MEASI
Institute *of* Management

534C3A

INFORMATION SYSTEMS FOR BUSINESS

COURSE MATERIAL

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INFORMATION SYSTEMS FOR BUSINESS

VISION & MISSION STATEMENTS

VISION

To emerge as the most preferred Business School with Global recognition by producing most competent ethical managers, entrepreneurs and researchers through quality education.

MISSION;

- Provide a pedagogy that blends academic rigor and experiential learning. (PEO1)
- Inculcate an entrepreneurial mindset through curated activities. (PEO2)
- Establish a conducive environment for research. (PEO3)
- Foster a culture of innovation and collaboration to progress in a dynamic business landscape. (PEO2, PEO4)
- Promote humanistic values to produce socially responsible leaders. (PEO5)

Program Educational Objectives (PEOs)

PEO 1 – Employability:
To develop students with industry specific knowledge & skills to meet the industry requirements and also join public sector undertaking through competitive examinations.

PEO 2 - Entrepreneur:
To create effective business service owners, with a growth mindset by enhancing their critical thinking, problem solving and decision-making skills.

PEO3 – Research and Development:
To instil and grow a mindset that focusses efforts towards inculcating and encouraging the students in the field research and development.

PEO 4 – Contribution to Business World:
To produce ethical and innovative business professionals to enhance growth of the business world.

PEO 5 – Contribution to the Society:
To work and contribute towards holistic development of society by producing competent MBA professionals.

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LIST OF PROGRAM OUTCOMES

Regulation	2022-2023
Batch	2022-2024
PO1	**Problem Solving Skill:** Application of tools and techniques relevant to management theories and practices in analysing & solving business problems
PO2	**Decision Making Skill:** Fostering analytical and critical thinking abilities for data-based decision making
PO3	**Ethical Value:** Ability to develop value-based leadership attributes.
PO4	**Communication Skill:** Ability to understand, analyse and effectively communicate global, economic, legal and ethical aspects of business
PO5	**Individual and Team Leadership Skill:** Ability to be self-motivated in leading and driving a team towards achievement of organisational goals and contributing effectively to establish industrial harmony
PO6	**Employability Skill:** Foster and enhance employability skills through relevant industry subject knowledge
PO7	**Entrepreneurial Skill:** Equipped with skills and competencies to become a global entrepreneur
PO8	**Contribution to Society:** Strive towards becoming a global influencer and motivating future generations towards building a legacy that contributes to overall growth of humankind

Program Specific Outcomes (PSO)

PSO1: Finance: The students should demonstrate proficiency in analysing financial statements, evaluating investment opportunities and making financial decision to maximize shareholders' value.

PSO2: Marketing: Students should be able to create a comprehensive marketing plan that integrates effective communication strategies, leading to customer success and the accomplishment of marketing objectives.

PSO3: Logistics: Students will acquire knowledge of inventory management for domestic and global supply chains, thereby developing problem solving skills in logistics to optimise supply chain efficiency

PSO4: Business Analytics: The students should be able to analyse data, communicate insights, take data-driven decisions and solve business problems efficiency

Course Objectives

C1 - To enable students to understand the fundamentals of information system and its role of information in managerial decision making

C2 - To throw light on fundamentals of information systems like TPS, DSS, and EIS. C3 - To manage system applications and data to best support functional areas of business

C4 To provide insights in securely managing database and information using SDLC process

C5 - To elucidate the need and importance of ERP, its selection and implementation in the workplace.

Syllabus

Unit I

Introduction to information system-The management, structure and activities-Information needs and sources-Types of management decisions and information need. System classification Elements of system, input, output, process and feedback.

Unit II

Transaction Processing information system, Office Automation System (OAS) - Knowledge workers System(KWS); MIS; Information system for managers, Intelligence information system –Decision support system-Executive information systems.

Unit III

Functional Management Information System: Production / Operations Information system, Marketing Information Systems, Accounting Information

system, Financial Information system, Human resource Information system.

Unit IV

System Analysis and Design: The work of a system analyst- SDLC-System design – AGILE Model – Waterfall Model – Spiral Model – Iterative and Incremental Model - RAD Model - Requirement analysis-Data flow diagram, relationship diagram, design- Implementation-Evaluation and maintenance of MIS, Database System: Overview of Database- Components-advantages and disadvantages of database; Data Warehousing and Data Mining; Business Intelligence; Artificial Intelligence; Expert System; Big Data; Cyber Safety and Security- Cryptography; RSA Model of Encryption; Data Science - Block Chain Technology; E-commerce and E-Business models; IOT - RFID.

Unit V

Enterprise Resource Planning (ERP) System, Benefits of the ERP, ERP how different from conventional packages , Need for ERP , ERP components , Selection of ERP Package, ERP implementation, Customer Relationship management. Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, various channels of information and MIS; Information system audit and control – E-Governance.

Course Outcomes

C01 Learn the importance of data and information in managerial decision making. (PO1, PO2, PO6)

C02 Possess on the various IS and the its relevance to organisational environment

(PO3, PO5, PO8)

C03 Understand the application of IS on the various functions like Accounting, Finance, Marketing, Operations and HR (PO1, PO3, PO5, PO8)

C04 Identify opportunities in implementing a new database system with the help of SDLC process. (PO1, PO2, PO6, PO7)

C05 Be exposed on the importance of selecting the appropriate ERP and its implementation. (PO1, PO2, PO5, PO8)

Reading List

- Information Systems for Business and Beyond – opentextbooks.site.
- Management Information Systems: Managing the Digital firm www.textbooks.com
- Information systems Journal – Wiley Online Library.
- Information Systems management in Business and development organisations – Harekrishna Misra – PHI Learning.

Reference Books

- Azam, M., Management Information System, McGrawHill Education, 2012
- Laudon, K., Laudon, J. and Dass, R., Management Information Systems – Managing the Digital Firm, 11th Edition, Pearson, 2010.
- Murdick, R.G., Ross, J.E. and Claggett, J.R., Information Systems for Modern Management, 3rd Edition, PHI, 2011.

- O'Brien, J.A., Morakas, G.M. and Behl, R., Management Information Systems, 9th Edition, Tata McGraw-Hill Education, 2009.
- Saunders, C.S. and Pearson, K.E., Managing and Using Information Systems, 3rd Edition, Wiley India Pvt. Ltd., 2009.
- Stair, R. and Reynolds, G., Information Systems, 10th Edition, Cengage Learning,2012.

E-Resources

- http://ebooks.lpude.in/management/mba/term_4/DMGT505_management_in formation_system.pdf
- https://www.sigc.edu/department/mba/studymet/ManagmentInformationSystem.pdf
- http://164.100.133.129:81/econtent/Uploads/Management_Information_Syst em.pdf
- http://www.himpub.com/documents/Chapter963.pdf
- http://dlc.ui.edu.ng/oer.dlc.ui.edu.ng/app/upload/CIS%20302_1507198171.pdf

Additional Reference Books

- Post, Gerald V., Management Information Systems: Solving Business Problems with Information Technology, Third edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
- D P Goya, Management Information Systems – Managerial perspectives, Fourth edition, Vikas publishing house, 2014
- Scott, George M., Principles of Management Information Systems,

McGraw- Hill Book Company, Singapore, 2003.

- Shrivastava - Fundamental of Computer& Information Systems (Wiley Dreamtech)
- Leon - Fundamentals of Information Technology, (Vikas)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	3	2				3		
CO 2			3		3			3
CO 3	2		3		2			3
CO 4	3	3				2	3	
CO 5	3	2			2			3

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COURSE MATERIAL

UNIT I

Introduction to information system-The management, structure and activities-Information needs and sources-Types of management decisions and information need. System classification Elements of system, input, output, process and feedback

1. INFORMATION AND THE MIS CONCEPT

- Information is a set of classified and interpreted data used in decision making. It has also been defined as 'some tangible or intangible entity which serves to reduce uncertainty about future state or events
- A management information system (MIS) is 'an integrated user-machine system for providing information to support operations, management and decision making functions in an organization. The system utilizes computers, manual procedures, models for analysis, planning, control and decision making, and a database'
- MIS facilitates managerial functioning. Management information is an important input at every level in the organization for decision making, planning, organizing, implementing, and monitoring and controlling.
- MIS is valuable because of its content, form and timing of presentation. In the context of different levels of decision making, information can be described as:
    - Source,
    - Data,
    - Inferences and predictions drawn from data,

- Value and choices (evaluation of inferences with regard to the objectives and then choosing a course of action), and
- Action which involves course of action.

The MIS concept comprises three interrelated and interdependent key elements:

1. management,
2. system and
3. information

1.1 INFORMATION SYSTEM

An information system is a set of organized procedures that, when executed, provides information to perform decision making in an enterprise

Components of an **Information** System

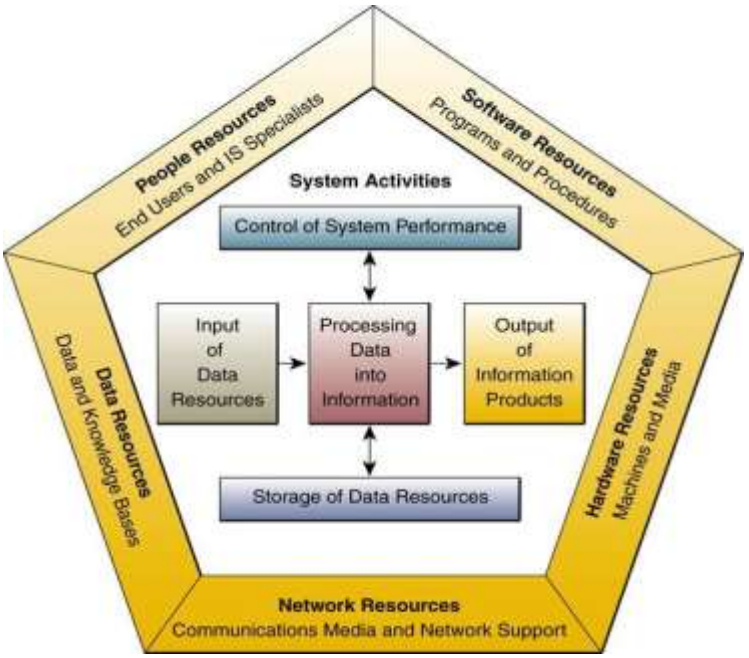


Fig 1.1: Component of Information Systems

- People Resources
  - End Users
  - IS Specialists
- Hardware Resources
  - Computer systems
  - Peripherals
- Software Resources
  - System software
  - Application software
  - Procedures
- Data Resources
  - Data versus Information
- Network Resources
  - Communication media
  - Network support

Data	Input that the system takes to produce information.
Hardware	A computer and its peripheral equipment: input, output, and storage devices. Hardware also includes data communication equipment.
Software	Sets of instructions that tell the computer how to take data in, how to process it, how to display information, and how to store data and information.
Telecommunications	Hardware and software that facilitate fast transmission and reception of text, pictures, sound, and animation in the form of electronic data.
People	Information systems professionals and users who analyze organizational information needs, design and construct information systems, write computer programs, operate the hardware, and maintain software.
Procedures	Rules for achieving optimal and secure operations in data processing. Procedures include priorities in running different applications on the computer and security measures.

Fig 1.2: Components of an information system

2 . ORGANIZATIONAL STRUCTURE AND MIS

MIS has been described as a pyramidal structure, with four levels of information resources. The levels of information would depend upon the organizational structure. The top level supports strategic planning and policy making at the highest level of management. The second level of information resources aid tactical planning and decision making for management control. The third level supports day-to-day operations and control. The bottom level consists of information for transaction processing. It then follows that since decision making is specific to hierarchical levels in an organization, the information requirements at each level vary accordingly.

2.1 Organizational structural implications for information systems

Concept	Implications for Information Systems
Hierarchy of authority	A tall hierarchy with narrow span of control requires more formal control information at upper levels than a flat hierarchy with wide span of control.
Specialization	Information system applications have to fit the specialization of the organization.
Formalization	Information systems are a major method for increasing formalization.
Centralization	Information systems can be designed to suit any level of centralization.

Modification of basic model	Information systems can be designed to support product or service organizations, project organizations, lateral relations and matrix organizations.
Information model of organization	Organizational mechanisms reduce the need for information processing and communication. Vertical information systems are an alternative to lateral relations. Information systems are used to coordinate lateral activities.
Organizational culture	Organizational culture affects information requirements and system acceptance.
Organizational power	Organizational power affects organizational behaviour during information system planning, resource allocation and implementation. Computer systems can be an instrument of organizational power through access to information.
Organizational growth	The information system may need to change at different stages of growth.
Goal displacement	When identifying goals during requirements determination, care should be taken to avoid displaced goals.
Organizational learning	Suggests need for information system design for efficiency measures to promote single loop learning and effectiveness measures for double loop learning.

Project model of organizational change	Describes general concepts for managing change with information system projects.
Case for stable system	Establish control over frequency of information system changes.
Systems that promote organizational change	Reporting critical change variables, organizational change, or relationships, and use of multiple channels in a semi-confusing system may be useful for promoting responses to a changing environment.
Organizations as socio-technical systems	Provides approach to requirements determination and job design when both social and technical considerations are involved.

3. INFORMATION NEED

Information

Information is processed data and takes the meaning as a tangible or intangible entity that reduces uncertainty and triggers action.

Data Processing Information

INFORMATION NEED

1) To reduce uncertainty
2) As a means of communication
3) To improve accuracy
4) To complete the task effectively
5) To simplify complications

The factors that determine the information need are

1) The Environment

2) The Size of the Organisation
3) The functional Area
4) The Managerial Level

3.1 Sources of Information

1) Forms and Documents in the organisation
2) User system
3) Procedure manuals
4) Primary data collection methods like market survey, census, opinion polls, etc.,
5) Government publications and other Industry publications
6) Research studies
7) Various reports available in the organisation
8) Ledgers, Payrolls, Sales reports
9) Internets
10) Journals, Magazines, Newspapers.

3.2 INFORMATION FLOW

Information flow along the various functions in an organisation

- Purchase
- Production
- Accounting
- Personnel
- Marketing
- Management and Administration

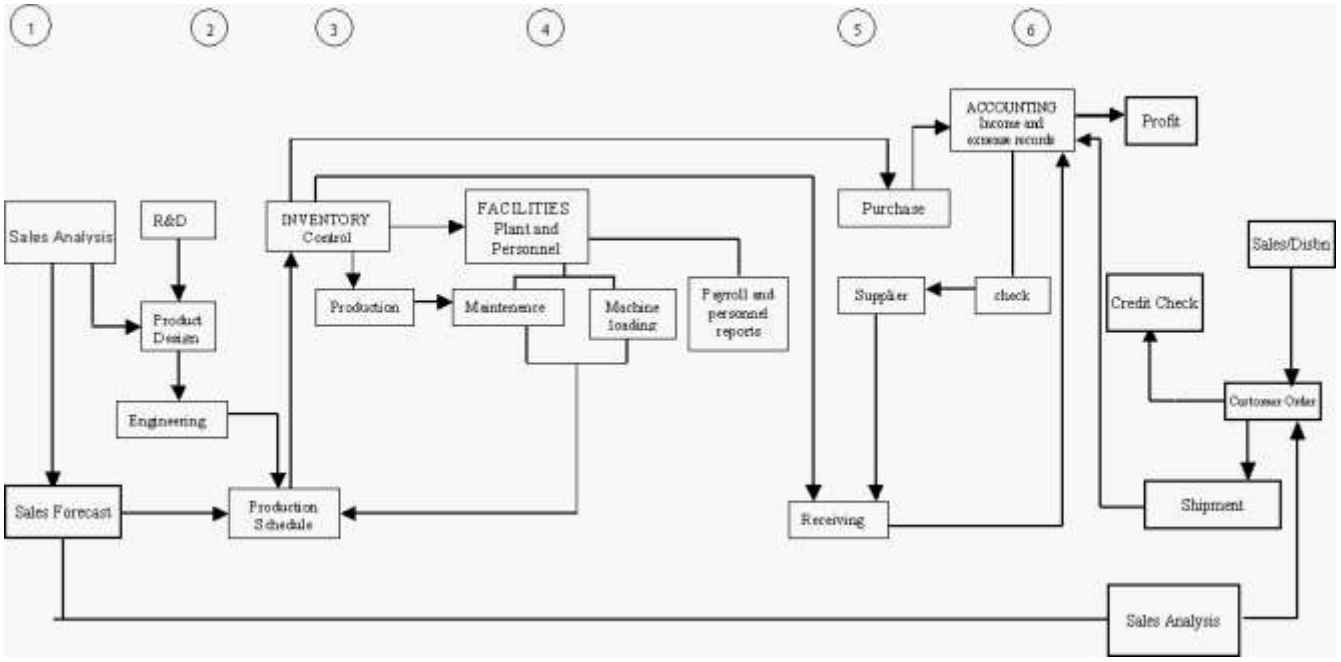


Fig1.3: information flow in an organization

4. MANAGEMENT AND THE MIS PROCESS

An MIS is directed towards the managerial functions of planning, controlling and monitoring, and decision making.

Planning

Planning consists of five sequential and interactive steps These are:

1. Selecting objectives
2. Identification of the activities which are required to achieve the stipulated objectives;
3. Detailing the resources - including the various skills - required to undertake the activities;
4. Determining the duration of each activity to be performed; and
5. Defining the sequence of the activities.

Monitoring and controlling

Controlling 'compels events to conform to plans' \ It involves:

- establishing standards of performance in order to reach the objective;
- measuring actual performance against the set standards; and
- keeping actions on course by correcting deviations as they appear (mid- course corrections).

The requirements for successful development of a control system are:

- defining expectations in terms of information attributes; and
- developing the logic for reporting deviations to all levels of management prior to the actual occurrence of the deviation.

Decision making

Decision making is the process of selecting the most desirable or optimum alternative to solve a problem or achieve an objective. The quality and soundness of managerial decisions is largely contingent upon the information available to the decision-maker.

- ***Strategic*** decisions are future-oriented because of uncertainty. They are part of the planning activity.
- ***Tactical*** decision making combines planning activities with controlling. It is for short-term activities and associated allocation of resources to them to achieve the objectives.
- ***Technical*** decision making is a process of ensuring efficient and effective implementation of specific tasks.

Elements of decision making

The four components of the decision making process are

· *Model* A model is an abstract description of the decision problem. The model may be quantitative or qualitative.

· *Criteria* The criteria must state how goals or objectives of the decision problem can be achieved. When there is a conflict between different criteria, a choice has to be made through compromise.

· *Constraints.* Constraints are limiting factors which define outer limits and have to be respected while making a decision. For example, limited availability of funds is a constraint with which most decision makers have to live.

· *Optimization* Once the decision problem is fully described in a model, criteria for decision making stipulated and constraints identified, the decision-maker can select the best possible solution.

4.1 TYPES OF MANAGEMENT DECISIONS

1. *Programmed and non-programmed decisions:*

Programmed decisions are concerned with the problems of repetitive nature or routine type matters.

A standard procedure is followed for tackling such problems. These decisions are taken generally by lower level managers. Decisions of this type may pertain to e.g. purchase of raw material, granting leave to an employee and supply of goods and implements to the employees, etc. Non-programmed decisions relate to difficult situations for which there is no easy solution.

2. *Routine and strategic decisions:*

- Routine decisions are related to the general functioning of the organisation. They do not require much evaluation and analysis and can be taken quickly. Ample powers are delegated to lower ranks to take these decisions within the broad policy structure of the organisation.
- Strategic decisions are important which affect objectives, organisational goals and other important policy matters. These decisions usually involve huge investments or funds. These are non-repetitive in nature and are taken after careful analysis and evaluation of many alternatives. These decisions are taken at the higher level of management.

3. *Tactical (Policy) and operational decisions:*

- Decisions pertaining to various policy matters of the organisation are policy decisions. These are taken by the top management and have long term impact on the functioning of the concern. For example, decisions regarding location of plant, volume of production and channels of distribution (Tactical) policies, etc. are policy decisions.
- Operating decisions relate to day-to-day functioning or operations of business. Middle and lower level managers take these decisions.
- An example may be taken to distinguish these decisions. Decisions concerning payment of bonus to employees are a policy decision. On the other hand if bonus is to be given to the employees, calculation of bonus in respect of each employee is an operating decision.

4. *Organisational and personal decisions:*

- When an individual takes decision as an executive in the official capacity,

it is known as organisational decision.

- If decision is taken by the executive in the personal capacity (thereby affecting his personal life), it is known as personal decision.
- Sometimes these decisions may affect functioning of the organisation also. For example, if an executive leaves the organisation, it may affect the organisation. The authority of taking organizational decisions may be delegated, whereas personal decisions cannot be delegated.

5. *Major and minor decisions:*

- Decision pertaining to purchase of new factory premises is a major decision. Major decisions are taken by top management.
- Purchase of office stationery is a minor decision which can be taken by office superintendent.

6. *Individual and group decisions:*

- When the decision is taken by a single individual, it is known as individual decision. Usually routine type decisions are taken by individuals within the broad policy framework of the organisation.
- Group decisions are taken by group of individuals constituted in the form of a standing committee. Generally very important and pertinent matters for the organisation are referred to this committee. The main aim in taking group decisions is the involvement of maximum number of individuals in the process of decision- making.

5. SYSTEMS APPROACH

Modern management is based upon a systems approach to the organization. The systems approach views an organization as a set of interrelated sub-systems in which variables are mutually dependent. A system can be perceived as having:

- some components, functions and the processes performed by these various components;
- relationships among the components that uniquely bind them together into a conceptual assembly which is called a system; and
- an organizing principle that gives it a purpose

The organizing system has five basic parts, which are interdependent They are:

- the individual;
- the formal and informal organization;
- patterns of behaviour arising out of role demands of the organization;
- the role perception of the individuals; and
- the physical environment in which individuals work.

The interrelationship of the sub-systems within an organization is fundamental to the systems approach. The different components of the organization have to operate in a coordinated manner to attain common organizational goals. This results in synergic effects. The term *synergy* means that when different sub-systems work together they tend to be more efficient than if they work in. Thus, the output of a system with well integrated sub-systems would be much more than the sum of the outputs of the independent sub-systems working in isolation.

The systems approach provides a total view of the organization. It enables analysis of an organization in a scientific manner, so that operating management systems can be developed and an appropriate MIS designed.

By providing the required information, an MIS can help interrelate, coordinate and integrate different sub-systems within an organization, thus facilitating and increasing coordinated working of the sub-systems, with consequent synergism. The interaction between different components of the organization depends upon integration, communication and decision making. Together they create a linking process in the organization.

Integration ensures that different sub-systems work towards the common goal. Coordination and integration are useful controlling mechanisms which ensure smooth functioning in the organization, particularly as organizations become large and increasingly complex. As organizations face environmental complexity, diversity and change, they need more and more internal differentiation, and specialization becomes complex and diverse. The need for integration also increases as structural dimensions increase.

Communication integrates different sub-systems (specialized units) at different levels in an organization. It is thus a basic element of the organizational structure necessary for achieving the organization's goals.

5.1 SYSTEM

A system is a set of components (subsystems or elementary parts) that operate together to achieve a common objective (or multiple objective).

- input-process-output an orderly arrangement of interdependent ideas or

constructs (Abstract System)

- A set of elements which operate together to accomplish an objective (Physical System)

ELEMENTS OF A SYSTEM

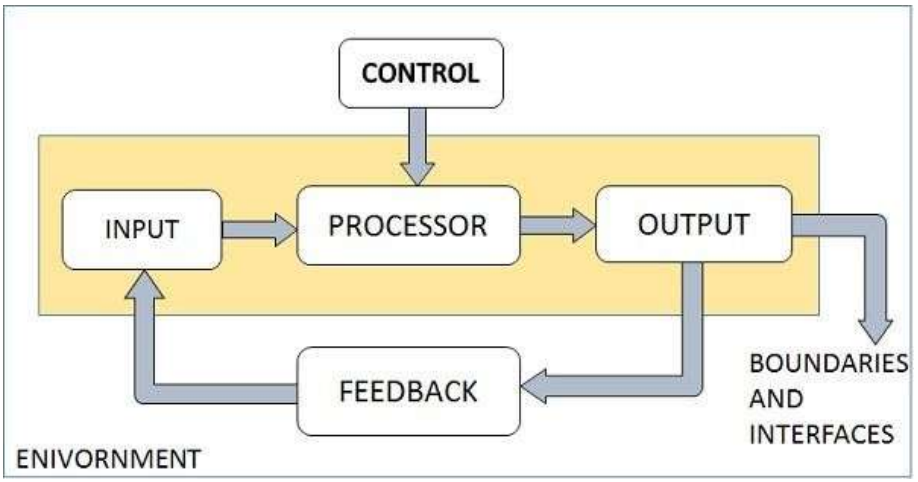


Fig 1.4: Elements of a system

- Input: Input is what data the system receives to produce a certain output.
- Output: What goes out from the system after being processed is known as Output.
- Processing: The process involved to transform input into output is known as Processing.
- Control: In order to get the desired results it is essential to monitor and control the input, Processing and the output of the system. This job is done by the control.
- Feedback: The Output is checked with the desired standards of the output set and the necessary steps are taken for achieving the output as per the standards, this process is called as Feedback. It helps to achieve a much better control in the system.

- Boundaries: The boundaries are nothing but the limit of the system. Setting up boundaries helps for better concentration of the actives carried in the system.
- Environment: The things outside the boundary of the system are known as environment. Change in the environment affects the working of the system.
- Interfaces: The interconnections and the interactions between the sub- systems is known as the Interfaces. They may be inputs and outputs of the systems.

FIGURE 10.1
The "black-box" view of a system.

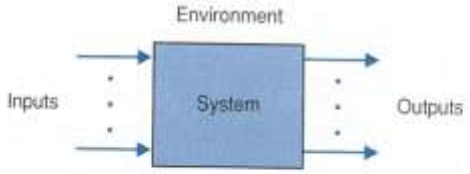


FIGURE 10.2
A system and its descriptors.

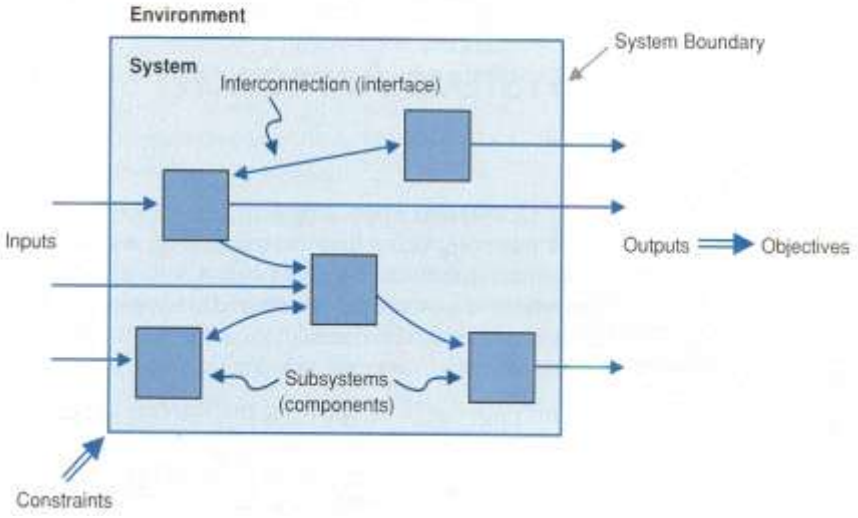


Fig 1.5: A system and its descriptors

5.2 Organization as a system:

The focus is on interdependency of the subsystem components of the system.

1. Subsystems: production, managerial, adaption/innovation subsystem
2. Each subsystems has goals and contributes or may be not to the whole system
3. Thus encouraging the interdependency of the subsystems.
4. The interdependency depends on communication.

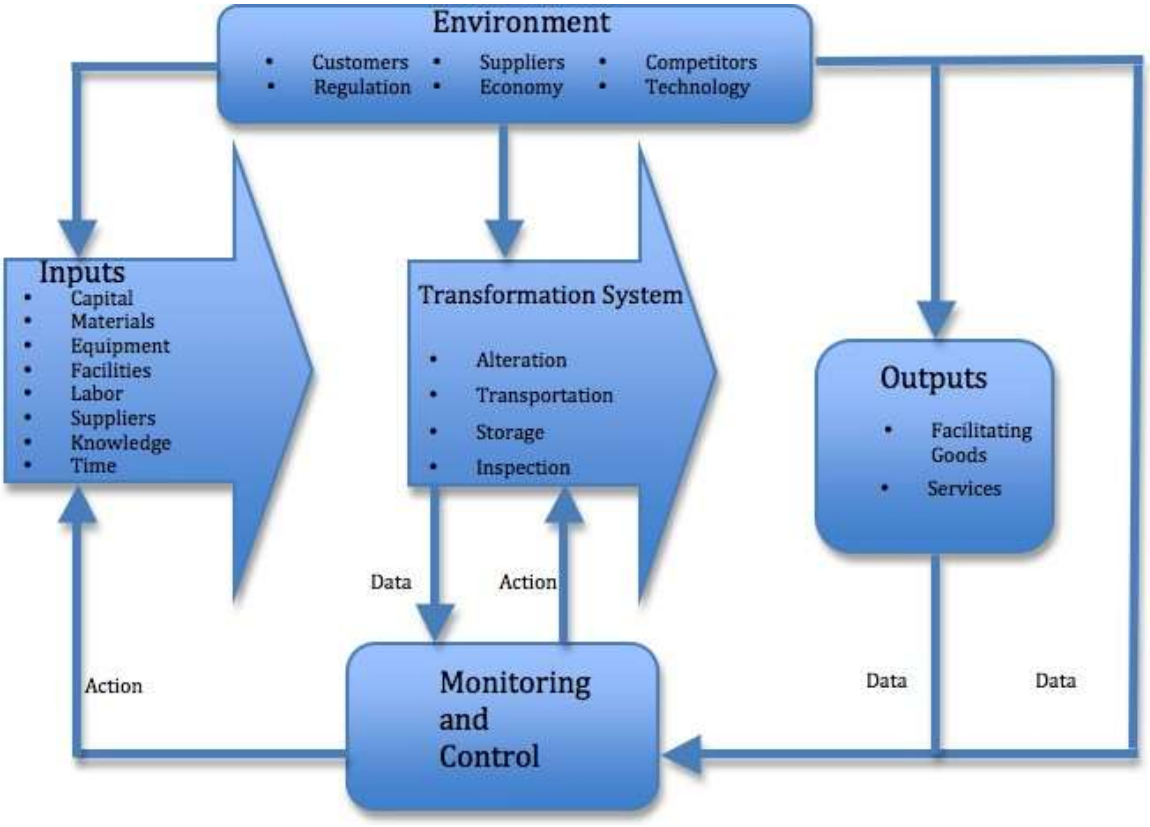


Fig 1.6: A typical system

5.3 SYSTEM CLASSIFICATION

Deterministic versus probabilistic

1. Deterministic: The interaction between the parts or subsystems is known for certain

example: a computer program which performs exactly to a set of instructions

2. Probabilistic: A system that can be described in terms of probable behavior (a certain degree of error); examples: An inventory system, a five year old (who does not follow a certain set of instructions).

