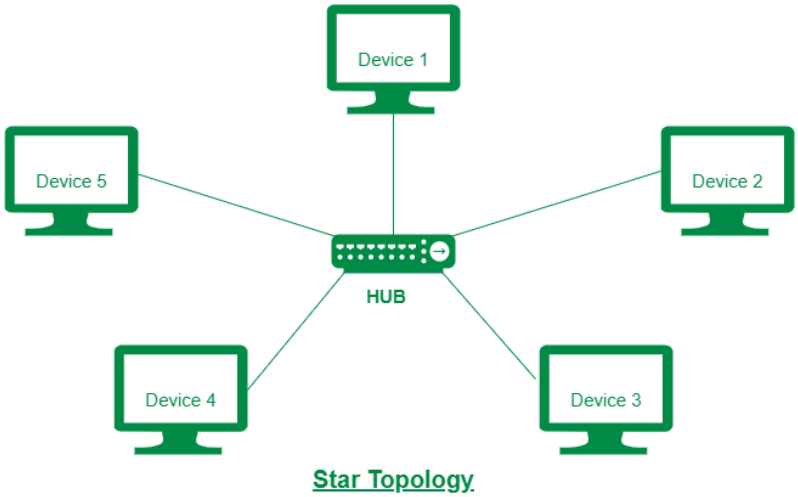
Figure 1: Bus Topology

MESH NETWORK TOPOLOGY -- A dedicated point-to-point link connects each device on the network to another device on the network, only carrying data between two devices.



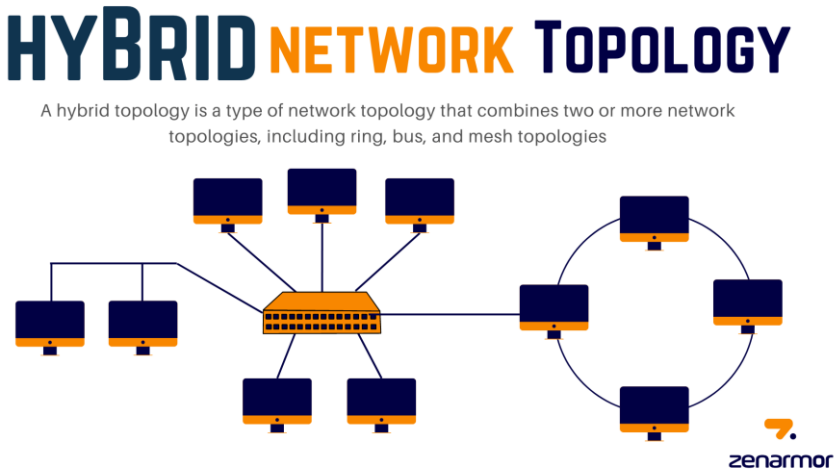
Ring Network Topology -- Two dedicated point-to-point links connect a device to the two devices located on either side of it, creating a ring of devices through which data is forwarded via repeaters until it reaches the target device.

Star Network Topology -- The most common network topology, star topology connects each device in the network to a central hub. Devices can only communicate with each other indirectly through the central hub.

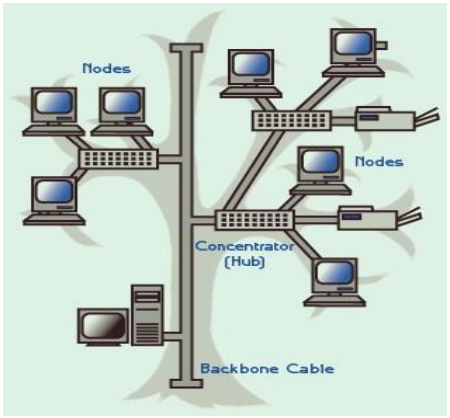


Star Topology

HYBRID NETWORK TOPOLOGY -- Any combination of two or more topologies is a hybrid topology.

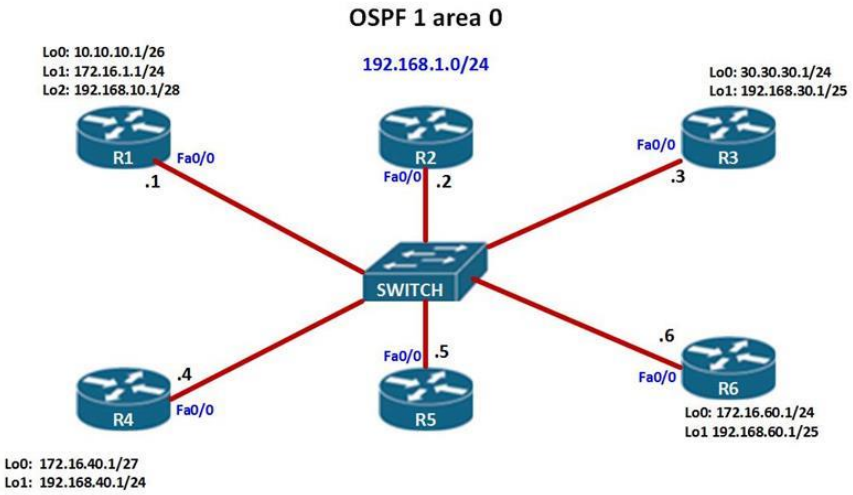


TREE NETWORK TOPOLOGY -- This topology consists of a parent-child hierarchy in which star networks are interconnected via bus networks. Nodes branch out linearly from one root node, and two connected nodes only share one mutual connection.

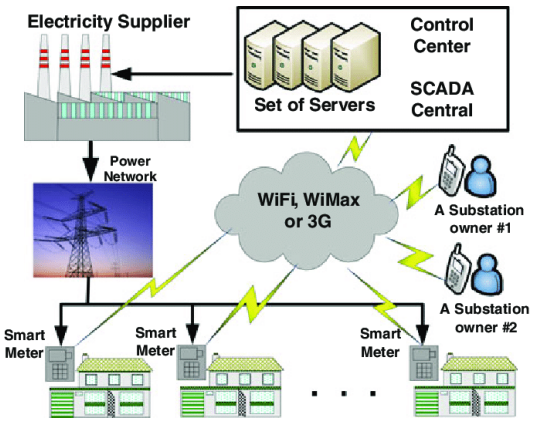


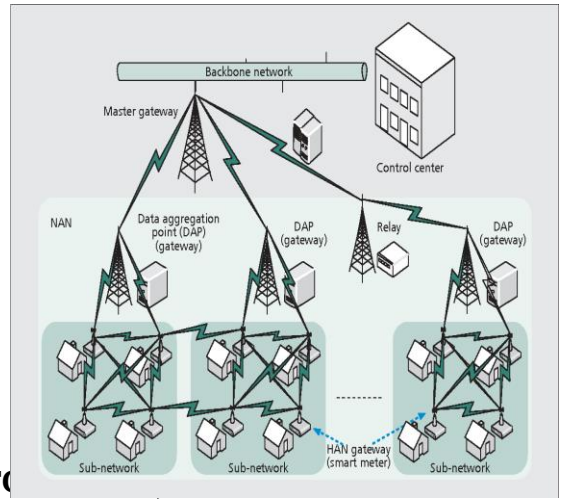
MULTI-ACCESS NETWORK TOPOLOGY, also known as a ***Non-broadcast Multiple Access***

Network (NBMA), consists of multiple linked hosts in which data is transferred directly from one computer to another single host across a switched fabric or over a virtual circuit.



z**Smart Grid Network Topology** refers to the network configurations that are necessary to facilitate system operations in a smart grid. A smart grid is an electrical network of smart meters, smart appliances, renewable energy resources, and energy efficient resources that condition and control the production and distribution of electricity.



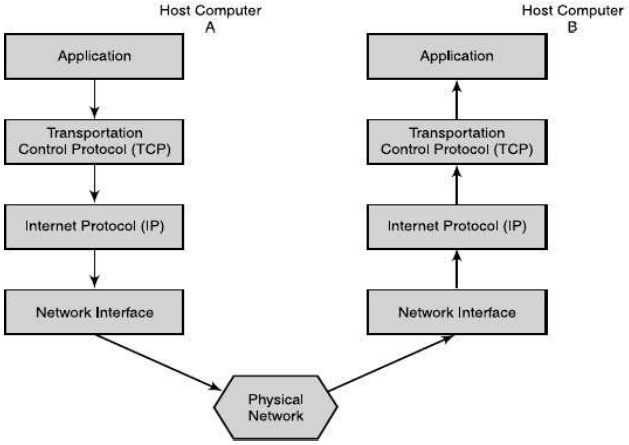


Models of Connectivity for Network (TC

Key Terms in Network Technology and Applications

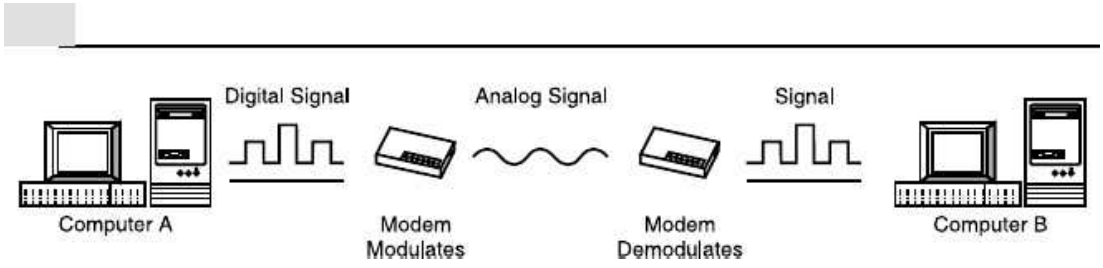
- Bandwidth
- PBX (Private Branch Exchange):

- Gateway
- Router
- Blue tooth
- Wide Area Network
- Value Added Network (VAN)
- Integrated Services Digital Network (ISDN)
- Teleconferencing
- Data conferencing
- Video conferencing
- Electronic Data Interchange (EDI)



Data communication

Data communication is a process of transporting the data from one location to the other. Air-lines reservation system, automated banking and the point of sale system used in departmental stores are the examples of the data communication, which is central to these systems. The data communication, therefore, needs a system to transport the data.



