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DIRECTORATE OF DISTANCE EDUCATION

M.A. (PM&IR)

III- SEMESTER

30832

MANAGEMENT INFORMATION SYSTEM

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MANAGEMENT INFORMATION SYSTEM

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UNIT I - INTRODUCTION OF INFORMATION SYSTEM

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1.1. INTRODUCTION OF INFORMATION SYSTEM

Definition: An information system (IS) refers to a collection of multiple pieces of equipment involved in the dissemination of information. Hardware, software, computer system connections and information, information system users, and the system's housing are all part of an IS.

There are several types of information systems, including the following common types:

- Operations support systems, including transaction processing systems
- Management information systems
- Decision support systems
- Executive information systems

An information system commonly refers to a basic computer system but may also describe a telephone switching or environmental controlling system. The IS involves resources for shared or processed information, as well as the people who manage the system. People are considered part of the system because without them, systems would not operate correctly.

There are many types of information systems, depending on the need they are designed to fill. An operations support system, such as a

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transaction processing system, converts business data (financial transactions) into valuable information. Similarly, a management information system uses database information to output reports, helping users and businesses make decisions based on extracted data.

In a decision support system, data is pulled from various sources and then reviewed by managers, who make determinations based on the compiled data. An executive information system is useful for examining business trends, allowing users to quickly access custom strategic information in summary form, which can be reviewed in more detail. An information system is software that helps you organize and analyze data. This makes it possible to answer questions and solve problems relevant to the mission of an organization.

1.2. MEANING

Many organizations work with large amounts of data. Data are basic values or facts and are organized in a database. Many people think of data as synonymous with information; however, information actually consists of data that has been organized to help answers questions and to solve problems. An information system is defined as the software that helps organize and analyze data. So, the purpose of an information system is to turn raw data into useful information that can be used for decision making in an organization.

General Purpose vs. Specialized Information Systems

There are some general types of information systems. For example, a database management system (DBMS) is a combination of software and data that makes it possible to organize and analyze data. DBMS software is typically not designed to work with a specific organization or a specific type of analysis. Rather, it is a general-purpose information system. Another example is an electronic spreadsheet. This is a tool for basic data analysis based on formulas that define relationships among the data. For example, you can use a spreadsheet to calculate averages for a set of values or to plot the trend of a value over time.

In contrast, there are a number of specialized information systems that have been specifically designed to support a particular process within an organization or to carry out very specific analysis tasks. For example, enterprise resource planning (ERP) is an information system used to integrate the management of all internal and external information across an entire organization. Another example is a geographic information system (GIS), which is used to manage and analyze all types of geographical data. Expert systems are another example of information systems. An experts system is designed to solve complex problems by following the reasoning of an expert.

1.3. ROLE OF INFORMATION SYSTEMS

Now, explored the different components of information systems, we need to turn our attention to the role that information systems play in an organization. So far we have looked at what the components of an

information system are, but what do these components actually do for an organization? From our definitions above, we see that these components collect, store, organize, and distribute data throughout the organization. In fact, we might say that one of the roles of information systems is to take data and turn it into information, and then transform that into organizational knowledge. As technology has developed, this role has evolved into the backbone of the organization. To get a full appreciation of the role information systems play, we will review how they have changed over the years.

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Figure 1.1: IBM 704 Mainframe (Copyright: Lawrence Livermore National Laboratory).

The Mainframe Era: From the late 1950s through the 1960s, computers were seen as a way to more efficiently do calculations. These first business computers were room-sized monsters, with several refrigerator-sized machines linked together. The primary work of these devices was to organize and store large volumes of information that were tedious to manage by hand. Only large businesses, universities, and government agencies could afford them, and they took a crew of specialized personnel and specialized facilities to maintain. These devices served dozens to hundreds of users at a time through a process called time-sharing. Typical functions included scientific calculations and accounting, under the broader umbrella of data processing.



Registered trademark of International Business Machines

In the late 1960s, the Manufacturing Resources Planning (MRP) systems were introduced. This software, running on a mainframe computer, gave companies the ability to manage the manufacturing process, making it more efficient. From tracking inventory to creating bills of materials to scheduling production, the MRP systems (and later the MRP II systems) gave more businesses a reason to want to integrate computing into their processes. IBM became the dominant mainframe company. Nicknamed “Big Blue,” the company became synonymous with business computing. Continued improvement in software and the

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availability of cheaper hardware eventually brought mainframe computers (and their little sibling, the minicomputer) into most large businesses.

The PC Revolution: In 1975, the first microcomputer was announced on the cover of Popular Mechanics: the Altair 8800. Its immediate popularity sparked the imagination of entrepreneurs everywhere, and there were quickly dozens of companies making these “personal computers”. Though at first just a niche product for computer hobbyists, improvements in usability and the availability of practical software led to growing sales. The most prominent of these early personal computer makers was a little company known as Apple Computer, headed by Steve Jobs and Steve Wozniak, with the hugely successful “Apple II”. Not wanting to be left out of the revolution, in 1981 IBM (teaming with a little company called Microsoft for their operating-system software) hurriedly released their own version of the personal computer, simply called the “PC”. Businesses, which had used IBM mainframes for years to run their businesses, finally had the permission they needed to bring personal computers into their companies, and the IBM PC took off. The IBM PC was named Time magazine’s “Man of the Year” for 1982.

Because of the IBM PC’s open architecture, it was easy for other companies to copy, or “clone” it. During the 1980s, many new computer companies sprang up, offering less expensive versions of the PC. This drove prices down and spurred innovation. Microsoft developed its Windows operating system and made the PC even easier to use. Common uses for the PC during this period included word processing, spreadsheets, and databases. These early PCs were not connected to any sort of network; for the most part they stood alone as islands of innovation within the larger organization.

Client-Server: In the mid-1980s, businesses began to see the need to connect their computers together as a way to collaborate and share resources. This networking architecture was referred to as “client-server” because users would log in to the local area network (LAN) from their PC (the “client”) by connecting to a powerful computer called a “server,” which would then grant them rights to different resources on the network (such as shared file areas and a printer). Software companies began developing applications that allowed multiple users to access the same data at the same time. This evolved into software applications for communicating, with the first real popular use of electronic mail appearing at this time.



Registered trademark of SAP: This networking and data sharing all stayed within the confines of each business, for the most part. While there was sharing of electronic data between companies, this was a very specialized function. Computers were now seen as tools to collaborate internally, within an organization. In fact, these networks of computers were becoming so powerful that they were replacing many of the functions previously performed by the larger mainframe computers at a fraction of

the cost. It was during this era that the first Enterprise Resource Planning (ERP) systems were developed and run on the client-server architecture. An ERP system is a software application with a centralized database that can be used to run a company's entire business. With separate modules for accounting, finance, inventory, human resources, and many, many more, ERP systems, with Germany's SAP leading the way, represented the state of the art in information systems integration.

The World Wide Web and E-Commerce: First invented in 1969, the Internet was confined to use by universities, government agencies, and researchers for many years. Its rather arcane commands and user applications made it unsuitable for mainstream use in business. One exception to this was the ability to expand electronic mail outside the confines of a single organization. While the first e-mail messages on the Internet were sent in the early 1970s, companies who wanted to expand their LAN-based e-mail started hooking up to the Internet in the 1980s. Companies began connecting their internal networks to the Internet in order to allow communication between their employees and employees at other companies. It was with these early Internet connections that the computer truly began to evolve from a computational device to a communications device.

In 1989, Tim Berners-Lee developed a simpler way for researchers to share information over the network at CERN laboratories, a concept he called the World Wide Web. This invention became the launching point of the growth of the Internet as a way for businesses to share information about themselves. As web browsers and Internet connections became the norm, companies rushed to grab domain names and create websites.



Registered trademark of Amazon Technologies, Inc.

In 1991, the National Science Foundation, which governed how the Internet was used, lifted restrictions on its commercial use. The year 1994 saw the establishment of both eBay and Amazon.com, two true pioneers in the use of the new digital marketplace. A mad rush of investment in Internet-based businesses led to the dot-com boom through the late 1990s, and then the dot-com bust in 2000. While much can be learned from the speculation and crazy economic theories espoused during that bubble, one important outcome for businesses was that thousands of miles of Internet connections were laid around the world during that time. The world became truly "wired" heading into the new millennium, ushering in the era of globalization.

As it became more expected for companies to be connected to the Internet, the digital world also became a more dangerous place. Computer viruses and worms, once slowly propagated through the sharing of computer disks, could now grow with tremendous speed via the Internet. Software written for a disconnected world found it very difficult to defend against these sorts of threats. A whole new industry of computer and Internet security arose.

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Web 2.0: As the world recovered from the dot-com bust, the use of technology in business continued to evolve at a frantic pace. Websites became interactive; instead of just visiting a site to find out about a business and purchase its products, customers wanted to be able to customize their experience and interact with the business. This new type of interactive website, where you did not have to know how to create a web page or do any programming in order to put information online, became known as web 2.0. Web 2.0 is exemplified by blogging, social networking, and interactive comments being available on many websites. This new web-2.0 world, in which online interaction became expected, had a big impact on many businesses and even whole industries. Some industries, such as bookstores, found themselves relegated to a niche status. Others, such as video rental chains and travel agencies, simply began going out of business as they were replaced by online technologies. This process of technology replacing a middleman in a transaction is called disintermediation.

As the world became more connected, new questions arose. Should access to the Internet be considered a right? Can I copy a song that I downloaded from the Internet? How can I keep information that I have put on a website private? What information is acceptable to collect from children? Technology moved so fast that policymakers did not have enough time to enact appropriate laws, making for a Wild West-type atmosphere.

The Post-PC World: After thirty years as the primary computing device used in most businesses, sales of the PC are now beginning to decline as sales of tablets and smartphones are taking off. Just as the mainframe before it, the PC will continue to play a key role in business, but will no longer be the primary way that people interact and do business. The limited storage and processing power of these devices is being offset by a move to “cloud” computing, which allows for storage, sharing, and backup of information on a massive scale. This will require new rounds of thinking and innovation on the part of businesses as technology continues to advance.

Era	Hardware	Operating System	Applications
Mainframe (1970s)	Terminals connected to mainframe computer.	Time-sharing (TSO) on MVS	Custom-written MRP software
PC (mid-1980s)	IBM PC or compatible. Sometimes connected to mainframe computer via expansion card.	MS-DOS	WordPerfect, Lotus 1-2-3
Client-Server (late 80s to early 90s)	IBM PC “clone” on a Novell Network.	Windows for Workgroups	Microsoft Word, Microsoft Excel

World Wide Web (mid-90s to early 2000s)	IBM PC “clone” connected to company intranet.	Windows XP	Microsoft Office, Internet Explorer
Web 2.0 (mid-2000s to present)	Laptop connected to company Wi-Fi.	Windows 7	Microsoft Office, Firefox
Post-PC (today and beyond)	Apple iPad	iOS	Mobile-friendly websites, mobile apps

1.4. SYSTEM CONCEPTS

1.4.1 System

A set of inter-related, inter-connected or inter-dependent elements that operates collectively to accomplish some common purpose or goal, is called SYSTEM.” For example:

Human Body

Elements: Head, Hand, Legs, Heart, Eyes, etc.

Objective: To make human life comfortable, tolerable and possible.

Computer

Elements: Monitor, CPU, Keyboard, Printer, Disks, Software etc.

Objective: Data Processing.

Business Organization

Elements: Men, Machine, Material, Method Money etc.