Closed and open systems:

3. Closed system: self-contained, one that does not exchange material, information, or energy with its environment.

Example: A chemical reaction in a sealed, insulated container.

Relatively closed systems: in organizations and in information processing, there are systems that are relatively isolated from the environment, but are not completely closed, these will be considered closed systems. Example: a computer

program with well defined inputs, a process and an output (No agents)

4. Open Systems: exchange information, material, or energy with the environment, including random and undefined inputs.
    - Open systems tend to have form and structure
    - Adapt to changes in environment so as to continue to exist

Examples: Biological Systems, and Organizational Systems

UNIT II

Transaction Processing information system, Office Automation System (OAS) - Knowledge workers System (KWS); MIS; Information system for managers, Intelligence information system –Decision support system-Executive information systems.

1. TYPES OF INFORMATION SYSTEM

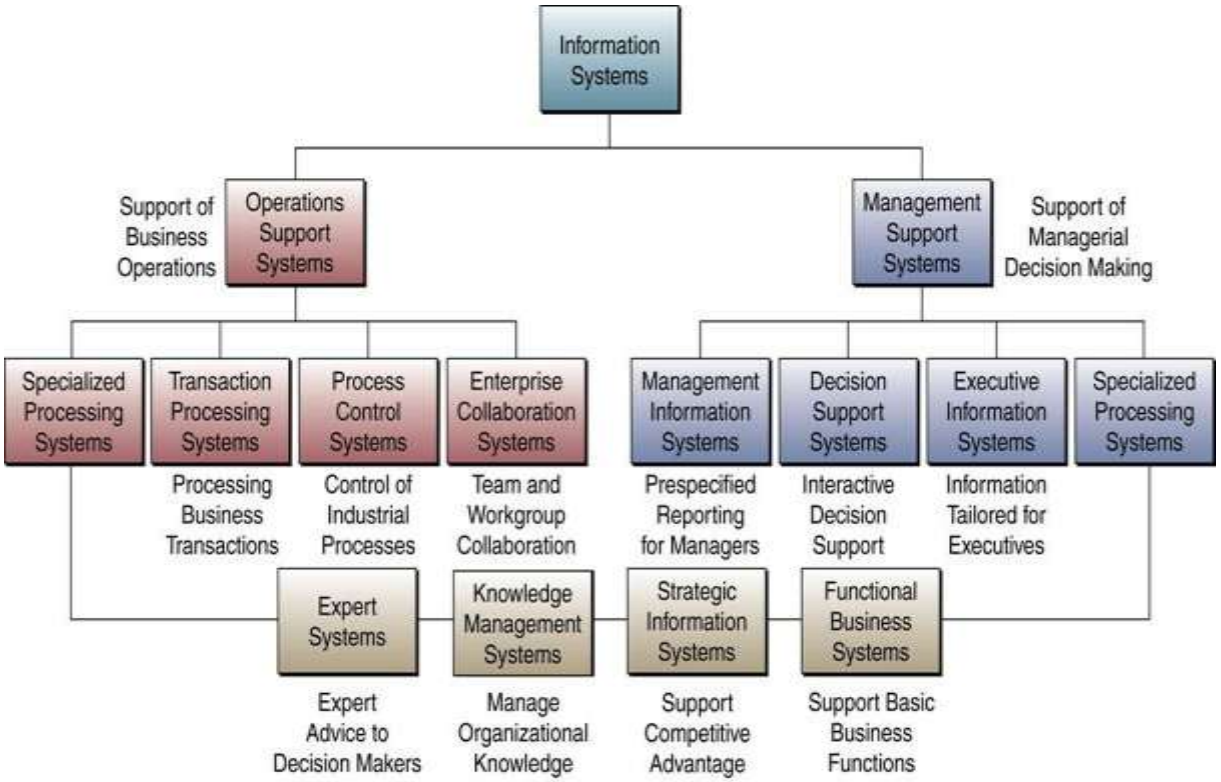


Fig 2.1: Types of Information System

i. Transaction Processing System (TPS)

a. Transactions could be externally generated or events internal to an organization.

ii. Office Automation Systems (OAS)

a. OAS refers to the application of computer and communication technology to office functions. These systems include word processing, e-filling, e-mail, data storage, voice communications, etc..,

iii. Knowledge Workers System (KWS)

a. A knowledge work system (KWS) is a management system that supports the creation of new knowledge and its integration into an organization.

KWSs are designed for engineers, scientists, and other intelligent people

iv. Management Information System (MIS)

a. MIS is an IS which processes data and converts into information.

v. Intelligence Information System (IIS)

a. Intelligence Information System (IIS) refers to a specialized software or technology platform used by intelligence agencies, law enforcement, and military organizations. It is designed to collect, analyze, and disseminate intelligence information to support national security and decision-making. IIS systems play a crucial role in the intelligence cycle, facilitating the collection, analysis, and distribution of intelligence data to protect a nation's security interests..

vi. Decision Support System (DSS)

a. A DSS is an IS application that assists decision making.
b. Elements in DSS: 1. Database, 2. Model base, 3. User interface.

vii. Executive Information/Support System (EIS/ESS)

a. EIS is an extension of the MIS which is a special king of DSS.

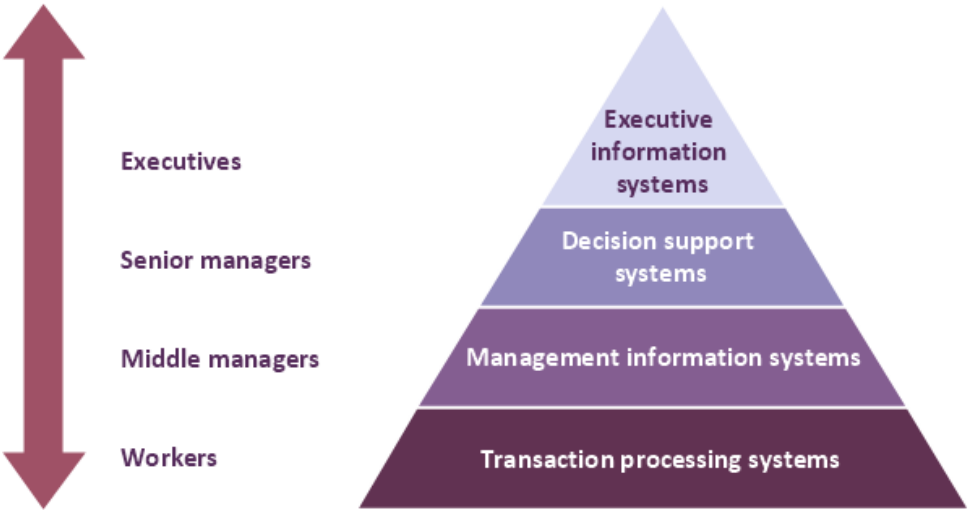


Fig 2.1: Information System and Organizational Level

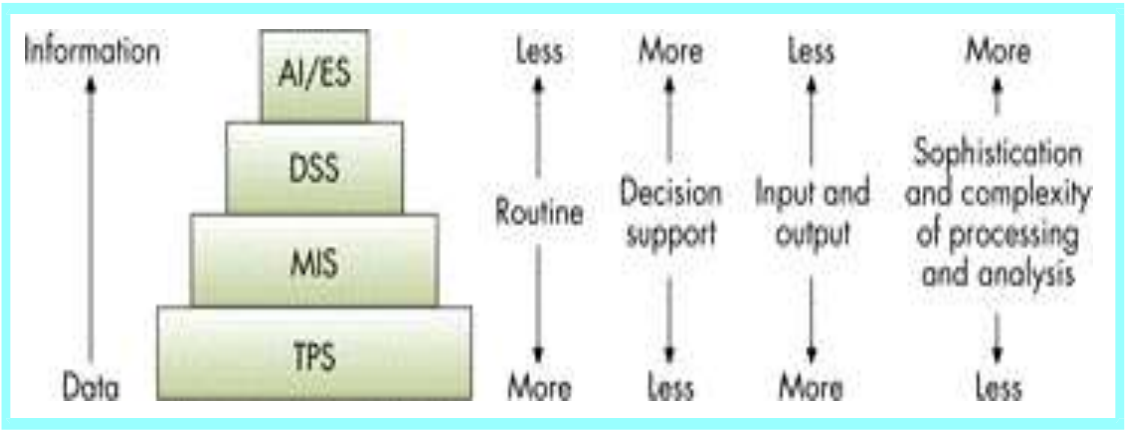


Fig 2.2 Comparison between Information Systems

2. Transaction Processing System (TPS)

Transaction

Basic business operations such as customer orders, purchase orders, receipts, time cards, invoices, and payroll checks in an organization

2.1 TPS – Meaning & Objectives

- Perform routine operations and serve as a foundation for other systems
- Provide all the information needed to keep the business running properly and efficiently.
    - Provide timely documents and reports
    - Provide data for other systems
    - Safeguard information

2.2 Characteristics of TPS

- Performs routine operations on a regular basis
- Provides data to other systems
- High level of detail, accuracy, security
- Limited support for decision making
- A lot of input and output; large storage needs
- Limited sophisticated or complex processing

2.3 Types of TPS

Batch Processing (original)

A system whereby business transactions are accumulated over a period of time and prepared for processing as a single unit or batch.

On-Line Transaction Processing (OLTP)

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

2.4 Steps in TPS

1) Data Collection
    - Begins with a transaction (e.g. an order)
    - Manual or automated
    - Source Data Automation (e.g. bar code scanners)
2) Data Editing
    - Validity and completeness
3) Data Correction
    - Feedback regarding errors
    - Opportunity to re-enter
4) Data Manipulation
    - Performing calculations
    - Classifying
    - Sorting
    - Summarizing
5) Data Storage
    - Updating databases
    - An output of TPS
    - Input to all other systems
6) Document Production
    - Paycheck, Invoices, Packing slips, etc.,

TPS - Example

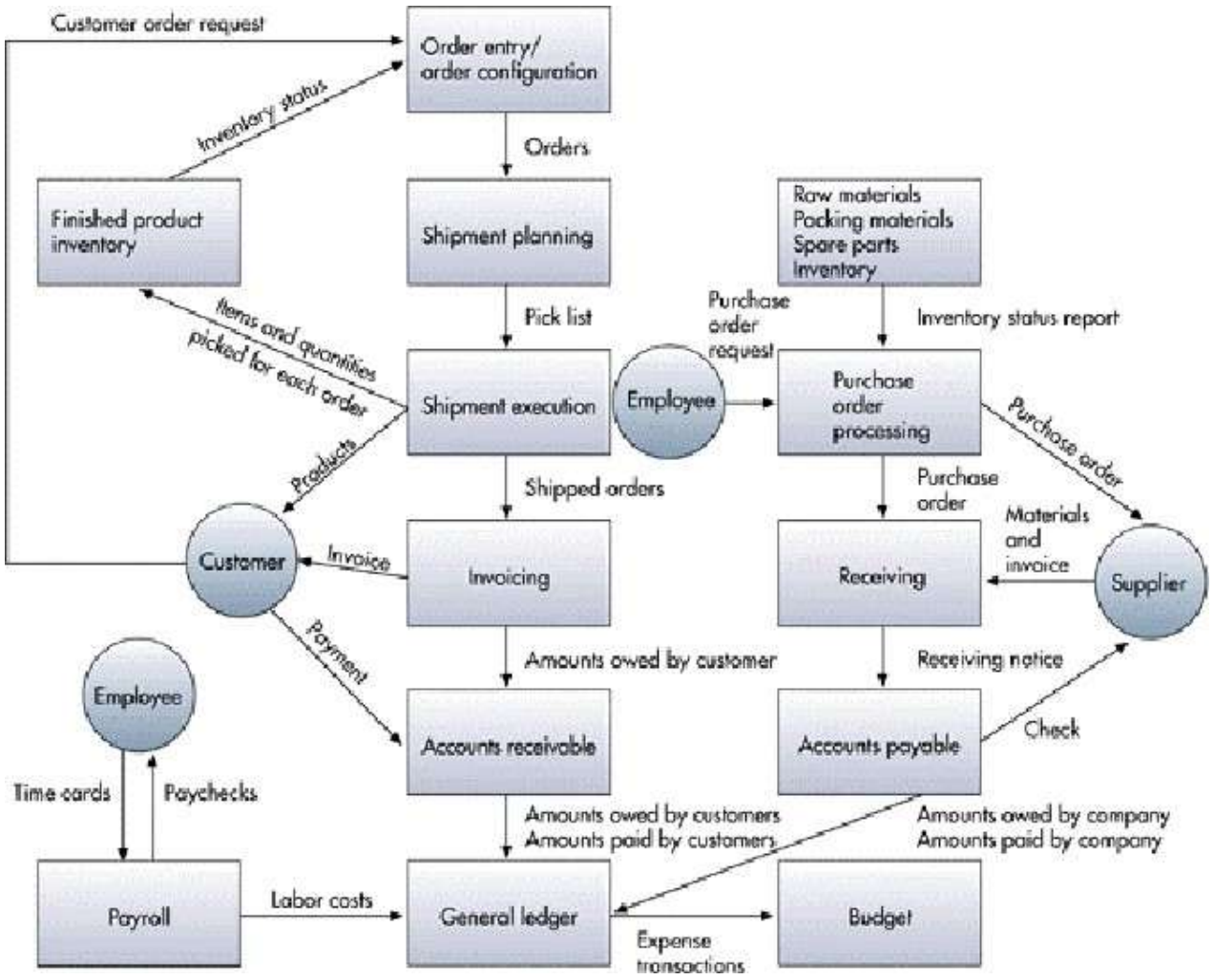


Fig 2.3 TPS process

3. Office Automation System (OAS)

An Office Automation System (OAS) is a set of software tools, hardware, and processes that are designed to enhance and streamline various office operations and tasks. These systems help organizations improve efficiency, productivity, and communication within the office environment

3.1 Functions of OAS

a. Document Processing and Management:

- Word Processing: Creating, editing, and formatting text documents.
- Spreadsheet Analysis: Managing and analyzing data in spreadsheets.
- Presentation Software: Creating and delivering presentations.
- Document Management: Storing, version control, and collaboration on documents.
- Task Management: Creating and tracking tasks, projects, and deadlines.

b. ***Communication and Collaboration***:

- Email Communication: Managing emails and communication.
- Calendar and Scheduling: Scheduling appointments, meetings, and reminders.
- Communication Tools: Instant messaging and video conferencing for real-time communication.
- Collaborative Tools: Enabling document sharing and real-time editing.
- Workflow Automation: Automating repetitive tasks and workflows.

c. Data and Information Management:

- Database Management: Organizing and managing data efficiently.
- Data Storage and Backup: Secure data storage and backup solutions.
- Reporting and Analytics: Generating reports and assessing productivity and performance.
- Security and Access Control: Controlling access to sensitive data and ensuring security.
- Customer Relationship Management (CRM): Managing customer data and interactions.

d. ***Administrative and Productivity Tools***:

- Fax Services: Electronic faxing solutions.
- Task Management: Managing tasks and projects.
- Human Resources Management: Handling HR functions, including payroll and recruitment.
- Accounting and Finance: Managing financial tasks, including accounting and payroll.
- Access Control and Security: Ensuring data security and access control.

e. ***Automation and Integration***:

- Workflow Automation: Automating routine tasks and processes.
- Integration with Other Systems: Connecting OAS with other software and systems.
- Customization and Scalability: Adapting OAS to specific organizational needs.
- Reporting and Analytics: Analyzing data for insights and decision-making.
- Data Storage and Backup: Safeguarding data through storage and backup solutions

3.2 Examples of OAS

Microsoft Office 365:

Microsoft Office 365 is a comprehensive OAS that provides a suite of productivity tools in real-time. Users can collaborate on documents, spreadsheets, and presentations using Microsoft Word, Excel, and PowerPoint. Additionally, it includes cloud-based email and calendar solutions with real-time updates, making it easy for teams to work together and access their files from anywhere.

Trello:

Trello is a popular task and project management OAS that enables teams to organize work using boards, lists, and cards. It offers real-time updates on task progress, changes, and user interactions. Team members can see the status of projects, who is responsible for each task, and any comments or updates made by colleagues in real time.

Slack:

Slack is a real-time communication and collaboration OAS that provides instant messaging, file sharing, and integration with various apps and services. It offers

real-time notifications, so team members can receive updates, messages, and alerts in real-time, making it a valuable tool for team communication.

Google Workspace (formerly G Suite):

Google Workspace is an OAS that includes cloud-based productivity tools like Google Docs, Google Sheets, and Google Slides. These applications offer real-time collaboration features, allowing multiple users to work on the same document simultaneously. Changes are updated in real time, and users can see each other's edits and comments.

4. Knowledge Workers System (KWS)

A knowledge worker is a professional who generates value for the organization with their expertise, critical thinking and interpersonal skills. They're often tasked with developing new products or services, problem-solving, or creating strategies and action plans that will drive better business outcomes. Knowledge

workers have formal training or significant experience, are skilled communicators and can learn and adapt to a shifting work environment.

A knowledge work system (KWS) is a management system that supports the creation of new knowledge and its integration into an organization. KWSs are designed for engineers, scientists, and other intelligent people

4.1 KWS Process

The process involved in Knowledge Worker Systems (KWS) is focused on enabling knowledge workers to effectively create, share, and apply knowledge within an organization. These systems are designed to support the unique needs and workflow of knowledge workers.

- Knowledge Creation:
  - Data Collection: Knowledge workers collect data from various sources, both internal and external to the organization.
  - Data Analysis: They analyze and process the data to extract meaningful insights and create knowledge.
- Knowledge Sharing:
  - Document and Content Management: Knowledge workers create, organize, and manage documents, reports, and other forms of knowledge content.
  - Collaboration: They collaborate with colleagues, sharing knowledge and expertise through tools like email, messaging apps, and collaboration platforms.

  - Knowledge Repositories: KWS often include repositories or databases where knowledge workers can store and retrieve information and documents.

- Knowledge Application:
  - Problem Solving: Knowledge workers use their expertise to solve complex problems and make decisions based on the knowledge they have accumulated.
  - Innovation: They apply their knowledge to innovate and improve processes, products, or services.
  - Decision Support: KWS may provide decision support tools and dashboards to assist knowledge workers in making informed decisions.
- Continuous Learning and Updating:
  - Knowledge workers engage in continuous learning to stay current in their field.
  - They update existing knowledge with new information and insights, ensuring that it remains relevant.
- Knowledge Management:
  - KWS may include knowledge management tools to capture, organize, and categorize knowledge for easy retrieval.
  - Taxonomies and metadata may be used to tag and classify knowledge resources.
- Communication and Collaboration:
  - Knowledge workers rely on communication and collaboration

tools to connect with colleagues and share their expertise.

- Video conferencing, messaging apps, and collaborative workspaces are commonly used.

- Performance Measurement:
  - Organizations may implement performance metrics and key performance indicators (KPIs) to assess the effectiveness and productivity of knowledge workers.
  - Metrics can help in identifying areas for improvement and optimization.
- Security and Data Protection:
  - Ensuring the security and protection of sensitive knowledge and data is crucial. KWS should incorporate security measures, access controls, and data encryption.
- Integration with Other Systems:
  - KWS often need to integrate with other enterprise systems such as Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), and Business Intelligence (BI) systems to access and share data.
- Adaptation to Technological Advances:
  - Knowledge Worker Systems need to adapt to new technologies and tools as they evolve. This includes staying updated with the latest software, AI, and machine learning applications.
- Training and Development:
  - Organizations may provide training and development programs for knowledge workers to enhance their skills and competencies, ensuring they can effectively utilize KWS.

- Feedback and Improvement:
    - Organizations should encourage knowledge workers to provide feedback on the KWS to make necessary improvements and enhancements.

The process in Knowledge Worker Systems is iterative and dynamic, as knowledge workers are continuously evolving their knowledge and adapting to changing organizational needs and technological advancements. Effective KWS support this dynamic process, enabling knowledge workers to be more productive and innovative.

4.2 Characteristics of KWS:

- They promote the creation of knowledge and ensure that knowledge and technical skills are properly integrated into business.
- They provide an online directory where users can look for company employees who can provide them with the precise information they require.
- They run on workstations customized to knowledge workers' unique operations.
- They require strong links to external knowledge bases in addition to specialized hardware and software.

Knowledge workers are workers whose main capital is knowledge.

Examples include:

- ICT Professionals, Physicians, Pharmacists, Architects, Engineers, Scientists,

Design thinkers, Public accountants, Lawyers, Editors, Academics.

5. Management Information System (MIS)

Management Information System (MIS) is an integrated man/machine system for providing information to hold up the operations, management and decision making functions in an organization.

5.1 Objectives of MIS

- Data Capturing

MIS capture data from various internal and external sources of the organization. Data capturing may be manual or through computer terminals.

- Processing of Data

The captured data is processed to convert into the required information. Processing of data is done by such activities as calculating, sorting, classifying, and summarizing.

- Storage of Information

MIS stores the processed or unprocessed data for future use. If any information is not immediately required, it is saved as an organization record, for later use.

- Retrieval of Information

MIS retrieves information from its stores as and when required by various users.

- Dissemination of Information

Information, which is a finished product of MIS, is disseminated to the users in the organization. It is periodic or online through a computer terminal.

5.2 Characteristics of MIS

- System Approach

The information system follows a System's approach. The system's approach implies a holistic approach to the study of system and its performance in the light for the objective for which it has been constituted.

- Management Oriented

The top-down approach must be followed while designing the MIS. The top-down approach suggests that the system development starts from the determination of management needs and overall business objectives.

The MIS development plan should be derived from the overall business plan. Management oriented characteristic of MIS also implies that the management actively directs the system development efforts.

- Need-Based

MIS design and development should be as per the information needs of managers at different levels, strategic planning level, management control level and operational control level. In other words, MIS should cater to the specific needs of managers in an organization's hierarchy.

- Exception Based

MIS should be developed on the exception-based reporting principle, which means an abnormal situation, i.e. the maximum; minimum or expected values vary beyond tolerance limits. In such situations, there should BE exception reporting to the decision-maker at the required level.

- Future Oriented

Besides exception-based reporting, MIS should also look at the future. In

other words, MIS should not merely provide past or historical information; rather it should provide information, on the basis of projections based on which actions may be initiated.

- Integrated

Integration is a necessary characteristic of a management information system. Integration is significant because of its ability to produce more meaningful information.

For example, in order to develop an effective production scheduling system, it is necessary to balance such factors as setup costs, Workforce, Overtime rates, Production capacity, Inventory level, Capital requirements and Customer services.

- Long Term Planning

MIS is developed over relatively long periods. Such a system does not develop overnight. A heavy element of planning is involved. The MIS designer must have the future objectives and needs of the company in mind.

- Sub-System Concept

The process of MIS development is quite complex and one is likely to lose insight frequently. Thus, the system, though viewed as a single entity, must be broken down into digestible sub-systems which are more meaningful at the planning stage.

- Central Database

A central database is a mortar that holds the functional systems together.

Each system requires access to the master file of data covering inventory, personnel, vendors, customers, etc. It seems logical to gather data once, validate it properly and place it on a central storage medium, which can be accessed by any other subsystem.

5.3 Role of MIS in an Organization

- Decision making

Management Information System (MIS) plays a significant role in the decision-making process of any organization. In any organization, a decision is made on the basis of relevant information which can be retrieved from the MIS.

- Coordination among the department

Management Information System satisfy multiple need of an organization across the different functional department.

- Finding out Problems

As we know that MIS provides relevant information about every aspect of activities. Hence, if any mistake is made by the management then MIS, information will help in finding out the solution to that problem.

- Comparison of Business Performance

MIS store all past data and information in its Database. That why the management information system is very useful to compare business organization performance.

- Strategies for an Organization

Today each business is running in a competitive market. An MIS supports the organization to evolve appropriate strategies for the business to assent in a

competitive environment.

6. Intelligence Information System (IIS)

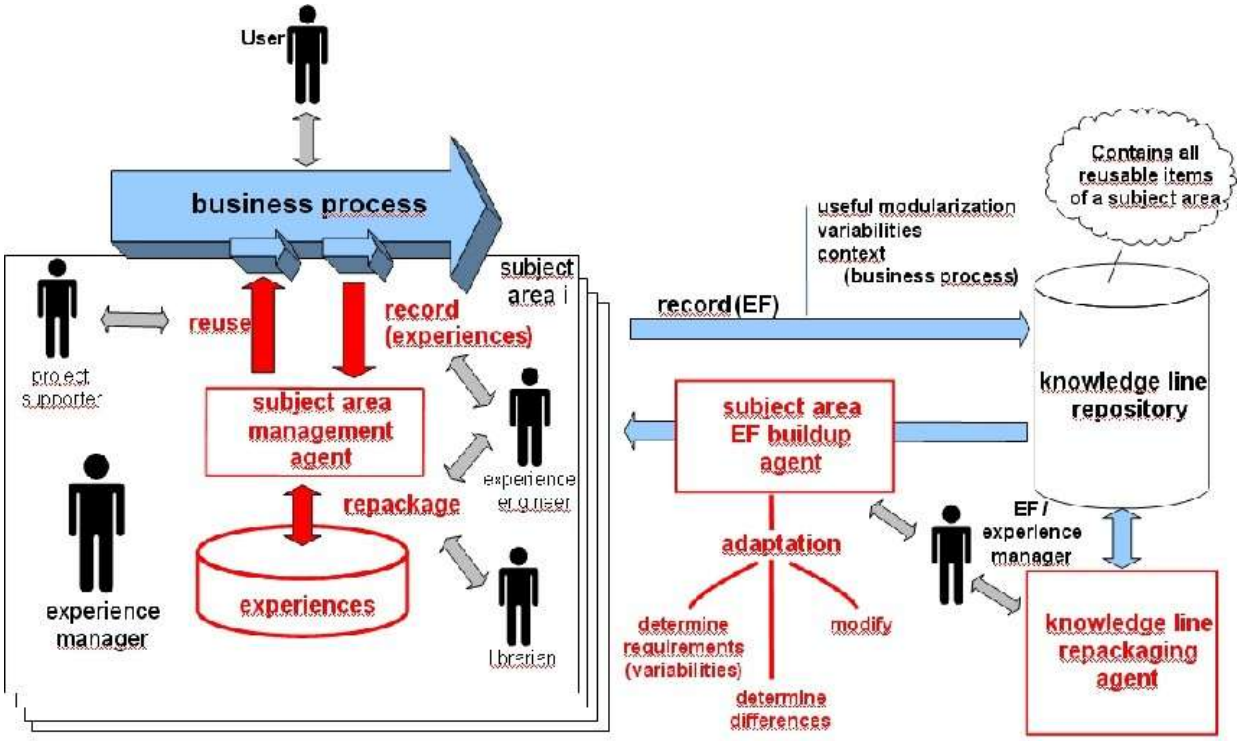
Intelligence Information System (IIS) refers to a specialized software or technology platform used by intelligence agencies, law enforcement, and military organizations. It is designed to collect, analyze, and disseminate intelligence information to support national security and decision-making. IIS systems play a crucial role in the intelligence cycle, facilitating the collection, analysis, and distribution of intelligence data to protect a nation's security interests.

In the AI world, intelligence is generally viewed as encompassing:

- Awareness of (knowledge about and the ability to interact with) the surrounding environment, and
- An ability to learn from experience and adapt accordingly.

1. The first of these criteria presupposes an efficient method of encoding, storing and retrieving knowledge. Several different methods exist for doing so, including if...then (or fuzzy) production rules, frames (schema), semantic Networks.
2. The second criteria raises the issue of “learning” from experience, incorporating such knowledge into a “Knowledge Base” (KB), and consulting this knowledge when encountering new situations and circumstances, whether consciously or unconsciously (i.e., relying not just on reasoning but also on intuition). It also implies some pattern recognition ability, in order to extrapolate from known situations, to

apply heuristics (rules-of-thumb), and to build upon existing knowledge.