Communication Link

The communication is performed through three activities — entry, transmission and de-livery. The communication software handles all the three, and while handling the process it controls errors, edits the data and formats the same for presentation. It controls the transmission by routing process and network features. The communication of the message does not take place as a whole. It is broken into small packets. Each packet has the source and destination address, at the start and end of the pack-et; and an error control field to check the integrity of the packet. The packets are then transmitted through the network routes that are free to follow any available

path in the network. The packets are reassembled at the destination in a proper order to form the complete original message.

Models of Connectivity for Network (TCP/IP, OSI)

These are different models for achieving connectivity in the networks. The Transmission Control Protocol/Internet Protocol (TCP/IP) model helps to link disparate computer systems using different hardware and software platforms. The United States Department of Defense in 1972 developed this model. Fig. 17.7 shows TCP/IP model of five layers, application, TCP,CIP, network interface, and physical communication network.

The five layers, which makes TCP/IP model protocol, are explained further hereunder:

1.Application:

Converts the message into user/host software for screen presentation. Applications include e-mail, file transfer (FTP), and HTTP.

2.Transmission Control Protocol (TCP):

Breaks the application data into TCP 'packets' called as datagrams. Each packet consists of header and address of the sending host computer, information on how to put back the data together at the receiving computer, and information on how to protect the packets from corruption. The packet model is header – datagram – trailer.

3.Internet Protocol (IP):

Receives 'datagrams'/'packets' from TCP and breaks them in to smaller IP packets. IP packet has a header with address and portion of information and data of the TCP packet. IP also routes the individual datagrams from host computer A to host computer

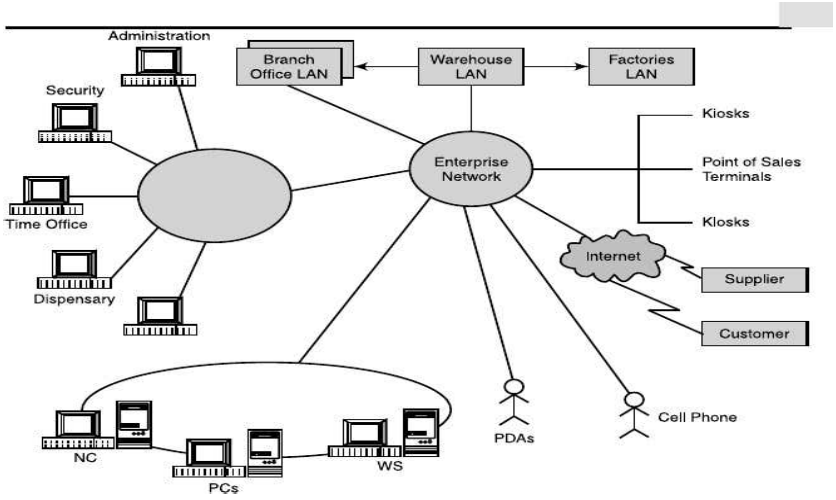
4.Network Interface:

Facilitates packet transmission from one node to another node.

5.Physical Network:

Defines electrical transmission characteristics for the packet for sending along communication network.

Enterprise Networking



Enterprise network helps to reduce transaction costs, and provides capabilities to run business applications such as e-commerce, ERP, and SCM CRM. Enterprise network is powered by network and Internet technologies.

DATABASE

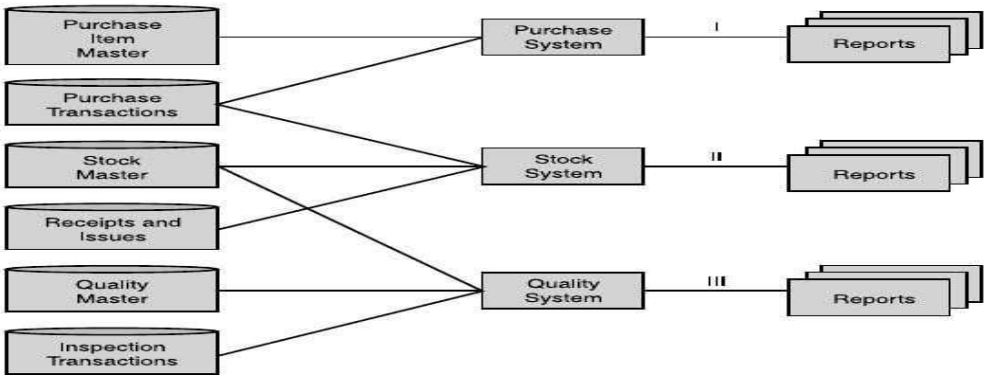
A database is an integrated collection of well defined data and information, centrally controlled in all its aspects, created and stored in a typical structure for an organisation. In an organisation the database could be, one or more, depending upon the needs and the operations of the organisation.

Why Database

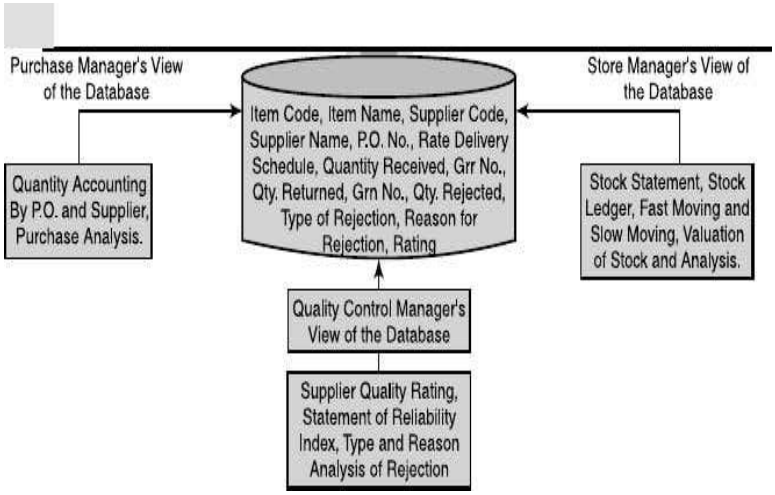
Conventionally, in an information system, the information is obtained by developing thesystems and integrating them. This calls for breaking the system into various subsystems and developing the information systems independently.

Data Entities

Purchase system	Stock accounting	Quality accounting system
Item code	Item code	Item code
Item name	Item names	Item name
PO No		PO No
Supplier code		Supplier code
Supplier name		Supplier name
Delivery Schedule		
Qty. received	Qty. received	Qty. received
Qty. Rejected	Qty. Rejected	Qty. Rejected
Qty. accepted	Qty. accepted	Qty. accepted
Goods received Note No.	Goods received Note No.	Goods received Note No.
Goods returned Qty.	Goods returned Qty.	Goods returned Qty.



Database for Materials Management and Different Views



Disadvantages

The Data Redundancy and Inconsistency

Since the files are created for each application differently, the files are likely to have different formats and data designs as they are created by different designers and programmers over a period of time. Hence, the same data record may be present in more than on file, the creation, updation, and deletion of which is managed by different programmes. Over a period of time, a situation arises when the data is redundant and inconsistent, due to the changes not being incorporated simultaneously, in all the applications and in all the files.

Difficulty in Access to the Data

In conventional system design, the file structure is consistent to the specific information needs. If the information needs change, gaining access to the data present in different files to satisfy the revised need, requires writing the necessary application programmes every time. This is difficult and very time consuming at critical times.

Concurrent Access Anomalies

In a dedicated file system application, the concurrent access is provided to improve the response of processing. However, the file systems are incapable of supervising and coordinating the changes arising out of the concurrent access to the record. It is quite likely that the record may be accessed within seconds and information may not be current. This creates information anomalies in a short space of time.

Security Problems

The file systems have a limitation of controlling the access to the record causing insecurity with respect to the information. Since the application programmes are written time and again, it is difficult to enforce a discipline on the security constraints across all the applications.

Integrity of the Data

In a file system it is difficult to maintain an integrity of the data across the applications. The integrity rules are added when the programmes are written. If any changes in the rules occur, it is very difficult to ensure that it is effected across the files in all the applications.