Objective: Maximization of Profit

All the elements of a system can be classified into two main categories: **Abstract elements** and **Physical elements**. The elements which can't be seen and touched but their presence can only be felt are called Abstract and the elements which can be seen and touched are called Physical. E.g.

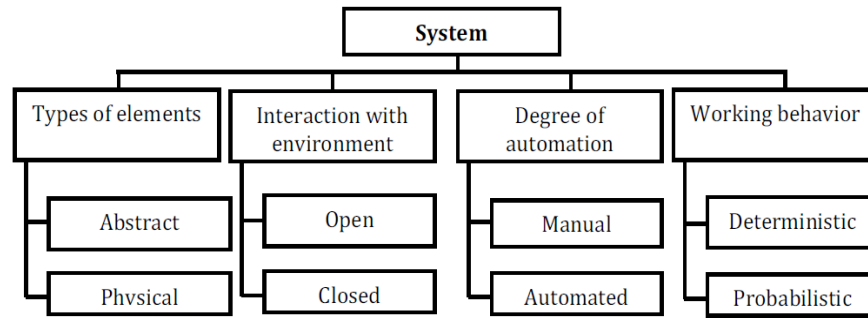
- In a human body heart is a physical element and heart beats are abstract.
- In computer system CPU, VDU, keyboard are all physical element and the data, software are all abstract.
- In Business organization money, material machine are all physical elements and the business processes like marketing, forecasting, planning are abstract.

1.4.2 Types of System

We can distinguish systems on the following basis –

- Types of element
- Interaction with environment
- Degree of automation
- Working behaviour

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1.4.2.1 Types of elements

Depending upon the majority of elements we also classify system into two categories: Abstract System and Physical system.

Abstract System: Also known as conceptual system, Abstract system is an orderly arrangement of concepts, ideas, of theories. For example – Theology, is a system of orderly arrangement of ideas about God and its relationship with Human.

Physical System: A physical system is a set of tangible elements operates together to accomplish objectives. For example – Computer system, Circulatory system, Transportation system etc.

1.4.2.2 Interaction with Environment

Interaction with Environment –

	Open	Closed
1.	The system which interacts with its environment.	The system which does not interacts with its environment.
2.	It takes input from environment and gives output back to environment.	It neither take input nor provides output to environment Self contained, self sufficient systems.
3.	It gets influenced by the changes taking place in the environment.	It remains uninfluenced by the environmental changes.
4.	The life time OS such system is relatively longer.	It's life time is much shorter compared to open system.
5.	E.g. Business organization.	E.g. Use and throw digital watch.

1.4.2.3 Degree of Automation

	Manual	Automated
1.	Here data collection, manipulation and final reporting is done absolutely by human efforts.	Here computer or microprocessor perform all the tasks.
2.	It can handle less volume of data.	It can handle relatively huge volume of data which is not possible by human efforts.
3.	Their processing speed is relatively slow and change of human error is always there.	It offers quick and accurate processing of data.
4.	Data are difficult to transmit from one place to another.	Data can be transported easily through computer network.
5.	Data analysis can be done only on sample and conclusion is drawn about population.	Full population can be analysed.

1.4.2.4 Working behavior

	Deterministic	Probabilistic
1.	It behave in a predictable manner.	It behaves in a unpredictable manner.
2.	If the current state of the system is known to us then its future state can be determined.	The future state can't be determined even if the current state is known for sure.
3.	It has strong relationship among elements.	It has weak relationship among the elements.
4.	An error free computer program is an example of such type of system.	Business organization is an example of such type of system.

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1.5. ORGANIZATION AS A SYSTEM

A typical organization is divided into operational, middle, and upper level. The information requirements for users at each level differ. Towards that end, there are number of information systems that support each level in an organization.

This tutorial will explore the different types of information systems, the organizational level that uses them and the characteristics of the particular information system.

The different Classification of Information are:

- Pyramid Diagram of Organizational levels and information requirements
- Transaction Processing System (TPS)
- Management Information System (MIS)
- Decision Support System (DSS)
- Artificial intelligence techniques in business
- Online Analytical Processing (OLAP)

Pyramid Diagram of Organizational levels and information requirements

Understanding the various levels of an organization is essential to understand the information required by the users who operate at their respective levels. The following diagram illustrates the various levels of a typical organization.

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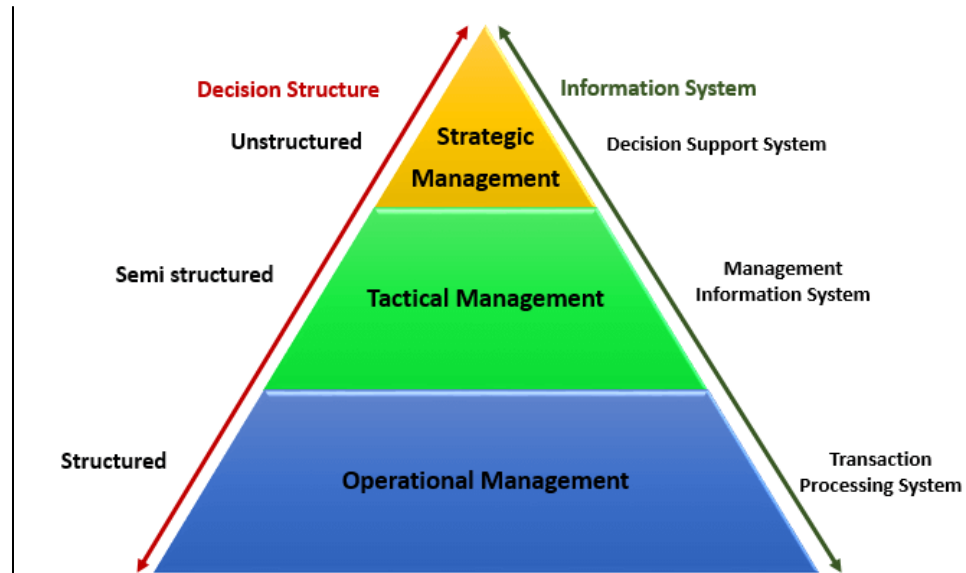


Figure 1.2: Organizational levels and information requirements

Operational management level: The operational level is concerned with performing day to day business transactions of the organization. Examples of users at this level of management include cashiers at a point of sale, bank tellers, nurses in a hospital, customer care staff, etc. Users at this level use make structured decisions. This means that they have defined rules that guide them while making decisions. For example, if a store sells items on credit and they have a credit policy that has some set limit on the borrowing. All the sales person needs to decide whether to give credit to a customer or not are based on the current credit information from the system.

Tactical Management Level: This organization level is dominated by middle-level managers, heads of departments, supervisors, etc. The users at this level usually oversee the activities of the users at the operational management level. Tactical users make semi-structured decisions. The decisions are partly based on set guidelines and judgmental calls. As an example, a tactical manager can check the credit limit and payments history of a customer and decide to make an exception to raise the credit limit for a particular customer. The decision is partly structured in the sense that the tactical manager has to use existing information to identify a payments history that benefits the organization and an allowed increase percentage.

Strategic Management Level: This is the most senior level in an organization. The users at this level make unstructured decisions. Senior level managers are concerned with the long-term planning of the organization. They use information from tactical managers and external data to guide them when making unstructured decisions.

Transaction Processing System (TPS): Transaction processing systems are used to record day to day business transactions of the organization. They are used by users at the operational management level. The main

objective of a transaction processing system is to answer routine questions such as;

- How printers were sold today?
- How much inventory do we have at hand?
- What is the outstanding due for John Doe?

By recording the day to day business transactions, TPS system provides answers to the above questions in a timely manner.

- The decisions made by operational managers are routine and highly structured.
- The information produced from the transaction processing system is very detailed.

For example, banks that give out loans require that the company that a person works for should have a memorandum of understanding (MoU) with the bank. If a person whose employer has a MoU with the bank applies for a loan, all that the operational staff has to do is verify the submitted documents. If they meet the requirements, then the loan application documents are processed. If they do not meet the requirements, then the client is advised to see tactical management staff to see the possibility of signing a MoU.

Examples of transaction processing systems include;

- **Point of Sale Systems** – records daily sales
- **Payroll systems** – processing employees salary, loans management, etc.
- **Stock Control systems** – keeping track of inventory levels
- **Airline booking systems** – flights booking management

Management Information System (MIS): are used by tactical managers to monitor the organization's current performance status. The output from a transaction processing system is used as input to a management information system.

The MIS system analyzes the input with routine algorithms i.e. aggregate, compare and summarizes the results to produced reports that tactical managers use to monitor, control and predict future performance.

For example, input from a point of sale system can be used to analyze trends of products that are performing well and those that are not performing well. This information can be used to make future inventory orders i.e. increasing orders for well-performing products and reduce the orders of products that are not performing well.

Examples of management information systems includes;

- **Sales management systems** – they get input from the point of sale system
- **Budgeting systems** – gives an overview of how much money is spent within the organization for the short and long terms.
- **Human resource management system** – overall welfare of the employees, staff turnover, etc.

Tactical managers are responsible for the semi-structured decision. MIS systems provide the information needed to make the structured decision and based on the experience of the tactical managers, they make judgment

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calls i.e. predict how much of goods or inventory should be ordered for the second quarter based on the sales of the first quarter.

Decision Support System (DSS): are used by senior management to make non-routine decisions. Decision support systems use input from internal systems (transaction processing systems and management information systems) and external systems.

The main objective of decision support systems is to provide solutions to problems that are unique and change frequently. Decision support systems answer questions such as;

- What would be the impact of employees' performance if we double the production lot at the factory?
- What would happen to our sales if a new competitor entered the market?

Decision support systems use sophisticated mathematical models, and statistical techniques (probability, predictive modeling, etc.) to provide solutions, and they are very interactive.

Examples of decision support systems include;

- **Financial planning systems** – it enables managers to evaluate alternative ways of achieving goals. The objective is to find the optimal way of achieving the goal. For example, the net profit for a business is calculated using the formula Total Sales less (Cost of Goods + Expenses). A financial planning system will enable senior executives to ask what if questions and adjust the values for total sales, the cost of goods, etc. to see the effect of the decision and on the net profit and find the most optimal way.
- **Bank loan management systems** – it is used to verify the credit of the loan applicant and predict the likelihood of the loan being recovered.

Artificial intelligence techniques in business: Artificial intelligence systems mimic human expertise to identify patterns in large data sets. Companies such as Amazon, Facebook, and Google, etc. use artificial intelligence techniques to identify data that is most relevant to you. Let's use Facebook as an example, Facebook usually makes very accurate predictions of people that you might know or went with to school. They use the data that you provide to them, the data that your friends provide and based on this information make predictions of people that you might know.

Amazon uses artificial intelligence techniques too to suggest products that you should buy also based on what you are currently getting. Google also uses artificial intelligence to give you the most relevant search results based on your interactions with Google and your location. These techniques have greatly contributed in making these companies very successful because they are able to provide value to their customers.

Online Analytical Processing (OLAP): Online analytical processing (OLAP) is used to query and analyze multi-dimensional data and produce information that can be viewed in different ways using multiple dimensions.

Let's say a company sells laptops, desktops, and Mobile device. They have four (4) branches A, B, C and D. OLAP can be used to view the total sales of each product in all regions and compare the actual sales with the projected sales. Each piece of information such as product, number of sales, sales value represents a different dimension. The main objective of OLAP systems is to provide answers to ad hoc queries within the shortest possible time regardless of the size of the datasets being used.

1.6. COMPONENTS OF INFORMATION SYSTEM

The computer age introduced a new element to businesses, universities, and a multitude of other organizations: a set of components called the information system, which deals with collecting and organizing data and information.