2.4 Intelligence Information System - Process

6.1 Process of an Intelligence Information System

The process of an Intelligence Information System (IIS) encompasses the entire lifecycle of intelligence gathering, analysis, and dissemination. This process is often referred to as the "intelligence cycle." Here's a simplified overview of the key stages involved in the process of an IIS:

Collection:

- Data Gathering: The process begins with the collection of raw data from various sources, including open sources, classified information, human intelligence (HUMINT), signals intelligence

(SIGINT), imagery intelligence (IMINT), and more.

- Data Validation: Collected data is assessed for accuracy and reliability to ensure its trustworthiness.
- Data Integration: Data from diverse sources is integrated into a centralized repository, providing a comprehensive dataset.

Processing:

- Data Transformation: Data is cleaned and transformed into a usable format for analysis. This may involve data standardization, normalization, and structuring.
- Data Enhancement: Data is enriched with additional context and metadata to facilitate analysis.
- Data Storage: Processed data is stored in a secure and organized manner within the IIS.

Analysis:

- Data Analysis Tools: Intelligence analysts utilize various analytical tools, data mining techniques, and methodologies to extract insights, identify patterns, and make sense of the information.
- Threat Assessment: Analysts assess the significance of the intelligence, evaluate potential threats or opportunities, and provide context for decision-making.

Dissemination:

- Report Generation: Intelligence reports, including textual

summaries, charts, graphs, and maps, are created to convey findings and assessments.

- Alerts and Notifications: Real-time alerts and notifications may be issued for critical intelligence developments.
- Information Sharing: Intelligence data is shared with authorized users, agencies, or organizations using secure communication channels and protocols.

Storage and Retrieval:

- Archiving: Historical intelligence data is archived for future reference, research, or investigations.
- Data Retrieval: Authorized users can retrieve stored data for reference or further analysis.

Monitoring and Feedback:

- The IIS monitors user activity and system performance, recording audit trails for accountability and security.
- Feedback from users and analysts is used to improve system performance and capabilities.

Security and Access Control:

- Access controls and security measures are continually enforced to protect the confidentiality and integrity of the intelligence data.

Maintenance and Updates:

- Regular maintenance and updates of the IIS are performed to ensure it remains current, secure, and efficient.

6.2 Advantages of IIS:

Efficiency: IIS streamline the intelligence analysis process, helping agencies collect and analyze large volumes of data more efficiently.

Improved Collaboration: These systems facilitate information sharing and collaboration among different agencies and departments, enhancing coordination and intelligence sharing.

Data Integration: IIS can integrate data from various sources, providing a comprehensive view of threats and trends.

Security: Robust security measures and access controls ensure the confidentiality and integrity of sensitive intelligence data.

Data Analysis Tools: IIS include analytical tools and capabilities, such as data mining and machine learning, which aid in identifying patterns and trends in intelligence data.

Real-time Alerts: They can issue real-time alerts, allowing for timely responses to emerging threats.

Archiving and Retention: IIS help maintain historical records, ensuring that past data is accessible for reference and investigations.

Compliance and Audit Trails: Detailed audit trails help with accountability, compliance, and forensic investigations.

Customization: These systems can be customized to meet the specific needs of different intelligence agencies and organizations.

Scalability: IIS are designed to accommodate increasing data volumes and expanding user bases.

6.3 Disadvantages of IIS:

Cost: Developing, implementing, and maintaining sophisticated IIS can be costly, including software, hardware, and ongoing support expenses.

Complexity: The complexity of these systems may require extensive training for personnel to use them effectively.

Cybersecurity Risks: While they prioritize security, IIS can be attractive targets for cyberattacks, potentially leading to data breaches or espionage.

Data Overload: The integration of diverse data sources can lead to information overload, making it challenging to sift through and prioritize relevant data.

Interoperability Issues: Compatibility and interoperability issues may arise when sharing intelligence data with other agencies or organizations that use different systems.

Maintenance and Updates: Regular maintenance and updates are essential to keep IIS effective and secure, which can be resource-intensive.

Privacy Concerns: There can be ethical and legal concerns related to privacy when collecting and sharing data, particularly if it involves civilians or non- criminal entities.

Resistance to Change: Resistance from personnel who are accustomed to traditional methods may impede the adoption and effective use of IIS.

Human Error: Despite advanced technology, human errors can occur

during data entry, analysis, and interpretation.

Reliance on Technology: Overreliance on IIS can lead to a diminished ability to perform manual intelligence analysis in case of system failures or technological disruptions.

7. Decision Support System (DSS)

A decision support system (DSS) is a specific class of computerized information system that supports business and organizational decision-making activities. Properly designed decision support systems are interactive software-based systems intended to help decision-makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make business decisions.

7.1 DSS Models

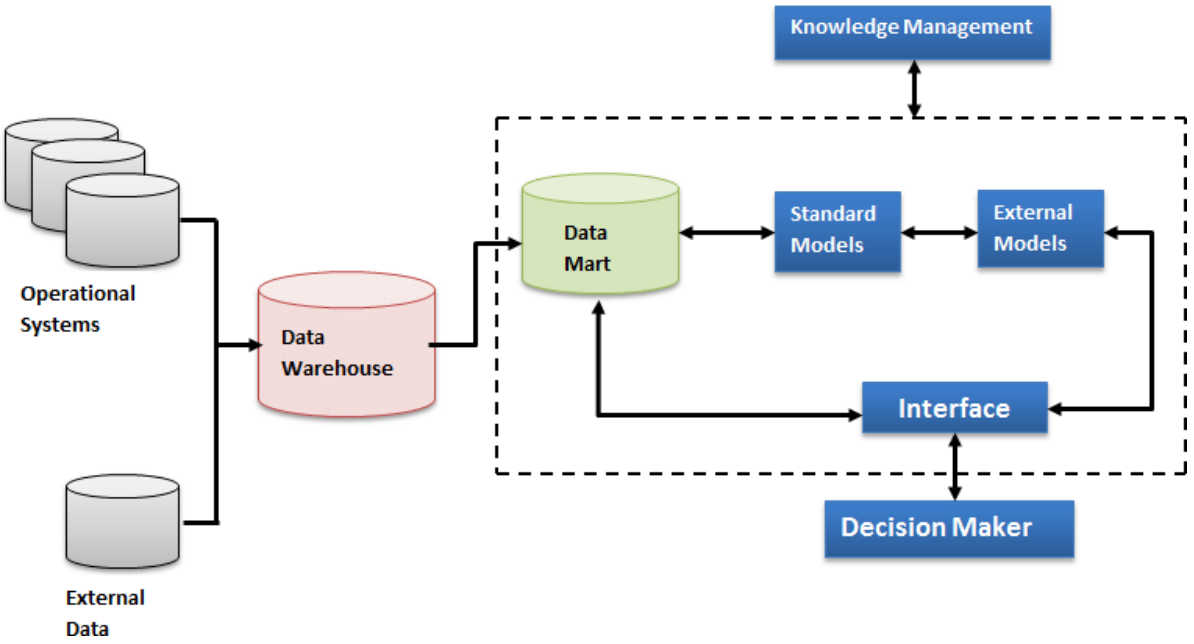
1) Optimization model
    - Finding the best solution
2) Satisfying model
    - Finding a good -- but not necessarily the best -- solution to a problem
3) Heuristics
    - Commonly accepted guidelines or procedures that usually find a good solution

7.2 Characteristics of DSS

- Handles large amounts of data from different sources
- Provides report and presentation flexibility

- Offers both textual and graphical orientation
- Supports drill down analysis
- Performs complex, sophisticated analysis and comparisons using advanced software packages
- Supports optimization, satisficing, and heuristic approaches
- Performs different types of analyses
    - "What-if" analysis
        - Makes hypothetical changes to problem and observes impact on the results
    - Simulation
        - Duplicates features of a real system
    - Goal-seeking analysis
        - Determines problem data required for a given result

7.3 DSS process

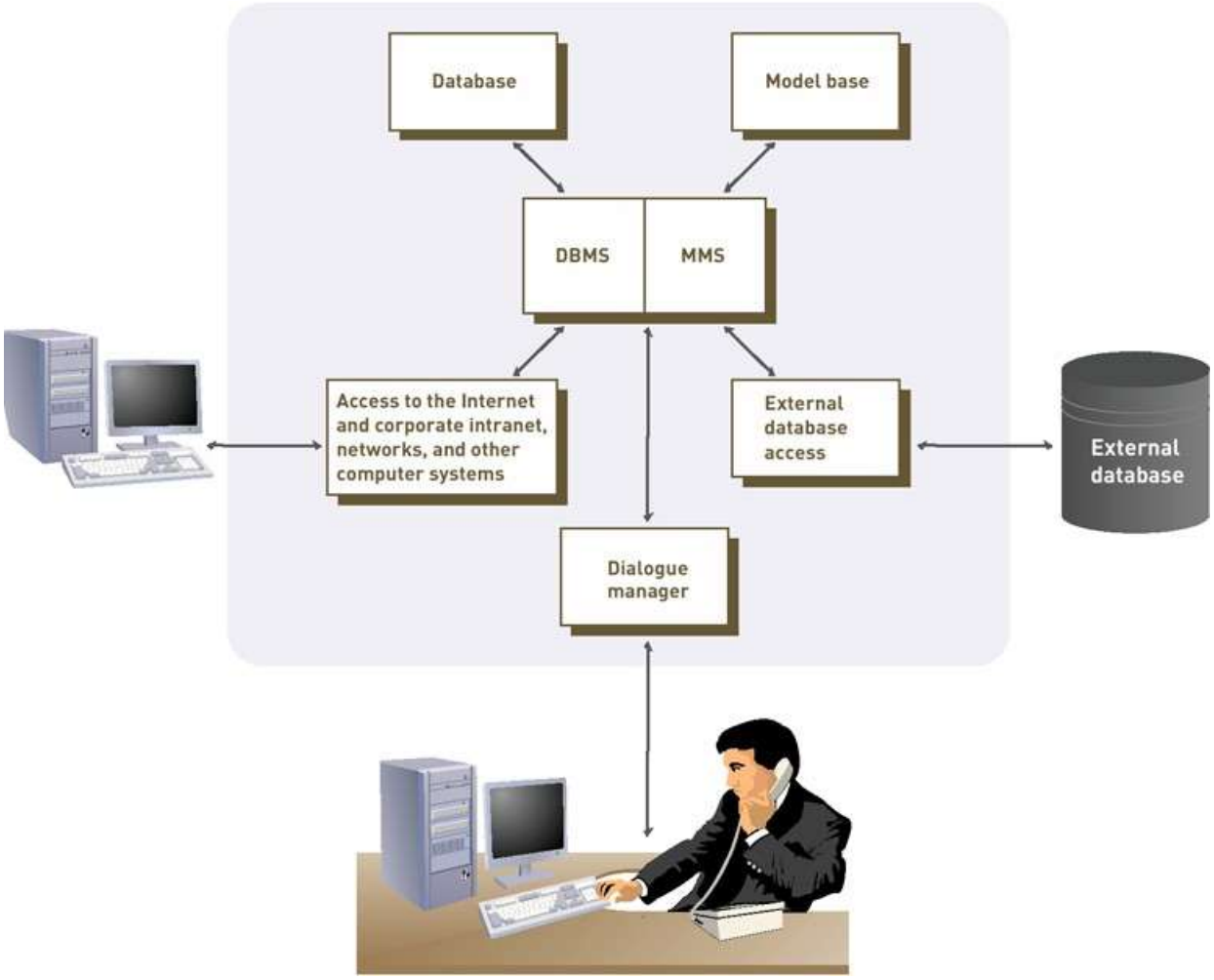


2.5 DSS Process

7.4 Components of DSS

Key Components of DSS are

- Database (Management system)
- Model base (Management system): provides decision makers access to a variety of models and assists them in decision making
- Dialogue manager (Dialog generation and Management system): allows decision makers to easily access and manipulate the DSS and to use common business terms and phrases
- External database access
- Software and Hardware -Access to the Internet and corporate intranet, networks, and other computer systems



2.6 DSS Components

Group Decision Support Systems (GDSS)

- A group decision support system (GDSS), also called group support system and computerized collaborative work system, consists of most of the elements in a DSS, plus GDSS software needed to provide effective support in group decision-making settings.
- GDSS software, often called groupware or workgroup software helps with joint work group scheduling, communication, and

management. One popular package, Lotus Notes, can capture, store, manipulate, and distribute memos and communications that are developed during group projects.

7.5 Benefits of DSS

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

8. Executive Support Systems (ESS) / Executive Information System (EIS)

- An executive information system (EIS) is a decision support system (DSS) used to assist senior executives in the decision-making process. It does this by providing easy access to important data needed to achieve strategic goals in an organization. An EIS normally features graphical displays on an easy-to-use interface
- As top-level executives often require specialized support when making strategic decisions, many firms have developed systems to assist executive decision making. This type of system, called an executive support system (ESS), is a specialized DSS that includes all hardware, software, data, procedures, and people used to assist senior-level

executives within the organization.

- In some cases, an ESS, also called an executive information system (EIS), supports the actions of members of the board of directors, who are responsible to stockholders. An ESS can also be used by individuals farther down in the organizational structure. An ESS is a special type of DSS, and, like a DSS, an ESS is designed to support higher-level decision making in the organization. The two systems are, however, different in important ways. DSSs providea variety of modeling and analysis tools to enable users to thoroughly analyze problems—that is, they allow users to answer questions.

8.1 Characteristics of ESS:

Tailored to individual executives. ESSs are typically tailored to individual executives; DSSs are not tailored to particular users. An ESS is an interactive, hands-on tool that allows an executive to focus, filter, and organize data and information.

Easy to use. A top-level executive's most critical resource can be his or her time. Thus, an ESS must be easy to learn and use and not overly complex.

Have drill down abilities. An ESS allows executives to drill down into the company to determine how certain data was produced. Drill down allows an executive to get more detailed information if needed.

Support the need for external data. The data needed to make effective top-level decisions is often external—information from competitors, the federal

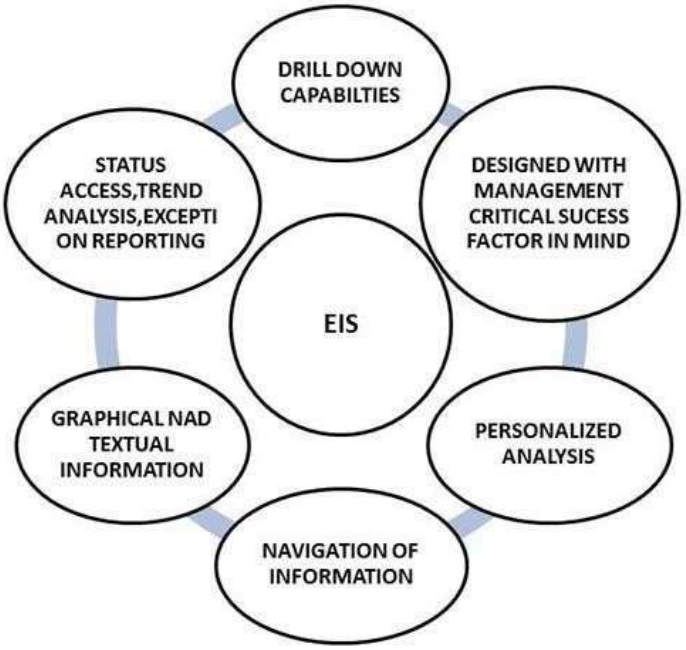
government, trade associations and journals, consultants, and so on. An effective ESS is able to extract data useful to the decision maker from a wide variety of sources including the Internet and other electronic publishing sources such as LexisNexis.

Can help with situations that have a high degree of uncertainty. There is a high degree of uncertainty with most executive decisions. Handling these unknown situations using modeling and other ESS procedures helps top- level managers measure the amount of risk in a decision.

Have a future orientation. Executive decisions are future oriented, meaning that decisions will have a broad impact for years or decades. The information sources to support future-oriented decision making are usually informal—from golf partners to members of social clubs or civic organizations.

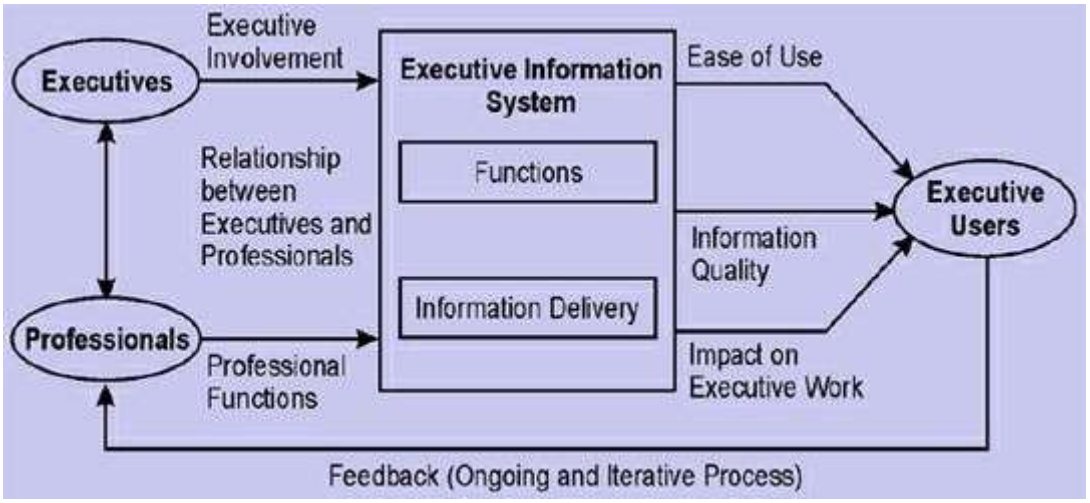
Are linked with value-added business processes. Like other information systems, executive support systems are linked with executive decision making about value-added business processes. For instance, executive support systems can be used by car-rental firms to analyze trends.

8.2 Functions of EIS



2.7 EIS functions

8.3 Process involved in EIS



2.8 EIS process

8.4 Advantages of EIS

- Easy for upper-level executives to use, extensive computer experience is not required in operations
- Provides strong drill-down capabilities to better analyze the given information.
- Information that is provided is better understood
- EIS provides timely delivery of information. Management can make decisions promptly.
- Improves tracking information
- Offers efficiency to decision makers

8.5 Disadvantages of EIS

- System dependent
- Limited functionality, by design
- Information overload for some managers
- Benefits hard to quantify
- High implementation costs
- System may become slow, large, and hard to manage
- Need good internal processes for data management
- May lead to less reliable and less secure data
- Excessive cost for small company

UNIT III

Functional Management Information System: Production / Operations Information system, Marketing Information Systems, Accounting Information system, Financial Information system, Human resource Information system.

1. PRODUCTION / OPERATIONS / MANUFACTURING INFORMATION SYSTEM

Manufacturing Information Systems are powerful software platforms capable of tracking the progress of raw materials into finished goods. An integrated MIS enables the control of multiple variables—from inputs to support services, to machines, and personnel—in real time so that management bot
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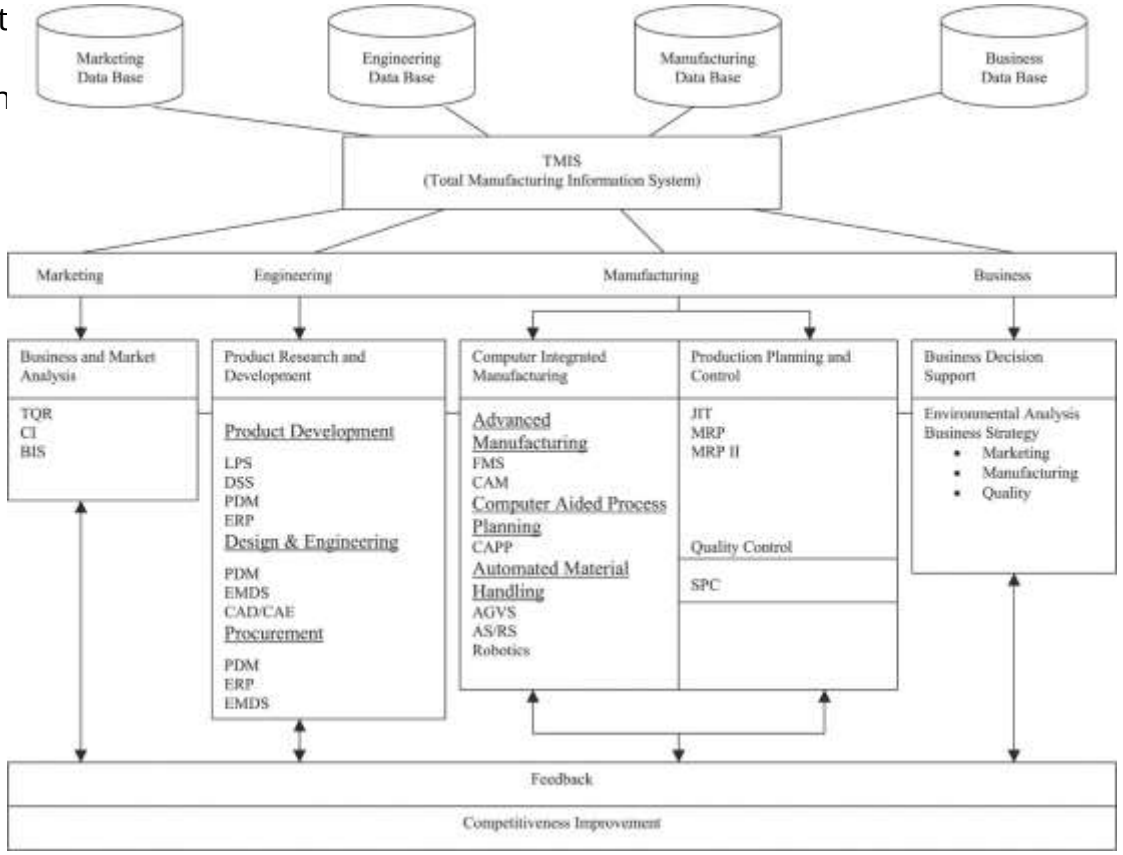


3.1 Components of Manufacturing Information System

1.1 Components of Manufacturing Information System

a. Production Planning and Control:

- Just-in-Time (JIT): JIT is a production strategy that aims to minimize inventory levels by producing only what is needed when it is needed. It focuses on reducing waste, improving efficiency, and meeting customer demand without excessive stockpiles.
- Material Requirements Planning (MRP): MRP is a system for planning and managing materials and inventory. It calculates the materials needed for production based on production schedules and demand, helping optimize material procurement and inventory levels.

b. Manufacturing Process and Automation:

- Computer-Aided Manufacturing (CAM): CAM involves the use of computer software and hardware to automate and optimize manufacturing processes, including CNC (Computer Numerical Control) machining, robotics, and 3D printing.
- Quality Control and Lean Production System (LPS): Lean Production System, often associated with Lean Manufacturing, focuses on minimizing waste, improving efficiency, and enhancing product quality. It includes principles like continuous improvement (Kaizen) and value stream mapping.

c. Inventory and Supply Chain Management:

- Inventory Management and JIT: JIT principles, including Kanban systems, are often used for inventory control, minimizing excess stock while ensuring materials are available as needed.
- Supply Chain Optimization: Effective supply chain management ensures that materials and components are sourced efficiently and delivered in a timely manner to support production.

d. Data Collection and Analysis:

- Data Monitoring and Analysis: Real-time data collection and analysis tools are essential for tracking production, quality, and equipment performance. They provide insights into the manufacturing process and areas for improvement.
- Data-Driven Decision Making: Manufacturing components, such as JIT, MRP, and CAM, rely on data to make informed decisions about production schedules, material orders, and process optimization.

e. Resource and Production Scheduling:

- Production Scheduling (MRP): MRP systems are used for scheduling manufacturing tasks and resources based on demand and material availability.
- Lean Production Scheduling: Lean principles, as part of LPS, focus on optimizing production schedules to reduce waste and ensure a smooth flow of work.

1.2 Benefits of Manufacturing Information System

- Streamlined product production
- Reduced costs, waste, and re-work
- Increased efficiency in set-up times
- Assessment of correct order priority
- Assignment and reassignment of inventory as necessary
- Evaluation of optimal times to turn machines on and off
- Scheduling and rescheduling equipment
- Embedding best practices
- Improving reaction time within the supply change management process
- Making and measuring parts
- Assigning personnel
- Moving inventory from one workstation to another
- Managing suppliers
- Embedding lean and six sigma thinking into your manufacturing process
- Improving efficiency
- Increasing transparency in record-keeping processes
- Audit preparation
- Increasing total output

2. MARKETING INFORMATION SYSTEM

The four main components of Marketing Information System (MIS) are:

1. Internal Records,
2. Marketing Intelligence,
3. Marketing Research (MR), and

4. Marketing Decision Support System.

1. ***Internal record:***

Marketing managers rely on internal reports related to customer orders, sales, price levels, cost, inventory levels, receivable and payables. The heart of the internal record system is the order-to-payment cycle. Customers send orders to the firms.

The sales department prepares invoices and transmits copies to various departments. The billing department sends invoices as quickly as possible. It is the order from the customer that sets the internal record keeping. This record becomes a vital source of information for analysis of sales, inventory levels, profit margins, credit policy to customers, etc.

2. ***Marketing intelligence system:***

The marketing intelligence system is a set of procedures and sources used by the managers to obtain everyday information about marketing environment.

- Sales force:

Sales representatives are trained to pick information and send it to the concerned manager. They can spot and report new developments.

- Distributors, retailers and other intermediaries:

A company can motivate the members of the distribution channel to pass information about shoppers. Information is also collected on sales force behaviour.

- External networking:

Managers can attend trade shows, read competitors published reports, talk to employees, and analyse new stories about competitors.

- Published data:

A company can take advantage of the government data resources. For instance, census supplies information on changes in population, demographic groups and changing family structure. Similarly, a company can purchase information from professional research agencies such as IMRB, A.C. Nielson Company, etc.

- Customer feedback:

This is a technique of collecting information at a low cost. The online customer feedback facilities make it more convenient for both the customer and the firm to collect and evaluate information.

3. ***Marketing decision support system:***

A growing number of organizations are using marketing decision support system to help the managers in taking better decisions. It is a system supported by software and hardware to gather information from business and environment.

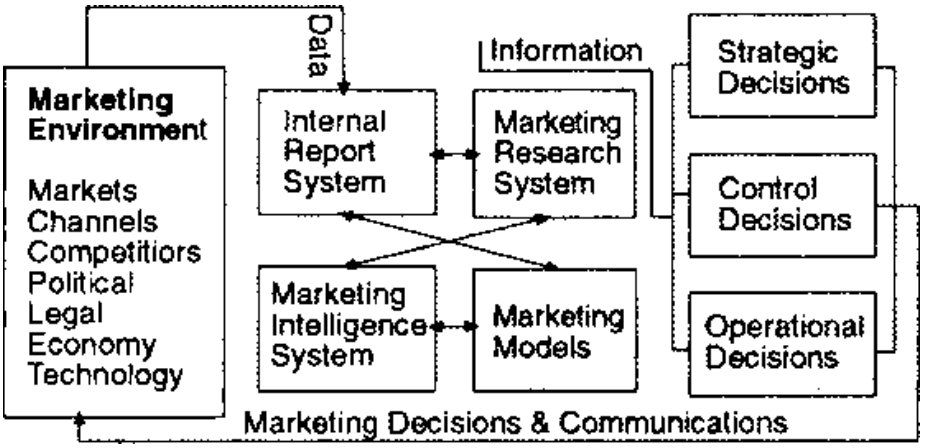
It helps managers in providing evidence for the decisions taken by them. The current marketing software programs assist in designing marketing research studies, market segmentation, selling prices, budget, analysing media, and planning sales force activity.

4. ***Marketing research:***

It acts as a tool for accurate decision-making in marketing. It is useful for studying and solving different marketing problems. Marketing research techniques are used by manufacturers, exporters, distributors and service organizations. Marketing research is an applied knowledge. Hence, it

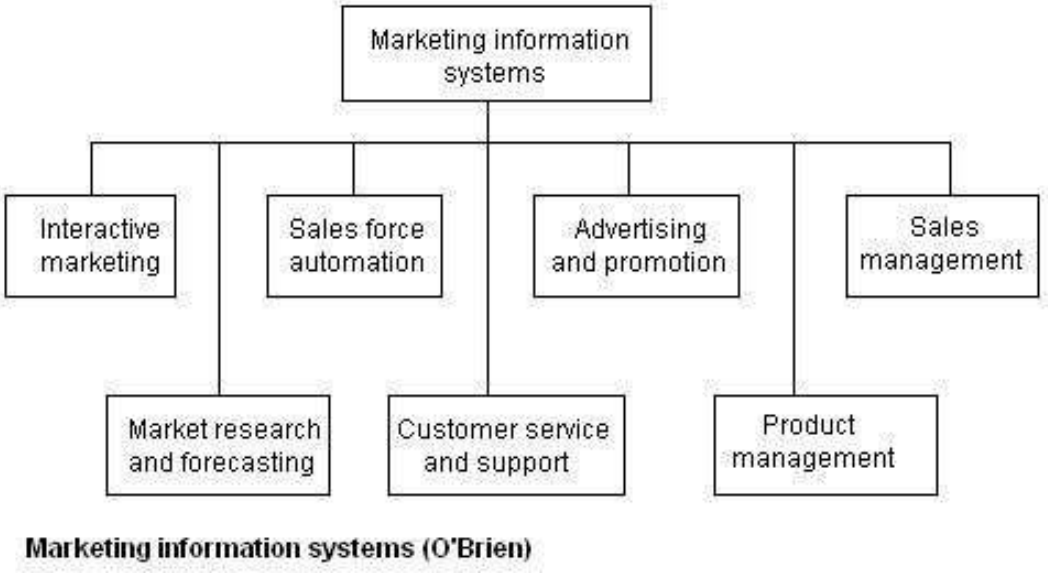
provides alternative solutions to deal with a specific problem.