Database Management System (DBMS)

The DBMS is a software designed to manage and maintain the database of an organisaiton. The main steps are data structuring, defining, interrogating, updating and creating. Through these steps, it manipulates the data and provides an environment which is appropriate to use in retrieving and storing the database information.

The DBMS is a collection of the interrelated files and a set of programmes through which the users can access and modify these files. In DBMS file contains tables.

The advantages in the database approach are as follows:

1. All the three managers are using the same database, hence, any report using the information will not be inconsistent.

2. All the three managers can view the database as per their needs.

3. The application systems can be developed independent of the database.

4. The data validation and updating will be once and same for all.

5. The data is shared by all the users.

6. The data security and privacy can be managed and ensured because the data entry in the

database occurs once only and is protected by the security measures.

7. Since the database is a storage of the structured information, the queries can be answered fast by using the logic of the data structures.

Terms to remember

Data Store

Data Definition and Data Directory

Interrogation

Updating

Creation

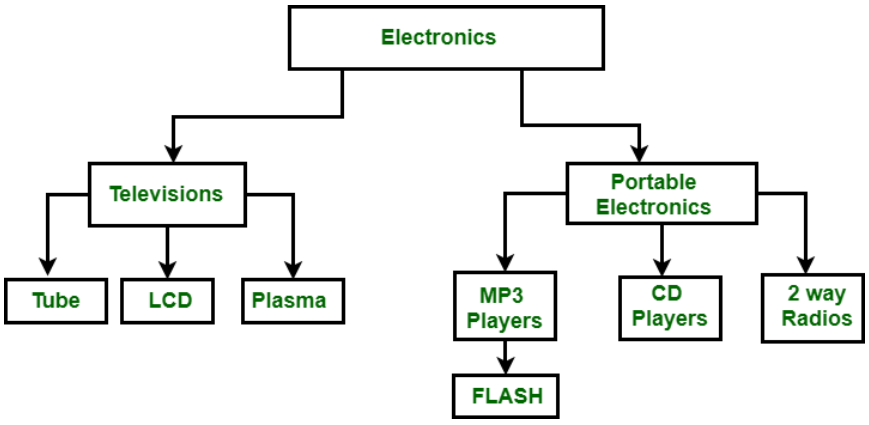
DATABASE MODELS

There are three types of database models which are common in the industry. They are—the Hierarchical Data Model, the Network Data Model and the Relational Data Model. These models have their own particular nature, and, therefore, they are application in the industry where a similar situation exists. There is a fourth model known as the Object Data Based Model (ODBM) in which data is structured as objects at a much higher level as compared to the other models providing a flexibility in designing the applications.

1.Hierarchical Database Model (HDBM)

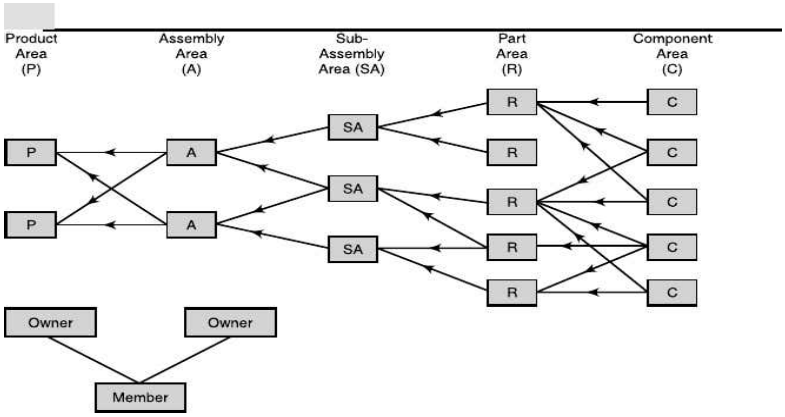
- The HDBM is applicable when the data in an organisation can be put down in the hierarchicalor in terms of the levels, one after another. The data model is equivalent to a tree. A tree has roots, branches and leaves; their equivalents in the HDBM beings records, nodes and fields. A typical hierarchical structure can be seen in a product manufactured out of the parts and the components.
- In the HDBM the data is stored in the hierarchical form recognising the fact that each of the levels is bounded by the Parent-Child relations to the earlier level. The typical characteristics of the HDBM are:
- 1. HDBM starts with a root and has several roots.
- 2. A root will have several branches.
- 3. Each branch is connected to one and only one root.
- 4. A branch has several leaves and a set of leaves are connected to one branch. A

hierarchical tree structure is made of the branches (nodes) and the leaves (fields).



Network Database Model (NDBM)

The NDBM interconnects the entities of on organisaiton into a network. The data model is shown by an arrangement of the blocks. The block represents an entity or a record. The collection of the blocks is called as the Area of database. The NDBM uses the blocks, the area and the arrows to represent the database of the organisaiton. The method, popularly known as the ***Bachman's diagram***, was suggested by Mr CW Bachman.



Relational Database Model (RDBM)

In the RDBM, the concept of two dimensional table is used to show the relation. In our example of the product database, the table showing the component name and the component number is a representation of the data in a table form (Table 18.2). RDBM model users theories of relational algebra in representing the data in various tables.

Component number	Component name
100	Washer
102	Nut
109	Bolt
111	Screw

Product Database

The relationship between a component and a part is shown in Table

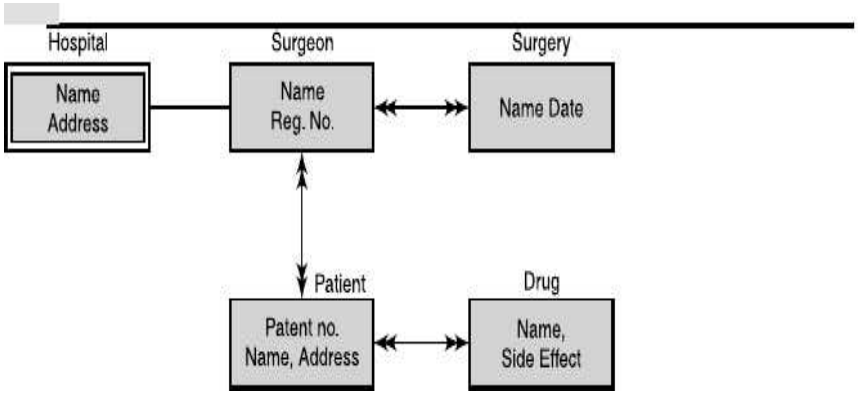
All the relationship are shown in a table form. For example, the washer number 100 is used in the part numbers 10 and 11, and this relation is shown in two rows in the table. In the RDBM, the relation is shown in table, attribute is shown in the column and record in the row of the table. The values of attributes are taken from a domain. The set of attributes is record and the record is identified by a unique key known as the primary key.

Component numbe r	Part number	Usage of compone nt in the part	Component name
100	10	3	Washer
102	11	2	Nut
109	12	1	Bolt
111	14	4	Screw
100	10	3	Washer
109	10	4	Bolt
111	12	6	Screw

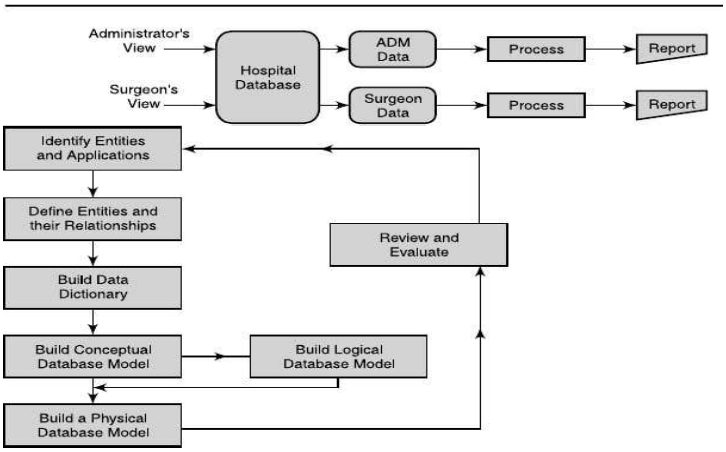
Basic Differences in DBMS Models

Particulars	NDBM		
1.Record relations	Pointers	Pointers	Values in tables.
2.Data storage	Sets and Record in Y structure.	Tree structures parent child relation.	Table structure.
3.Insertion of entity	Easily possible with Y structure.	Not possible.	Possible.
4.Deletion	One type set deleted but other record information gets deleted causing deletion of another set type.	Along with root, nodes are also deleted.	Possible.
5.Simplicity from users point of view	Not so simple	Have to know tree structure of database	Very simple
6.Requests for information	Complex and procedural	Have to be procedural in line with the tree structure	No possible dependency between relations. Hence can be nonprocedural
7.Degree of data independence	Low	Low	High

CONCEPTUAL MODEL AND PHYSICAL MODEL



Conceptual Model of Hospital Database



Physical Database Model

The physical model of the database is a stored framework of data a physical device. Since a large percentage of the databases are used in an on-line environment, one has to be concerned with the visible performance. The performance of the database is a multivariate functions with the physical model as a major variable. The designer of the database always tries to optimise the physical model for the space and the time considerations. The three areas, where he database designer needs expertise for an optimum performance of the database are:

1. Knowledge of the Database Management System.

2.Understanding of the characteristics of the direct access devices and the access needs.