While information systems may differ in how they are used within an organization, they typically contain the following components:

1. **Hardware:** Computer-based information systems use computer hardware, such as processors, monitors, keyboard and printers.
2. **Software:** These are the programs used to organize, process and analyze data.
3. **Databases:** Information systems work with data, organized into tables and files.
4. **Network:** Different elements need to be connected to each other, especially if many different people in an organization use the same information system.
5. **Procedures:** These describe how specific data are processed and analyzed in order to get the answers for which the information system is designed.

The first four components are part of the general **information technology (IT)** of an organization. Procedures, the fifth component, are very specific to the information needed to answer a specific question.

An information system is described as five components.

1. Computer hardware

This is the physical technology that works with information. Hardware can be as small as a smartphone that fits in a pocket or as large as a supercomputer that fills a building. Hardware also includes the peripheral devices that work with computers, such as keyboards, external disk drives, and routers. With the rise of the Internet of things, in which anything from home appliances to cars to clothes will be able to receive and transmit data, sensors that interact with computers are permeating the human environment.

2. Computer software

The hardware needs to know what to do, and that is the role of software. Software can be divided into two types: system software and application software. The primary piece of system software is the operating system, such as Windows or iOS, which manages the hardware's operation.

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Application software is designed for specific tasks, such as handling a spreadsheet, creating a document, or designing a Web page.

1.6.3. Databases and data warehouses.

This component is where the “material” that the other components work with resides. A database is a place where data is collected and from which it can be retrieved by querying it using one or more specific criteria. A data warehouse contains all of the data in whatever form that an organization needs. Databases and data warehouses have assumed even greater importance in information systems with the emergence of “big data,” a term for the truly massive amounts of data that can be collected and analyzed.

4. Network and Telecommunications

This component connects the hardware together to form a network. Connections can be through wires, such as Ethernet cables or fibre optics, or wireless, such as through Wi-Fi. A network can be designed to tie together computers in a specific area, such as an office or a school, through a local area network (LAN). If computers are more dispersed, the network is called a wide area network (WAN). The Internet itself can be considered a network of networks.

5. Human resources and procedures

The final, and possibly most important, component of information systems is the human element: the people that are needed to run the system and the procedures they follow so that the knowledge in the huge databases and data warehouses can be turned into learning that can interpret what has happened in the past and guide future action.

1.7. VARIOUS ACTIVITIES OF IS

There are three basic activities

1. Input
2. Processing, and
3. Output

1.7.1 Perspectives on Information Systems

An information system is a set of interrelated components that collect or retrieve process, store, and distribute information to support decision making and control in an organization. Information systems can also be used to analyze problems, visualize complex subjects, and create new products. Information is data, or raw facts, shaped into useful form for humans.

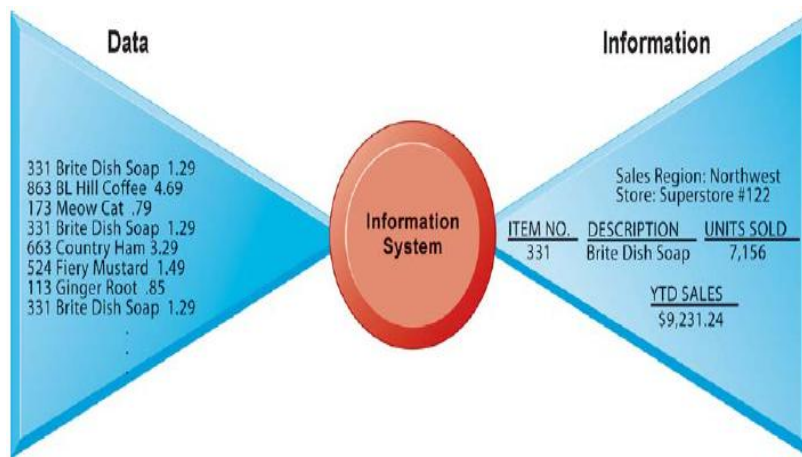


Figure 1.3: Data and Information.

Raw data from a supermarket checkout counter can be processed and organized to produce meaningful information, such as the total unit sales of dish detergent or the total sales revenue from dish detergent for a specific store or sales territory.

1.7.2 Activities of IS

Input, processing, and output are the three activities in an information system that produces the information an organization needs. Input captures or collects raw data from within the organization or from its external environment. Processing converts this raw input into a meaningful form. Output transfers the processed information to the people who will use it or to the activities for which it will be used. Information systems also require feedback, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage.

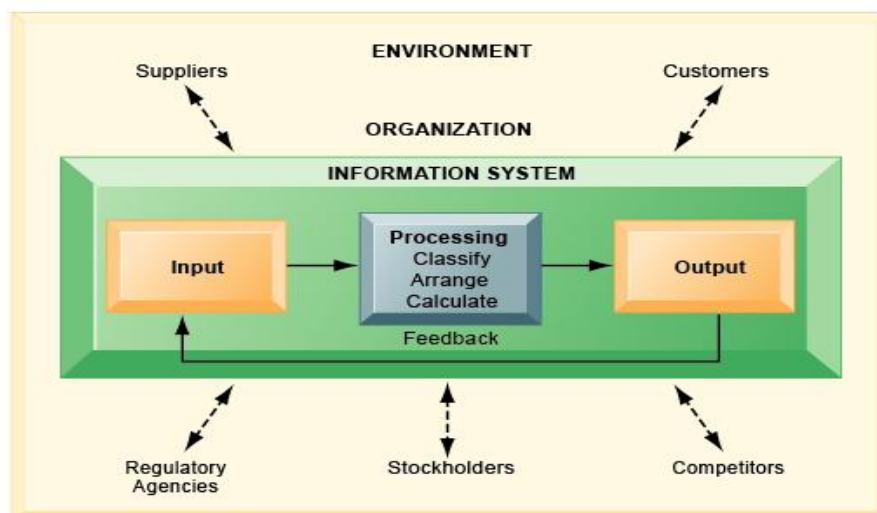


Figure 1.4: Functions of an Information System

Input: The capture or collection of raw data from within the organization or from its external environment for processing in an information system.

Processing: The conversion, manipulation, and analysis of raw input into a form that is more meaningful to humans

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Output: The distribution of processed information to the help who will use it or to the activities for which it will be used.

Feedback: Output that is returned to the appropriate members of the organization to help them evaluate or correct input.

An information system contains information about an organization and its surrounding environment. Three basic activities—input, processing, and output—produce the information organizations need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Environmental actors, such as customers, suppliers, competitors, stockholders, and regulatory agencies, interact with the organization and its information systems.

It is important to distinguish information systems, which are designed to produce information and solve organizational problems, from the computer technology and software that is typically used to create and manage information systems.

Computer literacy focuses primarily on knowledge of information technology. **Information systems literacy**, the understanding of information systems, includes a behavioral and technical approach to understanding the broader organization, management, and information technology dimension of systems and their power to provide solutions. The field of management information systems (MIS) tries to achieve this broader information systems literacy.



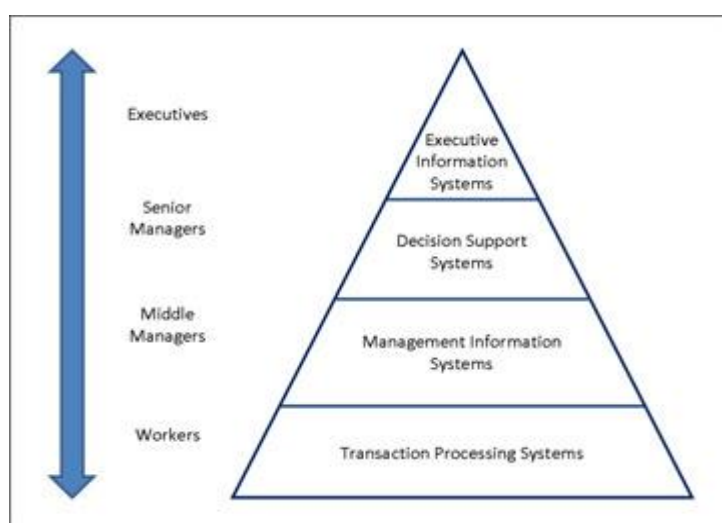
Figure 1.5: Information Systems Are More than Computers

Using information systems effectively requires an understanding of the organization, management, and information technology shaping the systems. An information system creates value for the firm as an organizational and management solution to challenges posed by the environment.

The dimensions of information systems include organizations, management, and information technology. The key elements of an organization are its people, structure, business processes, politics, and culture. An organization coordinates work through a structured hierarchy and formal standard operating procedures. Managerial, professional, and technical employees form the upper levels of the organization's hierarchy while lower levels consist of operational personnel.

1.8. DIFFERENT TYPES OF INFORMATION SYSTEMS

The many different types of information systems can be divided into categories based on where they are used in the hierarchy of an organization.



1. Executive Information System (EIS)
2. Decision Support System (DSS)
3. Management Information System (MIS)
4. Transaction Process System (TPS)

1.8.1. 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. Executive information systems can be used in many different types of organizations to monitor enterprise performance as well as to identify opportunities and problems.

Early executive information systems were developed as computer-based programs on mainframe computers to provide a company's description, sales performance and/or market research data for senior executives. However, senior executives were not all computer literate or

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confident. Moreover, EIS data was only supporting executive-level decisions but not necessarily supporting the entire company or enterprise. Current EIS data is available company- or enterprise-wide, facilitated by personal computers and workstations on local area networks (LANs). Employees can access company data to help decision-making in their individual workplaces, departments, divisions, etc.. This allows employees to provide pertinent information and ideas both above and below their company level. The typical EIS has four components: hardware, software, user interface and telecommunication.

1.8.2. Decision Support System (DSS)

A decision support system (DSS) is a computer-based application that collects, organizes and analyzes business data to facilitate quality business decision-making for management, operations and planning. A well-designed DSS aids decision makers in compiling a variety of data from many sources: raw data, documents, personal knowledge from employees, management, executives and business models. DSS analysis helps companies to identify and solve problems, and make decisions.

Decision-making analysis was conducted by the Carnegie Institute of Technology in the late 1950s and early 1960s. The Massachusetts Institute of Technology (MIT) applied computer technology to decision-making theory in the 1960s. By the 1980s, intensive research on DSS was underway, and new theories and concepts emerged from single-user models of DSS, including organizational decision support systems (ODSSs), group decision support systems (GDSSs) and executive information systems (EISs). By 1990 DSS was broadened to include data warehousing and online analytical processing.

Typical information gathered by a DSS may include:

- Projected revenue and sales figures, some based on new product sales projections
- Comparative sales figures between selected time periods
- Inventory data organized into relational databases for timely analysis

In some DSS applications, timely analysis includes the consequences of different decision alternatives. DSS applications are used in many diverse fields, including medical diagnosis, credit loan verification, evaluating bids on engineering projects, business and business management, agricultural production at the farm and policy levels, forest management and railroad (for evaluation of defective rails).

1.8.3. Management Information System (MIS)

A management information system (MIS) is a broadly used and applied term for a three-resource system required for effective organization management. The resources are people, information and technology, from inside and outside an organization, with top priority given to people. The system is a collection of information management methods involving computer automation (software and hardware) or otherwise supporting and improving the quality and efficiency of business operations and human decision making.

It is important to note that a management information system should not only indicate the status of a business's conditions, but also indicate why the conditions are improving or deteriorating. For example, an MIS should report performance relative to cost and profitable or unprofitable projects, while identifying individual accountability – both current and past. This can be done only if such reports are based on constantly updated information accessible to those in authority who are responsible for assessing and assuring it is used for timely decision-making.