2.1 Process



3.4 Marketing Information System - Process

2.2 Scope of Marketing Information Systems



3.5 Scope of Marketing Information System

2.3 Advantages of Marketing information systems

- Organized Data collection – MkIS can help the managers to organize loads of data collected from the market, thus results in an increment in the productivity.
- A broad perspective – With a proper MkIS in place, the organization can be

tracked which can be used to analyze independent processes. This helps in establishing a broader perspective which helps us know which steps can be taken to facilitate improvement.

- Storage of Important Data – The storage of important data is essential in execution and thus proves again that MkIS is not important only for information but also for execution.
- Avoidance of Crisis – The best way to analyze a stock (share market) is to see its past performance. Top websites like moneycontrol thrive on MIS. Similarly MIS helps you keep tracks of margins and profits. With an amazing information system established, an organizations direction can be analysed and probably crises averted before they place.
- Co-ordination – Consumer durables and FMCG companies have huge number of processes which needs to be co-ordinated. These companies depend completely on MIS for the proper running of the organization.
- Analysis and Planning – MkIS plays a crucial role in the planning process, considering the planning procedure requires information. For planning, the first thing which is needed is the organizations capabilities, then the business environment and finally competitor analysis. In a proper MkIS, all these are present by default and are continuously updated. Therefore, MkIS is very important for planning and analysis.
- Control – Just like MkIS can help in a crisis, in normal times it provides control as you have information of the various processes going on and what is happening across the company."

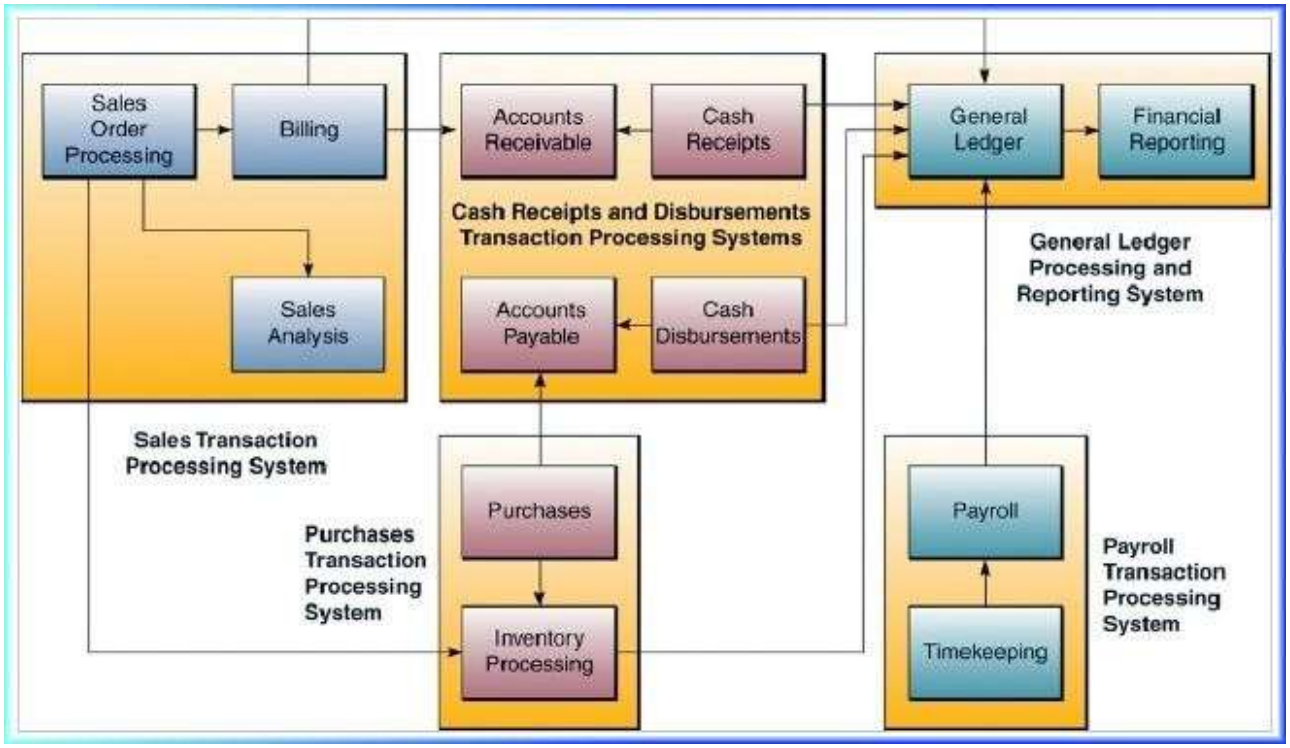
3. ACCOUNTING INFORMATION SYSTEM

An Accounting Information System (AIS) involves the collection, storage, and processing of financial and accounting data used by internal users to report information to investors, creditors, and tax authorities. It is generally a computer- based method for tracking accounting activity in conjunction with information technology resources

3.1 Parts of an Accounting Information System

An accounting information system typically has six basic parts:

1. *People* who use the system, including accountants, managers, and business analysts
2. *Procedure* and instructions are the ways that data are collected, stored, retrieved, and processed
3. *Data* including all the information that goes into an AIS
4. *Software* consists of computer programs used for processing data
5. *Information technology infrastructure* includes all the hardware used to operate the AIS
6. *Internal controls* are the security measures used to protect data



3.2 Parts of Accounting Information System

3.2 Functions of an Accounting Information System

Accounting information systems have three basic functions:

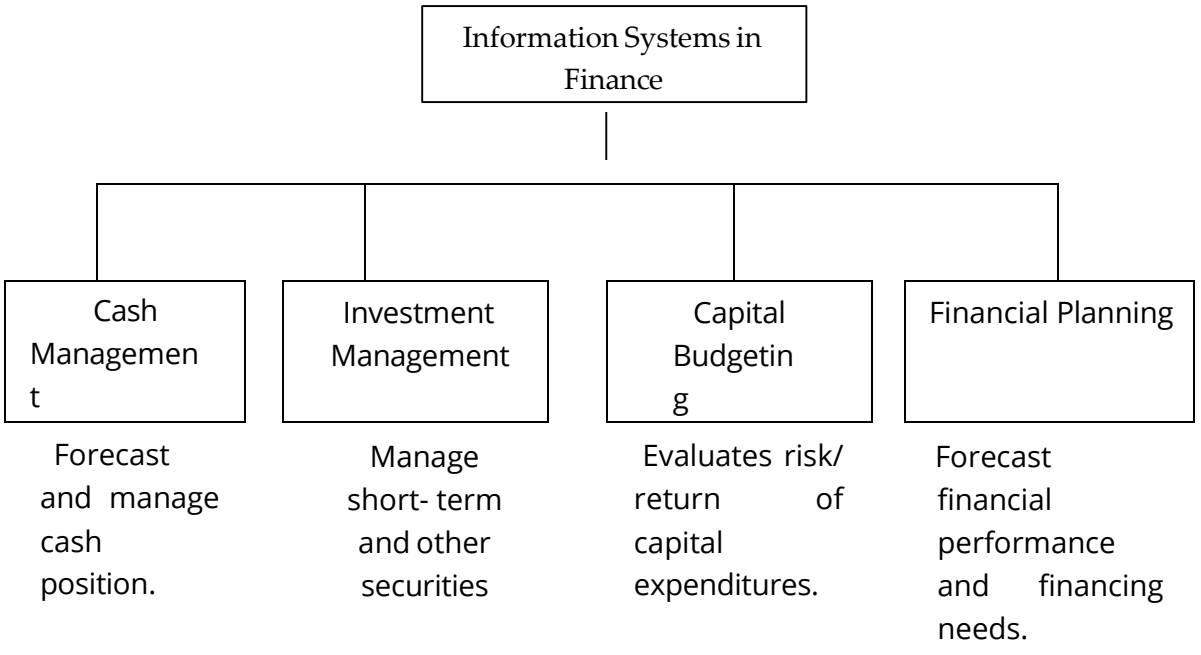
1. The first function of an AIS is the efficient and effective collection and storage of data concerning an organization's financial activities, including getting the transaction data from source documents, recording the transactions in journals, and posting data from journals to ledgers.
2. The second function of an AIS is to supply information useful for making decisions, including producing managerial reports and financial statements.
3. The third function of an AIS is to make sure controls are in place to accurately record and process data.

4. FINANCIAL INFORMATION SYSTEM

A financial information system is an organized approach to collecting and interpreting information, which is usually computerized. A well-run financial information system is essential to a business, since managers need the resulting information to make decisions about how to run the organization.

- Financial Planning / forecasting
- Capital Budgeting
- Investment Management
- Funds Management
- Working Capital
- Auditing and Control
- Asset Management

Financial Management Systems



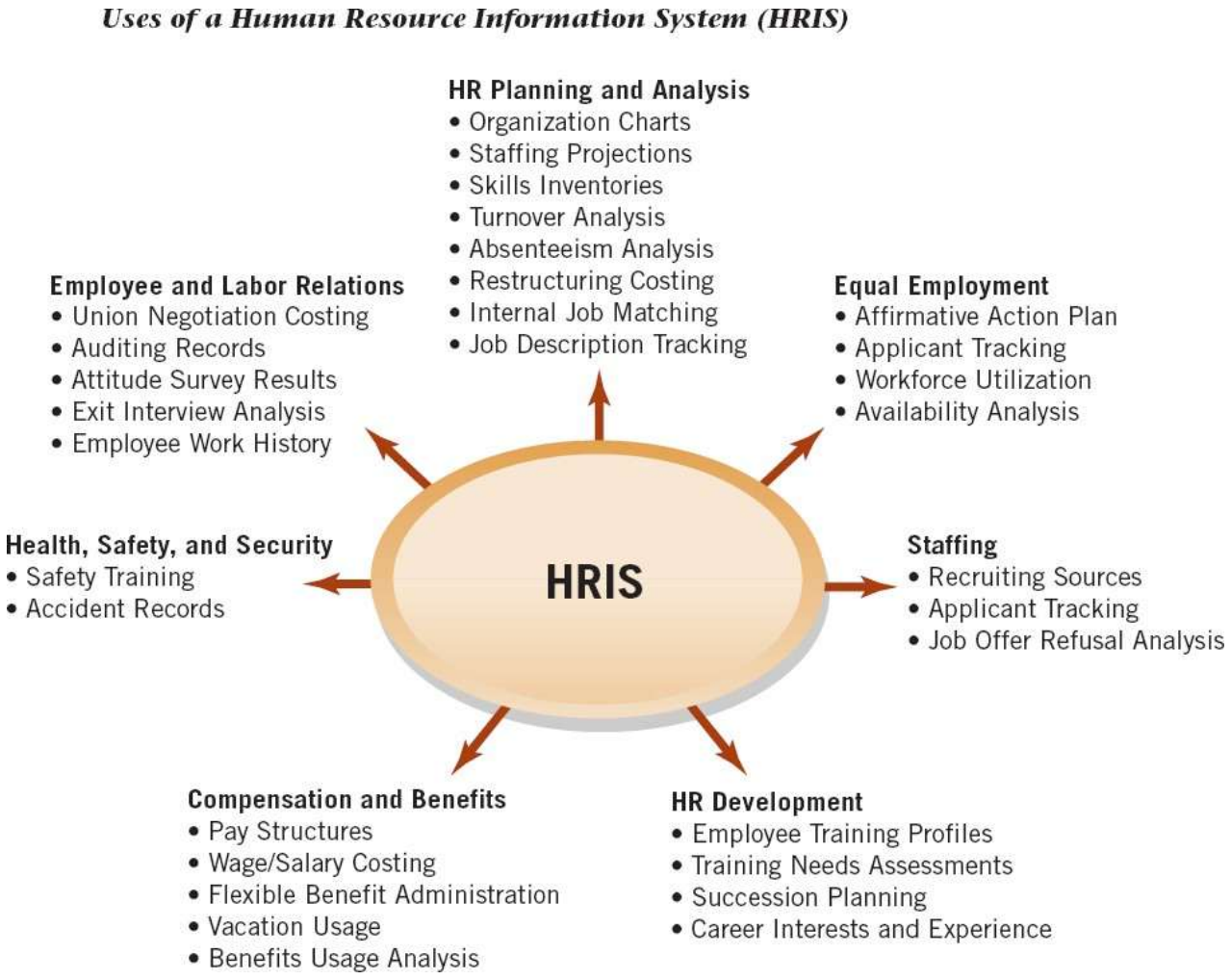
3.3 Components of Financial Information System

4.1 Advantages of Financial Information System

- Ensure that there are sufficient funds on hand to pay for obligations as they come due for payment
- Put excess funds to use in appropriate and reasonably liquid investments
- Determine which customers, products, product lines and subsidiaries are the most and least profitable
- Locate the bottleneck areas within the business
- Determine the maximum amount of funds that can safely be distributed to investors in the form of dividends
- Determine the maximum debt load that the organization can sustain

5. HUMAN RESOURCE / PERSONNEL INFORMATION SYSTEM

A human resource information system (HRIS) is a software package developed to aid human resources professionals in managing data. Human resource professionals utilize these systems to facilitate work flow, improve efficiency and store and collect information. Several companies offer HRIS packages to employers. HRIS packages can be customized to the specific needs and requirements of the employer.



3.3 Components of HRIS

5.1 Applications of HRIS

- Paid time off (PTO) and attendance
- Pay scale history
- Positions and pay grades
- Overall performance development strategies
- Coaching obtained
- Disciplinary actions
- Personal staff data

- Key staff succession plans
- Identification of prospective staff
- Applicant administration, including interview process and selection

System Analysis and Design: The work of a system analyst- SDLC-System design – AGILE Model – Waterfall Model – Spiral Model – Iterative and Incremental Model - RAD Model - Requirement analysis-Data flow diagram, relationship diagram, design-Implementation-Evaluation and maintenance of MIS, Database System: Overview of Database- Components-advantages and disadvantages of database; Data Warehousing and Data Mining; Business Intelligence; Artificial Intelligence; Expert System; Big Data; Cyber Safety and Security- Cryptography; RSA Model of Encryption; Data Science - Block Chain Technology; E-commerce and E-Business models; IOT - RFID.

1. System Analyst

- A systems analyst is a person who involves in analyzing the business, identifying opportunities for improvement, and designing information systems to implement these ideas.
- It is important to understand and develop through practice the skills needed to successfully design and implement new information systems.

Role of a System Analyst

1) Estimate cost and time for the project
2) Perform resource planning and scheduling
3) Develop procedural standards for performing tasks
4) Plan and direct acquisitions, training and development of system personnel
5) Perform interview and data gathering
6) Document current system operations
7) Prepare specification for system improvements

8) Develop conversion plans
9) Develop file structures
10) Develop forms and reports
11) Design processing and control procedures 12)Evaluate results
13) Document results
14) Assist in system testing and implementation
15) Fulfill administrative reporting requirements

2. Systems Development Life Cycle (SDLC)

SDLC is a sequence of events carried out by analysts, designers and users to develop and implement an information system.

The steps in SDLC are

1) System Study
2) Feasibility study
3) System Analysis
4) System Design
   - Development of software's
   - Systems testing
5) Implementation
6) Maintenance

Systems Development Life Cycle (SDLC) puts emphasis on decision making processes that affect system cost and usefulness. These decisions must be based on full consideration of business processes, functional requirements, and economic and technical feasibility.

- The primary objectives of any SDLC is to deliver quality system which meets or exceed customer expectations and within cost estimates, work effectively and efficiently within the current and planned infrastructure, and is an inexpensive to maintain.
- SDLC establishes a logical order of events for conducting system development that is controlled, measured, documented, and ultimately improved. Any software is not all complete and there are enough rooms to add new features to existing software.

i. System Study

Preliminary system study is the first stage of system development life cycle. This is a brief investigation of the system under consideration and gives a clear picture of what actually the physical system is? In practice, the initial system study involves the

preparation of a System proposal which lists the Problem Definition, Objectives of the Study, Terms of reference for Study, Constraints, Expected benefits of the new system, etc. in the light of the user requirements. The system proposal is prepared by the System Analyst (who studies the system) and places it before the user management. The management may accept the proposal and the cycle proceeds to the next stage. The management may also reject the

proposal or request some modifications in the proposal. In summary, we would say that system study phase passes through the following steps:

- problem identification and project initiation
- background analysis
- inference or findings

Detailed System Study

The detailed investigation of the system is carried out in accordance with the objectives of the proposed system. This involves detailed study of various operations performed by a system and their relationships within and outside the system. During this process, data are collected on the available files, decision points and transactions handled by the present system. Interviews, on-site observation and questionnaire are the tools used for detailed system study. Using the following steps it becomes easy to draw the exact boundary of the new system under consideration:

- Keeping in view the problems and new requirements
- Workout the pros and cons including new areas of the system

All the data and the findings must be documented in the form of detailed data flow diagrams (DFDs), data dictionary, logical data structures and miniature specifications. It includes planning for the new system, analysis of requirement, system constraints, functions and proposed system architecture, prototype of the proposed system and its analysis.

ii. Feasibility Study

In case the system proposal is acceptable to the management, the next phase is to

examine the feasibility of the system. The feasibility study is basically the test of the proposed system in the light of its workability, meeting user's requirements, effective use of resources and of course, the cost effectiveness. These are categorized as technical, operational, economic, schedule and social feasibility. The main goal of feasibility study is not to solve the problem but to achieve the scope. In the process of feasibility study, the cost and benefits are estimated with greater accuracy to find the Return on Investment (ROI). This also defines the resources needed to complete the detailed investigation. The result is a feasibility report submitted to the

management. This may be accepted or accepted with modifications or rejected. In short, following decision are taken in different feasibility study:

- Economic feasibility - The likely benefits outweigh the cost of solving the problem which is generally demonstrated by a cost/ benefit analysis.
- Operational feasibility - Whether the problem can be solved in the user's environment with existing and proposed system workings?
- Organizational feasibility – Whether the proposed system is consistent with the organization's strategic objectives?
- Technical feasibility - Whether the problem be solved using existing technology and resources available?
- Social feasibility – Whether the problem be solved without causing any social issues? Whether the system will be acceptable to the society?

iii. System Analysis

- It is the process of gathering and interpreting facts, diagnosing problems and using the information to recommend improvements in the system.
- System analysis is a process of collecting factual data, understand the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning.
- This involves studying the business processes, gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system so as to achieve the organizational goals.
- System Analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes.

The major objectives of systems analysis are to find answers for each business process:

- What is being done?
- How is it being done?
- Who is doing it?
- When is he doing it? Why is it being done?
- How can it be improved?

It is more of a thinking process and involves the creative skills of the System Analyst. It attempts to give birth to a new efficient system that satisfies the current needs of the user and has scope for future growth within the organizational constraints. The result of this process is a logical system design. System analysis is an iterative process that continues until a preferred and

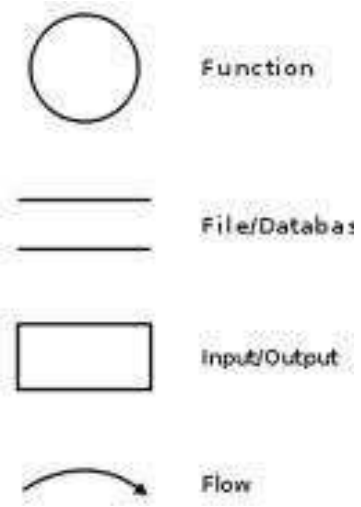
acceptable solution emerges.

3.1 Steps in System Analysis

- The drawing of system flow charts and data flow diagrams.
- The identification of the proposed system's objectives.
- Facts about the system that is going to be replaced.
- An outline of any constraints or limits (e.g. lack of time, money, or staff training).
- An updated cost/benefit analysis.
- An outline of any further developments of the system.

3.2 System Analysis Tools Data Flow Diagram (DFD)

- DFD are widely used graphic tools for describing the movement of data within or outside the system
- These diagrams convey to both software developers and users, how the current system is working and how the proposed system will work

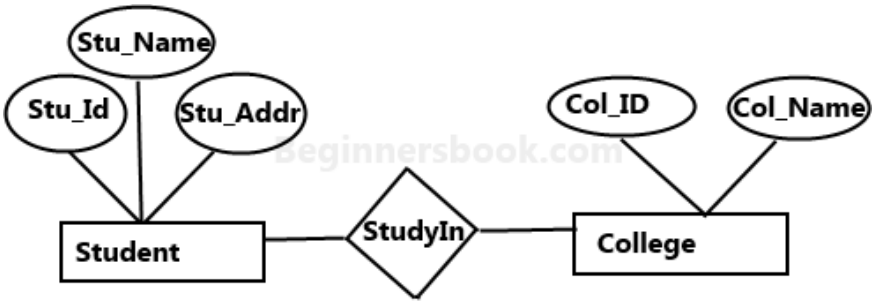


Data Dictionary

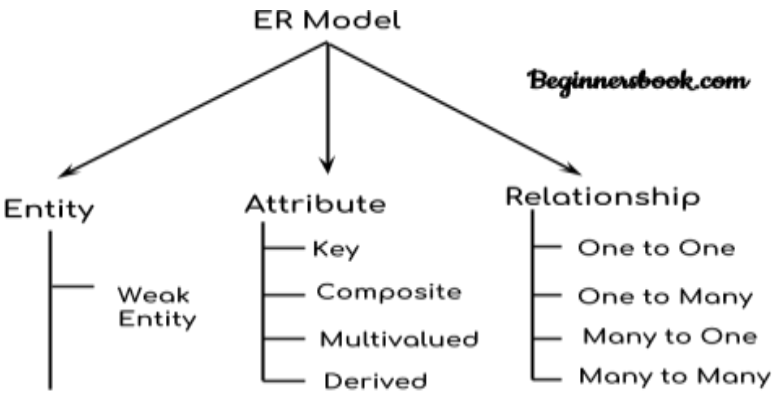
A data dictionary is a catalogue of all the elements in a system. It is document that collects, co-ordinates, and confirms what a specific data terms mean to different people in the organisation.

3.3 Entity Relationship Diagram (ERD)

ER Diagram or ER model, is a type of structural diagram for use in database design. An ERD contains different symbols and connectors that visualize two important information. The major entities within the system scope, and the inter-relationships among these entities.



Sample E-R Diagram



Components of ER Diagram

Uses of ER Diagram

Database design - Depending on the scale of change, it can be risky to alter a database structure directly in a DBMS. To avoid ruining the data in a production database, it is important to plan out the changes carefully. ERD is a tool that helps. By drawing ER diagrams to visualize database design ideas, you have a chance to identify the mistakes and design flaws, and to make corrections before executing the changes in the database.

Database debugging - To debug database issues can be challenging, especially when the database contains many tables, which require writing complex SQL in getting the information you need. By visualizing a database schema with an ERD, you have a full picture of the entire database schema. You can easily locate entities, view their attributes and identify the relationships they have with others. All these allow you to analyze an existing database and to reveal database problems easier.

Database creation and patching - Visual Paradigm, an ERD tool, supports a database generation tool that can automate the database creation and

patching process by means of ER diagrams. So, with this ER Diagram tool, your ER design is no longer just a static diagram but a mirror that reflects truly the physical database structure.

Aid in requirements gathering - Determine the requirements of an information system by drawing a conceptual ERD that depicts the high-level business objects of the system. Such an initial model can also be evolved into a physical database model that aids the creation of a relational database, or aids in the creation of process maps and data flow modes.

iv. System Design

4.1 Meaning

It is the process of planning a new business system or complement an existing system

- Based on the user requirements and the detailed analysis of a new system, the new system must be designed.
- . It is the most crucial phase in the development of a system.
- The logical system design arrived at as a result of system analysis and is converted into physical system design. In the design phase the SDLC process

  continues to move from the what questions of the analysis phase to the how .
- The logical design produced during the analysis is turned into a physical design - a detailed description of what is needed to solve original problem. Input, output, databases, forms, codification schemes and processing

specifications are drawn up in detail.

- In the design stage, the programming language and the hardware and software platform in which the new system will run are also decided. Data structure, control process, equipment source, workload and limitation of the system, Interface, documentation, training, procedures of using the system, taking backups and staffing requirement are decided at this stage.

4.2 Objectives / Functions of System Design

- Design procedures for data entry
- Design the human-computer interface
- Design system controls
- Design files and/or database
- Design backup procedures

4.3 Process of System design.

- Coding
  - The system design needs to be implemented to make it a workable system. his demands the coding of design into computer language, i.e., programming language.
  - This is also called the programming phase in which the programmer converts the program specifications into computer instructions, which we refer to as programs.
  - It is an important stage where the defined procedures are transformed into control specifications by the help of a computer

language.

- The programs coordinate the data movements and control the entire process in a system. A well written code reduces the testing and maintenance effort. It is generally felt that the programs must be modular in nature.
- This helps in fast development, maintenance and future changes, if required. Programming tools like compilers, interpreters and language like c, c++, and java etc., are used for coding .with respect to the type of application. The right programming language should be chosen.

- Testing
  - Before actually implementing the new system into operations, a test run of the system is done removing all the bugs, if any. It is an important phase of a successful system.
  - After codifying the whole programs of the system, a test plan should be developed and run on a given set of test data.
  - The output of the test run should match the expected results. Sometimes, system testing is considered as a part of implementation process.

Using the test data following test run are carried out:

- Program test
- System test
- Program test : When the programs have been coded and compiled and brought to working conditions, they must be individually tested with the

prepared test data. All verification and validation be checked and any undesirable happening must be noted and debugged (error corrected).

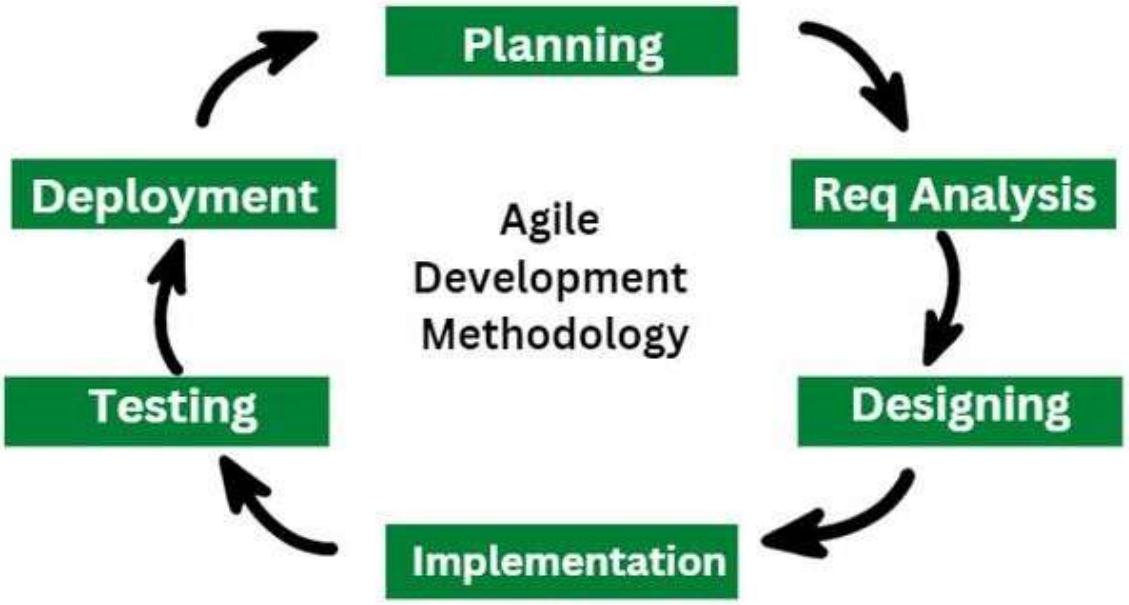
- System Test : After carrying out the program test for each of the programs of the system and errors removed, then system test is done. At this stage the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the results or output of the system is analyzed. During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are fixed and further tested for the expected output. All independent modules be brought together and all the interfaces to be tested between multiple modules, the whole set of software is tested to establish that all modules work together correctly as an application or system or package.

When it is ensured that the system is running error-free, the users are called with their own actual data so that the system could be shown running as per their requirements.

4.3 Agile Development

Agile model in the context of system design is a flexible and adaptive approach to designing systems that can respond to changing requirements and customer needs. The key objective is to create a functioning system as soon as possible and to refine it depending on input from stakeholders.

Phases of Agile Model in Designing System



i. Planning: The team defines the project's overall goals during the planning phase of the agile model and decides what must be accomplished throughout each sprint. This entails determining the project's scope, identifying the main stakeholders, and developing a high-level roadmap for the system design. The development methodology, including the agile procedures and practices to be followed, is also established by the team.

ii. Requirement Analysis: The team collaborates with the stakeholders throughout the requirement analysis phase to compile and examine the system's requirements. This entails gathering requirements and prioritizing them according to their urgency and importance. Additionally, the team identifies any potential hazards or limitations that could affect the project and creates a strategy to mitigate them.

iii. Designing: The team develops intricate designs for the system interfaces and components at this stage. The team creates any necessary prototypes as well as the architecture and design patterns that will be employed. This phase's objectives are to lay a strong framework for the system and make that the design is scalable and consistent.

iv. Implementation: The team constructs the system's individual parts and incorporates them into the overall design during the implementation phase. The team completes each sprint with the delivery of usable software. The team also makes adjustments to the backlog of needs and makes that the system is being developed in accordance with the design.