3. Knowledge of the 'applications'.

Implementation of Physical Model

1. *Physical Creation*
2. *Operations*
3. *Reorganisaiton*
4. *Restructuring*
5. Performance Monitoring and Tuning
6. Security in the Database Environment
7. Users
8. *Partial Retrieval of Records*
9. *Retrieval of all Records*
10. *Deletion of Certain Records*
11. Programmers/System Personnel

RDBMS

- The software used to store, manage, query, and retrieve data stored in a relational database is called a relational database management system (RDBMS).
- Modern RDBMS allows high level security by providing various tools to the system administrators, the database owners and the users to grant and revoke permissions to

the specified users or a group of users on the specified tables, view, columns, stored procedures and commands. In the traditional DBMS system, the data was required to store in different data- bases in line with the security levels. While in the modern RDBMS system a multiple security is taken care of by one integrated database management system.

- The latest RDBMS allows an online maintenance, rapid recovery and software-based fault tolerance. These features ensure the availability of the database round the clock as the database maintenance is possible on-line when the system is in use.
- The maintenance activity consists of the following tasks:
- (a) Backup
- (b) Diagnostics
- (c) Integrity changes
- (d) Recovery
- (e) Design changes
- (f) Performance tuning.

The characteristics of the modern RDBMS includes

1. hardware independence.
2. software in-dependence.
3. workability under a client-server architecture.
4. a control feature of integrity.
5. security and autonomy and built-in communication facilities to achieve and open the system feature for the MIS.
6. It, therefore, provides a very efficient and effective tool to a skilful de-signer, developer and user for handling the information needs of the business enterprise.

EIFCodd* prescribe 12 rules to determine how relational a DBMS product is. If these twelve rules are satisfied, then the DBMS product is fully relational. The rules are as under.

1. The Information Rule

- Information in database is represented by values in column positions within rows of

tables and this is the only war it can be done.

2. The Guaranteed Access Rule

- Every individual scalar value in the database is uniquely addressable by a primary key, containing table, column and row identities.

3. Systematic Traditional of Null Values

- Missing or inapplicable information is termed as null value which is distinct from zero. DBMS should provide systematic method of handling null values in contrast to value zero.

4. Active on-line Catalog

- The DBMS supports on-line catalog accessible to authorised users.

5. Sublanguage Rule

- DBMS must support one relational language which helps data definition, manipulation security, integrity constraints, and begin, commit, and rollback operations.

6. The View Update Rule

- All possible views must be updateable by the system.

7. High Level 'Insert, Update, and Delete'

- DBMS must support all the three at time required by three different operators.

8. Physical Data Independence

- It does not matter for the application how data is physically stored in database.

9. Logical Data Independence

- The data store and its application is not determined by the logic applied in use of data.

10. Integrity Independence

- Integrity or rules of constraints must be possible to handle without affecting the application.

11. Distribution Independence

- DBMS should function with no error even though data is distributed.
- ***12. The Non-Subversion Rule***

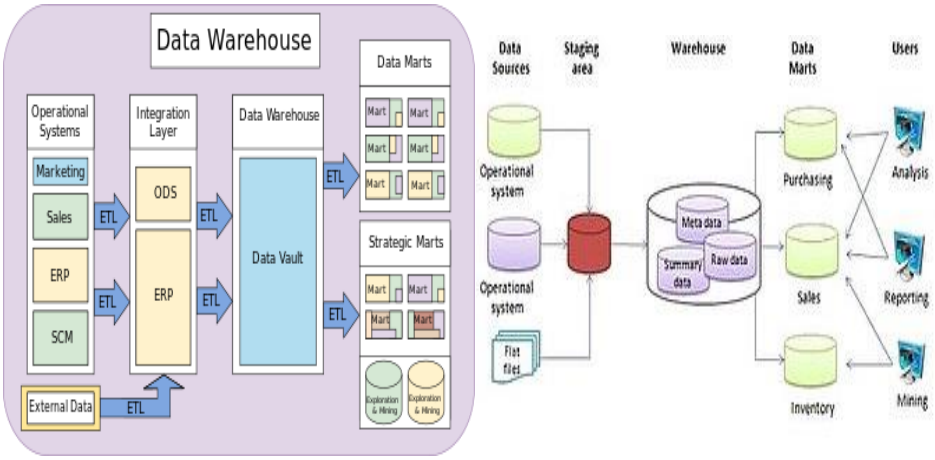
- A low level interface provided by the DBMS should not subvert the system's relational security or integrity constraint. Some of the major advantages of RDBMS against HDBMS and NDBMS are:
- • Scalable high performance.
- •System-based integrity, security and autonomy.
- • Longer availability of time to the users.
- • Handles simultaneously the multiple RDBMS.
- • Operates on the character terminals and bit-mapped workstations.
- • High level data management of different classifications

Data Warehouse

- The Data Warehouse is defined by Bill Inmon as,
- "A collection of non-volatile data of different business subjects and objects, which is time variant and integrated down various sources and applications and stored in a manner to make a quick analysis of business situation".
-

Data-Ware house is a

- Subject oriented data organised by business topics: Functions/results and not by custo mer, vendor, item code and so on.
- Integrated data stored in single unit in same structure or organisation. Distributed data in different files is rationalised and organised to one structure.
- Nonvolatile data once stored is not discarded or over written. New data on the topic is added on scheduled basis.
- TimeVariant Data stored with time dimension to study the trends and changes with times.



- Following are the characteristics of Data Warehouse which differentiate it from Database.
- • The scope of Data Warehouse is the whole organisation.
- • It contains the historical record of business created from existing application.
- • It enables you to take business view, application view and physical view at a point-in-time on any aspects of business situation.
- • Data Warehouse supports cross functional Decision Support Systems (DSS) to manage the business, as it provides detail, historical, consistent, normalised business data for further manipulation by the decision makers.

Difference Between Database and Data Warehouse

Basis	Database	Data Warehouse
Workloads	Operational and transactional	Analytical
Data Type	Structured or semi-structured	Structured and/or semi-structured
Schema Flexibility	Rigid or flexible schema depending on database type	Pre-defined and fixed schema definition for ingest (schema on write and read)
Users	Application developers	Business analysts and data scientists
Data Freshness	Real time	May not be up-to-date based on frequency of ETL processes

Modules 5

Information Technology Infrastructure: Introduction, data processing, transaction processing, application Processing, information system processing, TQM of IS, introduction network, network topology, data communication, Data & Clint Service Architecture RDBMS, Data Ware House,

Introduction to E-business, models of E-business, internet and World Wide Web (WWW), Intranet and extranet, Security in E-business, electronic payment system, Impact of web on strategic management, web enabled business management, MIS in web environment.

PART II

E-business

E-business is a term that is often used interchangeably with e-commerce, but this is not accurate. E-business uses the Internet and online technologies to create operational efficiencies, thereby increasing value to the customer. Its focus is internal—for example, online inventory control systems; accounting systems; procurement processes; supplier performance evaluation processes; tools to increase supply chain efficiency; processing requests for machine repairs; and the integration of planning, sourcing, and manufacturing. Critical business systems are connected to critical constituencies—customers, vendors, and suppliers—via the Internet, extranets, and intranets. No revenue is generated, but "e-business applications turn into e-commerce precisely when an exchange of value occurs."

E-business processes should be introduced wherever there is a process that is currently working but is costing unnecessary time and money to implement via paper. This would certainly apply to the small business that finds itself drowning in paperwork. Small businesses should always consider that e-business processes could improve their operational and cost efficiencies overall, so thinking about e-business implications should be part of many decisions. E-business can work for any small business "because it involves the whole business cycle for production, procurement, distribution, sales, payment, fulfilment, restocking, and marketing. It's about relationships with customers, employees, suppliers, and distributors. It involves support services like banks, lawyers, accountants, and government agencies." The way you do business and your future profitability will be affected by e-business. Converting your current business into e-business may require some redesign and reshaping, depending on the size of your company. However, e-business integration should be seen as an essential element in the efforts of a small business to increase its agility in responding to customer, market, and other strategic requirements.

E-Business Components

E-business involves several major components: business intelligence (BI), customer relationship management (CRM), supply chain management (SCM), enterprise resource planning (ERP), e-commerce, conducting electronic transactions within the firm, collaboration, and online activities among businesses.

Business intelligence is about the activities that a small business may undertake to collect, store, access, and analyse information about its market or competition to help with decision making. When conducted online, BI is efficient and quick, helping companies to identify noteworthy trends and make better decisions faster. BI has been described as "the crystal ball of the 21st century."

Customer relationship management (CRM) refers to "…a customer service approach that focuses on building long-term and sustainable customer relationships that add value for the customer and the company." It is a company-wide strategy that brings together information from all data sources within an organization (and sometimes from external data sources) to give one holistic view of each customer in real-time. The goal is to reduce costs and increase profitability while providing customer satisfaction. CRM applications are available for even the smallest businesses

Every small business has a supply chain, a network of vendors that provide the raw components that are needed to make a product or deliver a service. The management of this network is known as **supply chain management (SCM)**. SCM is about efficiently and effectively improving the way that a company finds those raw components and then delivers the product or the service to the customer. SCM applications are now available for small businesses.