Examples of the broad scope and varied contexts of MISs are:

- Decision support systems
- Enterprise resource planning (ERP)
- Supply chain management
- Customer relationship management (CRM)
- Project management
- Executive information systems (EIS)

The term MIS and "information system" are often confused. Information systems, by themselves, are differentiated from the decision-making process. Of course, the data within them may facilitate the decision-making process.

1.8.4. Transaction Process System (TPS)

A transaction process system (TPS) is an information processing system for business transactions involving the collection, modification and retrieval of all transaction data. Characteristics of a TPS include performance, reliability and consistency.

TPS is also known as transaction processing or real-time processing. A transaction process system and transaction processing are often contrasted with a batch process system and batch processing, where many requests are all executed at one time. The former requires the interaction of a user, whereas batch processing does not require user involvement. In batch processing the results of each transaction are not immediately available. Additionally, there is a delay while the many requests are being organized, stored and eventually executed. In transaction processing there is no delay and the results of each transaction are immediately available. During the delay time for batch processing, errors can occur. Although errors can occur in transaction processing, they are infrequent and tolerated, but do not warrant shutting down the entire system.

To achieve performance, reliability and consistency, data must be readily accessible in a data warehouse, backup procedures must be in place and the recovery process must be in place to deal with system failure, human failure, computer viruses, software applications or natural disasters.

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2. <https://www.techopedia.com/definition/24142/information-system-is>

3. <https://www.britannica.com/list/5-components-of-information-systems>

4. <https://www.guru99.com/mis-types-information-system.html>

Notes

Check your Progress:

1. What is an information system?
2. What are the types of elements in IS?
3. What is Conceptual System?
4. What are different types of Information Systems?
5. What is TPS?

1.9. ANSWERS TO CHECK YOUR PROGRESS

1. An information system (IS) refers to a collection of multiple pieces of equipment involved in the dissemination of information. Hardware, software, computer system connections and information, information system users, and the system's housing are all part of an IS.
2. Depending upon the majority of elements we also classify system into two categories:
 - Abstract system
 - Physical system
3. Abstract system is an orderly arrangement of concepts, ideas, of theories. For example – Theology, is a system of orderly arrangement of ideas about God and its relationship with Human. Abstract System also known as conceptual system.
4. The many different types of information systems can be divided into categories based on where they are used in the hierarchy of an organization.
 - Executive Information System (EIS)
 - Decision Support System (DSS)
 - Management Information System (MIS)
 - Transaction Process System (TPS)
5. A transaction process system (TPS) is an information processing system for business transactions involving the collection, modification and retrieval of all transaction data. Characteristics of a TPS include performance, reliability and consistency.

1.10. SUMMARY

- An information system (IS) refers to a collection of multiple pieces of equipment involved in the dissemination of information.
- A set of inter-related, inter-connected or inter-dependent elements that operates collectively to accomplish some common purpose or goal, is called SYSTEM.
- A physical system is a set of tangible elements operates together to accomplish objectives.
- An information system is a set of interrelated components that collect or retrieve process, store, and distribute information to support decision making and control in an organization.

1.11. KEYWORDS

- **Online Analytical Processing (OLAP):** Online analytical processing (OLAP) is used to query and analyse multi-dimensional data and produce information that can be viewed in different ways using multiple dimensions.
- **Decision Support System (DSS):** Decision Support System are used by senior management to make non-routine decisions. Decision support systems use input from internal systems (transaction processing systems and management information systems) and external systems.
- **Management Information System (MIS):** Management Information System are used by tactical managers to monitor the organization's current performance status. The output from a transaction processing system is used as input to a management information system.

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1.12. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What are the Components of Information system?
2. What are the various activities of IS?
3. What is the Perspectives on Information Systems?
4. Define EIS?
5. What is Network and Telecommunications?

Long Answer questions:

1. Explain briefly about Components of Information system?
2. Explain briefly about Different types of Information Systems?
3. Explain about System Concepts?

1.13. FURTHER READINGS

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Notes

UNIT II - Information System

Structure

- 2.1. Concepts of Information system
- 2.2. Management Information system design and development
 - 2.2.1 Design
 - 2.2.2 Development
- 2.3. Implementation testing and conversion
 - 2.3.1 Implementation of MIS
 - 2.3.2 Testing
 - 2.3.3 Conversion
- 2.4. Evolution and Element of MIS.
 - 2.4.1 Evolution of Management Information System
 - 2.4.2 Element of MIS
- 2.5 Answers to Check Your Progress
- 2.6 Summary
- 2.7 Keywords
- 2.8 Self-Assessment Questions and Exercises
- 2.9 Further Readings

2.1 CONCEPTS OF INFORMATION SYSTEM

The MIS is an idea which is associated with man, machine, marketing and methods for collecting information's from the internal and external source and processing this information for the purpose of facilitating the process of decision-making of the business.

MIS is not new, only the computerization is new , before computers MIS techniques existed to supply managers with the information that would permit them to plan and control business operations. The computer has added on more dimensions such as speed, accuracy and increased volume of data that permit the consideration of more alternatives in decision-making process.

Management information system is an integrated set of component or entities that interact to achieve a particular function, objective or goal. Therefore it is a computer based system that provides information for decisions making on planning, organizing and controlling the operation of the sub-system of the firm and provides a synergistic organization in the process.

The component of an information system includes: a hardware which is used for input/output process and storage of data, software used to process data and also to instruct the hand-ware component, data bases which is the location in the system where all the organization data will be

automated and procedures which is a set of documents that explain the structure of that management information system.

There are various driving factors of management information system for example:-

Technological revolutions in all sectors make modern managers to need to have access to large amount of selective information for the complex tasks and decisions.

The lifespan of most product has continued getting shorter and shorter and therefore the challenge to the manager is to design product that will take a longer shelf life and in order to do this, the manager must be able to keep abreast of the factors that influences the organization product and services thus, management information system come in handy in supporting the process.

There are huge amount of information available to today's manager and this had therefore meant that managers are increasingly relying on management information system to access the exploding information. Management information services helps manager to access relevant, accurate, up-to-date information which is the more sure way of making accurate decisions. It also helps in automation and incorporation of research and management science techniques into the overall management information system for example probability theory.

The management information services are capable of taking advantage of the computational ability of the company like processing, storage capacity among others. Based on this relevancy, management information system should be installed and upgraded in various organizations since today's managers need them to access information for managerial decision making and also management functions.

2.2. MANAGEMENT INFORMATION SYSTEM DESIGN AND DEVELOPMENT

2. 2.1 Design

Systems development is systematic process which includes phases such as planning, analysis, design, deployment, and maintenance. Here, in this tutorial, we will primarily focus on –

- Systems analysis
- Systems design

1. Systems Analysis

It is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components.

System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

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Analysis specifies what the system should do.

2. Systems Design

It is a process of planning a new business system or replacing an existing system by defining its components or modules to satisfy the specific requirements. Before planning, you need to understand the old system thoroughly and determine how computers can best be used in order to operate efficiently.

System Design focuses on **how to accomplish the objective of the system.**

System Analysis and Design (SAD) mainly focuses on –

- Systems
- Processes
- Technology

2.2.2 Development

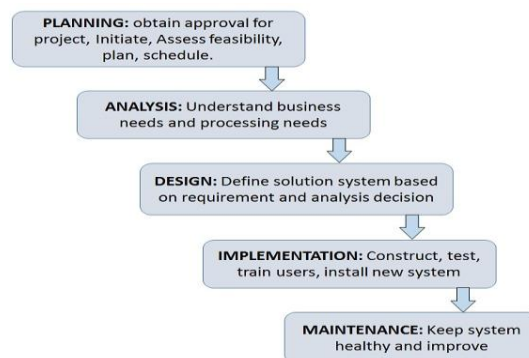
An effective System Development Life Cycle (SDLC) should result in a high quality system that meets customer expectations, reaches completion within time and cost evaluations, and works effectively and efficiently in the current and planned Information Technology infrastructure.

System Development Life Cycle (SDLC) is a conceptual model which includes policies and procedures for developing or altering systems throughout their life cycles. SDLC is used by analysts to develop an information system. SDLC includes the following activities –

- Requirements
- Design
- Implementation
- Testing
- Deployment
- Operations
- Maintenance

Phases of SDLC

Systems Development Life Cycle is a systematic approach which explicitly breaks down the work into phases that are required to implement either new or modified Information System.



Feasibility Study or Planning

- Define the problem and scope of existing system.
- Overview the new system and determine its objectives.
- Confirm project feasibility and produce the project Schedule.
- During this phase, threats, constraints, integration and security of system are also considered.
- A feasibility report for the entire project is created at the end of this phase.

Analysis and Specification

- Gather, analyze, and validate the information.
- Define the requirements and prototypes for new system.
- Evaluate the alternatives and prioritize the requirements.
- Examine the information needs of end-user and enhances the system goal.
- A Software Requirement Specification (SRS) document, which specifies the software, hardware, functional, and network requirements of the system is prepared at the end of this phase.

System Design

- Includes the design of application, network, databases, user interfaces, and system interfaces.
- Transform the SRS document into logical structure, which contains detailed and complete set of specifications that can be implemented in a programming language.
- Create a contingency, training, maintenance, and operation plan.
- Review the proposed design. Ensure that the final design must meet the requirements stated in SRS document.
- Finally, prepare a design document which will be used during next phases.

Implementation

- Implement the design into source code through coding.
- Combine all the modules together into training environment that detects errors and defects.
- A test report which contains errors is prepared through test plan that includes test related tasks such as test case generation, testing criteria, and resource allocation for testing.
- Integrate the information system into its environment and install the new system.

Maintenance/Support

- Include all the activities such as phone support or physical on-site support for users that is required once the system is installing.

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- Implement the changes that software might undergo over a period of time, or implement any new requirements after the software is deployed at the customer location.
- It also includes handling the residual errors and resolve any issues that may exist in the system even after the testing phase.
- Maintenance and support may be needed for a longer time for large systems and for a short time for smaller systems.

2.3. IMPLEMENTATION TESTING AND CONVERSION

2.3.1 Implementation of MIS

Implementation of a system is as much important as the creation of it. Implementation can easily destroy the good work done in the earlier phases and bring the system to a standstill. Implementation requires technical and managerial skills as the implementers work as change agents. Implementation is also a process that has a series of sequential steps which culminates in making operational the new system.

Implementation as an activity has to be carefully managed. It requires client interaction at every stage. The implementers need the full support and cooperation of the client and the IS department functionaries to successfully execute the implementation of information systems. In order to help them perform this task of implementation smoothly, a series of predefined steps are followed. These implementation tasks are as follows:

Implementation Plan

It is the series of action-oriented steps planned for making the implementation smooth. It normally involves the following steps:

1. Creating a master schedule of the implementation activities
2. Setting timelines for critical and non-critical activities
3. Identifying major bottlenecks and their solutions
4. Communication of the plan

This step is required to help the user community to understand the time frame for installation of the new system. Communication plays a vital role in the implementation and without proper communication especially, from the top management on the installation and implementation of the new system the change management will be difficult. Resistance to change related issues will come to the fore making the difficult task of implementation more difficult. Communication of the plan of implementation to the user community helps the users to prepare for the change and makes them mentally prepared for it. The communication is required to be formal so that rumors cannot be spread about the system. The communication process may itself be in several phases. The top level can communicate the general intent of the new system and then detailed briefings to staff may be left to the divisional heads. The communication process also indicates (indirectly), the role each employee is required to play in the implementation process.