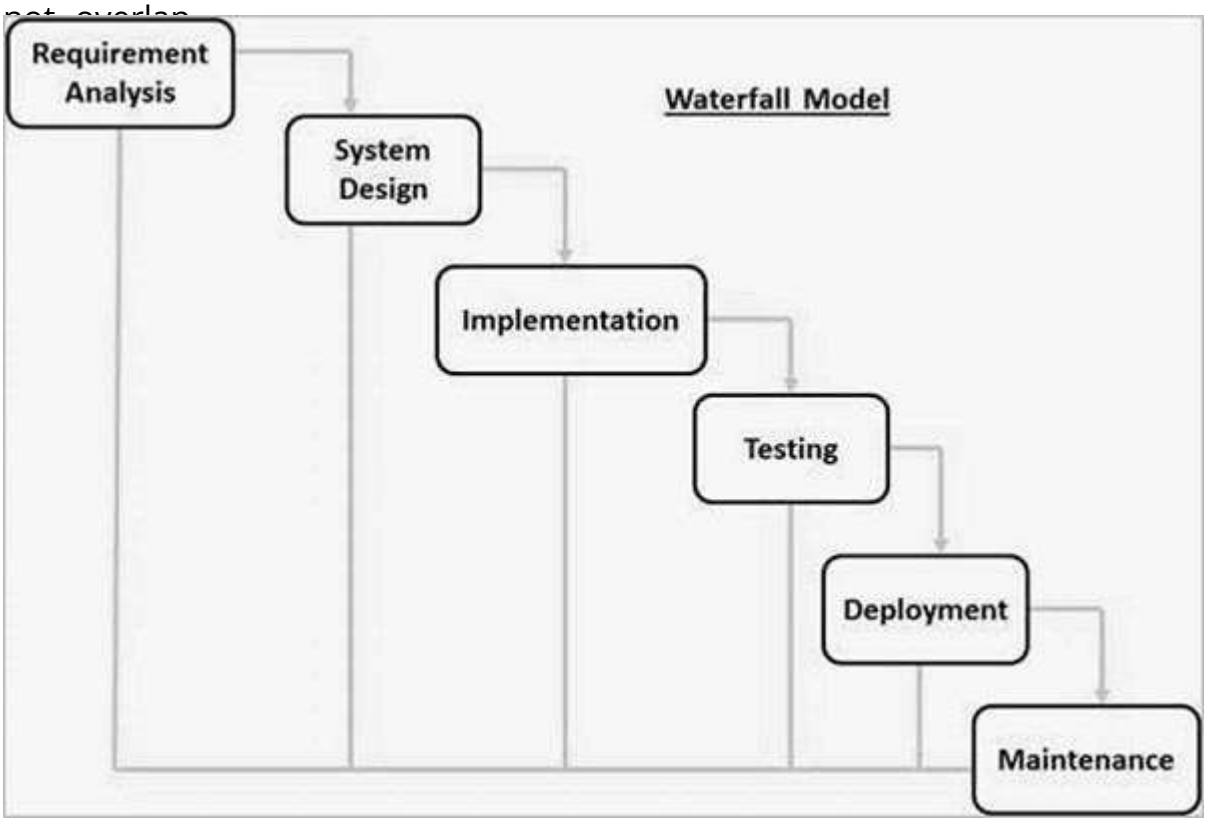
v. Testing: During the testing phase, the team validates the system by putting each component through its paces and making sure it complies with the specifications. The crew also finds and resolves any flaws or problems that come up while testing. Making ensuring the system is high-quality and prepared for deployment is the aim of this phase.

vi. Deployment: The system is given to the end users during this last phase. The team deploys the system in collaboration with the stakeholders and offers any required support and training. This phase's objective is to guarantee that the system is correctly implemented and that end users can efficiently utilize it.

4.4 The waterfall method

It is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. The Waterfall model is the earliest SDLC approach that was used for software development.

The waterfall Model illustrates the software development process in a linear sequential flow. This means that any phase in the development process begins only if the previous phase is complete. In this waterfall model, the phases do not overlap.



Phases in Waterfall Model

i. Requirement Gathering and analysis − All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.

ii. System Design − The requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.

iii. Implementation − with inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.

iv. Integration and Testing − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

v. Deployment of system − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.

vi. Maintenance − There are some issues which come up in the client environment. To fix those issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

Features of the Waterfall Model

- Sequential Approach: The waterfall model involves a sequential approach to software development, where each phase of the project is completed

  before moving on to the next one.
- Document-Driven: The waterfall model relies heavily on documentation to ensure that the project is well-defined and the project team is working towards a clear set of goals.
- Quality Control: The waterfall model places a high emphasis on quality control and testing at each phase of the project, to ensure that the final product meets the requirements and expectations of the stakeholders.
- Rigorous Planning: The waterfall model involves a rigorous planning process, where the project scope, timelines, and deliverables are carefully defined and monitored throughout the project lifecycle.

4.5 Spiral Model

The spiral model combines the idea of iterative development with the systematic, controlled aspects of the waterfall model. This Spiral model is a combination of iterative development process model and sequential linear development model i.e. the waterfall model with a very high emphasis on risk analysis. It allows incremental releases of the product or incremental refinement through each iteration around the spiral.

Spiral Model - Design

The spiral model has four phases. A software project repeatedly passes

through these phases in iterations called Spirals.

i. Identification

This phase starts with gathering the business requirements in the baseline spiral. In the subsequent spirals as the product matures, identification of system requirements, subsystem requirements and unit requirements are all done in this phase.

This phase also includes understanding the system requirements by continuous communication between the customer and the system analyst. At the end of the spiral, the product is deployed in the identified market.

ii. Design

The Design phase starts with the conceptual design in the baseline spiral and involves architectural design, logical design of modules, physical product design and the final design in the subsequent spirals.

iii. Construct or Build

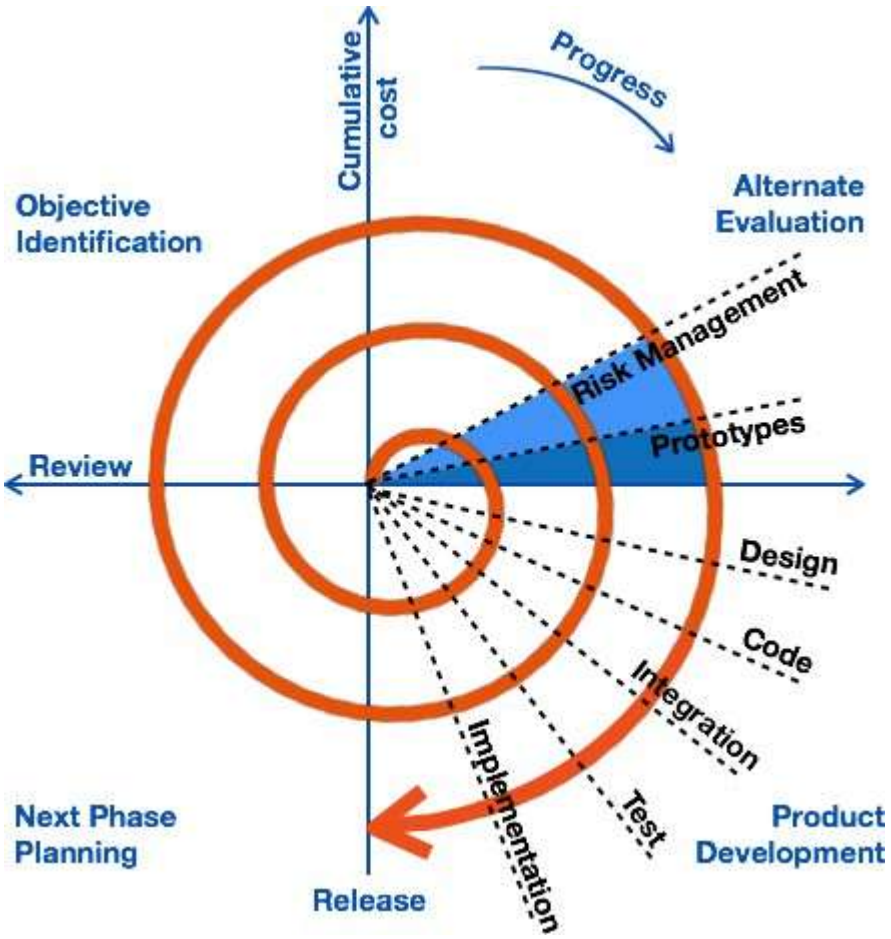
The Construct phase refers to production of the actual software product at every spiral. In the baseline spiral, when the product is just thought of and the design is being developed a POC (Proof of Concept) is developed in this phase to get customer feedback.

Then in the subsequent spirals with higher clarity on requirements and design details a working model of the software called build is produced with a version number. These builds are sent to the customer for feedback.

iv. Evaluation and Risk Analysis

Risk Analysis includes identifying, estimating and monitoring the technical

feasibility and management risks, such as schedule slippage and cost overrun. After testing the build, at the end of first iteration, the customer evaluates the software and provides feedback.



Spiral Model Application

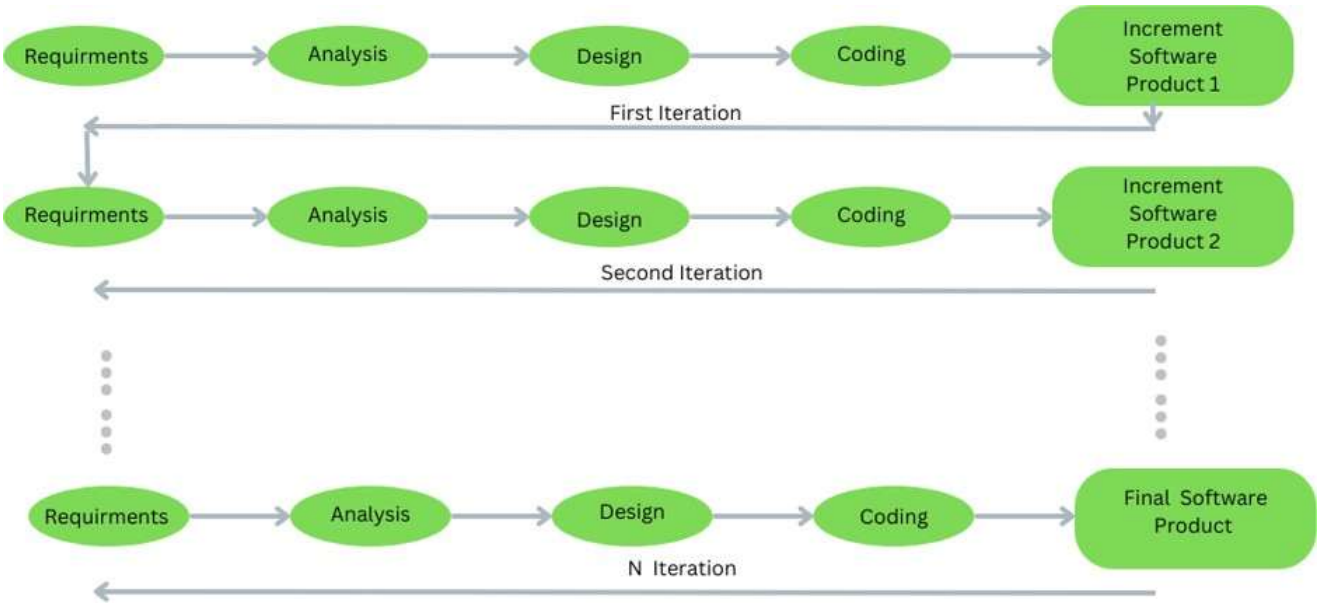
The Spiral Model is widely used in the software industry as it is in sync with the natural development process of any product, i.e. learning with maturity which involves minimum risk for the customer as well as the development firms.

The following pointers explain the typical uses of a Spiral Model −

- When there is a budget constraint and risk evaluation is important.
- For medium to high-risk projects.
- Long-term project commitment because of potential changes to economic priorities as the requirements change with time.
- Customer is not sure of their requirements which is usually the case.
- Requirements are complex and need evaluation to get clarity.
- New product line which should be released in phases to get enough customer feedback.
- Significant changes are expected in the product during the development cycle.

4.6 Iterative Incremental model in Designing System

- It is a versatile and adaptable method of creating software that enables the gradual release of additions and functionalities.
- The procedure for developing software is split up into smaller iterations or increments in this paradigm. Every iteration involves the creation of a compact, useful component of the software system.
- The increments are created and constructed one after the other, each one building on the one before it.
- In order to attain the necessary level of functionality, the building process is repeated throughout each iteration. This makes it possible for continuous testing and feedback, which might result in a better final product.



A diagram to display Iterative Incremental Model

Different phases in Iterative Incremental Model:

The following are the typical phases in the Iterative Incremental Model:

i. Planning Phase: In this phase, the team identifies the goals and objectives of the project, along with the project scope, requirements, and constraints on them. The team then identifies different iterations that would be needed to complete the project successfully.

ii. Requirements Analysis and Design Phase: In this phase, the requirements met are then analyzed and the according system is designed based on these requirements. The projected design should be modular, which would allow easy modification and testing in subsequent iterations.

iii. Implementation Phase: In this phase, the system is implemented based on the design created in the previous phase. The implementation should be done in small, manageable pieces or increments, which can then be tested in the next phase of the cycle.

iv. Testing Phase: In this phase, the system is tested against the requirements identified in the planning phase. Testing is done for each iteration, and any defects or issues are identified and resolved, and this helps in each iteration.

v. Evaluation Phase: In this phase, the team evaluates the performance of the system based on the results of testing. Feedback is gathered from users and stakeholders, and changes are made to the system as needed which makes the system more scalable and flexible.

vi. Incremental Release: In this phase, the completed iterations are released to users and stakeholders. Each release builds on the previous release, providing new functionality or improving existing functionality to a great extent.

Benefits or Strengths of the Iterative Incremental Model:

- Prioritized needs can be created first.
- Delivery of the initial product is quicker.
- Customers receive critical functionality at the earliest.
- Lowers the initial cost of delivery.
- Every release is indeed a product increment, ensuring a usable product available for the client.
- Changes in requirements can be addressed with ease.

Drawbacks of the Iterative Incremental Model:

- It requires efficient iteration planning.
- Iterative Incremental Model requires adequate design in order to guarantee the inclusion of the needed functionality and allow for

future adjustments.

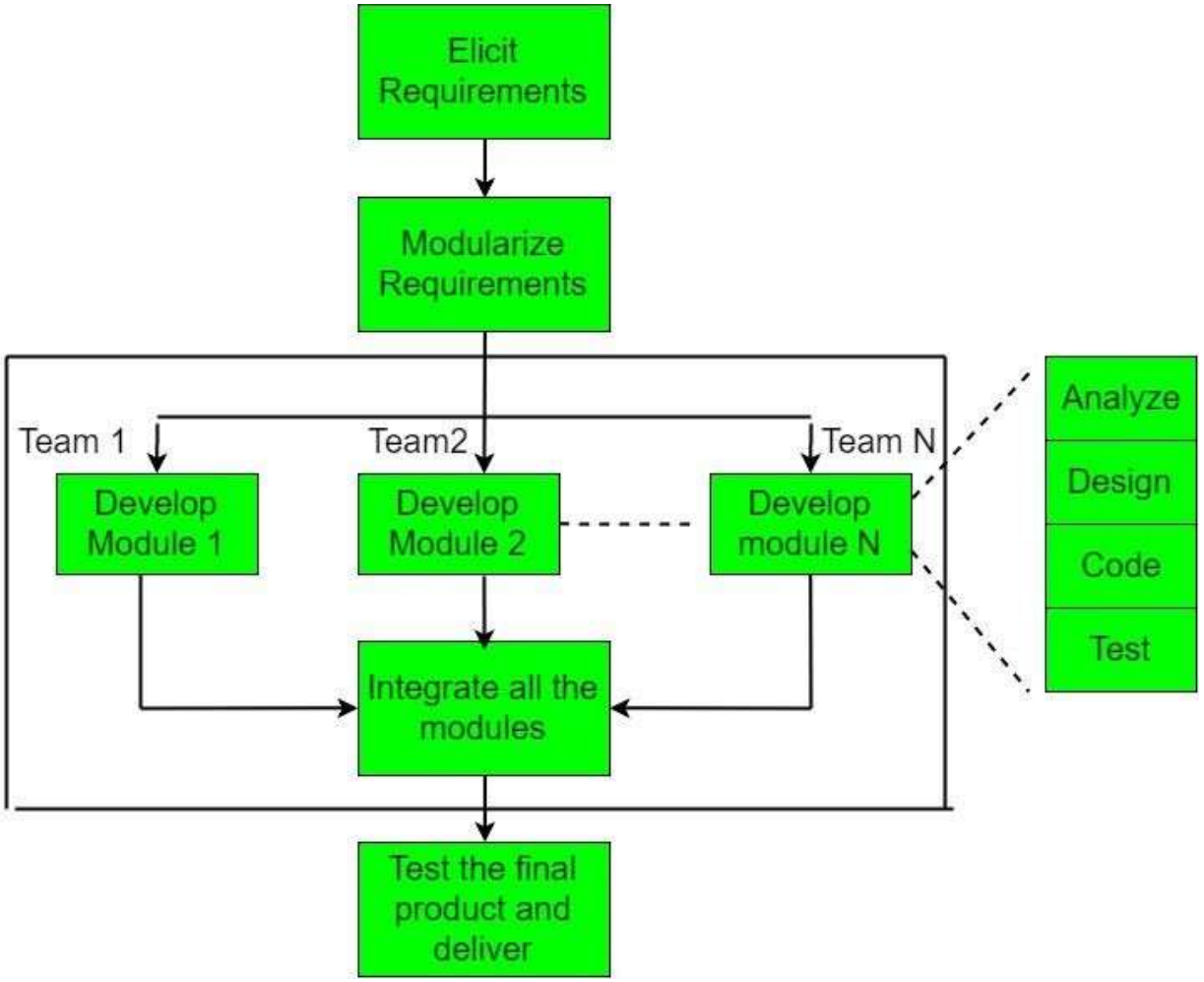
- As some modules are developed far before others, it is necessary to have well-defined module interfaces.
- The overall price of the system is not lower.

Applications of Iterative Incremental Model:

- This model is also ideal for rapid prototyping, as it allows developers to quickly build and test a prototype
- Iterative Incremental Model is ideal for software products that include requirements such as agile Software Development, Android Development, and website development.
- It is used in places where requirements are a priority.
- It is also used in places where projects have lengthy schedules for development.

4.7 Rapid application development model (RAD)

The RAD model is a type of incremental process model in which there is extremely short development cycle. When the requirements are fully understood and the component-based construction approach is adopted then the RAD model is used. Various phases in RAD are Requirements Gathering, Analysis and Planning, Design, Build or Construction, and finally Deployment. Multiple teams work on developing the software system using RAD model parallely.



Phases of RAD

The use of powerful developer tools such as JAVA, C++, Visual BASIC, XML, etc. is also an integral part of the projects. This model consists of 4 basic phases:

1. Requirements Planning – It involves the use of various techniques used in requirements elicitation like brainstorming, task analysis, form analysis, user scenarios, FAST (Facilitated Application Development Technique), etc. It also consists of the entire structured plan describing the critical data, methods to obtain it, and then processing it to form a final refined model.

2. User Description – This phase consists of taking user feedback and building the prototype using developer tools. In other words, it includes re-examination and validation of the data collected in the first phase. The dataset attributes are also identified and elucidated in this phase.
3. Construction – In this phase, refinement of the prototype and delivery takes place. It includes the actual use of powerful automated tools to transform processes and data models into the final working product. All the required modifications and enhancements are too done in this phase.
4. Cutover – All the interfaces between the independent modules developed by separate teams have to be tested properly. The use of powerfully automated tools and subparts makes testing easier. This is followed by acceptance testing by the user.

Advantages:

- The use of reusable components helps to reduce the cycle time of the project.
- Feedback from the customer is available at the initial stages.
- Reduced costs as fewer developers are required.
- The use of powerful development tools results in better quality products in comparatively shorter time spans.
- The progress and development of the project can be measured through the various stages.
- It is easier to accommodate changing requirements due to the short iteration time spans.
- Productivity may be quickly boosted with a lower number of employees.

Disadvantages:

- The use of powerful and efficient tools requires highly skilled professionals.
- The absence of reusable components can lead to the failure of the project.
- The team leader must work closely with the developers and customers to close the project on time.
- The systems which cannot be modularized suitably cannot use this model.
- Customer involvement is required throughout the life cycle.
- It is not meant for small-scale projects as in such cases, the cost of using automated tools and techniques may exceed the entire budget of the project.
- Not every application can be used with RAD.
-

Applications:

1. This model should be used for a system with known requirements and requiring a short development time.
2. It is also suitable for projects where requirements can be modularized and reusable components are also available for development.
3. The model can also be used when already existing system components can be used in developing a new system with minimum changes.
4. This model can only be used if the teams consist of domain experts. This is because relevant knowledge and the ability to use powerful techniques are a necessity.
5. The model should be chosen when the budget permits the use of automated tools and techniques required.

v. Implementation

After having the user acceptance of the new system developed, the implementation phase begins. Implementation is the stage of a project during which theory is turned into practice. The major steps involved in this phase are:

- Acquisition and Installation of Hardware and Software
- Conversion
- User Training
- Documentation

Acquisition and Installation of Hardware and Software

- The hardware and the relevant software required for running the system must be made fully operational before implementation.
- The conversion is also one of the most critical and expensive activities in the system development life cycle.
- The data from the old system needs to be converted to operate in the new format of the new system.
- The database needs to be setup with security and recovery procedures fully defined.

User Training

During this phase, all the programs of the system are loaded onto the user's computer. After loading the system, training of the user starts. Main topics of such type of training are:

- How to execute the package?
- How to enter the data?
- How to process the data (processing details)?

- How to take out the reports?

After the users are trained about the computerized system, working has to shift from manual to computerized working. The process is called Changeover. The following strategies are followed for changeover of the system.

i. Direct Changeover: This is the complete replacement of the old system by the new system. It is a risky approach and requires comprehensive system testing and training.

ii. Parallel run : In parallel run both the systems, i.e., computerized and manual, are executed simultaneously for certain defined period. The same data is processed by both the systems. This strategy is less risky but more expensive because of the following facts:

- Manual results can be compared with the results of the computerized system.
- The operational work is doubled.
- Failure of the computerised system at the early stage does not affect the working of the organization, because the manual system continues to work, as it used to do.

(iii) Pilot run: In this type of run, the new system is run with the data from one or more of the previous periods for the whole or part of the system. The results are compared with the old system results. It is less expensive and risky than parallel run approach. This strategy builds the confidence and the errors are traced easily without affecting the operations.

Documentation

The documentation of the system is also one of the most important activity in the system development life cycle. This ensures the continuity of the system.

Generally following two types of documentations are prepared for any system.

- User or Operator Documentation
- System Documentation

User Documentation: The user documentation is a complete description of the system from the user's point of view detailing how to use or operate the system. It also includes the major error messages likely to be encountered by the user.

System Documentation: The system documentation contains the details of system design, programs, their coding, system flow, data dictionary, process description, etc. This helps to understand the system and permit changes to be made in the existing system to satisfy new user needs.

vi. Maintenance

Maintenance is necessary to eliminate errors in the system during its working life and to tune the system to any variations in its working environments. It must meet the scope of any future enhancement, future functionality and any other added functional features to cope up with the latest future needs. It has been seen that there are always some errors found in the systems that must be noted and corrected. It also means the review of the system from time to time. The review of the system is done for:

- knowing the full capabilities of the system
- knowing the required changes or the additional requirements
- Studying the performance.

If a major change to a system is needed, a new project may have to be set up to carry out the change. The new project will then proceed through all the above life cycle phases.

5. PITFALLS IN MIS DEVELOPMENT

i. Pitfalls in system Analysis

a. Poor defining of problem
b. Lack of communication skill
c. Time and resources not properly allocated
d. Poor staffing
e. Specification poorly documented

ii. Pitfalls in Design

a. System is not flexible
b. Drastic changes in roles and procedures
c. Documents poorly done

iii. Pitfalls in Coding

a. Time and cost of development underestimated
b. Programmers not given complete specifications
c. Not following proper software engineering concepts

iv. Pitfalls in Testing

a. Poor test plan
b. Users not involved in testing

v. Pitfalls in Conversion

a. Inadequate training for users
b. No performance standards
c. Provisions for system maintenance is inadequate

d. System and user documentation is incomplete

6. Database

A database is collection of information in the digital form related to a particular subject or purpose.

6.1 Objectives of Database

1. Availability : Data should be available
2. Share ability: Data items prepared by one application.
3. Evolvability: The database can evolve as application usage.
4. Data independence: The users of the database establish their view of the data.
5. Data integrity: The database establishes a uniform high level of accuracy.

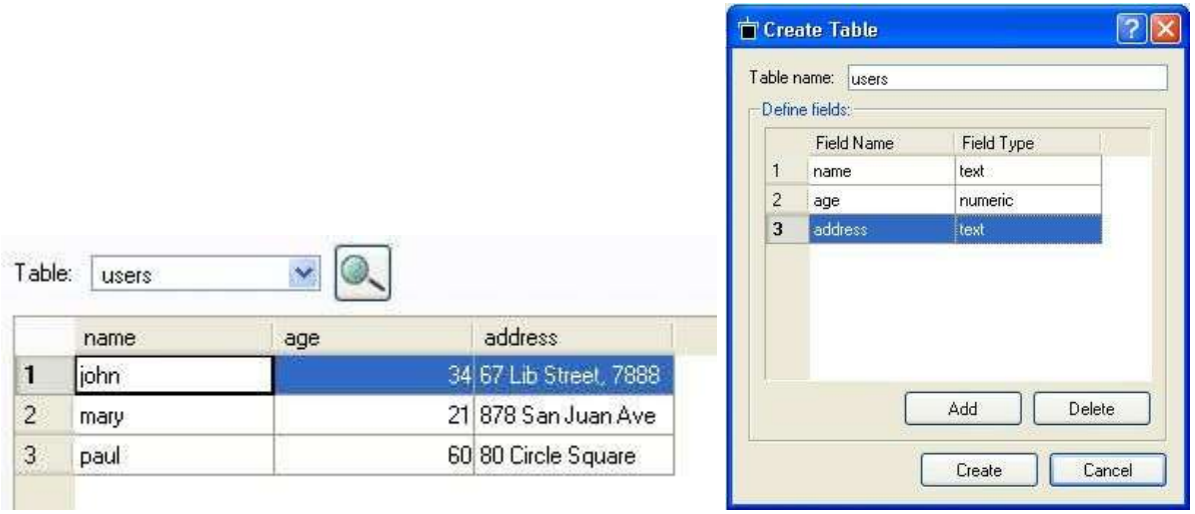
6.2 Database Structures

Database structure consists of

i. Tables
ii. Queries
iii. Forms
iv. Reports
v. Indexes

Tables

- Tables are the structures that store your data in the database. Each table is composed of a number of FIELDS, also known as COLUMNS in some database engines.
- Eg: A table can be created named USERS, with the following fields: NAME, AGE and ADDRESS.



Fields

Field types form a basic type of validation in that the database won't allow you to enter, say, text in a date field

Common field types are:

- whole numbers
- decimal numbers
- text
- dates
- Boolean (or yes/no)

Queries

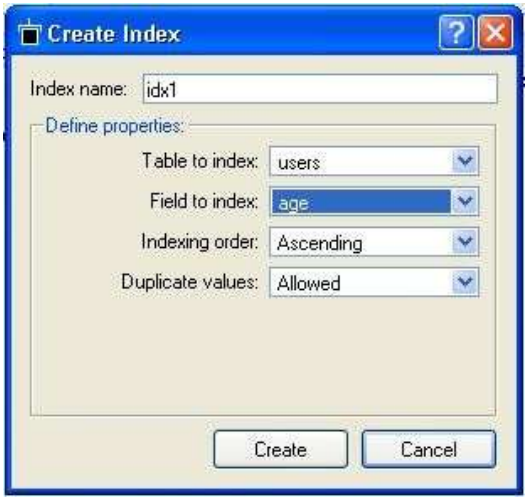
A query can be thought of as a stored question about the data. They are used to filter, sort and summarise data. Special queries called action queries are used to manipulate data and database structure. They can create, delete or modify records and create new tables

Reports

- Reports are designed in a similar way to forms and can get their data either directly from a table or filtered by a query. Reports can alsodisplay data in the form of charts and pivot tables.
- The report tool is ideal for creating a wide range of documents based on the data in your database such as invoices, statements or shipping documents and even envelopes or lists of mailing labels

Indexes

- An index is just like the index in a book - it is an extra bit added on to the database to help the database program find records quickly.
- When creating the records, but you should index all key fields and any fields that you regularly use to search or sort.



7. Database Management Systems

A database management system (DBMS) is simply the software the permits an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs.

A database management system has three components:

1. ***Data Definition Language (DDL)***

   A data definition language is the formal language programmers use to specify the content and structure of the database.

2. ***Data Manipulation Language (DML)***

   This language contains commands that permit and users and programming specialist to extract data from the database to satisfy information requests and develop applications.

3. ***Data Dictionary***

   This is an automated or manual file that stores definitions of data elements and data characteristics such as usage, physical representation, ownership and security.

7.1 Types of Databases:

1. ***Operational Databases***

   Operational databases store detailed data needed to support the business processes and operations of a company.

2. ***Distributed Databases***

   Organizations database to network servers at a variety of sites.

   It can reside on network servers on the WWW, Intranets or extranets.

3. ***External Databases***

External databases are available for a fee from commercial online services, and with or without charge from many sources on the WWW.

4. ***Hypermedia Databases***

Internet and corporate intranets and extranets has dramatically increased the use of databases of hypertext and hypermedia documents.

5. ***Data Warehouses***

They contain a vast amount of data.