Enterprise resource planning (ERP) is about integrating all departments and functions across a company (sales, marketing, human resources, finance, accounting, production, engineering, etc.) into a single computer system that can serve the particular needs of each department. The objective is to provide information quickly and efficiently to those who need it. Small businesses have many vendor choices for ERP systems. There are more than thirty vendors in the field, and they are looking to small and midsize businesses as their primary growth market.

E-commerce is the marketing, selling, and buying of goods and services online. It generates revenue, which e-business does not. E-commerce is typically associated with e-marketing, but most of this chapter is dedicated to the operational, nonmarketing dimensions of e-commerce.

Conducting **electronic transactions** within a firm can occur through an intranet, e-mail, and instant messaging. An intranet is a private network within a business that is used for information sharing, processing, and communication. The goal is to "streamline the workplace and allow easy information exchange within an organization."

Collaboration can occur internally or externally, and it often involves business partners. The goal is to help teams or business partners communicate with each other more effectively and efficiently, manage projects and shared materials, save companies the costs of travel, and reduce travel-related productivity losses. E-mail, instant messaging, newsgroups, bulletin boards, discussion boards, virtual team rooms, online meetings, and wikis are common means of collaboration. A wiki is a web page that can be viewed and modified by anybody with a web browser and access to the Internet unless it is password protected.

Online activities between businesses focus on information sharing and communication via e-mail, online meetings, instant messaging, and extranets. An extranet is the part of an intranet that is made available to business partners, vendors, or others outside a company. It allows a business "to share documents, calendars, and project information with distributed employees, partners, and customers" and "it enables 24/7 private, secure access to collaborative tools with just an Internet connection." They make communication easier, eliminate redundant processes, reduce paperwork, increase productivity, provide immediate updates and information, and provide quick response times to problems and questions. The result is money and time saved for employees, the company, vendors, and your customers. Commercial transactions typically do not take place on extranets.

E-business models

A business model can be defined as the organisation of product, service and information flows, and the sources of revenues and benefits for suppliers and customers. An e-business model is the adaptation of an organisation's business model to the internet economy. A business model is adopted by an organisation as a framework for maximising value in this new economy. Through use of a business model, an organisation can identify where and how in its value chain it can create added value and profit.

E-business models utilise the benefits of electronic communications to achieve these value adding processes. The internet has increased the number and combination of possible business models that link consumers, public and private organisations, and government bodies.

	Government	**Business**	**Consumer**
Government	G2G (Co-ordination)	G2B (Information)	G2C (Information)
Business	B2G (Procurement)	**B2B (e-business)**	**B2C (e-commerce)**
Consumer	C2G (Tax compliance)	**C2B (Compare price)**	**C2C (Auctions)**

A framework for e-business markets

E-business models can be linked to e-business markets. Some may be operated across different markets, (e.g. e-auctions can be undertaken in B2C, B2B or C2C markets), whilst others are aimed at one specific e-business

sector (e-procurement in the B2B market). The e-business models relating to e-business markets can be summarised as:

- Business-to-Consumer (B2C): e-shops, e-malls, e-auctions, buyer aggregators, infomediaries, classifieds, portaling, manufacturer model, subscription;
- Business-to-Business (B2B): e-auctions, infomediaries, e-procurement, e-distribution, portaling, e-marketing, trading communities, third-party marketplaces, collaboration platforms, value chain integrators, value chain service providers, affiliates;
- Consumer-to-Consumer (C2C): e-auctions, virtual communities.

Types of e-business models

Brokerages- Brokers are intermediaries who bring together buyers and sellers for transactions purposes. There are several forms of brokerage models and they are operated across all e-business markets. In a simple buy/sell fulfilment model, revenue is gained by the brokerage through charging a fee for each transaction completed. In a market exchange model the broker charges the seller a fee based on the value of the sale. Brokerages take on many forms of e-business models.

E-shops- Websites are designed to promote the firm and the products or services it sells. However, most e-businesses have gone beyond the basic marketing and promoting of their products and services via their website to incorporate facilities for transactions. E-shops provide firms with a channel of communication to customers and provide valuable information about what products and services are sought by customers. E-shops can also be a first step to competing in global markets since the cost of entry is small and there are economies of scale to be gained from extending the market reach.

E-malls- An electronic mall is a collection of e-shops. Normally, the e-shops that comprise the e-mall have some commonality between them. This may include the types of products or services offered, the type of payment system used or a common market segment targeted. The benefits sought by firms operating in e-malls stem mainly from supporting activities such as advertising, additional services or supporting technologies. Customers benefit from the ease of access to a number of e-shops in the same business category.

E-auctions- The internet is an ideal medium for the exchange of information about products and services. Electronic auctions provide a channel of communication through which the bidding process for products and services can take place between competing buyers. E-businesses gain income from the technology platform that facilitates the bidding process, from a percentage of the transaction fees and from advertising on the website. Consumers benefit from ease of access to a large amount of information on a wide range of products, low transactions costs and efficiency in the transacting process.

Trading communities Sometimes referred to as a 'vertical web community', trading communities provide a source of information and communication that is necessary for e-business activity to take place in a particular industry. The participants in the industry form a trading community where specific information is accessible to members in buyers' guides, directories of products, lists of suppliers as

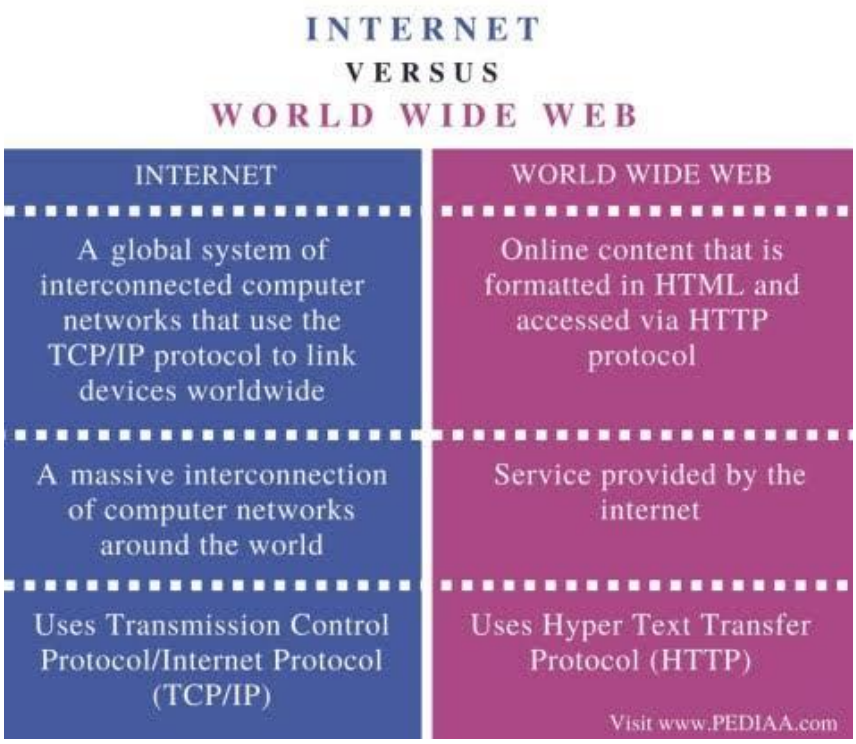
well as up-to-date industry news, articles and job listings. Members pay a subscription to the developers and operators of trading community sites.

Virtual communities- Customers are attracted to websites because of the added value they offer. Specialist websites appeal to customers with a particular interest. The shared interest of customers provides the basis for virtual communities to emerge. This is a community of customers who share a common interest and use the internet to communicate with each other. Amazon.com provides websites for the exchange of information on a wide range of subjects relating to their portfolio of products and services. Virtual communities benefit from network externalities whereby the more people who join and contribute to the community the greater the benefits that accrue, but without any additional cost to participants.

Classifieds- Online classified advertisements run on the same principles as newspaper classifieds. Content providers list items for sale by sellers and purchases wanted by buyers. Revenue is gained by listing charges and is collected whether or not a transaction takes place.

Internet and World Wide Web (WWW)

The World Wide Web is a system of public webpages that are connected and accessible through the internet. It is also known as WWW, W3, or the Web.
The World Wide Web was invented in 1989 by British computer scientist Tim Berners-Lee. In 1992, Berners-Lee and his team released a text-based web browser. However, it wasn't until the release of the Mosaic browser in 1993 that the WWW became widely accepted and used.



The World Wide Web has three components:

- Uniform Resource Locator (URL): A system for resources on the web
- HyperText Transfer Protocol (HTTP): Specifies communication between the browser and server
- Hyper Text Markup Language (HTML): Defines the structure, organization, and content of a webpage

Intranet

An intranet is a firm's network that is based on the model of the internet. It uses internet technologies for the purposes of electronic internal communications. Access is restricted to the internal organisation. An intranet can be used to disseminate useful information such as:

- Directory of staff and contact numbers;
- List of company rules and regulations;
- Information on company procedures and processes;
- Up-dated information on products, prices, availability and quality;
- Staff development information;
- Company news;
- Job vacancies.