Organizing the MIS Department

The MIS department will be the custodian of the new system. Hence, they have to be gear up to support the new system. Organization of the department is therefore necessary before the new system becomes operational. The roles of each member of the MIS department have to be clearly laid out before the new system becomes operational. Effort is made to ensure that the role of the MIS staff is understood by each member of the organization. Training is provided to those who need training on the new system so that they in turn can help others. This process of organizing the MIS department starts much before the actual implementation process begins as it entails some hiring and training which requires some lead time. The organization is done in such a timeframe that staff is available when the actual implementation starts. This enables the MIS staff to provide support to the implementation team, when the implementation process starts. This will also help the MIS staff to understand the nitty-gritty of the new system as they will be able to get a hands-on experience in the implementation of the new system.

Selection and Procurement of Hardware

This step of the implementation process is an important step as it involves huge investments. Proper care is taken to ensure that the organization gets the best deal from such selection and procurement of the hardware. The process of selection and procurement of hardware also varies greatly from firm to firm depending on the size of the firm and the sector in which it operates the type of management. However, the following procedure is followed:

1. Preparation of vendor list-a list of reliable vendors is prepared. This list of vendors may be prepared after analyzing the vendor management experience of the organization with different vendors or may be prepared based on some accepted list of vendors in that business space prepared by some organization of repute or some industry body/regulatory body. The vendors that are selected to be part of the list are chosen carefully after a thorough checking of their credentials and goodwill in the market. This is essential as the vendor relationship is based on trust and compromise and not only on the basis of strict commercial terms.
2. Preparation of RFP-the implementation team must prepare the request for proposal document based on their understanding of the hardware requirement of the new system. The RFP must have complete technical details about the required hardware systems including specifications, format, performance expectation, and warranty and service quality requirements. This document is prepared by the implementers in consultation with the development team, management of the organization and the MIS team of the organization so that the need for each specification is well established and there is no scope for any difference of opinion. The consultative process results in the RFP which is a technical document. The RFP also has commercial details which the implementation team prepares in consultation with the management of the organization. The RFP is a quasi-legal document in some countries and proper legal opinion is normally sought before sending it to the enlisted vendors.

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3. Request for bids/proposal to select vendors-after the RFP is prepared it is sent by some mode of communication to the enlisted set of vendors. The communication medium can be an open advertisement in print or electronic media or may be in the form of a letter to the vendors with a deadline for submission of the proposal.

4. Evaluation of RFP-this is a difficult process. After bids are received before the deadline, they are checked (preliminary check) for basic errors. Those found to be prima facie proper are then evaluated. Several methods of evaluation exist. The evaluation could be on the basis of cost alone or quality alone or may be a mix of both cost and quality. Typically, a score based system of evaluation is used to rank the vendors' proposals. Scores are assigned to each attribute of a vendor's proposal like cost, goodwill, track record and service quality guarantee. Based on the weight age given to each attribute a composite score is prepared, which is used to evaluate the proposals. Whatever the methodology for evaluating the proposal, one must take care to apply the same evaluation criteria to all proposals. Different yardsticks should not be applied to different proposals.

5. Selection of vendor-based on the evaluation a single vendor or a select set of vendors are chosen for delivery of hardware. Contract negotiations and price negotiations are held with this select group of vendors and following the successful completion of the negotiations the final contract will be signed.

Procurement of Software

The new system being implemented will have been created based on assumptions of operating environment of the organization. Procurement of system software is done on similar lines as the procurement of hardware. The only difference in the case of procurement of software is that the choice of what software to purchase is already made at the design stage of the system development and hence, the RFP preparation process is straightforward. The implementation team need not prepare the specification for the system software. They only need to procure the system software that the new system is designed to run on. The rest of the process is almost similar to the hardware procurement process.

Creating the Database

The new system to be implemented will have data stores. In modern systems, data stores are databases. These databases are relational database management systems, which is a separate application software package. The database has to be created and structures inside the database have to be created in order to enable it to store data. The implementation team creates the database, its structures and rules so that the application system being implemented can be plugged into the database and start working.

Training of Users

Implementation is a larger issue than installation. The new system may get installed but without proper training of users, it may not be of good use. Implementation is a larger concept and focuses on the installation and hand-holding part of the transition process. A training needs assessment is

done to understand the training needs of the users. A training programme is planned and the required training given to users. This is an important part of the implementation process and helps in reducing the resistance to change related behavior among the user community. The training also helps users to appreciate the new features of the new system and helps build trust and appreciation for the new system.

Creating Physical Infrastructure

The new system being implemented may require a physical infrastructure. The implementation team must ensure that the system performance must not suffer due to infrastructure bottlenecks. The implementers will have to use their persuasive skills and convince the management of the organization to create the required physical infrastructure so that it does not affect the performance of the new system.

Transition to the New System

This is the last step in the implementation process. The transition if done wrongly leads to a lot of pain. Hence, it is necessary to move slowly on the transition front. Normally, after the new system is installed and ready, the new system and the old system are both used for a period to ensure that the company performance does not suffer due to transition problems. Slowly when the users gain more capability to handle the new system the old system is phased out.

2.3.2 Testing

The software system needs to be checked for its intended behavior and direction of progress at each development stage to avoid duplication of efforts, time and cost overruns, and to assure completion of the system within stipulated time. The software system needs to be checked for its intended behavior and direction of progress at each development stage to avoid duplication of efforts, time and cost overruns, and to assure completion of the system within stipulated time.

System testing and quality assurance come to aid for checking the system. It includes –

- Product level quality (Testing)
- Process level quality.

Testing

Testing is the process or activity that checks the functionality and correctness of software according to specified user requirements in order to improve the quality and reliability of system. It is an expensive, time consuming, and critical approach in system development which requires proper planning of overall testing process.

A successful test is one that finds the errors. It executes the program with explicit intention of finding error, i.e., making the program fail. It is a process of evaluating system with an intention of creating a strong system and mainly focuses on the weak areas of the system or software.

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Characteristics of System Testing

System testing begins at the module level and proceeds towards the integration of the entire software system. Different testing techniques are used at different times while testing the system. It is conducted by the developer for small projects and by independent testing groups for large projects.

Stages of System Testing

The following stages are involved in testing –

1. Test Strategy

It is a statement that provides information about the various levels, methods, tools, and techniques used for testing the system. It should satisfy all the needs of an organization.

2. Test Plan

It provides a plan for testing the system and verifies that the system under testing fulfils all the design and functional specifications. The test plan provides the following information –

- Objectives of each test phase
- Approaches and tools used for testing
- Responsibilities and time required for each testing activity
- Availability of tools, facilities, and test libraries
- Procedures and standards required for planning and conducting the tests
- Factors responsible for successful completion of testing process

3. Test Case Design

- Test cases are used to uncover as many errors as possible in the system.
- A number of test cases are identified for each module of the system to be tested.
- Each test case will specify how the implementation of a particular requirement or design decision is to be tested and the criteria for the success of the test.
- The test cases along with the test plan are documented as a part of a system specification document or in a separate document called **test specification** or **test description**.

4. Test Procedures

It consists of the steps that should be followed to execute each of the test cases. These procedures are specified in a separate document called test procedure specification. This document also specifies any special requirements and formats for reporting the result of testing.

5. Test Result Documentation

Test result file contains brief information about the total number of test cases executed, the number of errors, and nature of errors. These results are then assessed against criteria in the test specification to determine the overall outcome of the test.

Types of Testing

Testing can be of various types and different types of tests are conducted depending on the kind of bugs one seeks to discover –

1. Unit Testing

Also known as Program Testing, it is a type of testing where the analyst tests or focuses on each program or module independently. It is carried out with the intention of executing each statement of the module at least once.

- In unit testing, accuracy of program cannot be assured and it is difficult to conduct testing of various input combination in detail.
- It identifies maximum errors in a program as compared to other testing techniques.

2. Integration Testing

In Integration Testing, the analyst tests multiple module working together. It is used to find discrepancies between the system and its original objective, current specifications, and systems documentation.

- Here the analysts are try to find areas where modules have been designed with different specifications for data length, type, and data element name.
- It verifies that file sizes are adequate and that indices have been built properly.

3. Functional Testing

Function testing determines whether the system is functioning correctly according to its specifications and relevant standards documentation. Functional testing typically starts with the implementation of the system, which is very critical for the success of the system.

Functional testing is divided into two categories –

- **Positive Functional Testing** – It involves testing the system with valid inputs to verify that the outputs produced are correct.
- **Negative Functional Testing** – It involves testing the software with invalid inputs and undesired operating conditions.

Rules for System Testing

To carry out system testing successfully, you need to follow the given rules –

- Testing should be based on the requirements of user.

Notes

- Before writing testing scripts, understand the business logic should be understood thoroughly.
- Test plan should be done as soon as possible.
- Testing should be done by the third party.
- It should be performed on static software.
- Testing should be done for valid and invalid input conditions.
- Testing should be reviewed and examined to reduce the costs.
- Both static and dynamic testing should be conducted on the software.
- Documentation of test cases and test results should be done.

2.3.3 Conversion

It is a process of migrating from the old system to the new one. It provides understandable and structured approach to improve the communication between management and project team.

Conversion Plan

It contains description of all the activities that must occur during implementation of the new system and put it into operation. It anticipates possible problems and solutions to deal with them.

It includes the following activities –

- Name all files for conversions.
- Identifying the data requirements to develop new files during conversion.
- Listing all the new documents and procedures that are required.
- Identifying the controls to be used in each activity.
- Identifying the responsibility of person for each activity.
- Verifying conversion schedules.

Conversion Methods

The four methods of conversion are –

- Parallel Conversion
- Direct Cutover Conversion
- Pilot Approach
- Phase-In Method

Method	Description	Advantages	Disadvantages
Parallel Conversion	Old and new systems are used simultaneously.	Provides fallback when new system fails. Offers greatest security and ultimately testing of new system.	Causes cost overruns. New system may not get fair trial.
Direct Cutover Conversion	New system is implemented and old system is replaced completely.	Forces users to make new system work Immediate benefit from new methods and control.	No fall back if problems arise with new system Requires most careful planning

Pilot Approach	Supports phased approach that gradually implement system across all users	Allows training and installation without unnecessary use of resources. Avoid large contingencies from risk management.	A long term phases in causes a problem of whether conversion goes well or not.
Phase-In Method	Working version of system implemented in one part of organization based on feedback, it is installed throughout the organization all alone or stage by stage.	Provides experience and line test before implementation When preferred new system involves new technology or drastic changes in performance.	Gives impression that old system is erroneous and it is not reliable.

2.4 Evolution and Element of MIS

2.4.1 Evolution of Management Information System

Management information system is the combination of information systems which generate information useful for managers in planning and control. Management information system is evolved from information system and management science.

Information system is as old as recorded human history. Information system moved fast towards the growth track in the last few centuries. The industrial revolution gave it a big fillip. Thereafter, business started growing and along with growth, business complexity also increased. Accounting systems, Organisation size, development of computing technology among other have ensured the fast growth of information systems during the last few centuries. An information system generates information using data. If the information systems generate information useful for managers in planning and control, the whole system is called management information system. The evolution of management information system, and it's fast growth in the last few decades, can be attributed to the following factors:-

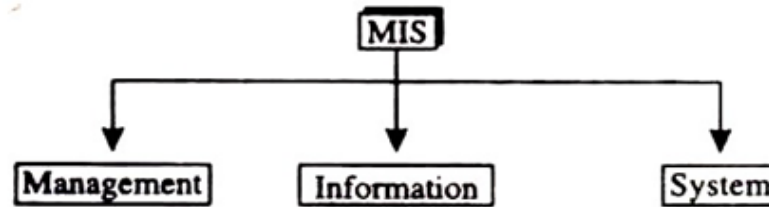
- (i) Growth of management theory and techniques.
- (ii) Growth of management accounting and it's applications in business.
- (iii) Changes in the production and distribution methods and the consequent changes in the organizational structure.
- (iv) Development of management science.
- (v) Introduction of computer into business data processing and the developments in information technology.