6. ***Unstructured Databases***

The web is emerging as a universal data repository, almost completely unstructured pages.

To allow applications to utilize data from many sources, with possibly widely varying formats.

7.2 Design Principles of Database

1. ***Determine the purpose of the database.***

Designing a database is to determine the purpose of the database and how it is to be used.

2. ***Determine the tables needed by the organization in the database***

Designing tables, pieces of information should be divided.

3. ***Determine the fields needed in the tables.***

Table contains information about the same subject, and field in a table contains individual facts about the table's subject.

4. ***Identify the primary/unique keys***

Database must include a field or set of fields that uniquely identifies each individual record in the table.

5. ***Determine the relationships between tables.***

To bring related information together between tables.

7.3 Database Administration

Evolving Approaches to Database Administration:

1. Data policies, procedures and standards
2. Planning
3. Data conflict resolution
4. Internal Marketing
5. Managing the information repository
6. Selection of hardware and software
7. Installing and upgrading the DBMS
8. Tuning database performance
9. Improving database query processing

performance 10. Managing data security, privacy,

and integrity

11. Data backup and recovery

Evolving Approaches to Data Administration:

1. Database planning
2. Database analysis
3. Database design
4. Database implementation
5. Operations and maintenance

7.4 Advantages of Database;

1. Redundancy Control

   Each application has its own data, which causes duplication of common data items in more than one file.

2. Data Consistency

   Updating multiple file management system leads to inaccurate data.

3. Management Queries

   It is a convenient approach to handle even unstructured queries.

4. Data Independence

   The database approach provides independence between the file structure and program structure.

5. Enforcement of Standards

   Data being stored at one central place, standards can easily be enforced.

7.5 Disadvantages of Database;

1. Centralized Database

   Data structure may become quite complex because of the centralized database supporting many applications in an organization.

2. More Disk Space

   Needs more disk space for program storage.

3. Operationality of the system

   Whether due to a system fault, database corruption, etc.., all users unable to access the database.

4. Security Risk

   Being a centralized database, it is more prone to security disasters.

8. RELATIONAL DATABASE

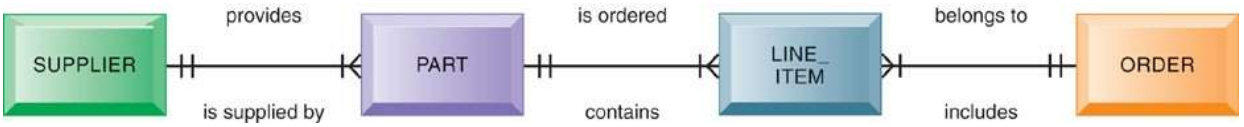
It represents data as two-dimensional tables called relations or files. Each table contains data on entity and attributes

- Table: grid of columns and rows
- Rows (tuples): Records for different entities
- Fields (columns): Represents attribute for entity
- Key field: Field used to uniquely identify each record
- Primary key: Field in table used for key fields
- Foreign key: Primary key used in second table as look-up field to identify records from original table

Establishing Relationships

Entity-Relationship diagram (ER diagram)

- Used by database designers to document the data model
- Illustrates relationships between entities



Relational database tables may have:

- One-to-one relationship
- One-to-many relationship
- Many-to-many relationship

Requires creating a table (join table, Intersection relation) that links the two tables to join information

Normalization

- Process of streamlining complex groups of data to:
- Minimize redundant data elements
- Minimize awkward many-to-many relationships
- Increase stability and flexibility

Referential integrity rules

- Used by relational databases to ensure that relationships between coupled tables remain consistent
- E.g. When one table has a foreign key that points to another table, you may not add a record to the table with foreign key unless there is a corresponding record in the linked table

Operations of a Relational DBMS

Three basic operations used to develop useful sets of data

- Select: Creates subset of data of all records that meet stated criteria
- Join: Combines relational tables to provide user with more information than available in individual tables
- Project: Creates subset of columns in table, creating tables with only the information specified

Object-Oriented DBMS (OODBMS)

- Stores data and procedures as objects
- Capable of managing graphics, multimedia, Java applets
- Relatively slow compared with relational DBMS for processing large numbers of transactions
- Hybrid object-relational DBMS: Provide capabilities of both OODBMS and relational DBMS

9. Data Warehousing

Data warehousing is a collection of decision support technologies, aimed at enabling the knowledge worker (executive, manager, and analyst) to make better and faster decisions.

Data Warehouse

A data warehouse is a "subject-oriented, integrated, time varying, non-volatile collection of data that is used primarily in organizational decision making. The data warehouse supports On-Line Analytical Processing (OLAP), the functional

and performance requirements of which are quite different from those of the On-Line Transaction Processing (OLTP) applications traditionally supported by the operational databases.

Characteristics of Data warehouse

- Subject Oriented: Data that gives information about a particular subject instead of about a company's ongoing operations.
- Integrated: Data that is gathered into the data warehouse from a variety of sources and merged into a coherent whole.
- Time-variant: All data in the data warehouse is identified with a particular time period.
- Non-volatile: Data is stable in a data warehouse. More data is added but data is never removed. This enables management to gain a consistent picture of the business

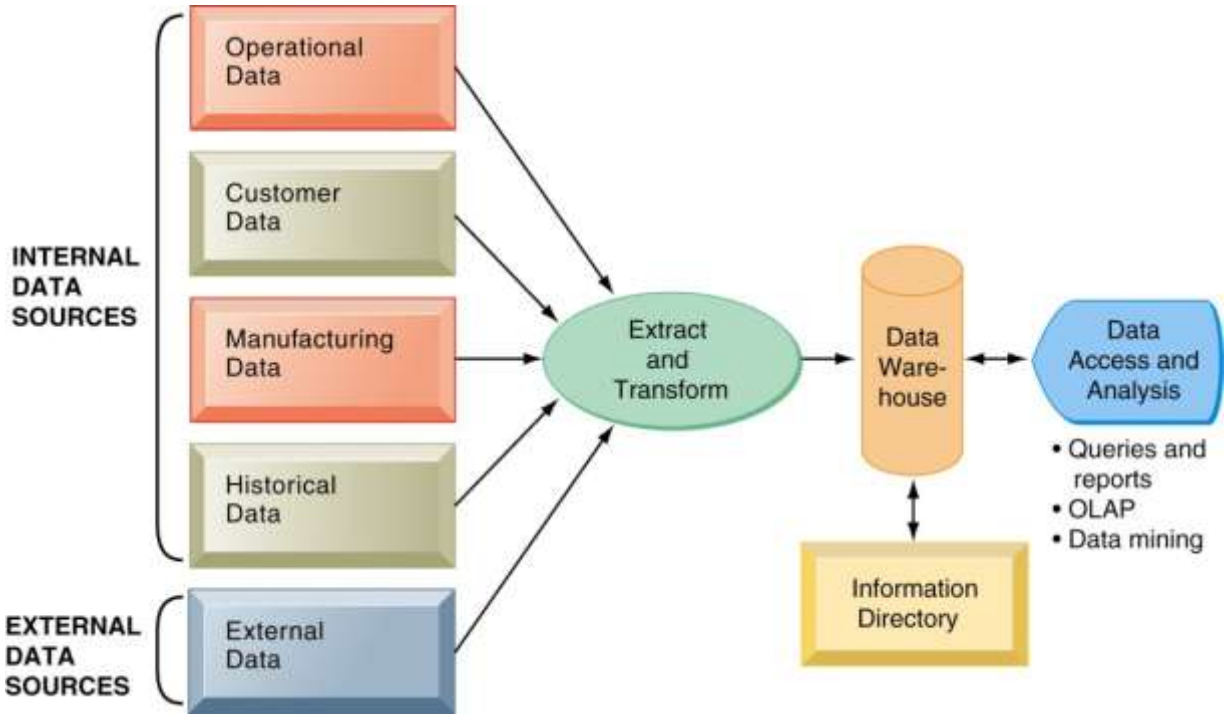
Functions of data warehouse

- Stores current and historical data from many core operational transaction systems
- Consolidates and standardizes information for use across enterprise, but data cannot be altered
- Data warehouse system will provide query, analysis, and reporting tools

OLTP vs Data warehouse

- **OLTP**
  - Application Oriented
  - Used to run business
  - Detailed data
  - Current up to date
  - Isolated Data
  - Clerical User
  - Few Records accessed at a time (tens)
  - Read/Update Access
  - No data redundancy
  - Database Size 100MB -100 GB
  - Transaction throughput is the performance metric
  - Thousands of users
  - Managed in entirety
- **Warehouse (DSS)**
  - Subject Oriented
  - Used to analyze business
  - Summarized and refined
  - Snapshot data
  - Integrated Data
  - Knowledge User (Manager)
  - Large volumes accessed at a time (millions)
  - Mostly Read (Batch Update)
  - Redundancy present
  - Database Size 100 GB - few terabytes
  - Query throughput is the performance metric
  - Hundreds of users
  - Managed by subsets

Components of Data warehouse



- The data warehouse extracts current and historical data from multiple operational systems inside the organization.
- These data are combined with data from external sources and reorganized into a central database designed for management reporting and analysis.
- The information directory provides users with information about the data available in the warehouse.

Strategic uses of data warehousing

Industry	Functional areas of use	Strategic use
Airline	Operations; marketing	Crew assignment, aircraft development, mix of fares, analysis of route profitability, frequent flyer program promotions
Banking	Product development; Operations; marketing	Customer service, trend analysis, product and service promotions, reduction of IS expenses
Credit card	Product development; marketing	Customer service, new information service, fraud detection
Health care	Operations	Reduction of operational expenses
Investment and Insurance	Product development; Operations; marketing	Risk management, market movements analysis, customer tendencies analysis, portfolio management
Retail chain	Distribution; marketing	Trend analysis, buying pattern analysis, pricing policy, inventory control, sales promotions, optimal distribution channel
Telecommunications	Product development; Operations; marketing	New product and service promotions, reduction of IS budget, profitability analysis
Personal care	Distribution; marketing	Distribution decisions, product promotions, sales decisions, pricing policy
Public sector	Operations	Intelligence gathering

Disadvantages of data warehouses

- Data warehouses are not the optimal environment for unstructured data.
- Because data must be extracted, transformed and loaded into the warehouse, there is an element of latency in data warehouse data.

- Over their life, data warehouses can have high costs. Maintenance costs are high.
- Data warehouses can get outdated relatively quickly. There is a cost of delivering suboptimal information to the organization.
- There is often a fine line between data warehouses and operational systems. Duplicate, expensive functionality may be developed. Or, functionality may be developed in the data warehouse that, in retrospect, should have been developed in the operational systems and vice versa.

10. Data Mining

- Data Mining is the process of extracting information from the company's various databases and re-organizing it for purposes other than what the databases were originally intended for.
- It provides a means of extracting previously unknown, predictive information from the base of accessible data in data warehouses.
- Data mining process is different for different organizations depending upon the nature of the data and organization.
- Data mining tools use sophisticated, automated algorithms to discover hidden patterns, correlations, and relationships among organizational data.
- Data mining tools are used to predict future trends and behaviors, allowing businesses to make proactive, knowledge driven decisions.
- For ex: for targeted marketing, data mining can use data on past promotional mailings to identify the targets most likely to maximize the

return on the

company's investment in future mailings.

Types of information obtainable from data mining

- Associations: Occurrences linked to single event
- Sequences: Events linked over time
- Classification: Recognizes patterns that describe group to which item belongs
- Clustering: Similar to classification when no groups have been defined; finds groupings within data
- Forecasting: Uses series of existing values to forecast what other values will be

Data Mining - A KDD process

Knowledge Discovery in Databases (KDD) is the nontrivial process of identifying or Extracting non-trivial, implicit, valid, novel, potentially useful, and ultimately understandable patterns in data

Steps in KDD process

i. Data cleaning

To remove noise and inconsistent data

ii. Data integration

To integrate (compile) multiple data sources

iii. Data selection

Data relevant to analysis is selected

iv. Data transformation

Summary normalization aggregation operations are performed (convert data into two dimension form) and consolidate the data

v. Data mining

Intelligent methods are applied to the data to discover knowledge or patterns

vi. Pattern evaluation

Evaluation of the interesting patterns by thresholding, visualization, transformation, removing redundant patterns

vii. Knowledge Discovery

Visualization and presentation methods are used to present the mined knowledge to the user.

Data mining functionalities

- Multidimensional concept description: Characterization and discrimination

  Generalize, summarize, and contrast data characteristics, e.g., dry vs. wet regions

- Frequent patterns, association, correlation vs. causality
- Classification and prediction

  Construct models (functions) that describe and distinguish classes or concepts for future prediction

  E.g., classify countries based on (climate), or classify cars based on (gas mileage)

  Predict some unknown or missing numerical values

- Outlier analysis
  - Outlier: a data object that does not comply with the general behavior of the data

  It can be considered as noise or exception but is quite useful in fraud

detection, rare events analysis

- Trend and evolution analysis
    - Trend and deviation: regression analysis
    - Sequential pattern mining, periodicity analysis
    - Similarity-based analysis
- Other pattern-directed or statistical analyses Data mining softwares

1. Angoss software
2. Infor CRM Epiphany
3. Portrait Software
4. SAS
5. SPSS
6. ThinkAnalytics
7. Unica

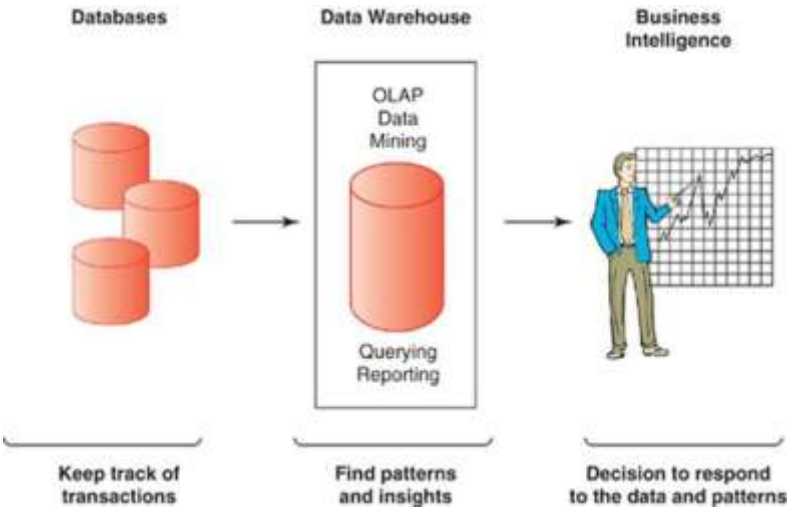
Applications of Data mining

APPLICATION	DESCRIPTION
Market segmentation	Identifies the common characteristics of customers who buys the same products from the company
Customer churn	Predicts which customers are likely to leave your company and go to a competitor
Fraud detection	Identifies which transactions are most likely to be fraudulent
Direct marketing	Identifies which prospects should be included in a mailing list to obtain the highest response rate
Market based analysis	Understands what products or services are commonly purchased together
Trend analysis	Reveals the difference between a typical customer this month versus last month
Science	Simulates nuclear explosions; visualizes quantum physics
Entertainment	Models customer flows in theme parks; analyzes safety of amusement parks rides
Insurance and health care	Predicts which customers will buy new policies; identifies behavior patterns that increase insurance risk; spots fraudulent claims
Manufacturing	Optimizes product design, balancing manufacturability and safety; improves shop-floor scheduling and machine utilization
Medicine	Ranks successful therapies for different illnesses; predicts drug efficacy; discovers new drugs and treatments
Oil and gas	Analyzes seismic data for signs of underground deposits ; prioritizes drilling locations; simulates underground flows to improve recovery
Retailing	Discerns buying-behavior patterns; predicts how customers will respond to marketing campaigns

11. Business Intelligence

- One ultimate use of the data gathered and processed in the data life cycle is for business intelligence.
- Business intelligence generally involves the creation or use of a data warehouse and/or data mart for storage of data, and the use of front-end analytical tools such as Oracle's Sales Analyzer and Financial Analyzer or Micro Strategy's Web.
- Such tools can be employed by end users to access data, ask queries, request ad hoc (special) reports, examine scenarios, create CRM activities, devise pricing strategies, and much more.

- Tools for consolidating, analyzing, and providing access to vast amounts of data to help users make better business decisions
- Principle tools include:
  - Software for database query and reporting
  - Online analytical processing (OLAP)
  - Data mining



A series of analytical tools works with data stored in databases to find patterns and insights for helping managers and employees make better decisions to improve organizational performance.

Application of Business Intelligence

- Financial modeling
- Budgeting
- Resource allocation
- Competitive intelligence.

Online analytical processing (OLAP)

- Supports multidimensional data analysis
- Enables viewing data using multiple dimensions
- Each aspect of information (product, pricing, cost, region, time period) is different dimension
    - E.g. how many washers sold in East in June
- OLAP enables rapid, online answers to ad hoc queries

On-Line Analytical Processing (OLTP) Vs On-Line Transaction Processing (OLAP)

	OLTP	OLAP
Users Function	Clerk, IT professional	Knowledge worker
	Day to day operations	Decision support
DB design	Application-oriented	Subject-oriented
Data	Current, up-to-date Detailed, flat relational Isolated	Historical, Summarized, multidimensional Integrated, consolidated

Usage	Repetitive	Ad-hoc
Access	Read/write, Index/hash on prim. Key	Lots of scans
Unit of work	Short, simple transaction	Complex query

12. Artificial Intelligence

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

Artificial Intelligence (AI) is the study and creation of computer systems that can perceive, reason and act. The primary aim of AI is to produce intelligent machines. The intelligence should be exhibited by thinking, making decisions, solving problems, more importantly by learning.

AI is an interdisciplinary field that requires knowledge in computer science, linguistics, psychology, biology, philosophy and so on for serious research.

Goals of Artificial intelligence

The central problems or goals of AI research include

(i) reasoning,

(ii) knowledge,

(iii) planning, learning,

(iv) natural language processing (communication),

(v) perception and

(vi) the ability to move and manipulate objects

Collaborators of AI / Domains of Study

- Philosophy - Logic, methods of reasoning, mind as physical system foundations of learning, language,rationality
- Mathematics - Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
- Economics - utility, decision theory •
- Neuroscience - physical substrate for mental activity
- Psychology - phenomena of perception and motor control, experimental techniques
- Computer engineering - building fast computers
- Control theory - design systems that maximize an objective function over time
- Linguistics - knowledge representation, grammar
- Statistics
- Cognitive Science
- Ethics

Challenges

- Still AI systems could not defeat even a three year old child on many counts: ability to recognize and remember different objects, adapt to new situations, understand and generate human languages, and so on.
- The main problem is that we, still could not understand how human

mind works, how we learn new things, especially how we learn languages and reproduce them properly.

Applications of AI

Table 13.1

Applications of AI technologies

Field	Example of an organization	Applications
Energy	Arco & Tenneco	Neural networks used to help pinpoint oil and gas deposits
Government	Internal Revenue Service	Testing a software to read tax returns and spot fraud
Human Services	Merced County in California	Expert systems used to decide if applicants should receive welfare benefits
Marketing	Spiegel	Neural networks used to determine most likely buyers from a long list
Telecommunications	BT Group	Heuristic search used for scheduling application that provides the work schedules of more than 20,000 engineers
Transportation	American Airlines	Expert systems used to schedule the routine maintenance of its airplanes
Inventory/forecasting	Hyundai Motors	Used neural nets and expert systems to reduce delivery time by 20% and increased inventory turns from 3 to 3.4
Inventory/forecasting	SCI Systems	Used neural nets and expert systems to reduce on-hand inventory by 15% resulting in $180 million in annual savings
Inventory/forecasting	Reynolds Aluminum	Used neural nets and expert systems to reduce forecasting errors by 2% that resulted in a reduction of one million pounds in inventory
Inventory/forecasting	Unilever	Used neural nets and expert systems to reduce forecasting errors from 40% to 25% yielding resulting in multi-million dollar savings

There are many AI applications that we witness: AI techniques are used to solve many real life problems

- Robotics,
- Machine translators,
- chatbots,
- voice recognizers

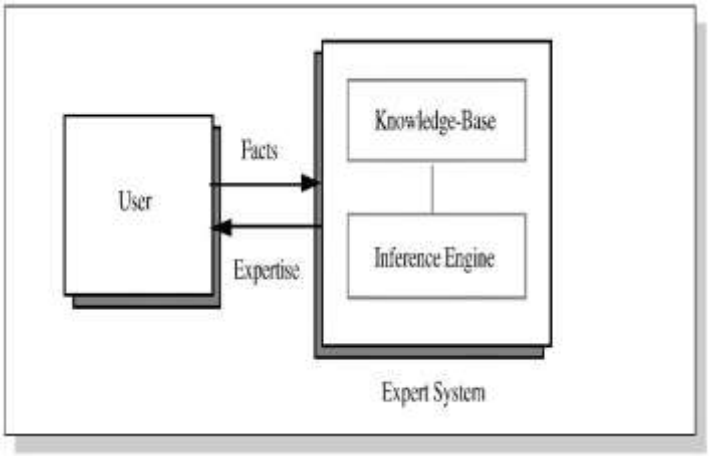
Some kind of robots are helping to find land-mines, searching humans trapped in rubbles due to natural calamities.

13. EXPERT SYSTEMS

An Expert System is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems

by reasoning about knowledge, represented primarily as if–then rules rather than through conventional procedural code

Components / Building blocks of an Expert System



(i) Knowledge base or Rule base

- The knowledge base is the collection of facts and rules which describe all the knowledge about the problem domain
- Contain everything necessary for understanding, formulating and solving a problem.
- Stores all relevant information, data, rules, cases, and relationships used by the expert system

The *knowledge base* of expert systems contains both factual and heuristic knowledge.

- *Factual knowledge* is that knowledge of the task domain that is widely

shared, typically found in textbooks or journals, and commonly agreed upon by those knowledgeable in the particular field.

- *Heuristic knowledge* is the less rigorous, more experiential, more judgmental knowledge of performance. In contrast to factual knowledge, heuristic knowledge is rarely discussed, and is largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field. It is the knowledge that underlies the "art of good guessing."

(ii) Inference engine

- Seeks information and relationships from the knowledge base and provides answers, predictions, and suggestions in the way a human expert would
- The inference engine is the part of the system that chooses which facts and rules to apply when trying to solve the user's query.
- It taps the knowledge base and working memory to derive new information and solve problems
- The inference engine is a computer program designed to produce reasoning on rules
- It is based on logic

(iii) User Interface

- The user interface is the part of the system which takes in the user's query in a readable form and passes it to the inference engine. It then displays the results to the user.
- The user communicates with the expert system through the

user interface.

- It allows the user to query the system, supply information and receive advice.
- The aims are to provide the same form of communication facilities provided by the expert.
- The code that controls the dialog between the user and the system

(iv) Backward chaining

A method of reasoning that starts with conclusions and works backward to the supporting facts

(v) Forward chaining

A method of reasoning that starts with the facts and works forward to the conclusions

Types of Expert Systems

- Rule-based Systems (Knowledge represented by series of rules)
- Frame-based Systems (Knowledge represented by frames)
- Hybrid Systems (Several approaches are combined, usually rules and frames)
- Model-based Systems (Models simulate structure and functions of systems)
- Off-the-shelf Systems (Ready made packages for general use)
- Custom-made Systems (Meet specific need)

Advantages of Expert Systems

- Increased availability

Expertise becomes available on any suitable computer hardware,

thus the system disseminates expertise more widely

- Reduced Cost

  Cost per user of providing expertise is lowered

- Reduced Danger

  Expert systems can be used in situations that would be hazardous to a human

- Permanence

  Human experts are impermanent

- Multiple expertise

  Can include the expertise of several human experts

- Increased Reliability

  Not subject to human variability

Limitations of Expert Systems

- Typical expert systems cannot generalize through analogy to reason about new situations in the way people can.
- A knowledge acquisition bottleneck results from the time-consuming and labor intensive task of building an expert system.
- Knowledge is not always readily available.
- It can be difficult to extract expertise from humans.
- There are frequently multiple correct assessments.
- Time pressures.
- Users have cognitive limits.
- ES works well only within a narrow domain of knowledge.
- Most experts do not have an independent means to validate results.
- Vocabulary is often limited and difficult to understand.

- Help from knowledge engineers is difficult to obtain and costly.
- Potential for lack of trust on the part of the end-users.
- Knowledge transfer is subject to biases.

14. Big Data

Big data is larger, more complex data sets, especially from new data sources. These data sets are so voluminous that traditional data processing software just can't manage them. But these massive volumes of data can be used to address business problems you wouldn't have been able to tackle before.

The three Vs of big data

Volume: The amount of data matters. With big data, you'll have to process high volumes of low-density, unstructured data. This can be data of unknown value, such

as Twitter data feeds, clickstreams on a web page or a mobile app, or sensor-enabled equipment. For some organizations, this might be tens of terabytes of data. For others, it may be hundreds of petabytes.

Velocity: Velocity is the fast rate at which data is received and (perhaps) acted on. Normally, the highest velocity of data streams directly into memory versus being written to disk. Some internet-enabled smart products operate in real time or near real time and will require real-time evaluation and action.

Variety: Variety refers to the many types of data that are available. Traditional data types were structured and fit neatly in a relational database. With the rise of big data, data comes in new unstructured data types. Unstructured and semi structured data types, such as text, audio, and video, require additional

preprocessing to derive meaning and support metadata.

Big data gives you new insights that open up new opportunities and business models.

Getting started involves three key actions:

i. Integrate

Big data brings together data from many disparate sources and applications. Traditional data integration mechanisms, such as extract, transform, and load (ETL) generally aren't up to the task. It requires new strategies and technologies to analyze big data sets at terabyte, or even petabyte, scale.

ii. During integration, you need to bring in the data, process it, and make sure it's formatted and available in a form that your business analysts can get started with.

iii. Manage

Big data requires storage. Your storage solution can be in the cloud, on premises, or both. You can store your data in any form you want and bring your desired processing requirements and necessary process engines to those data sets on an on-demand basis. Many people choose their storage solution according to where their data is currently residing. The cloud is gradually gaining popularity because it supports your current compute requirements and enables you to spin up resources as needed.

iv. Analyze

Your investment in big data pays off when you analyze and act on your data. Get new clarity with a visual analysis of your varied data sets. Explore

the data further to make new discoveries. Share your findings with others. Build data models with machine learning and artificial intelligence. Put your data to work.

15. Cyber Safety and Security

Cyber security is a discipline that covers how to defend devices and services from electronic attacks by nefarious actors such as hackers, spammers, and cybercriminals. While some components of cyber security are designed to strike first, most of today's professionals focus more on determining the best way to defend all assets, from computers and smartphones to networks and databases, from attacks.

Cyber security - Subdomains:

- Application Security

Application security covers the implementation of different defenses in an organization's software and services against a diverse range of threats. This sub- domain requires cyber security experts to write secure code, design secure application architectures, implement robust data input validation, and more, to minimize the chance of unauthorized access or modification of application resources.

- Cloud Security

Cloud security relates to creating secure cloud architectures and applications for companies that use cloud service providers like Amazon Web Services, Google, Azure, Rackspace, etc.

- Identity Management and Data Security

This subdomain covers activities, frameworks, and processes that enable authorization and authentication of legitimate individuals to an organization's information systems. These measures involve implementing powerful information storage mechanisms that secure the data, whether in transition or residing on a server or computer. In addition, this sub-domain makes greater use of authentication protocols, whether two-factor or multi-factor.

- Mobile Security

Mobile security is a big deal today as more people rely on mobile devices. This subdomain protects organizational and personal information stored on mobile devices like tablets, cell phones, and laptops from different threats like unauthorized access, device loss or theft, malware, viruses, etc. In addition, mobile security employs authentication and education to help amplify security.

- Network Security

Network security covers hardware and software mechanisms that protect the network and infrastructure from disruptions, unauthorized access, and other abuses. Effective network security protects organizational assets against a wide range of threats from within or outside the organization.

Types of Cyber Threats

Cybercrime is defined as any unauthorized activity involving a computer,

device, or network. There are three generally recognized classifications of cybercrime: computer-assisted crimes, crimes where the computer itself is a target, and crimes where the computer is incidental to the crime rather than directly related.

Here is a list of common cyber threats:

- Cyberterrorism: This threat is a politically-based attack on computers and information technology to cause harm and create widespread social disruption.
- Malware: This threat encompasses ransomware, spyware, viruses, and worms. It can install harmful software, block access to your computer resources, disrupt the system, or covertly transmit information from your data storage.

- Trojans: Like the legendary Trojan Horse of mythology, this attack tricks users into thinking they're opening a harmless file. Instead, once the trojan is in place, it attacks the system, typically establishing a backdoor that allows access to cybercriminals.
- Botnets: This especially hideous attack involves large-scale cyberattacks conducted by remotely controlled malware-infected devices. Think of it as a

  string of computers under the control of one coordinating cybercriminal. What's worse, compromised computers become part of the botnet system.
- Adware: This threat is a form of malware. It's often called advertisement-supported software. The adware virus is a potentially unwanted program (PUP) installed without your permission and automatically generates unwanted online advertisements.
- SQL injection: A Structured Query Language attack inserts malicious code into a SQL-using server.
- Phishing: Hackers use false communications, especially e-mail, to fool the recipient into opening it and following instructions that typically ask for personal information. Some phishing attacks also install malware.
- Man-in-the-middle attack: MITM attacks involve hackers inserting themselves into a two-person online transaction. Once in, the hackers can filter and steal desired data. MITM attacks often happen on unsecured public Wi-Fi networks.
- Denial of Service: DoS is a cyber attack that floods a network or computer

with an overwhelming amount of “handshake” processes, effectively overloading the system and making it incapable of responding to user requests.