An intranet is also useful for sharing information on customers, suppliers and partners within an organisation. Information that becomes available to one department may be useful to others and the intranet is a quick and efficient way of sharing such information. For example, if market research reveals that customers want a broader range of applications in a specific product, this information can be spread to research and development and manufacturing divisions using the intranet. This may result in better customer service and, ultimately, a competitive advantage. Intranets can also be used as a platform for business applications. The total cost of ownership (TCO) is the overall cost of managing information systems. Using an intranet can reduce the TCO compared to using multiple software programs that are more complex to manage, install and maintain.

Some of the other benefits of using an intranet include:

- The global reach of the medium;
- Low cost of access;
- Low cost of software;
- Low cost of hardware;
- Capability for being run on all platforms;
- Standardised file transfer, document creation and network protocol;
- Reduction in paper costs.

Extranet

An extranet is a network that links selected resources of a company with its customers, suppliers and partners, using the internet or private networks to communicate with other organisations' intranets. One of the key characteristics of the modern e-business environment is the high level of collaboration that exists between different firms who can gain mutual benefits from sharing knowledge.

An extranet is a way of facilitating partner inclusion in information flows from an organisation. The information made available may vary in depth and richness according to the nature of the relationship between partner organisations. It may simply involve giving access to information on prices, availability of products, specifications, delivery times, etc.

One of the most common uses of extranets is to enhance efficiency in supply chain management. An extranet can be used to communicate with all parties along the supply chain to ensure that inputs are transformed into outputs and delivered to customers in the most costeffective and efficient way. Very often a firm will have to link their intranet with another firm's intranet via an extranet to integrate business applications.

Security in e-business

Security in e-business and e-commerce typically entails setting in place systems that ensure: g Authenticity; g Data integrity; g Confidentiality; g Availability. Authenticity ensures that the parties to a transaction are who they say they are. Digital certificates, or keys, consist of encrypted numbers that are used to identify users. Data integrity ensures that data has not been modified or altered or interfered with during transmission over the internet. Encryption technology facilitates secure communication in open systems and ensures that only the intended recipient can view the material. Secure systems also ensure continuity and accessibility to internet services.

Other forms of security are designed to support the integrity of the application architecture and include: Authorisation that ensures only proper users are permitted entry;

- Non-repudiation that ensures proof of receipt of a communication;
- Digital time stamp that ensures the integrity of the message transmission;
- Digital signature that ensures the integrity of senders.

Electronic Payment System

An electronic payment system (e-payment) is a platform that allows individuals and businesses to make online transactions electronically. It can be used to pay for goods and services without the use of cash or cheques.

Examples of Electronic Payment Systems:

- Credit card
- Debit card
- Digital wallets
- Bank transfers
- ACH payments
- Cryptocurrencies
- Electronic funds transfer
- Payment cards
- Remittance
- Adhar card -(**AePS**)-Aadhaar Enabled Payment System
- Mobile payment
- Contactless payments
- Direct debit

- Electronic cheques
- Mobile wallets
- Net Banking
- Payment gateway
- Smart card
- Cash
- Electronic payment systems
- Entering payment information
- UPI

Impact of web on strategic management

The internet can impact strategic management in several ways, including:

- **Online platforms**- Online platforms can increase the size of a company's customer base, which can lead to better strategic management.

- **Brand awareness**- The internet can help establish brands through online channels. Companies can use the internet to build new brands through competitive e-commerce initiatives.

- **Customer behaviour**-Internet commerce allows companies to collect knowledge of their customers' buying behaviour. This can help companies offer more tailored offerings, better service, and greater purchasing convenience.

- **Big data analytics-** Big data analytics can help companies analyse large datasets to identify patterns, trends, and correlations. This can provide valuable insights for strategic decision-making, product development, and marketing campaigns.

- **Electronic commerce projects**-Electronic commerce projects can be intertwined with a firm's strategic plans. Some strategic effects at the business-unit level include value-added, differentiation, cost leadership, focus, and business growth strategies.

- **Organizational performance-**Electronic commerce can help companies improve their organizational performance by increasing profitability, gaining market share, improving customer service, and delivering products faster.

Web-enabled business management systems (WBMS)

Web-enabled business management systems (WBMS) are web-based software that can manage or run a website for business needs. WBMS can help business owners run their website with a business mindset.

Web-based management systems are usually developed using HTML, CSS, and JavaScript. These platforms create an interface that can exchange data with an external database through the internet.

Web-based systems can provide access to real-time information. They can replace paper reports with online reports and digital dashboards, which can improve the quality and speed of decision-making.

Web-enabled systems also offer a good way of accessing centralized data securely. Servers are only accessed directly by the person or team managing them.

In web environment the business initiative is passed in the hands of customer. The customer has access to information on sources of product and services, their availability and price to pay. These are very basic for deciding the purchase of products and services. With internet and variety of E-commerce tools, it is possible to execute a secured purchase transaction where selection of the product is possible, payment to genuine parties is ensured and delivery of the item can be tracked till item is delivered to the doorsteps. The process of ordering, payment and 173 delivery is very fast calling upon management to make sea change in existing conventional and traditional process of business management.

MIS in Web Environment

In internet and web environment the traditional role of MIS as a system to generate information for decision making and to meet reporting requirements of the organization has remain unchanged. But in this role, one more dimension is added due to business becoming customer centric. The business in internet and web has changed from push to customer – to pull from the customer. One more function is added into battery of functions, namely customer management or more precisely customer relations management. In information driven business, employees (knowledge workers) become assets and in customer centric business customers become the assets. The business management now concentrates on creating loyal customers and builds strategies to retain them. It is well known that new customers bring revenue and loyal customers bring profit. A new class of systems, called customer relations management (CRM) is now developed to manage customer relations.

The standard packages like Sibel, Clarify are widely used. Ultimately MIS is built with customer focus to improve the service based on following applications.

- Order processing management
- Real times services management
- Product configuration management
- Sales force management
- Post sales service management.

Modules 6

Emerging Exponential Technologies in Business Decision Making. Introduction to Emerging Technologies and its types. Introduction to AI and its Applications in Agriculture, Health, Business, Education. Introduction to IOT and its Applications at Smart home; Smart grid; Smart city; Wearable devices; Smart farming. Introduction to AR, VR and MR, Application of AR systems (education, medical, entertainment).

Introduction to Emerging Technologies

Although the word "emerging technology" is typically used to refer to new technologies, it can also refer to the ongoing evolution of current technologies. When used in contexts such as media, business, research, or education, the meaning of the term can change slightly. The phrase is often used to describe technologies that are in development or that should be ready in the next five to ten years. It is often reserved for innovations that have the potential to have a substantial impact on society or the economy.

Exponential Technologies- Technologies that exhibit exponential expansion in terms of capacity and performance within short time spans, along with decreasing costs over time, are referred to as exponential technologies. As a result, over time, their price-performance ratio approaches a point at which both large-scale use and business problem-solving applications are made possible. They have the power to totally alter how companies operate and accomplish their objectives, but they can also cause so much disruption since they can quickly render older technology outdated.

List of some currently available emerged technologies

• **Artificial Intelligence-** Artificial intelligence is the intelligence of machines or software, as opposed to the intelligence of living beings, primarily of humans. It is a field of study in computer science that develops and studies intelligent machines. Such machines may be called AIs.

• **Blockchain**- Blockchain is a type of database that stores data in blocks that are linked together in a chain. It's a decentralized ledger of transactions across a peer-to-peer network.

• **Augmented Reality and Virtual Reality-** AR adds digital elements to the real world in real time. AR users can control their presence in the real world and use sensors to understand the world around them. AR can be accessed with a smartphone and uses higher bandwidth than VR. AR can enhance both the real and virtual world.
VR is a completely immersive experience that replaces the real world with a simulated one. VR users are controlled by the system and move in a completely fictional world. VR requires a headset device, hardware, software, and often headphones. VR primarily enhances a fictional reality, which is primarily intended to enhance games.

• **Cloud Computing-** Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. Large clouds often have functions distributed over multiple locations, each of which is a data centre.

• **Angular and React**- Angular and React are both JavaScript frameworks used to build frontend projects. They both have component-based architecture and are used to develop the frontend of mobile or web applications.

• **DevOps**- DevOps is a methodology in the software development and IT industry. Used as a set of practices and tools, DevOps integrates and automates the work of software development and IT operations as a means for improving and shortening the systems.

• **Internet of Things (IoT)**- The Internet of things describes devices with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. The Internet of things encompasses electronics, communication, and computer science engineering.

• **Intelligent Apps (I-Apps)**- I-Apps are applications which use real-time and historical user data to make relevant and useful user predictions and deliver adaptive and personalized user experiences.

• **Big Data**- Big data primarily refers to data sets that are too large or complex to be dealt with by traditional data-processing application software. Data with many entries offer greater statistical power, while data with higher complexity may lead to a higher false discovery rate.