Growth in computing technology made modern management information system possible, the speed, accuracy and the relevant facility in computers, also made it a pivot in modern management information system. Revolutionary are also taking place in information technology, which facilitated rapid growth of management information system.

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2.4.2 Elements of Management Information System

Managing with information involve gathering the necessary data (crude input or raw material) and processing these data into meaningful information. To understand MIS clearly, it is very much required to define these three words management, information, and system. It can be described with the help of figure 2.1.



2.1 Objectives of Management Information System.

When any organization wishes to establish the MIS, it must be very clear about the need of information required by the different levels of management.

Followings are the reasons for the adoption of the MIS:

1. To provide information for planning, organizing and controlling purposes.
2. To store and manage data efficiently from all the functional areas of the business.
3. To process the collected data and derive information out of them.
4. To provide information quickly as and when required.
5. To reduce the risk and uncertainties in the managerial decision-making.
6. To collect and store the data for the purpose of internal research.
7. To assist in identifying the managerial problems and their solution.
8. To provide information regarding work force planning.
9. To provide the information regarding the financial health of the business organization.
10. To provide information regarding production and inventory.
11. To provide information regarding sales and other marketing aspects i.e. product, price, promotion, market, physical distribution, payment collection, market segmentation etc.
12. To speed up the execution of the results with the reliable data available.
13. To smooth up the flow of data through various levels of the organization.
14. To provide information regarding work force planning.
15. To provide the information regarding the financial health of the business organization.
16. To speed up the execution of the results with the reliable data available.
17. To smooth up the flow of data through various level of the organization.

Check your Progress:

1. What is SDLC?
2. What are the phase of SDLC?
3. What is Testing?
4. What are the stages of system Testing?
5. What are Types of Testing?

Notes

2.5. ANSWERS TO CHECK YOUR PROGRESS

1. System Development Life Cycle (SDLC) is a conceptual model which includes policies and procedures for developing or altering systems throughout their life cycles. SDLC is used by analysts to develop an information system.
2. Systems Development Life Cycle is a systematic approach which explicitly breaks down the work into phases that are required to implement either new or modified Information System.
 - requirements
 - design
 - implementation
 - testing
 - deployment
 - operations
 - maintenance
3. Testing is the process or activity that checks the functionality and correctness of software according to specified user requirements in order to improve the quality and reliability of system. It is an expensive, time consuming, and critical approach in system development which requires proper planning of overall testing process.
4. The stages are involved in testing:
 - Test Strategy
 - Test Plan
 - Test Case Design
 - Test Procedures
 - Test Result Documentation
5. Testing can be of various types and different types of tests are conducted depending on the kind of bugs one seeks to discover:
 - Unit Testing
 - Integration Testing
 - Functional Testing

2.6. SUMMARY

- Management information system is an integrated set of component or entities that interact to achieve a particular function, objective or goal.
- Function testing determines whether the system is functioning correctly according to its specifications and relevant standards

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documentation. Functional testing typically starts with the implementation of the system, which is very critical for the success of the system.

- Conversion is a process of migrating from the old system to the new one. It provides understandable and structured approach to improve the communication between management and project team.
- Management information system is the combination of information systems which generate information useful for managers in planning and control. Management information system is evolved from information system and management science.

2.7. KEYWORDS

- **Positive Functional Testing:** It involves testing the system with valid inputs to verify that the outputs produced are correct.
- **Negative Functional Testing:** It involves testing the software with invalid inputs and undesired operating conditions
- **Systems Analysis:** Systems Analysis is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components.

2.8. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What is Procurement of Software?
2. What are the Rules for System Testing?
3. What is the Conversion plan?
4. What are the Methods of Conversion?
5. What is Evolution of Management Information System?

Long Answer questions:

1. Explain briefly about Evolution and element of MIS?
2. Explain briefly about Stages of System Testing and its types of testing?
3. Explain about Management Information system design and development?

2.9. FURTHER READINGS

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UNIT – III MANAGEMENT INFORMATION SYSTEM

- 3.1 Definition- MIS
- 3.2. Characteristics and Basic Requirement of MIS
 - 3.2.1 MIS principal concerns
 - 3.2.2 Elements of MIS
 - 3.2.3 Characteristics of an Effective MIS
 - 3.2.4 Basic requirement of MIS
 - 3.2.4.1 MIS
 - 3.2.4.2 The need for MIS
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- 3.5. Computerized MIS
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- 3.8 Answers to Check Your Progress
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- 3.10 Keywords
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3.1. INTRODUCTION - DEFINITION

Management Information System (MIS)

Traditionally Only 5 resources were needed by managers to run a business organization and they are 5M's: Men, Money, Machine, Material, and Method. But today due to volatile and complex business environment and intense competition, *Information* is regarded as an important resource by managers to manage business.

MIS is an organization's functional area that provides this information to managers. It is obligatory for any organization to provide right information, in right quantity, to right person, at right time. MIS deals with the critical information that affects the success of any business

organization. MIS is a tool for better management and scientific decision making.

1. Definition

An integrated user-machine system for providing information to support operations, management and decision making functions in an organization. The system utilizes computerized and manual procedures; models for analysis, planning, control and decision making; and a database.

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3.2. CHARACTERISTICS AND BASIC REQUIREMENT OF MIS

3.2.1 MIS principal concerns

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

- to the people who need it
- on time
- in a usable form

According to G.B. Davis –

MIS is an: Integrated man- machine system, for providing timely information to managers, to support managerial function and decision making.

It utilizes: Computer Hardware and Software, Manual procedures, Decision Models and Data Bases

3.2.2 Elements of MIS:-

MIS consists of 3 elements: Management, *Information* and *System*.

Management
As a Group of People

- Determining goals and objectives
- Develop plans to achieve them
- Identification and acquisition of resources exercising Control
- Performance Evaluation
- Co-ordinating group efforts

As a Set of activities

- Planning
- Organizing
- Staffing
- Directing
- Controlling
- DecisionMaking

ii. Information

According to Davis and Olsan–

“Information is data that has been processed into a form that is meaningful to the recipient and is of some value in current or progressive decision”.

iii. Systems

A set of elements which are interdependent, interacting and

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operating together to achieve a common goal. Example – Business organization, Computer, MIS etc. since MIS can be defined as system following is the diagram showing functions of MIS as system –

3.2.3 Characteristics of an effective MIS

- **Management Oriented:** It means that effort for the development of the information system should start from an appraisal of management needs and overall business objectives.
- **Management Directed:** Because of management orientation of MIS, it is necessary that management should actively direct the system's development efforts.
- **Integrated:** Development of information should be an integrated one which means that all the functional and operational information sub- system should be tied together into one entity.
- **Common Data Flows:** It means the use of common input, processing and output procedures and media whenever required.
- **Heavy Planning Element:** An MIS usually takes 3 to 5 years and sometimes even longer period to get established firmly within accompany.
- **Sub System Concept:** Even though the information system is viewed as a single entity, it must be broken down into digestible sub-systems which can be implemented one at a time by developing a phasing plan.
- **Common Database:** Database is the mortar that holds the functional systems together. It is defined as a "super-file" which consolidates and integrates data records formerly stored in many separate data files.
- **Computerized:** Though MIS can be implemented without using a computer, the use of computers increases the effectiveness of the system.

3.2.4 Basic requirement of MIS

3.2.4.1 MIS

MIS is the use of information technology, people, and business processes to record, store and process data to produce information that decision makers can use to make day to day decisions.

MIS is the acronym for **Management Information Systems**. In a nutshell, MIS is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information that is useful to the organization.

3.2.4.2. The need for MIS

The following are some of the justifications for having an MIS system

- **Decision makers need information to make effective decisions.** Management Information Systems (MIS) make this possible.
- **MIS systems facilitate communication within and outside the organization** – employees within the organization are able to easily access the required information for the day to day operations. Facilitates such as Short Message Service (SMS) & Email make it possible to communicate with customers and suppliers from within the MIS system that an organization is using.
- **Record keeping** – management information systems record all business transactions of an organization and provide a reference point for the transactions.

3.2.4.3 Components of MIS

The major components of a typical management information system are;

- **People** – people who use the information system
- **Data** – the data that the information system records
- **Business Procedures** – procedures put in place on how to record, store and analyze data
- **Hardware** – these include servers, workstations, networking equipment, printers, etc.
- **Software** – these are programs used to handle the data. These include programs such as spreadsheet programs, database software, etc.

3.2.4.4 Types of Information Systems

The type of information system that a user uses depends on their level in an organization. The following diagram shows the three major levels of users in an organization and the type of information system that they use.



1. Transaction Processing Systems (TPS)

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This type of information system is used to record the day to day transactions of a business. An example of a Transaction Processing System is a Point of Sale (POS) system. A POS system is used to record the daily sales.

2. Management Information Systems (MIS)

Management Information Systems are used to guide tactic managers to make semi-structured decisions. The output from the transaction processing system is used as input to the MIS system.

3. Decision Support Systems (DSS)

Decision support systems are used by top level managers to make semi-structured decisions. The output from the Management Information System is used as input to the decision support system. DSS systems also get data input from external sources such as current market forces, competition, etc.

4. Physical Structure of Management Information System

A management information system (MIS) is an organized combination of people, hardware, communication networks and data sources that collects, transforms and distributes information in an organization. An MIS helps decision making by providing timely, relevant and accurate information to managers. The physical components of an MIS include

- Hardware
- Software
- Database
- personnel
- Procedures.

Hardware

All physical components of a computer system compose the computer hardware. Important components include the central processing unit, input/output devices, storage units and communication devices. Communication can be over fiber-optic cables or wireless networks.

Software

Software provides the interface between users and the information system. Software can be divided into two generic types: system software and applications. The system software comprises of the operating system, utility programs and special purpose programs. Applications are developed to accomplish a specific task. For users of MIS it is much more important to understand the software than the hardware. Software maintenance can take 50 to 70 percent of all personnel activity in the MIS function. When the organization moves to implement an advanced information system the hardware and software environment becomes more complex.

Database

A database is a centrally controlled collection of organized data. Central control reduces redundancy and duplication of data. Data is stored in an

organized and structured way to facilitate sharing and improve availability to those who need it. The database improves efficiency of storage by elimination of redundant files and improves efficiency of processing by providing all required data in a single file rather than separate files. This also improves efficiency of information retrieval.