Cyber Security tactics

- Using two-way authentication
- Securing passwords
- Installing regular updates
- Running antivirus software
- Using firewalls to disable unwanted services
- Avoiding phishing scams
- Employing cryptography, or encryption
- Securing domain name servers, or DNS

16. Cryptography

Cryptography is technique of securing information and communications through use of codes so that only those person for whom the information is intended can understand it and process it. Thus preventing unauthorized access to information. The prefix “crypt” means “hidden” and suffix “graphy” means “writing”.

Techniques used For Cryptography: In today’s age of computers cryptography is often associated with the process where an ordinary plain text is converted to cipher text which is the text made such that intended receiver of the text can only decode it and hence this process is known as encryption. The process

of conversion of cipher text to plain text this is known as decryption.

Features of Cryptography:

- Confidentiality: Information can only be accessed by the person for whom it is intended and no other person except him can access it.
- Integrity: Information cannot be modified in storage or transition between sender and intended receiver without any addition to information being detected.
- Non-repudiation: The creator/sender of information cannot deny his intention to send information at later stage.
- Authentication: The identities of sender and receiver are confirmed. As well as destination/origin of information is confirmed.

Types of Cryptography:

- Symmetric Key Cryptography: It is an encryption system where the sender and receiver of message use a single common key to encrypt and decrypt messages. Symmetric Key Systems are faster and simpler but the problem is that sender and receiver have to somehow exchange key in a secure manner. The most popular symmetric key cryptography system are Data Encryption System(DES) and Advanced Encryption System(AES).
- Hash Functions: There is no usage of any key in this algorithm. A hash value with fixed length is calculated as per the plain text which makes it impossible for contents of plain text to be recovered. Many operating systems use hash functions to encrypt passwords.
- Asymmetric Key Cryptography: Under this system a pair of keys is used to

encrypt and decrypt information. A receiver's public key is used for encryption and a receiver's private key is used for decryption. Public key and Private Key are different. Even if the public key is known by everyone the intended receiver can only decode it because he alone know his private key. The most popular asymmetric key cryptography algorithm is RSA algorithm.

Applications Of Cryptography:

- Computer passwords: Cryptography is widely utilized in computer security, particularly when creating and maintaining passwords. When a user logs in, their password is hashed and compared to the hash that was previously stored. Passwords are hashed and encrypted before being stored. In this technique, the passwords are encrypted so that even if a hacker gains access to the password database, they cannot read the passwords.
- Digital Currencies: To safeguard transactions and prevent fraud, digital currencies like Bitcoin also use cryptography. Complex algorithms and cryptographic keys are used to safeguard transactions, making it nearly hard to tamper with or forge the transactions.
- Secure web browsing: Online browsing security is provided by the use of cryptography, which shields users from eavesdropping and man-in-the-middle assaults. Public key cryptography is used by the Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols to encrypt data sent between the web server and the client, establishing a secure channel for communication.

- Electronic signatures: Electronic signatures serve as the digital equivalent of a handwritten signature and are used to sign documents. Digital signatures are created using cryptography and can be validated using public key cryptography. In many nations, electronic signatures are enforceable by law, and their use is expanding quickly.
- Authentication: Cryptography is used for authentication in many different situations, such as when accessing a bank account, logging into a computer, or using a secure network. Cryptographic methods are employed by authentication protocols to confirm the user's identity and confirm that they have the required access rights to the resource.
- Cryptocurrencies: Cryptography is heavily used by cryptocurrencies like Bitcoin and Ethereum to safeguard transactions, thwart fraud, and maintain the network's integrity. Complex algorithms and cryptographic keys are used to safeguard transactions, making it nearly hard to tamper with or forge the transactions.
- End-to-End Encryption: End-to-end encryption is used to protect two-way communications like video conversations, instant messages, and email. Even if the message is encrypted, it assures that only the intended receivers can read the message. End-to-end encryption is widely used in communication apps like WhatsApp and Signal, and it provides a high level of security and privacy for users.

Advantages

- Access Control: Cryptography can be used for access control to ensure that

only parties with the proper permissions have access to a resource. Only those

with the correct decryption key can access the resource thanks to encryption.

- Secure Communication: For secure online communication, cryptography is crucial. It offers secure mechanisms for transmitting private information like passwords, bank account numbers, and other sensitive data over the internet.
- Protection against attacks: Cryptography aids in the defence against various types of assaults, including replay and man-in-the-middle attacks. It offers strategies for spotting and stopping these assaults.
- Compliance with legal requirements: Cryptography can assist firms in meeting a variety of legal requirements, including data protection and privacy legislation.

17. RSA Model of Encryption

The Rivest-Shamir-Adleman (RSA) encryption algorithm is an asymmetric encryption algorithm that is widely used in many products and services. Asymmetric encryption uses a key pair that is mathematically linked to encrypt and decrypt data. A private and public key are created, with the public key being accessible to anyone and the private key being a secret known only by the key pair creator. With RSA, either the private or public key can encrypt the data, while the other key decrypts it.

Where is RSA encryption used?

RSA encryption is often used in combination with other encryption schemes, or for

digital signatures which can prove the authenticity and integrity of a message. It isn't generally used to encrypt entire messages or files, because it is less efficient

and more resource-heavy than symmetric-key encryption.

To make things more efficient, a file will generally be encrypted with a symmetric-key algorithm, and then the symmetric key will be encrypted with RSA encryption. Under this process, only an entity that has access to the RSA private key will be able to decrypt the symmetric key.

Without being able to access the symmetric key, the original file can't be decrypted. This method can be used to keep messages and files secure, without taking too long or consuming too many computational resources.

RSA algorithm in Cryptography works in 3 steps

1. Generation of public and private keys.
2. Encryption of message by the sender using the public key.
3. The decryption of the message by the receiver using the private key.

Advantages of RSA algorithm in Cryptography

- In comparison to the DSA algorithm, the RSA one encrypts data more quickly.
- If you encrypt a message with the receiver's public key, you ensure the message's confidentiality and authenticity since no one else will be able to decrypt it without knowing the receiver's private key, which is only known to the receiver of the message or data.

Disadvantages of RSA algorithm in Cryptography

- With the RSA algorithm in Cryptography, there's just too much computation going on.
- The encryption and decryption processes take a long time, and generating keys is cumbersome.

18. Data Science

- Data science is a concept to bring together ideas, data examination, Machine Learning, and their related strategies to comprehend and dissect genuine phenomena with data.
- It is an extension of data analysis fields such as data mining, statistics, and predictive analysis.

- It is a huge field that uses a lot of methods and concepts that belong to other fields like information science, statistics, mathematics, and computer science.
- Some of the techniques utilized in Data Science encompass machine learning, visualization, pattern recognition, probability modeling data, data engineering, signal processing, etc.

The Data Science Lifecycle

Data science projects constitute several small sub-projects from making data science notebooks to deploying over the web so that they can be used continuously by the users. Here we will see how the whole data science project can be defined into smaller development stages.

i. Understanding The Business Problem: Before starting any data science projects we understand the business requirement and needs of the projects. This helps us in what type of model and evaluation matrix to use for our model.
ii. Data Collection: After understanding the business requirement we collect the data that can be useful to our model building.
iii. Data Preparation: In working with real-life projects the data we have are not suitable for direct feeding to the model. our data may have missing values,

categorical data, or outliers data. we first handle all these issues and clean our dataset in the dataset preparation task.

iv. Model Building: In the model building stage we choose our type of model

based on our data knowledge also we choose different hyperparameters like evaluation matrix, and the percentage of data to use for training and testing.

v. Model Deployment: In model deployment, we use serializing method to upload our model from the Python object to disk and again deserialize the model to make predictions on a new dataset from it. we also used cloud web services to host our model.

Data Science Tools and Technologies

- Programming Languages
  - Python
  - R
- Data Visualization Tools
  - Tableau
  - Power BI
- Machine Learning Libraries
  - Scikit-learn
  - TensorFlow
- Big Data Frameworks
  - Apache Hadoop
  - Apache Spark

Applications of Data Science

Data science is used in almost all economic and non-economic sectors. Today every company wants to use data science to increase their productivity

- Finance: Data science tools are very much useful in financial sectors from the stock market to companies' portfolios data science tools are used at a large scale in the companies
- Pharmaceutical: Almost all pharmaceutical companies use data science for their research. They use data science to check what the efficiency of their new medicines is. They do this by making a null hypothesis and using data science to validate the hypothesis
- Search Engines: Various search engines use user data to personalize user feed with the most appropriate article that users might be interested to read. Also, they use data to show you personalized ads for companies' branding.
- Agriculture: Data science is used for research in the agriculture sector to optimize the growth of the crop. It uses soil and weather conditions to recommend farmers personalize crops seed.

Data Science Ethics and Challenges

In real-life projects handling data science projects is not easy we have to deal with several challenges at different stages of the project.

- Data Privacy and Security – Data scientists must ensure they protect the privacy and confidentiality of the individuals whose information they collect and analyze.
- Bias and Fairness in Algorithms – Unbiased and fair techniques should be used to analyze the collected data. Data scientists must not perpetuate discrimination or inequality.

- Data Quality and Reliability – Data scientists must ensure that their work aligns with ethical and legal standards.
- Multiple Data Source – In companies data comes from multiple different sources handling all this data is a very challenging process. Also, data coming from these

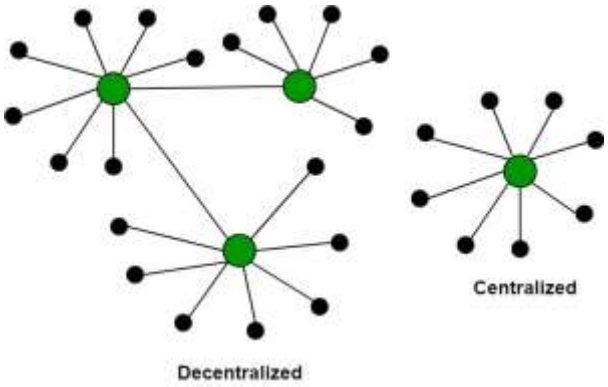
  sources may not be cleaned or not in a structured format.

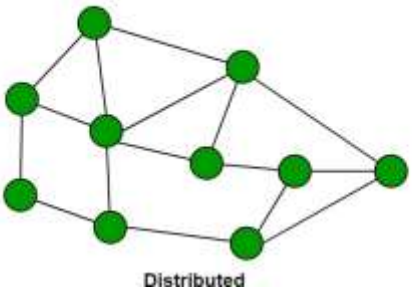
- Irrelevant Data Columns – We find columns in the dataset that are not useful in our problem solution. Ireevalent columns can lead us to a bad performance model or they can cause overfitting.
- Computing Resources – Handling millions of rows and thousands of columns requires a large computing source which may not be available on our local computers.

19. Block Chain Technology

The blockchain is a distributed database of records of all transactions or digital events that have been executed and shared among participating parties. Each transaction is verified by the majority of participants of the system.

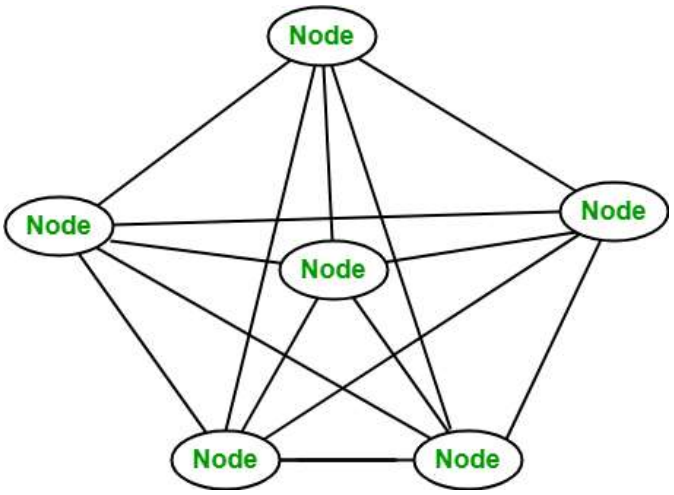
It contains every single record of each transaction. Bitcoin is the most popular cryptocurrency an example of the blockchain. Blockchain Technology first came to light when a person or group of individuals name 'Satoshi Nakamoto' published a white paper on "*BitCoin: A peer-to-peer electronic cash system*" in 2008.





Blockchain nodes

A node is a computer connected to the Blockchain Network. Node gets connected with Blockchain using the client. The client helps in validating and propagating transactions onto the Blockchain. When a computer connects to the Blockchain, a copy of the Blockchain data gets downloaded into the system and the node comes in sync with the latest block of data on Blockchain. The



Node connected to the Blockchain which helps in the execution of a Transaction in return for an incentive is called Miners.

Benefits of Blockchain

- Time-saving: No central Authority verification is needed for settlements making the process faster and cheaper.
- Cost-saving: A Blockchain network reduces expenses in several ways. No need for third-party verification. Participants can share assets directly. Intermediaries are reduced. Transaction efforts are minimized as every participant has a copy of the shared ledger.
- Tighter security: No one can tamper with Blockchain Data as it is shared among millions of Participants. The system is safe against cybercrimes and Fraud.
- Collaboration: It permits every party to interact directly with one another while not requiring third-party negotiation.
- Reliability: Blockchain certifies and verifies the identities of every interested party. This removes double records, reducing rates and accelerating transactions.

Application of Blockchain

- Leading Investment Banking Companies like Credit Suisse, JP Morgan Chase, Goldman Sachs, and Citigroup have invested in Blockchain and are experimenting to improve the banking experience and secure it.
- Following the Banking Sector, the Accountants are following the same path. Accountancy involves extensive data, including financial statements spreadsheets containing lots of personal and institutional

data. Therefore, accounting can be layered with blockchain to easily track confidential and sensitive data and reduce human error and fraud. Industry Experts from Deloitte, PwC, KPMG, and EY are proficiently working and using blockchain- based software.

- Booking a Flight requires sensitive data ranging from the passenger's name, credit card numbers, immigration details, identification, destinations, and sometimes even accommodation and travel information. So sensitive data can be secured using blockchain technology. Russian Airlines are working towards the same.
- Various industries, including hotel services, pay a significant amount ranging from 18-22% of their revenue to third-party agencies. Using blockchain, the involvement of the middleman is cut short and allows interaction directly with the consumer ensuring benefits to both parties. Winding Tree works extensively with Lufthansa, AirFrance, AirCanada, and Etihad Airways to cut short third-party operators charging high fees.
- Barclays uses Blockchain to streamline the Know Your Customer (KYC) and Fund Transfer processes while filling patents against these features.
- Visauses Blockchain to deal with business-to-business payment services.
- Unilever uses Blockchain to track all their transactions in the supply chain and maintain the product's quality at every stage of the process.
- Walmart has been using Blockchain Technology for quite some time to keep track of their food items coming right from farmers to the

customer. They let the customer check the product's history right from its origin.

- DHL and Accenture work together to track the origin of medicine until it reaches the consumer.
- Pfizer, an industry leader, has developed a blockchain system to keep track of and manage the inventory of medicines.
- The government of Dubai looking forward to making Dubai the first-ever city to rely on entirely and work using blockchain, even in their government office.
- Along with the above organizations, leading tech companies like Google, Microsoft, Amazon, IBM, Facebook, TCS, Oracle, Samsung, NVIDIA, Accenture, and PayPal, are working on Blockchain extensively.

Future Scope of Blockchain Technology

Finance, supply chain management, and the Internet of Things are just a few of the sectors that blockchain technology has the power to upend (IoT). The following are some potential uses for blockchain in the future:

- Digital Identity: Blockchain-based digital IDs might be used to store personal data safely and securely as well as offer a means of establishing identity without the need for a central authority.
- Smart Contracts: A variety of legal and financial transactions could be automated using smart contracts, self-executing contracts with the terms of the agreement put straight into lines of code.
- Decentralized Finance (DeFi): Using blockchain technology, decentralized

financial systems might be built that support peer-to-peer transactions and do away with conventional intermediaries like banks.

- Supply Chain Management: Blockchain technology can be applied to a permanent record of how goods and services have been moved, enabling improved openness and traceability across the whole supply chain.
- Internet of Things (IoT): Blockchain technology may be used to build decentralized, secure networks for IoT devices, enabling them to exchange data and communicate with one another in an anonymous, safe manner.

Advantages of Blockchain Technology:

- Decentralization: The decentralized nature of blockchain technology eliminates the need for intermediaries, reducing costs and increasing transparency.
- Security: Transactions on a blockchain are secured through cryptography, making them virtually immune to hacking and fraud.
- Transparency: Blockchain technology allows all parties in a transaction to have access to the same information, increasing transparency and reducing the potential for disputes.
- Efficiency: Transactions on a blockchain can be processed quickly and efficiently, reducing the time and cost associated with traditional transactions.

- Trust: The transparent and secure nature of blockchain technology can help to build trust between parties in a transaction.

Disadvantages of Blockchain Technology

- Scalability: The decentralized nature of blockchain technology can make it difficult to scale for large-scale applications.
- Energy Consumption: The process of mining blockchain transactions requires significant amounts of computing power, which can lead to high energy consumption and environmental concerns.
- Adoption: While the potential applications of blockchain technology are vast, adoption has been slow due to the technical complexity and lack of understanding of the technology.
- Regulation: The regulatory framework around blockchain technology is still in its early stages, which can create uncertainty for businesses and investors.
- Lack of Standards: The lack of standardized protocols and technologies can make it difficult for businesses to integrate blockchain technology into their existing systems.

20. E-commerce and E-Business models

Ecommerce is a business model that allows businesses and consumers to make purchases or sell things online

Types of Ecommerce Business Models

i. B2C (Business-to-consumer).

B2C businesses sell directly to their end-users. Anything you buy in an online store as a consumer — from wardrobe and household supplies to entertainment — is done as part of a B2C transaction.

The decision-making process for a B2C purchase is much shorter than a business- to-business (B2B) purchase, especially for lower-value items. Because of this shorter sales cycle, B2C businesses typically spend less marketing dollars to make a sale while having a lower average order value and fewer recurring orders than their B2B counterparts.

B2C includes both products and services as well. B2C innovators have leveraged technology like mobile apps, native advertising and remarketing to market directly to their customers and make their lives easier.

ii. B2B (Business-to-business).

In a B2B business model, a business sells its product or service to another business. Sometimes the buyer is the end-user, but often the buyer resells to the consumer. B2B transactions generally have a longer sales cycle, but higher-order value and more recurring purchases.

Recent B2B innovators have made a place for themselves by replacing catalogs

and order sheets with ecommerce storefronts and improved targeting in niche markets.

In 2021, 60% of B2B buyers were millennials — nearly double the amount from 2012. As younger generations enter the age of making business transactions, B2B selling in the online space is becoming more important.

iii. B2B2C (Business-to-business-to-consumer).

B2B2C stands for Business-to-Business-to-Consumer. It is a business model where a company sells its product or service in partnership with another organization to an end customer.

Unlike when you white label a product — where a company rebrands an item to present it as its own — the end customer understands that they are buying a product or using a service from the original company

iv. B2G (Business-to-government).

Business-to-government (B2G) is an ecommerce model where a business sells and markets its products to government entities or public administrations — whether local, county, state or federal.

This model relies on the successful bidding of government contracts. A government agency will typically put up a request for proposal (RFP) and ecommerce businesses will have to bid on these projects.

While a more secure business model, B2G differs from other businesses or consumers. The bureaucratic nature of government agencies often leads to a much more glacial pace, which can limit potential revenue streams.

v. C2B (Consumer-to-business).

C2B businesses allow individuals to sell goods and services to companies. In this ecommerce model, a site might enable customers to post the work they want to be completed and have businesses bid for the opportunity. Affiliate marketing services would also be considered C2B.

The C2B ecommerce model's competitive edge is in pricing for goods and services. This approach gives consumers the power to name their prices or have businesses directly compete to meet their needs.

Recent innovators have used this model creatively to connect companies to social media influencers to market their products.

vi. D2C (Direct-to-consumer).

A direct-to-consumer business sells its own product directly to its end customers, without the help of third-party wholesalers or online retailers.

As opposed to other business models such as B2B2C, there is no middle man between the consumer and a business.

vii. C2C (Consumer-to-consumer).

C2C ecommerce businesses — sometimes referred to as online marketplaces — connect consumers to exchange goods and services and typically make their money by charging transaction or listing fees. C2C businesses benefit from self-propelled growth by motivated buyers and sellers, but face a key challenge in quality control and technology maintenance. Online businesses like Craigslist, Walmart, Alibaba and eBay pioneered this model in the early days of the internet.

21. RFID in IoT

RFID

RFID (Radio Frequency Identification) is a type of wireless communication that uses electromagnetic or electrostatic coupling in the radio frequency spectrum to uniquely identify an object, animal, or human.

It is a technology used for automatically identifying and recording data about an object via a tiny, uniquely identifiable microchip tag connected to the object. A built-in antenna on the RFID tag interacts with a scanning device that can remotely read the tag's data.

The scanning device scans the tag when it comes in range. After that, the data is sent from the scanning equipment to an application program. With the help of the application, the user will store and send it wherever he desires.

Working of RFID

- RFID, or radio frequency identification, is a technique for automatically identifying and capturing data about an object that has been stored in a small microchip tag attached to the object. An antenna built into the RFID tag communicates with a scanning device that reads the data remotely.
- This data is then transferred from the scanning device to the data-housing enterprise application software. Each RFID tag has a unique identification number.
- RFID can be used to track and control asset and personnel movement.

RFID tags can be found on the back of library books and even in the new biometric passports. It simplifies the management of assets contained in boxes or pallets.

Components of RFID

Radio Frequency Identification technology consists of three main components:

- The RFID tag: The RFID tag comprises an integrated circuit, a substrate, and an antenna. If the tag has an active power source and thus can support a sensor, it is called an active RFID tag. If the tag doesn't have an active power source, it is called a passive RFID tag.
- The RFID reader: It is a device that reads RFID tags and gathers data about the connected object. It can be both wired and wireless. It can use many technologies to communicate with the software, including USBs and Bluetooth connections.
- The RFID software: The software monitors and tracks the object connected to the RFID tags. It can be called data exchange and management software.

Applying RFID to IoT Devices

- RFID tags are helpful in cameras, GPS, and other smart sensors when used in IoT. They can aid in the identification and location of objects. It is a low-cost way to make household objects "smart," similar to the popular Google Nest products. RFID tags are being used by some healthcare systems to track patients and their medical records.

- RFID is used in transportation systems to read passenger data, control traffic, and update transportation systems.

Role of RFID in IoT

- Radio Frequency Identification technology is one of the three main components of IoT, along with the Savant system and the Internet. Thus, it has had wide-ranging implications for IoT development as a whole.
- RFID technology has a wide range of applications in the Internet of Things. RFID tags are generally used to enable ordinary things to interact with one another and with the central hub and report their status. These features serve as the building blocks for an IoT system. To put it another way, RFID technology allows IoT to connect items to a network and will enable them to produce and deliver data.

Applications of RFID in IoT

- RFID has seen applications since the 1940s when they were first introduced. Its use rapidly increased to mainstream levels during the 70s. With the rise of IoT, it has threatened barcodes and NFCs as the most efficient technology to identify and track objects, livestock and humans uniquely.
- RFID tags are useful in cameras, GPS, and other smart sensors when utilised in the IoT. They can help with identifying and locating items. It's a low-cost approach to make household items seem "smart", as many companies are now entering the smart home market.

- Healthcare institutions also use RFID tags to track patients and their medical information. They are being used in transportation systems to read passenger data, regulate traffic, and update transportation systems.

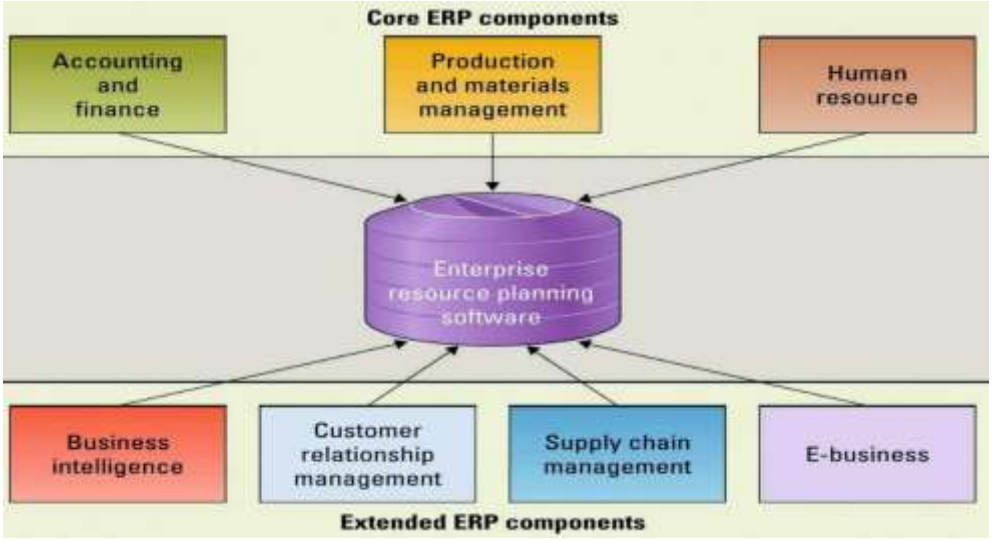
UNIT V

Enterprise Resource Planning (ERP) System, Benefits of the ERP, ERP how different from conventional packages , Need for ERP , ERP components , Selection of ERP Package, ERP implementation, Customer Relationship management. Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, various channels of information and MIS; Information system audit and control – E-Governance.

1. Enterprise Resource Planning (ERP) System

An ERP system is an attempt to integrate all functions across a company to a single computer system that can serve all those functions' specific needs. ERP – integrates (or integrated set of IT systems) so that employees can make enterprise wide decisions by viewing enterprise wide information on all business operations (enterprise wide information)

1.1 Components of ERP



1.2 ERP Steps

Software cost: Purchasing the software.

Consulting fees: Hiring external experts to help implement the system correctly.

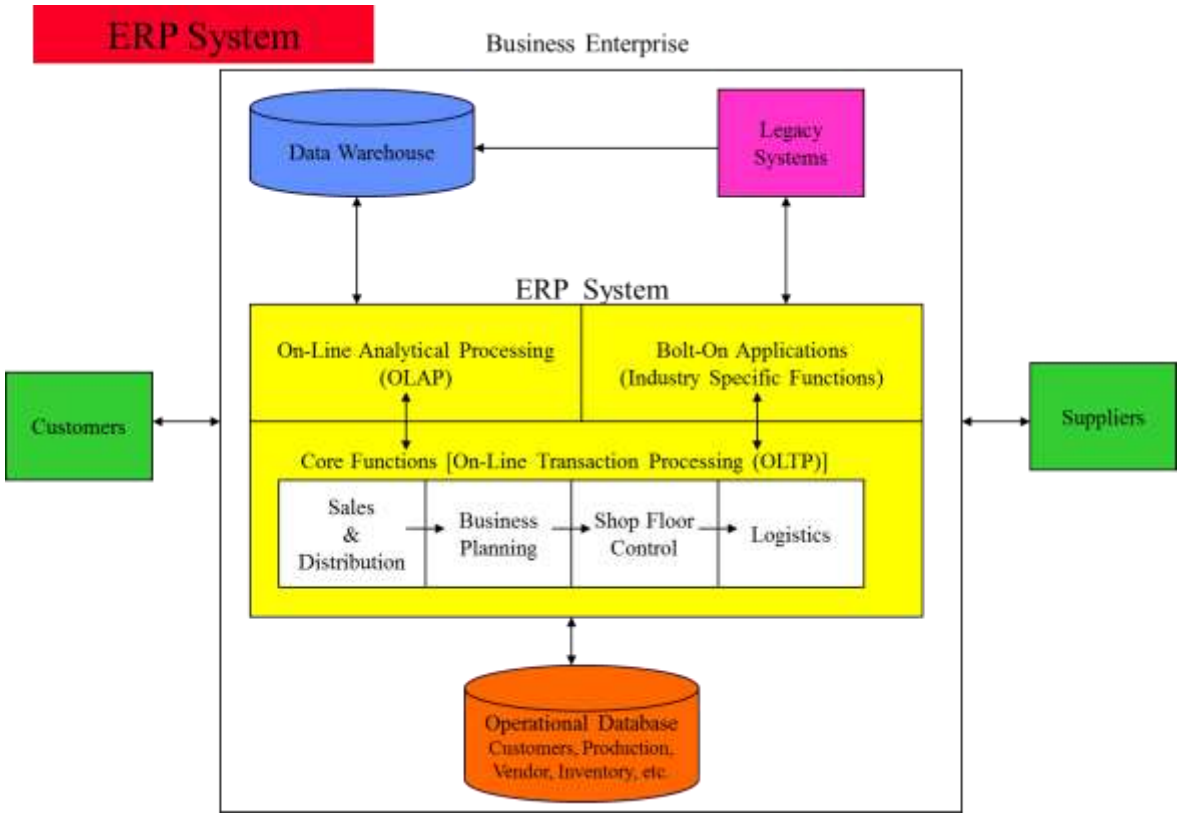
Process rework: Redefining processes in order to ensure the company is using the most efficient and effective processes.

Customization: If the software package does not meet all of the company's needs, it may be required to customize the software.

Integration and testing: Ensuring all software products, including disparate systems not part of the ERP system, are working together or are integrated. Testing the ERP system includes testing all integrations.

Training: Training all new users.

Data warehouse integration and data conversion: Moving data from an old system into the new ERP system.