• **Robotic Processor Automation (RPA)**- Robotic process automation is a form of business process automation that is based on software robots or artificial intelligence agents. It is sometimes referred to as software robotics.

Introduction to AI

Artificial Intelligence is composed of two words Artificial and Intelligence.

Artificial defines "man-made," and intelligence defines "thinking power", or "the ability to learn and solve problems" hence Artificial Intelligence means "a man-made thinking power." So, we can define Artificial Intelligence (AI) as the branch of computer science by which we can create intelligent machines which can behave like a human, think like humans, and able to make decisions.

Intelligence, as we know, is the ability to acquire and apply knowledge. Knowledge is the information acquired through experience. Experience is the knowledge gained through exposure (training). Summing the terms up, we get artificial intelligence as the "copy of something natural (i.e., human beings) 'WHO' is capable of acquiring and applying the information it has gained through exposure."

Applications of AI

Following are some sectors which have the application of Artificial Intelligence:

1. AI in agriculture

➢ Agriculture is an area that requires various resources, labour, money, and time for the best result. Now a day's agriculture is becoming digital, and AI is emerging in this field. Agriculture is applying AI as agriculture robotics, solid and crop monitoring, predictive analysis. AI in agriculture can be very helpful for farmers.

2. AI in Healthcare

➢ In the last, five to ten years, AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry.

➢ Healthcare Industries are applying AI to make a better and faster diagnosis than humans. AI can help doctors with diagnoses and can inform when patients are worsening so that medical help can reach the patient before hospitalization.

3. AI in education:

➢ AI can automate grading so that the tutor can have more time to teach. AI chatbot can communicate with students as a teaching assistant.

➢ AI in the future can be work as a personal virtual tutor for students, which will be accessible easily at any time and any place.

Introduction to IOT

The description of the Internet of Things is related to different definitions used by several groups for promoting the particular concept in the whole world.

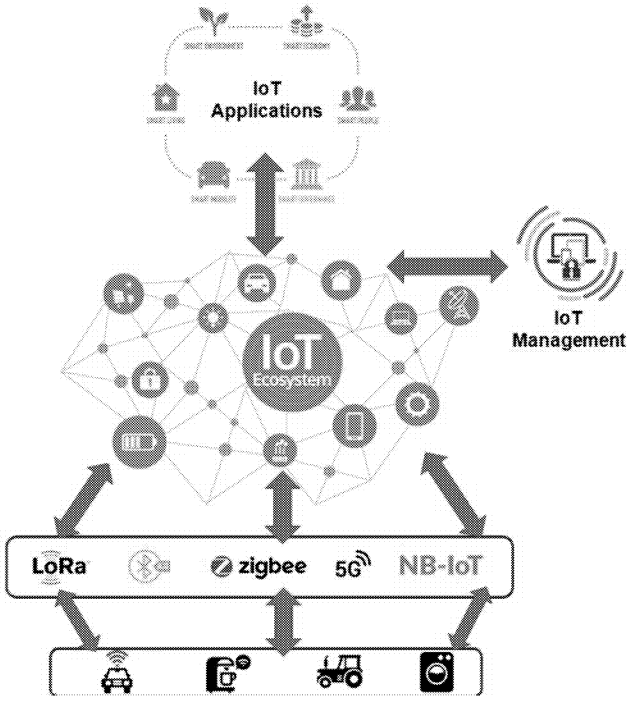
➢ According to the Internet Architecture Board's (IAB) definition, IoT is the networking of smart objects, meaning a huge number of devices intelligently communicating in the presence of internet protocol that cannot be directly operated by human beings but exist as components in buildings, vehicles or the environment.

➢ According to the Internet Engineering Task Force (IETF) organization's definition, IoT is the networking of smart objects in which smart objects have some constraints such as limited bandwidth, power, and processing accessibility for achieving interoperability among smart objects.

➢The term Internet of Things (IoT) according to the 2020 conceptual framework is expressed through a simple formula such as:

IoT= Services+ Data+ Networks + Sensors

Simply stated, the Internet of Things consists of any device with an on/off switch connected to the Internet. This includes almost anything you can think of, ranging from cell phones to building maintenance to the jet engine of an airplane. The IoT consists of a gigantic network of internet connected "things" and devices. Ring, a doorbell that links to your smartphone, provides an excellent example of a recent addition to the Internet of Things.



Applications of IoT

The versatile nature of IoT makes it an attractive option for so many businesses, organizations, and government branches, that it doesn't make sense to ignore it. Here's a sample of various industries, and how IoT can be best applied.

• **Agriculture** - For indoor planting, IoT makes monitoring and management of micro climate conditions a reality, which in turn increases production. For outside planting, devices using IoT technology can sense soil moisture and nutrients, in conjunction with weather data, better control smart irrigation and fertilizer systems. If the sprinkler systems dispense water only when needed, for example, this prevents wasting a precious resource.

• **Consumer Use** - For private citizens, IoT devices in the form of wearables and smart homes make life easier. Wearables cover accessories such as Fitbit, smartphones, Apple watches, health monitors, to name a few. These devices improve entertainment, network connectivity, health, and fitness. Smart homes take care of things like activating environmental controls so that your house is at peak comfort when you come home. Dinner that requires either an oven or a crockpot can be started remotely, so the food is ready when you arrive. Security is made more accessible as well, with the consumer having the ability to control appliances and lights remotely, as well as activating a smart lock to allow the appropriate people to enter the house even if they don't have a key.

• **Healthcare** - First and foremost, wearable IoT devices let hospitals monitor their patients' health at home, thereby reducing hospital stays while still providing up to the minute real time information that could save lives. In hospitals, smart beds keep the staff informed as to the availability, thereby cutting wait time for free space. Putting IoT sensors on critical equipment means fewer breakdowns and increased reliability, which can mean the difference between life and death. Elderly care becomes significantly more comfortable with IoT. In addition to the above-mentioned real-time home monitoring, sensors can also determine if a patient has fallen or is suffering a heart attack.

• **Insurance** - Even the insurance industry can benefit from the IoT revolution. Insurance companies can offer their policyholders discounts for IoT wearables such as Fitbit. By employing fitness tracking, the insurer can offer customized policies and encourage healthier habits, which in the long run benefits everyone, insurer, and customer alike.

• **Manufacturing** - The world of manufacturing and industrial automation is another big winner in the IoT sweepstakes. RFID and GPS technology can help a manufacturer track a product from its start on the factory floor to its placement in the destination store, the whole supply chain from start to finish. These sensors can gather information on travel time, product condition, and environmental conditions that the product was subjected to. Sensors attached to factory equipment can help identify bottlenecks in the production line, thereby reducing lost time and waste. Other sensors mounted on those same machines can also track the performance of the machine, predicting when the unit will require maintenance, thereby preventing costly breakdowns.

• **Retail** - IoT technology has a lot to offer the world of retail. Online and in-store shopping sales figures can control warehouse automation and robotics, information gleaned from IoT sensors. Much of this relies on RFIDs, which are already in heavy use worldwide. Mall locations are iffy things; business tends to fluctuate, and the advent of online shopping has driven down the demand for brick-and-mortar establishments. However, IoT can help analyse mall traffic so that stores located in malls can make the necessary adjustments that enhance the customer's shopping experience while reducing

overhead. Speaking of customer engagement, IoT helps retailers target customers based on past purchases.

IoT Based Smart Home

Smart Home initiative allows subscribers to remotely manage and monitor different home devices from anywhere via smartphones or over the web with no physical distance limitations. With the ongoing development of mass-deployed broadband internet connectivity and wireless technology, the concept of a Smart Home has become a reality where all devices are integrated and interconnected via the wireless network. These "smart" devices have the potential to share information with each other given the permanent availability to access the broadband internet connection.

• **Remote Control Appliances:** Switching on and off remotely appliances to avoid accidents and save energy.

• **Weather**: Displays outdoor weather conditions such as humidity, temperature, pressure, wind speed and rain levels with the ability to transmit data over long distances.

• **Smart Home Appliances**: Refrigerators with LCD screen telling what's inside, food that's about to expire, ingredients you need to buy and with all the information available on a smartphone app. washing machines allowing you to monitor the laundry remotely, and. The kitchen ranges with the interface to a Smartphone app allowing remotely adjustable temperature control and monitoring the oven's self-cleaning feature.

• **Safety Monitoring**: cameras, and home alarm systems making people feel safe in their daily life at home. • Intrusion Detection Systems: Detection of window and door openings and violations to prevent intruders.

• **Energy and Water Use:** Energy and water supply consumption monitoring to obtain advice on how to save cost and resources, & many more.

IoT Based Smart City

In cities, the development of smart grids, data analytics, and autonomous vehicles will provide an intelligent platform to deliver innovations in energy management, traffic management, and security, sharing the benefits of this technology throughout society.

• **Structural Health**: Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.

• **Lightning**: intelligent and weather adaptive lighting in street lights.

• **Safety:** Digital video monitoring, fire control management, public announcement systems.

• **Transportation:** Smart Roads and Intelligent High-ways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

• **Smart Parking**: Real-time monitoring of parking spaces available in the city making residents able to identify and reserve the closest available spaces,

• **Waste Management**: Detection of rubbish levels in containers to optimize the trash collection routes. Garbage cans and recycle bins with RFID tags allow the sanitation staff to see when garbage has been put out.