Procedures

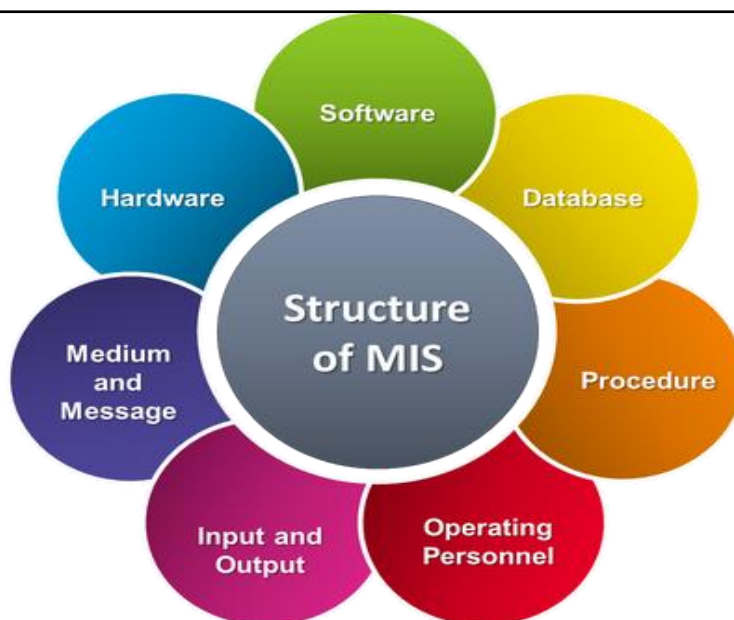
Three types of procedures are required for an MIS to operate effectively: user instructions, instructions for input preparation and operating instructions for MIS personnel who maintain the MIS.

Personnel

The personnel in the MIS function include computer operators, programmers, systems analysts and managers. Human resource requirements should be assessed by considering both the present system needs and the future system growth. The quality of MIS personnel is a key factor in its effectiveness. An MIS manager needs a combination of both managerial and technical skills.

Notes

3.3 STRUCTURE OF MIS



3.4. APPROACHES TO MIS DEVELOPMENT

There are two basic approaches for development of MIS

3.4.1 System Development Life Cycle

The system development life cycle have following steps of development:

- i) Systems Planning
- ii) Systems Analysis
- iii) Systems Design
- iv) Systems Implementation
- v) Systems Operation and Support (System Maintenance)

Notes

3.4.2 Prototyping

Prototyping is the process of creating an incomplete model of the future full-featured system, which can be used to let the users have a first idea of the completed program or allow the clients to evaluate the program.

- i) The designer and implementer can obtain feedback from the users early in the project development.
- ii) The client and the contractor can compare that the developing system matches with the system specification, according to which the system is built.
- iii) It also gives the engineer some idea about the accuracy of initial project estimates and whether the deadlines can be successfully met.

3.4.2.1 Steps for process of prototyping

The process of prototyping involves the following steps

- i) Identify basic requirements.
- ii) Develop initial prototype.
- iii) Review: The customers, including end-users, examine the prototype and provide feedback for additions or changes.
- iv) Revise and Enhance the Prototype: Using the feedback both the specifications and the prototype can be improved. If changes are introduced then a repetition of steps 3 and 4 may be needed.

3.4.2.2 Types of prototyping

System prototyping are of various kinds. However, all the methods are in some way based on two major types of prototyping:

1. **Throwaway Prototyping:** Throwaway or Rapid Prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the finally delivered system. After preliminary requirements gathering is accomplished, a simple working model of the system is constructed to visually show the users what their requirements may look like when they are implemented into a finished system. The most obvious reason for using Throwaway Prototyping is that it can be done quickly.
2. **Evolutionary Prototyping:** Evolutionary Prototyping (also known as Breadboard Prototyping) is quite different from Throwaway Prototyping. The main goal when using evolutionary Prototyping is to build a very good prototype in a structured manner so that we can refine it or make further changes to it. The reason for this is that the Evolutionary prototype, when built, forms the heart of the new system, and the improvements and further requirements will be built on to it. It is not discarded or removed like the Throwaway Prototype. When developing a system using Evolutionary Prototyping, the system is continually refined and rebuilt.
3. **Incremental Prototyping:** The final product is built as separate prototypes. At the end the separate prototypes are merged in an overall design.

3.4.2.3 Advantages of Prototyping:

i) **Reduced Time and Costs:** Prototyping can improve the quality of requirements and specifications provided to developers. Early determination of what the user really wants can result in faster and less expensive software.

ii) **Improved and Increased User Involvement:** Prototyping requires user involvement and allows them to see and interact with a prototype; allowing them to provide better and more complete feedback and specifications. Since users know the problem better than anyone, the final product is more likely to satisfy the users desire for look, feel and performance.

3.4.2.4 Disadvantages of Prototyping:

i) **Insufficient Analysis:** Since a model has to be created, developers will not properly analyse the complete project. This may lead to a poor prototype and a final project that will not satisfy the users.

ii) **User Confusion of Prototype and Finished System:** Users can begin to think that a prototype, intended to be thrown away, is actually a final system that merely needs to be finished or polished. Users can also become attached to features that were included in a prototype for consideration and then removed from the specification for a final system.

iii) **Excessive Development Time of the Prototype:** A key property to prototyping is the fact that it is supposed to be done quickly. If the developers forget about this fact, they will develop a prototype that is too complex.

iv) **Expense of Implementing Prototyping:** The startup costs for building a development team focused on prototyping may be high. Many companies have to train the team for this purpose which needs extra expenses.

3.5. COMPUTERIZED MIS

3.5.1 Computerized information system

Computerized systems were developed to address the challenges of manual information systems. The major difference between a manual and computerized information system is a computerized system uses a combination of software and hardware to record, store, analyze and retrieve information.

3.5.2 Advantages and Disadvantages of a computerized information system (MIS)

The following are some of the disadvantages of a computerized information system.

Advantages:

The following are the advantages of computerized information systems

- **Fast data processing and information retrieval** – this is one of the biggest advantages of a computerized information system. It

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processes data and retrieves information at a faster rate. This leads to improved client/customer service

- **Improved data accuracy** – easy to implement data validation and verification checks in a computerized system compared to a manual system.
- **Improved security** – in addition to restricting access to the database server, the computerized information system can implement other security controls such as user's authentication, biometric authentication systems, access rights control, etc.
- **Reduced data duplication** – database systems are designed in such a way that minimized duplication of data. This means updating data in one department automatically makes it available to the other departments
- **Improved backup systems** – with modern day technology, backups can be stored in the cloud which makes it easy to recover the data if something happened to the hardware and software used to store the data
- **Easy access to information** – most business executives need to travel and still be able to make a decision based on the information. The web and Mobile technologies make accessing data from anywhere possible.

Disadvantages:

- **It is expensive to set up and configure** – the organization has to buy hardware and the required software to run the information system. In addition to that, business procedures will need to be revised, and the staff will need to be trained on how to use the computerized information system.
- **Heavy reliance on technology** – if something happens to the hardware or software that makes it stop functioning, then the information cannot be accessed until the required hardware or software has been replaced.
- **Risk of fraud** – if proper controls and checks are not in place, an intruder can post unauthorized transactions such as an invoice for goods that were never delivered, etc.

3.5.3 Effect of using Computer for MIS:-

- (1) Speed of processing & accessing of data increases - timeliness of information can be met
- (2) Scope of use of MIS has expanded -due to the use of network & communication system
- (3) Scope of analysis widened-more at can be considered in analysis
- (4) Complexity of system design and operation increased - because technicality in its use and operations is increased.

- (5) Integration of Sub-system in possible - common database is possible even in high volume due to computer disks.
- (6) Effectiveness of information system increases - because timeliness and accuracy of information is increased.
- (7) More comprehensive information is made available to executives – covering all aspect of the problem.

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3.6. PRE-REQUISITES OF AN EFFECTIVE MIS

An effective MIS should have the following ingredient ready before it is operationalized -

a. Data Base-

A rich data base is required for an effective MIS. This database should be -

- User oriented
- Common to all Sub-system
- Accessible to authorized person only
- Controlled by separate authority

b. Qualified system and Management Staff-

- Success of any system depends upon the people who operate it, their knowledge and experience.
- MIS need 2 type of experts:
 1. System expert
 2. Management expert
- System expert in addition to their expertise should also understand management concepts and processes of decision making.
- Management expert should understand the concept and operations of computer.
- This pre-requisite is confronted with many problems such as non-availability or experts, their high turnover, high mobility. These can be offset by recruiting fresh candidate and developing them accordingly.

C. Support of Top Management-

For the 2 main reasons support of top management is required -

1. To obtain data from sources
2. To get funds in order to acquire there's our convolved in computer based system.

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To gain support of top management MIS should place, before top management all the facts and the benefits to the organization from MIS.

D. Control & Maintenance of MIS-

- Users sometimes creates shortcut to use the system, which reduce effectiveness of MIS. A control plan should be developed to check such practices.
- Similarly there are times when improvements in the system are required. Formal plan & methods should be devised to provide periodic maintenance to the system.

E. Evaluation of MIS-

Evaluation of MIS means testing -

- Whether it is capable of meeting current and future information requirement of manager's or not.
- Whether it is enough flexible to meet changing information requirement in future or not.

Following factors must be considered in evaluation -

- (1) Examining the existence of flexibility in the system
- (2) Ascertain the views of user & developers
- (3) Guide the steps to be taken to improve the effectiveness of MIS.

3.7. LIMITATIONS OF MIS

- (1) Quality of output depends upon quality of input-i.e.GIGO
- (2) MIS is just a tool in hands of management & does not replace managerial judgment,
- (3) MIS is not very flexible to update itself quickly with the changing need.
- (4) MIS cannot provide tailor-made information.
- (5) MIS takes into account only quantitative factors and not qualitative factors.
- (6) MIS is less useful in on programmed decisions.
- (7) MIS is less effective in the organization where culture of not sharing information with other holds.
- (8) Effectiveness of MIS decreases due to frequent changes in to pmgt.

Check your Progress:

1. What are the physical components of an MIS?
2. What is prototyping?
3. What is Computerized MIS?
4. What is the need for MIS?
5. What is Throwaway Prototyping?

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3.8. ANSWERS TO CHECK YOUR PROGRESS

1. The physical components of an MIS include:
 - Hardware
 - Software
 - Database
 - personnel
 - Procedures
2. Prototyping is the process of creating an incomplete model of the future full-featured system, which can be used to let the users have a first idea of the completed program or allow the clients to evaluate the program.
3. Computerized systems were developed to address the challenges of manual information systems. The major difference between a manual and computerized information system is a computerized system uses a combination of software and hardware to record, store, analyse and retrieve information.
4. some of the justifications for having an MIS system:
 - Decision makers need information to make effective decisions
 - MIS systems facilitate communication within and outside the organization
 - Record keeping
5. Throwaway or Rapid Prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the finally delivered system.

3.9. SUMMARY

- An integrated user-machine system for providing information to support operations, management and decision-making functions in an organization. The system utilizes computerized and manual procedures models for analysis, planning, control and decision making and a database.
- Prototyping requires user involvement and allows them to see and interact with a prototype; allowing them to provide better and more complete feedback and specifications. Since users know the problem better than anyone, the final product is more likely to satisfy the users desire for look, feel and performance.
- Computerized systems were developed to address the challenges of manual information systems. The major difference between a manual and computerized information system is a computerized

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system uses a combination of software and hardware to record, store, analyse and retrieve information.

3.10. KEYWORDS

- **Record keeping:** management information systems record all business transactions of an organization and provide a reference point for the transactions.
- **Information:** Information is data that has been processed into a form that is meaningful to the recipient and is of some value in current or progressive decision.
- **Incremental Prototyping:** The final product is built as separate prototypes. At the end the separate prototypes are merged in an overall design.

3.11. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What is Evolutionary Prototyping?
2. What is Incremental Prototyping?
3. What are the types of Prototyping?
4. What are the advantages of Computerized information system?
5. What are the types of Information Systems?

Long Answer questions:

1. What are the Advantages and Disadvantages of a computerized information system (MIS)?
2. Explain briefly about Prototyping and its types?
3. Explain about Basic Requirement of MIS?