1.3 Advantages of ERP over Conventional Packages

i. Ease of Integration

- Generally, ERP software facilitates enterprise-wide integrated information system covering every organisational functional area such as accounts, human resources, sales and distribution, marketing, manufacturing among others.
- A standalone business application is limited to a specific functional area, say if it is an accounting function, the application does not seamlessly integrate with other functional areas.
- The main differences between ERP software and standalone business applications are on functionality and characteristics. Unlike the standalone business applications, Enterprise resource planning software not only addresses the current needs of the organisation but also offers continuous opportunity of refining and improving the business processes.

ii. Flexibility

- Most organisations deploy ERP software to enhance coordination among various business entities within the same firm as well as business partners. Due to their inflexibility, standalone business applications are not able to go beyond the specific entities in which they are used.
- In addition, ERP software can be centrally managed and necessary controls imposed to ensure proper usage within the entire organisation without interference.

iii. Cost-effectiveness

- In as much as a business enterprise would prefer to deploy standalone business applications, they tend to be very costly, especially when you have several entities that need separate applications to facilitate their operations.
- ERP software deployment is cost-effective since the software is modular and an organisation can choose the specific modules that are appropriate to the organisation and in case of future additions, the cost of additional modules cannot be commensurate to setting up a standalone business application when needs arise.

iv. Ease of Communication

- ERP software facilitates the integration of all organisational entities thus making it easy for all the entities to share information and communicate with each other. For instance a report generated by the procurement department can easily be shared with the finance office and any other relevant department.
- Most ERP systems come with enhanced communication facilities to enable ease of communication. On the other hand, a standalone business application does not support communication with other organisational entities and in case a report is generated, it cannot be shared unless it is printed or emailed.

1.4 Need for ERP

- Integrate financial information
- Integrate customer order information

- Standardize and speed up operations processes
- Reduce inventory
- Standardize Human Resources information

1.5 Potential Benefits of ERP

- Integration of a single source of data
- Common data definition
- A real-time system
- Increased productivity
- Reduced operating costs
- Improved internal communication
- Foundation for future improvement
- Improved customer service and order fulfillment
- Improved communication with suppliers and customers
- Enhanced competitive position
- Increased sales and profits

1.6 Challenges of ERP

- Limitations of ERP technical capabilities
- Inconsistency with existing business processes
- Costs - implementation (hardware, software, training, consulting) and maintenance
- Impact on organizational structure (front office vs. back office, product lines, etc.)
- Changes in employee responsibilities

1.7 Selection Criteria for ERP Packages

i. Meet functional requirements. The first analysis to do is mapping the functional requirements with the system capabilities. When doing this exercise, it is important to distinguish *must have* from *nice to have* needs and prioritize them accordingly. ERP implementations are usually phased and it is recommended to focus on *must have* requirements in the initial phase, leaving more advanced or complex needs for later phases.

ii. Platform flexibility and scalability. Although we might have a clear list of functional requirements that need to be addressed during the implementation, the reality is that some of the current organization's needs probably won't be fully covered with standard features or new needs will appear in the future. We need to be sure that it will be possible to address them. Software flexibility and scalability will remove possible limitations in the present and in the future.

iii. Ease of use and intuitive user interface. Usability is a very important criterion that needs to be taken into account. In the end, the easier the system is to use, the greater return it will provide. Users need to be productive and self-sufficient when recording new transactions and searching for the information they need. This will even have an impact on customer service quality.

iv. Innovative technology. As ERP systems have a long lifespan, it is important that their technology is innovative enough to not to become obsolete too early. Technology evolves very quickly and what can be enough today, might be a bottleneck in the future. Currently, cloud-ready solutions that

can be accessed from anywhere and any device are a must.

v. Competitive pricing and flexible financing. The ERP implementation will be an investment that will provide a return. As with any investment, it is important that costs are properly distributed over time. If possible, it is advisable to avoid big upfront investments and go with a model that allows you to pay a similar amount every year.

vi. Similar customer references. Certainly, your company or organization will not be the first one in your market segment willing to adopt specific ERP software. Another proof of having made the right selection is knowledge of other similar companies or organizations using the same solution.

vii. Local implementer and support. Choosing the right software is important, but working with the right partner is key. In an ERP project, there are 3 elements that are equally important: product, implementer and company involvement. Make sure your implementer is experienced in both the business and technology areas and can provide local support when needed.

viii. ERP vendor backup. An additional guarantee that the implementer will be able to provide the right support you need is having ERP vendor support. Working with an official vendor *partner* is essential. Ask for the SLAs the vendor has agreed with your implementer when receiving support.

ix. Freedom to access source code. Once you are sure you will work with the right implementer and vendor, make sure you will have enough freedom to change them if needed. Being able to access the source code and using standard languages will be a guarantee of freedom in

case you need to find another *partner*.

x. Compelling product roadmap. Finally, it is also advisable to look at the product roadmap for the coming years to check if the vendor's vision is aligned with yours and your future business plans. Make sure the ERP software will also evolve from a technology perspective so that you can benefit from future innovations in this field in addition to new features.

1.8 ERP Implementation Approaches

- The big bang – install a single ERP system across the entire organization
- Franchising – Independent ERP systems are installed in different units linked by common processes, e.g., bookkeeping.
- Slam dunk – install one or several ERP modules for phased implementation of key business processes

1.9 Steps in ERP Implementation

- Plan & Monitor – Consists of processes that involve developing a strategy to complete the work, as well as measure the progress and take corrective action as required. This occurs throughout the entire process.
- Analyze – This stage is a more detailed level of discovery and consists of processes that involve gathering detailed requirements and analyzing the client's business needs.
- Build – Involve processes that carry out the tasks identified in the strategy.
- Stabilize – Consists of a set of processes to ensure a solution meets the client's requirements and is ready for full deployment to a live production

environment. This also includes a client's readiness to use the solution.

- Deploy – Processes that will deploy the solution to a production environment.

- Post Go Live – Processes that are in place to support the client once they are live on the solution, which lead to project closure.

1.10 Few ERPs

Vendor/Web Address	ERP Specialties/Characteristics	Target Market
SAP www.sap.com	Customer relationship management, financial management, human resource management, and supply chain management	Large business
Oracle/PeopleSoft www.oracle.com	Financial management, human resource management, and supply chain management	Large business
SSA Global (Baan) www.ssaglobal.com	Customer relationship management, financial management, human resource management, and supply chain management	Large business
Microsoft (Great Plains) www.microsoft.com	Financial management, distribution, manufacturing, project accounting, human resource management, and business analytics	Small-to-medium business

2. Customer Relationship Management

CRM is an enterprise application module that manages a company's interactions with current and future customers by organizing and coordinating, sales and marketing, and providing better customer services along with technical support.

- CRM "is a business strategy that aims to understand, anticipate and manage

the needs of an organisation’s current and potential customers

- The approach of identifying, establishing, maintaining, and enhancing lasting relationships with customers
- CRM is a shift from traditional marketing as it focuses on the retention of customers in addition to the acquisition of new customers

A customer relationship management (CRM) solution helps you find new customers, win their business, and keep them happy by organizing customer and prospect information in a way that helps you build stronger relationships with them and grow your business faster. CRM systems start by collecting a customer's website, email, telephone, social media data, and more, across multiple sources and channels. It may also automatically pull in other information, such as recent news about the company's activity, and it can store personal details, such as a client's personal preferences on communications. The CRM tool organises this information to give you a complete record of individuals and companies overall, so you can better understand your relationship over time.

2.1 Basic Components of CRM

CRM is composed of different components that work together to help companies manage their customers, leads, and partners better. These components include:

- Lead Management. This component is used by companies to manage leads or information about prospective customers.
- Typerienting CRM. This component is used by companies to make sure that their strategies are directed at the right customers or markets.
- Marketing Management. This component is used by companies to make sure that their products and services are marketed properly to their target markets.
- Sales Management. This component is used by companies to make sure that their sales efforts are directed at the right leads or customers.
- Customer Service Management. This component is used by companies to make sure that they can give superior customer service to all of their customers, leads, and partners.

2.2 Value Addition of CRM software

- Make improvements to your bottom line.
  - Introducing a CRM platform has been shown to produce real results – including direct improvements to the bottom line.
- Identify and categorize leads.
  - A CRM system can help you identify and add new leads easily and quickly, and categorise them accurately. By focusing on the right leads, sales can prioritise the opportunities that will close deals, and marketing can identify leads that need more nurturing and prime them to become quality leads.
  - With complete, accurate, centrally held information about clients and prospects, sales and marketing can focus their attention and energy on the right clients.

- Increase referrals from existing customers.
  - By understanding your customers better, cross-selling and upselling opportunities become clear — giving you the chance to win new business from existing customers.
  - With better visibility, you'll also be able to keep your customers happy with better service. Happy customers are likely to become repeat customers, and repeat customers spend more —— up to 33% more according to some studies.

- Offer better customer support.
  - Today's customers expect fast, personalised support, at any time of day or night. A CRM system can help you provide the high-quality service that customers are looking for. Your agents can quickly see what products customers have ordered, and they can get a record of every interaction so they can give customers the answers they need, fast.

- Improve products and services.
  - A good CRM system will gather information from a huge variety of sources across your business and beyond. This gives you unprecedented insights into how your customers feel and what they are saying about your organisation
    — so you can improve what you offer, spot problems early, and identify gaps.

2.3 Importance of CRM

- Help marketing departments identify and target their best customers, manage campaigns as well as discover qualified leads. whatis.com
- Qualified Leads: prospects who seem most likely to buy because of some information known about them. Duncan, Tom
- Improve sales and streamline existing processes.

- Form individualized relationships with customers.
- Give employees information needed to improve customer service and also to better understand customer needs

2.4 Benefits of CRM

- Customer Focus : learn enough about the customer
- Retention : firm satisfies customer and offer variety such that customer repeats transactions. It cost six times more to get a new customer than to retain one. Higher retention rates increases revenue and reduces costs.
- Cross selling : marketing complementary products to existing customers
- Up-selling : higher value customers to existing/new customers
- Long Term profitability : customer focus, retention of loyal customers and greater share
- of customer implies long term profit.

2.5 Trends in CRM

- Customer engagement will move into mainstream B2C and B2B
- Integration, Automation, Intelligence
- Predictions: Understanding the behavior of the customer
- Convergence with other big trends

3. Types of Organisation

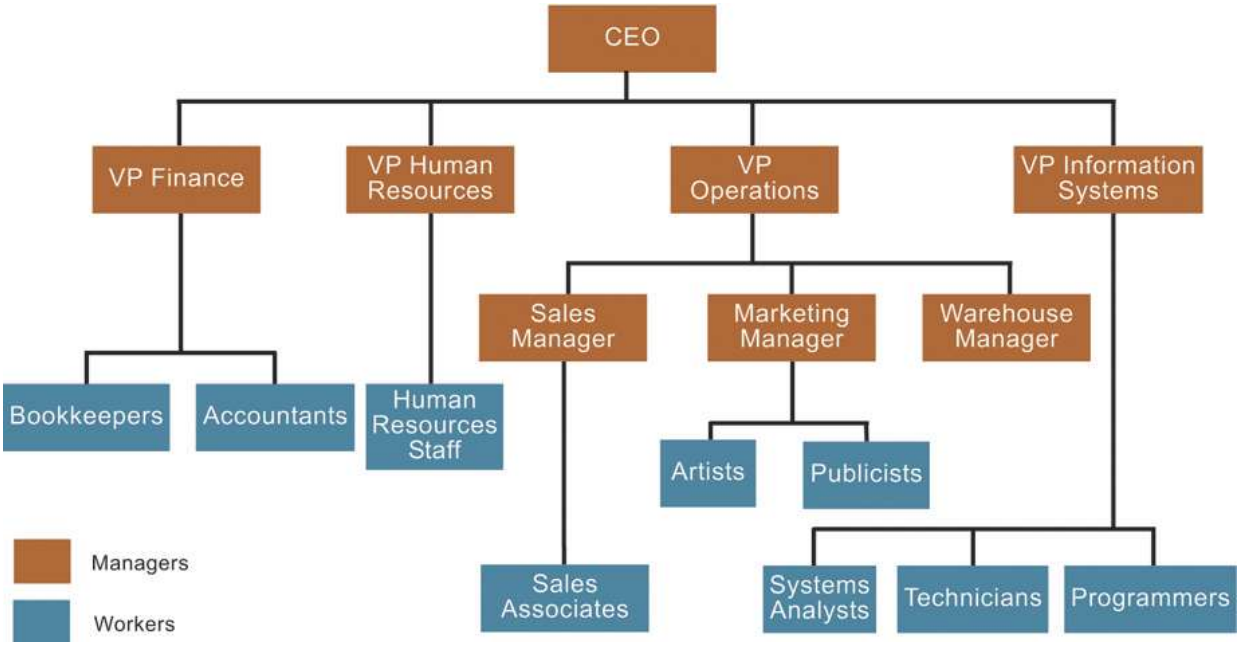
An organization is a stable, formal social structure that takes resources from the environment and processes them to produce output.

Mint berg's classifications, described below. Identify five basic of organizations.

1. Entrepreneurial Structure: Young, small firm in a fast changing environment.

2. Machine Bureaucracy: Large bureaucracy existing in a slowly changing environment.
3. Divisionalized Bureaucracy: Combination of multiple machine bureaucracies.
4. Professional Bureaucracy: Knowledge based organization where goods and services depend on the expertise and knowledge of professionals.
5. Adhocracy: "Task force" organization that must respond to rapidly changing environments.

3.1 Organisation Structure and Hierarchy



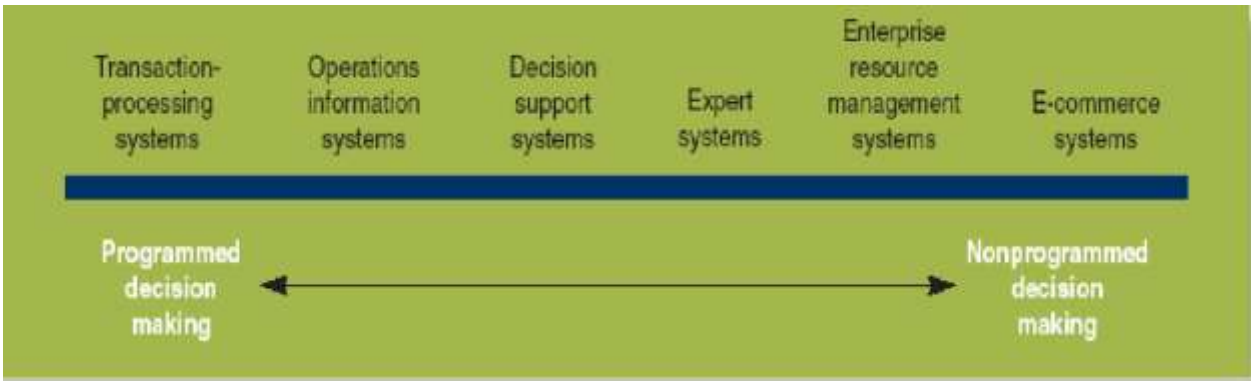
3.2 Managerial Decision Making

Programmed Decisions

- Situations occurred often enough to enable decision rules to be developed and applied in the future
- Made in response to recurring organizational problems

Non programmed Decisions

– in response to unique, poorly defined and largely unstructured, and have important consequences to the organization



3.3 Decision Making Models

1) Classical Model (Normative)
   a. Decision maker operates to accomplish goals that are known and agreed upon
   b. Decision maker strives for condition of certainty – gathers complete information
   c. Criteria for evaluating alternatives are known
   d. Decision maker is rational and uses logic

2) Administrative Model (Descriptive)
   a. Decision goals often are vague, conflicting and lack consensus among managers;
   b. Rational procedures are not always used
   c. Managers' searches for alternatives are limited
   d. Managers settle for a satisficing rather than a maximizing solution
   e. intuition, looks to past experience

3) Political Model (Coalition)
   a. Closely resembles the real environment in which most managers and decision makers operate
   b. Useful in making non-programmed decisions
   c. Decisions are complex
   d. Disagreement and conflict over problems and solutions are normal

Decision Making at various level

3.4 Stages /Phases of Decision Making

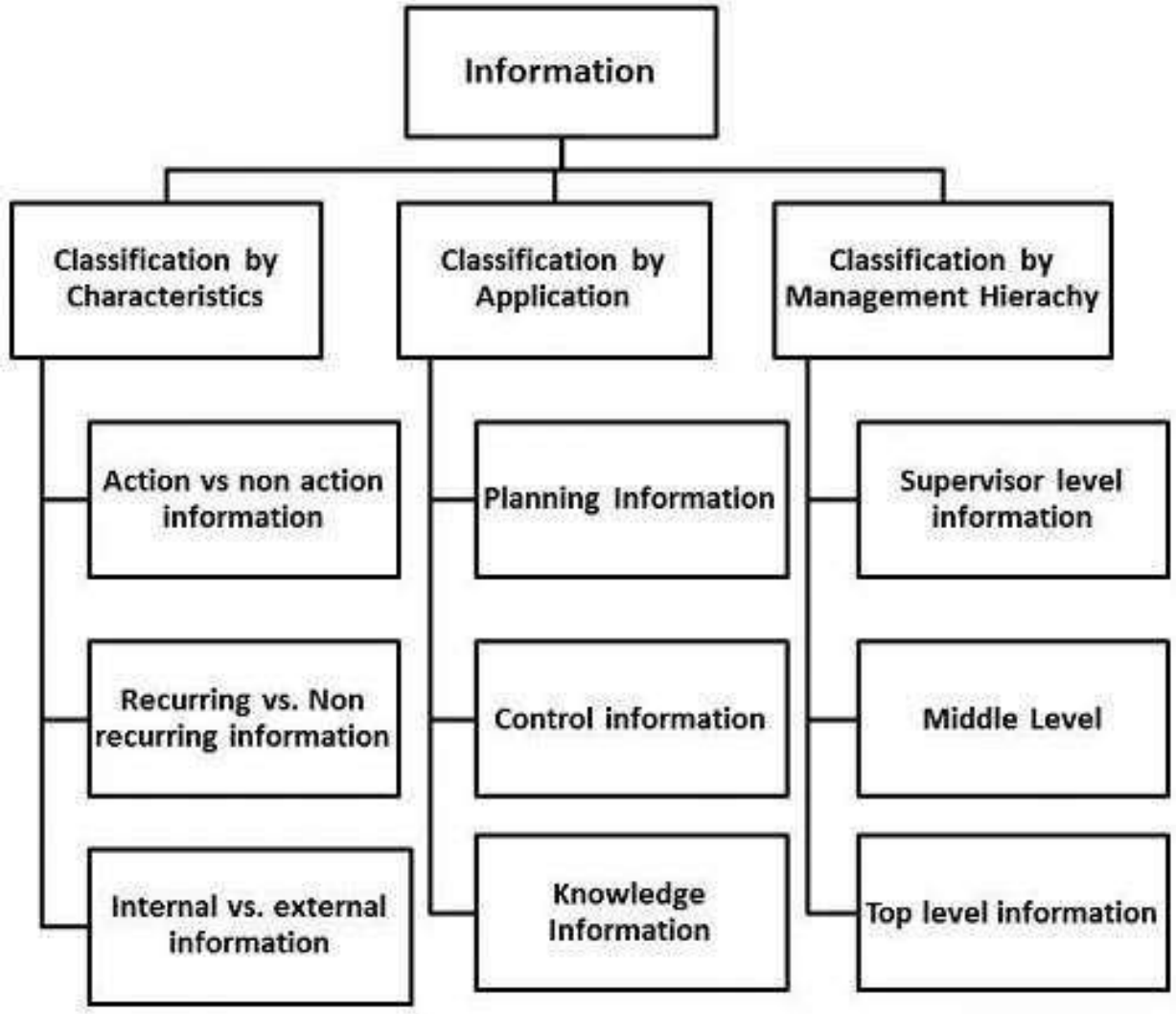
1. Intelligence Stage: MIS designed so as to answer pre-specified and evaluated.
2. Design Stage: Various alternatives are developed and evaluated.
3. Choice Stage: A course of action is selected and feedback is collected on the implementation decision.

4. Information

Information is processed data and takes the meaning as a tangible or intangible entity that reduces uncertainty and triggers action.

Data → Processing → Information

4.1 Classification of Information



4.1.1 Classification by Characteristic

Information used in business for decision-making is generally categorized into three types:

Strategic Information: Strategic information deals with the objectives of a business with long term policy decisions and checks whether these objectives are met up to their level or not. For example, acquiring a new plant, a new product, diversification of business etc, comes under strategic information.

Tactical Information: Tactical information deals with the information needed to control over business resources, like budgeting, quality control, service level, inventory level, productivity level etc.

Operational Information: Operational information deals with plant/business level information and is used to handle proper conduction of specific operational tasks as planned/intended. Various operator specific, machine specific and shift specific jobs for quality control checks comes under this category.

4.1.2 Classification by Application

In terms of applications, information can be categorized as:

Planning Information: These are the information used in business organizations maintaining standard norms and specifications. Everything is planned here. This information is used in strategic, tactical, and operation planning of any activity. Examples of such information are time standards, design standards.

Control Information: This information is required for specific activities performed by the system in order to attain their objectives. This information might be formal or informal. It is used for controlling attainment, nature and utilization of important processes in a system. When this information did get any deviation from the
established standards, the system should develop a decision or an action leading to control the information related to their objectives.

Knowledge Information: Knowledge is defined as "information about information". Knowledge information is acquired through experience and learning, and collected from archival data and research studies.

Organizational Information: Organizational information deals with an organization's environment, where organizational objectives are met. Karl Weick's Organizational Information Theory emphasizes that an organization reduces its equivocality or uncertainty by collecting, managing and using these information carefully. This information is used by everybody in the organization; examples of
such information are employee and payroll information.

Functional/Operational Information: This is operation specific information where the organization assists to perform its functions of day-day transactions. Mainly holds technical work For example, daily schedules in a manufacturing plant that refers to the detailed assignment of jobs to machines or machines to operators. In a
service oriented business, it would be the duty roster of various personnel. This information is mostly internal to the organization.

Database Information: Database information as we know that it is a collection of related data that is stored, retrieved and managed to form databases. It stores large quantities of information that has multiple usage and application. For example, material specification or supplier information is stored for multiple users. It is a type of software program.

4.2 Value of Information Normative

Value of Information

This information or knowledge is represented by an a priori assignment of probability of occurrence to the event and hence a calculated payoff. The a priori probability might be objective or subjective as the case may be and with the knowledge of additional information the probabilities are modified resulting in a change in the expected payoffs. This approach is however, only good for theoretical discussions as its practical applicability is poor. The

problem for such cases has to be highly structured, which is rarely the case in management.

Subjective Value of Information

It is the subject view of the information available. It is the subjective perception or impression of the information. This subjective value approach varies widely with individuals. In the subjective valuation of information, no probabilities are calculated. Subjective value of information is the person's (receiver's) comprehensive impression about the information content.

4.3 Channel Information System (CIS)

- The orderly flow if pertinent operational data, both internally and between channel members, for use as the basis for decision making
- Information about the channel members, channel flow of goods / services, transactions etc. all are Channel Information
- The purpose is to collect and analyze data about the operations of channels

Elements of CIS

- Market information
- Competition tracking
- Distributor profiles and database
- Primary sales
- Secondary sales
- Pricing trends
- Promotions history

- Promotions evaluation
- Inventory control
- Distribution costs

4.4 Characteristics of Information

1. Timeliness: Timeliness means that information must reach the recipients within the prescribed time-frame. (Timely information)
2. Accuracy : Accuracy is another key-attribute of management information(Accurately)
3. Relevance: Relevant information.
4. Adequacy: Adequacy means information must be sufficient in quality.
5. Completeness: Complete and should meet all his needs.
6. Explicitness: Good quality – does not require further analysis & vice versa.
7. Exception-Based: Top-managers need only exception report regarding performance of the organization.

4.5 Dimensions of Information

- Business Dimensions of Information
  1) Availability
  2) Flexibility
  3) Timeliness
  4) Programmability
  5) Completeness
  6) Suitability
- Technical Dimensions of Information
  1) Validity

2) Capacity
3) Response Time
4) Security
5) Interrelations of Data

5. Information Systems Audit

- The effectiveness of an information system's controls is evaluated through an information systems audit.
- An audit aims to establish whether information systems are safeguarding corporate assets, maintaining the integrity of stored and communicated data, supporting corporate objectives effectively, and operating efficiently.
- It is a part of a more general financial audit that verifies an organization's accounting records and financial statements. Information systems are designed so that every financial transaction can be traced.
- An audit trail must exist that can establish where each transaction originated and how it was processed.
- Aside from financial audits, operational audits are used to evaluate the effectiveness and efficiency of information systems operations, and technological audits verify that information technologies are appropriately chosen, configured, and implemented

6. Information Systems Control

To ensure secure and efficient operation of information systems, an organization institutes a set of procedures and technological measures called controls.

Information systems are safeguarded through a combination of general and application controls.

Types of Information control

i. General Control (controls software, hardware, computer operations, data security)
ii. Application Control (controls input, process and output)

i. General Controls

- A review to assess the policies, standards, procedures, and general computer controls aimed at providing a secure and stable environment for the application systems running on various platforms within the company.
- General computer controls are defined as any IS control that falls into one of the following four categories but that is not specific to any particular application system:
    - The implementation and monitoring of information security.
    - Controls over computer operations.
    - Controls over the acquisition, development and maintenance of systems
    - Controls over information systems support.

a. Software controls

- Authorised access to systems

b. Hardware controls

- Physically secure hardware
- Monitor for and fix malfunction
- Environmental systems and protection
- Backup of disk-based data

c. Computer operations controls

- Day-to-day operations of Information Systems
- Procedures
- System set-up
- Job processing
- Backup and recovery procedures

d. Data security controls

- Prevent unauthorised access, change or destruction
- When data is in use or being stored
- Physical access to terminals
- Password protection
- Data level access controls

e. Administrative controls

- Ensure organisational policies, procedures and standards and enforced
- Segregation of functions to reduce errors and fraud
- Supervision of personal to ensure policies and procedures are being adhered to

ii. Application Controls

- Application controls are specific to a given application and include such measures as validating input data, logging the accesses to the system, regularly archiving copies of various databases, and ensuring that information is disseminated only to authorized users.
- Identification of the inherent risks of technology deployed in client's business processes and minimization of the company's exposure to such risks, by ensuring that the necessary controls and security are in place.

a. Input controls

- Data is accurate and consistent on entry
- Direct keying of data, double entry or automated input
- Data conversion, editing and error handling
- Field validation on entry
- Input authorisation and auditing
- Checks on totals to catch errors

b. Processing controls

- Data is accurate and complete on processing
- Checks on totals to catch errors
- Compare to master records to catch errors
- Field validation on update

c. Output controls

- Data is accurate, complete and properly distributed on output
- Checks on totals to catch errors
- Review processing logs

- Track recipients of data

7. E-Governance

Electronic Governance or E-Governance is the application of Information and Communication Technology (ICT) for providing government services, interchange of statistics, communication proceedings, and integration of various independent systems and services. Through the means of e-governance, government services are made available to citizens in a suitable, systematic, and transparent mode. The three main selected groups that can be discriminated against in governance concepts are government, common people, and business groups.

7.1 Elements of E-Governance:

Basic elements of e-governance are:

1. Government
2. Citizens
3. Investors/Businesses

7.2 Types of E-Governance:

E-governance is of 4 types:

i. Government-to-Citizen (G2C): The Government-to-citizen mentions the government services that are acquired by the familiar people. Most of the government services come under G2C. Similarly, the primary aim of Government-to-citizen is to supply facilities to the citizens. It also

helps ordinary people to minimize the time and cost to carry out a transaction. A citizen can retrieve the facilities anytime from anywhere. Similarly, spending the administrative fee online is also possible due to G2C. The facility of Government-to-Citizen allows the ordinary citizen to outclass time limitations. It also focuses on geographic land barriers.

ii. Government-to-business (G2B): Government-to-business is the interchange of services between Government and Business firms. It is productive for both government and business firms. G2B provides access to pertinent forms needed to observe. It also contains many services interchanged between business sectors and government. Similarly, Government-to-business provides timely business information. A business organization can have easy and easy online access to government agencies. G2B plays an important role in business development. It upgrades the efficiency and quality of communication and transparency of government projects.

iii. Government-to-Government (G2G): The Government-to-Government mentions the interaction between different government departments, firms, and agencies. This increases the efficiency of government processes. In G2G, government agencies can share the same database using online communication. The government departments can work together. This service can increase international discretion and relations. G2G services can be at the local level or at the international level. It can

convey to both global government and local government. It also provides a safe and secure inter- relationship between domestic and foreign governments. G2G builds a universal database for all members to upgrade service.

iv. Government-to-Employee (G2E): The Government-to-Employee is the internal part of G2G section. It aims to bring employees together and improvise knowledge sharing. It provides online facilities to the employees. Similarly, applying for leave, reviewing salary payment record and checking the balance of holiday. The G2E sector yields human resource training and development. So, G2E is also the correlation between employees and government institutions.

7.3 Advantages of E-Governance:

- The supreme goal of e-governance is to be able to provide an increased portfolio of public services to citizens in a systematic and cost effective way. It allows for government transparency because it allows the public to be informed about what the government is working on as well as the policies they are trying to implement.
- The main advantage while executing electronic government will be to enhance the efficiency of the current system.
- Another advantage is that it increases transparency in the administration, reduces costs, increases revenue growth, and also improves relationships between the public and the civic authorities.

7.4 Disadvantages of E-Governance:

The main disadvantage regarding e-governance is the absence of fairness in public access to the internet, of trustworthy information on the web, and disguised agendas of government groups that could have an impact and could bias public opinions.