IoT Based Smart Farming.

• **Green Houses**: Control micro-climate conditions to maximize the production of fruits and vegetables and its quality. • Compost: Control of humidity and temperature levels in alfalfa, hay, straw, etc. to prevent fungus and other microbial contaminants.

• **Animal Farming/Tracking**: Location and identification of animals grazing in open pastures or location in big stables, Study of ventilation and air quality in farms and detection of harmful gases from excrements.

• **Offspring Care**: Control of growing conditions of the offspring in animal farms to ensure its survival and health.

• **Field Monitoring:** Reducing spoilage and crop waste with better monitoring, accurate ongoing data obtaining, and management of the agriculture fields, including better control of fertilizing, electricity and watering.

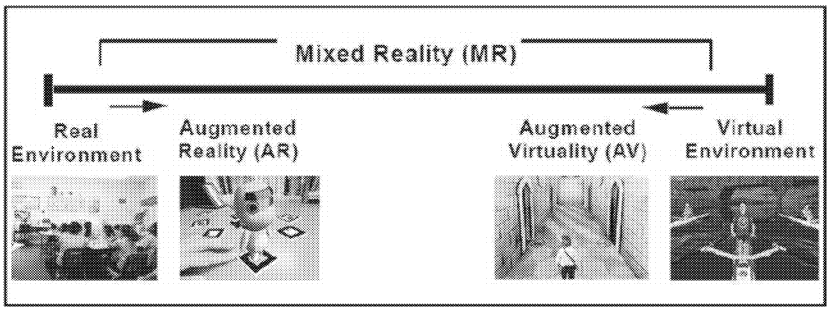
Introduction to AR

Augmented reality (AR) is a form of emerging technology that allows users to overlay computer generated content in the real world. AR refers to a live view of a physical real-world environment whose elements are merged with augmented computer-generated images creating a mixed reality. The augmentation is typically done in real-time and in semantic context with environmental elements. By using the latest AR techniques and technologies, the information about the surrounding real world becomes interactive and digitally usable. Through this augmented vision, a user can digitally interact with and adjust information about their surrounding environment.

Augmented Reality (AR) as a real-time direct or indirect view of a physical real-world environment that has been enhanced/augmented by adding virtual computer-generated information to it.

Virtual reality (VR), Augmented Reality (AR) vs Mixed reality (MR)

With constant development in computer vision and the exponential advancement of computer processing power, virtual reality (VR), augmented reality (AR), and mixed reality (MR) technology is becoming more and more prominent. With some overlap in the applications and functions of these emerging technologies, sometimes these terms get confused or are used incorrectly. The main differences between them are explained below:



Virtual Reality (VR)

VR is fully immersive, which tricks your senses into thinking you're in a different environment or world apart from the real world. Using a head-mounted display (HMD) or headset, you'll experience a computer-generated world of imagery and sounds in which you can manipulate objects and move around using haptic controllers while tethered to a console or PC. It is also called a computer-simulated reality. It refers to computer technologies using reality headsets to generate realistic sounds, images and other sensations that replicate a real environment or create an imaginary world. Advanced VR environment will engage all five senses (taste, sight, smell, touch, sound), but it is important to say that this is not always possible.

Most VR headsets are connected to a computer (Oculus Rift) or a gaming console (PlayStation VR) but there are standalone devices (Google Cardboard is among the most popular) as well. Most standalone VR headsets work in combination with smartphones – you insert a smartphone, wear a headset, and immerse in the virtual reality.

Augmented Reality (AR)

In augmented reality, users see and interact with the real world while digital content is added to it. If you own a modern smartphone, you can easily download an AR app and try this technology.

There's a different way to experience augmented reality, though – with special AR headsets, such as Google Glass, where digital content is displayed on a tiny screen in front of a user's eye. AR adds digital elements to a live view often by using the camera on a smartphone. Examples of augmented reality experiences include Snapchat lenses and the game Pokémon Go. Augmented Reality (AR) is a live, direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data.

Mixed Reality (MR)

Mixed Reality (MR), sometimes referred to as hybrid reality, is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real-time. It means placing new imagery within a real space in such a way that the new imagery is able to interact, to an extent, with what is real in the physical world we know.

For example, with MR, you can play a virtual video game, grab your real-world water bottle, and smack an imaginary character from the game with the bottle. Imagination and reality have never been so intermingled.

The key characteristic of MR is that the synthetic content and the real-world content are able to react to each other in real-time.

In mixed reality, you interact with and manipulate both physical and virtual items and environments, using next-generation sensing and imaging technologies. MR allows you to see and immerse yourself in the world around you even as you interact with a virtual environment using your own hands—all without ever removing your headset.

Applications of AR Systems

Technology is ever-changing and ever-growing. One of the newest developing technologies is augmented reality (AR), which can be applied to many different disciplines such as education, medicine, entertainment, military, etc.

AR In Education

Augmented reality allows flexibility in use that is attractive to education. AR technology can be utilized through a variety of mediums including desktops, mobile devices, and smartphones. The technology is portable and adaptable to a variety of scenarios. AR can be used to enhance content and instruction within the traditional classroom, supplement instruction in the special education classroom, extend content into the world outside the classroom, and be combined with other technologies to enrich their individual applications. More importantly, the following reasons for using augmented reality in education:

• **Affordable learning materials** - posters, digital illustrations, physical models, prototypes are very expensive and it's impossible for schools to find enough money to purchase all the supplementary materials they would like to. Using AR technology allows for avoiding investments in physical materials. Besides, students can get access to learning materials and interact with them anytime.

• **Interactive lessons** - when AR technology is used in classrooms, students can view models on their own smartphones and get a better idea of the concepts they are studying. That increases engagements and reinforces the learning.

• **Higher engagement** - when teachers integrate augmented reality into their lectures, they attract the attention of their students and make lessons more effective. When students are interested, it is much easier to make them work more productively.

• **Higher retention** - using the AR app, students can get access to augmented models that represent any real objects from a famous monument or work of art to a molecule. Besides, students can get access to a website with specific information. When learning with AR technology, students use different senses and retain more knowledge for a long time.

• **Boost intellectual curiosity** - augmented reality makes students more excited about learning certain subjects. Modern students were born in a digital era so they will always be excited with innovative technologies that can help them learn new ideas and develop their critical thinking skills.

AR In Medicine

Augmented reality is one of the current technologies changing all industries, including healthcare and medical education. The purpose of any invention and technology is to simplify our life. Augmented reality has the potential to play a big role in improving the healthcare industry. Only a few years since the first implementations of augmented reality in medicine, it has already filled an important place in doctors' and nurses' routine, as well as patients' lives. This new technology is enhancing medicine and healthcare towards more safety and efficiency. For now, augmented reality has already made significant changes in the following medical areas:

• surgery (minimally invasive surgery)
• education of future doctors
• diagnostics
• AR tools may also aid to detect the signs of depression and other mental illnesses by reading from facial expressions, voice tones, and physical gestures.

Generally, AR provides the following benefits to patients and healthcare workers:
• Reduce the risks associated with minimally invasive surgery.
• Better informed decisions about the right treatment and illness prevention.
• Make procedures more tolerable.
• Better aftercare
• Medical training and education.
• Assistance in medical procedures and routine tasks.

AR In Entertainment

Augmented reality can be used in various "entertainment" industries as entertainment covers quite a number of different industries – music, movies, live shows, games – and all of them can benefit from using augmented reality.

• **AR in games** - the AR games were praised for increasing physical activity in people – you actually have to move around to find your target, for example, Pokémon. At the same time, there are complaints that players could cause various incidents and accidents being too engrossed in the game. In any case, Pokémon GO has rightfully earned its popularity and opened the world of AR games to us.

• **AR in music** - music is not only about listening to favorite tracks and putting together playlists. When we like a piece, we often want to find out more about its background: the performers' bios, the lyrics of the song, the making of the recording or the music video. Augmented reality can do all that and much more providing complete information on the track or its performer. Augmented reality can enhance live performances by illustrating the story told by a track or displaying the way it was created by the band.

• **AR on TV** - this may seem a bit far-fetched, as television already shows a virtual world, thus adding augmented reality will raise it to the second power. However, some experiments of fusing augmented reality on TV are already being made with the promise of future enhancements. One way of integrating augmented reality in television is adding supplementary information to what is going on the TV screen – such as match scores, betting options, and the like.

• **AR in eSports** - recently, the industry of eSports has been gaining popularity in all parts of the globe. Competitive online gaming has become as fascinating as real sports, and the technology is following it closely with new solutions and unusual implementations. Augmented reality turns eSports shows into interactive experiences allowing the watchers to become participants.

• **AR in the theatre** - in this sector, augmented reality can serve not only for entertainment purposes but also for the purposes of accessibility. The possibility to overlay virtual objects over the real environment can be used, for example, for subtitling in various theatre shows. Now, many theatres use LED displays either to provide subtitles for translation or to assist hearing-impaired visitors. However, LED equipment is not available in each theatre and even when it is, it can distract the viewers from the show.