3.12. FURTHER READINGS

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UNIT-IV MIS AND DECISION SUPPORT SYSTEM (DSS)

Notes

- 4.1. Introduction (MIS -DSS)
 - 4.1.1. MIS
 - 4.1.2. DSS
 - 4.1.3. The need for MIS
 - 4.1.4. Components of MIS
 - 4.1.5. Types of Information Systems
 - 4.1.5.1. Transaction Processing Systems (TPS)
 - 4.1.5.2. Management Information Systems (MIS)
 - 4.1.5.3. Decision Support Systems (DSS)
- 4.2. MIS VS data processing
- 4.3. MIS and decision support system
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- 4.5. DSS and AI
- 4.6. Overview of AI
- 4.7. DSS models and software
 - 4.7.1 Decision Support System Models
 - 4.7.1.1. Behavioral Model.
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 - 4.7.2. Development of Dss
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 - 4.7.3. Methods of Developing Dss
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 - 4.7.3.2. DSS shells
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 - 4.7.4. DSS Software
- 4.8 Answers to Check Your Progress
- 4.9 Summary
- 4.10 Keywords
- 4.11 Self-Assessment Questions and Exercises
- 4.12 Further Readings

4.1. Introduction

4.1.1. MIS

MIS is the use of information technology, people, and business processes to record, store and process data to produce information that decision makers can use to make day to day decisions.

MIS is the acronym for **Management Information Systems**. In a nutshell, MIS is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information that is useful to the organization.

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MIS is the acronym for Management Information System. It is a collection of people, procedures, data, and information technology that aids managers to make informed decisions.

Management Information Systems (MIS) are used by middle-level managers to make semi-structured decisions

4.1.2. DSS

Decision support systems are used by top level managers to make semi-structured decisions. The output from the Management Information System is used as input to the decision support system. DSS systems also get data input from external sources such as current market forces, competition, etc.

Decision Support Systems are used by top level managers, and they help top level managers to make unstructured decisions.

4.1.3. The need for MIS

The following are some of the justifications for having an MIS system

- **Decision makers need information to make effective decisions.** Management Information Systems (MIS) make this possible.
- **MIS systems facilitate communication within and outside the organization** – employees within the organization are able to easily access the required information for the day to day operations. Facilitates such as Short Message Service (SMS) & Email make it possible to communicate with customers and suppliers from within the MIS system that an organization is using.
- **Record keeping** – management information systems record all business transactions of an organization and provide a reference point for the transactions.

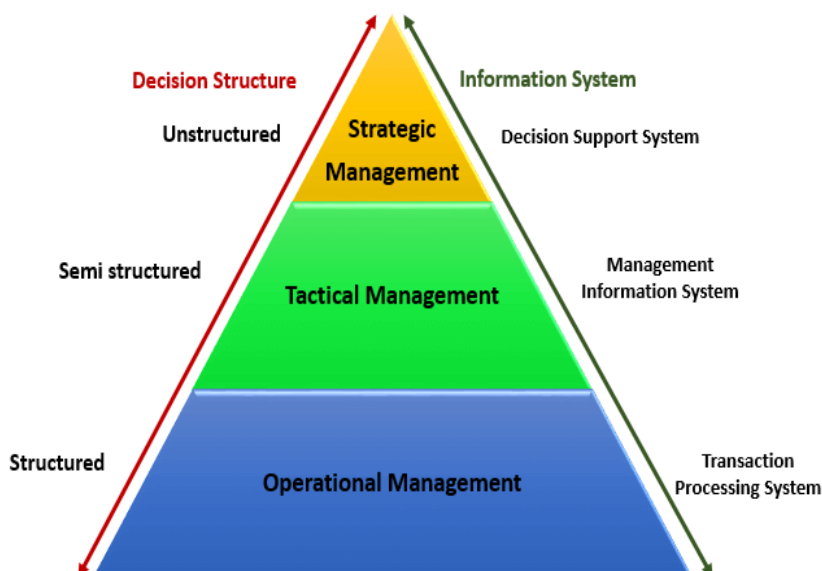
4.1.4. Components of MIS

The major components of a typical management information system are;

- **People**
- **Data**
- **Business Procedures**
- **Hardware**
- **Software**

4.1.5. Types of Information Systems

The type of information system that a user uses depends on their level in an organization. The following diagram shows the three major levels of users in an organization and the type of information system that they use.



4.1.5.1. Transaction Processing Systems (TPS)

This type of information system is used to record the day to day transactions of a business. An example of a Transaction Processing System is a Point of Sale (POS) system. A POS system is used to record the daily sales.

4.1.5.2. Management Information Systems (MIS)

Management Information Systems are used to guide tactic managers to make semi-structured decisions. The output from the transaction processing system is used as input to the MIS system.

4.1.5.3. Decision Support Systems (DSS)

Decision support systems are used by top level managers to make semi-structured decisions. The output from the Management Information System is used as input to the decision support system. DSS systems also get data input from external sources such as current market forces, competition, etc.

4.2. MIS VS Data Processing

Data processing

Data processing is the conversion of data into usable and desired form. This conversion or “processing” is carried out using a predefined sequence of operations either manually or automatically. Most of the data processing is done by using computers and thus done automatically. The output or “processed” data can be obtained in different forms like image, graph, table, vector file, audio, charts or any other desired format depending on the software or method of data processing used.

Fundamentals of data processing & how data is processed

Data processing is undertaken by any activity which requires a collection of data. This data collected needs to be stored, sorted, processed, analyzed

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and presented. This complete process can be divided into 6 simple primary stages which are:

1. Data collection
2. Storage of data
3. Sorting of data
4. Processing of data
5. Data analysis
6. Data presentation and conclusions

Once the data is collected the need for data entry emerges for storage of data. Storage can be done in physical form by use of papers, in notebooks or in any other physical form. With the emergence and growing emphasis on Big Data & Data Mining the data collection is large and a number of operations need to be performed for meaningful analysis and presentation, the data is stored in digital form. Having the data into digital form enables the user to perform a large number of operations in small time and allows conversion into different types. The user can thus select the output which best suits the requirement.

This continuous use and processing of data follow cycle called as data processing cycle and information processing cycle which might provide instant results or take time depending upon the need of processing data. The complexity in the field of data processing is increasing which is creating a need for advanced techniques.

Storage of data is followed by sorting and filtering. This stage is profoundly affected by the format in which data is stored and further depends on the software used. General daily day and noncomplex data can be stored as text files, tables or a combination of both in Microsoft Excel or similar software. As the task becomes complex which requires performing specific and specialized operations they require different data processing tools and software which is meant to cater to the peculiar needs.

Storing, sorting, filtering and processing of data can be done by single software or a combination of software whichever feasible and required. Data processing thus carried out by software is done as per the predefined set of operations. Most of the modern-day software allows users to perform different actions based on the analysis or study to be carried out. Data processing provides the output file in various formats.

Different types of output files obtained as “processed” data

1.Plain text file – These constitute the simplest form or processed data. Most of these files are user readable and easy to comprehend. Very negligible or no further processing is these type of files. These are exported as notepad or WordPad files.

2.Table/ spreadsheet– This file format is most suitable for numeric data. Having digits in rows and columns allows the user to perform various operations like filtering & sorting in ascending/descending order to make it easy to understand and use. Various mathematical operations can be applied when using this file output.

3.Charts& Graphs – Option to get the output in the form of charts and graphs is handy and now forms standard features in most of the software. This option is beneficial when dealing with numerical values reflecting trends and growth/decline. Though there are ample charts and graphs are available to match diverse requirements there exists situation when there is a need to have a user-defined option. In case no inbuilt chart or graph is available then the option to create own charts, i.e., custom charts/graphs come handy.

4.Maps/Vector or image file – When dealing with spatial data the option to export the processed data into maps, vector and image files is of great use. Having the information on maps is of particular use for urban planners who work on different types of maps. Image files are obtained when dealing with graphics and do not constitute any human readable input.

5.Other formats/ raw files – These are the software specific file formats which can be used and processed by specialized software. These output files may not be a complete product and require further processing. Thus there will need to perform multiple data processing.

Methods of data processing

1.Manual data processing: In this method data is processed manually without the use of a machine, tool or electronic device. Data is processed manually, and all the calculations and logical operations are performed manually on the data.

2.Mechanical data processing – Data processing is done by use of a mechanical device or very simple electronic devices like calculator and typewriters. When the need for processing is simple, this method can be adopted.

3.Electronic data processing – This is the modern technique to process data. The fastest and best available method with the highest reliability and accuracy. The technology used is latest as this method used computers and employed in most of the agencies. The use of software forms the part of this type of data processing. The data is processed through a computer; Data and set of instructions are given to the computer as input, and the computer automatically processes the data according to the given set of instructions. The computer is also known as electronic data processing machine.

Types of data processing on the basis of process/steps performed

1. Batch Processing
2. Real-time processing
3. Online Processing
4. Multiprocessing
5. Time-sharing

What makes processing of data important

Nowadays more and more data is collected for academic, scientific research, private & personal use, institutional use, commercial use. This collected data needs to be stored, sorted, filtered, analyzed and presented

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for it to be of any use. This process can be simple or complex depending on the scale at which data collection is done and the complexity of the results which are required to be obtained. The time consumed in obtaining the desired result depends on the operations which need to be performed on the collected data and on the nature of the output file required to be obtained. This problem becomes starker when dealing with the very large volume of data such as those collected by multinational companies about their users, sales, manufacturing, etc.

The need for data processing becomes more and more critical in such cases. In such cases, data mining and data management come into play without which optimal results cannot be obtained. Each stage starting from data collection to presentation has a direct effect on the output and usefulness of the processed data.

4.3. MIS and Decision Support System

4.3.1. Management Information System

A Management Information System (MIS) evaluates, analyzes and processes an organization's data to produce meaningful and useful information. It is a planned system to collect, store and distributed data as information. These information helps to carry out the functionalities of the organization.

MIS supports a variety of uses. It helps to capture data, process data, store information, retrieval and propagation. The summarized report for the MIS helps the middle-level management to monitor the organization current performance status. Sales Management Systems, Human Resources Management Systems are some examples of Management Information Systems.

4.3.2. Decision Support System

Decision Support System (DSS) allows senior managers to make non-routine decisions. These systems help to find solutions to the problems that are unique and changes frequently. Decision support systems use mathematical models, statistical techniques such as predictive modelling and probability to find solutions and for better decision making.

There are various types of DSS. There are data analysis systems such as cash flow analysis and inventory systems. There are also information analysis systems such as market analysis and sales analysis systems. Furthermore, the accounting systems keep track of account details of the business. Those are few Decision Support Systems. Overall, DSS is flexible, interactive, and easy to use. It allows decision making, supports interpersonal communication and helps to automate managerial processes.

4.3.3 Difference Between MIS and DSS

Definition

A Management Information System (MIS) is an information system that evaluates, analyzes, and processes an organization's data to produce meaningful and useful information based on which the management can

take right decisions to ensure future growth of the organization. A Decision Support System (DSS) is an information system that supports business or organizational decision-making activities.

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Decision Support Capabilities

MIS supports structured decision making. On the other hand, DSS supports unstructured or semi-structured decisions.

Type of Information

MIS provides information to support internal operations. DSS provides information to support specific situations.

Input and Output

MIS uses a large volume of data as the input and gives out a summarized report. DSS uses a low volume of data and the output is decision analysis.

Main Focus

MIS focuses on operational efficiency while DSS focuses on making effective decisions.

Type of users

Middle and low-level management use MIS. Senior managers and analysts use DSS.

Conclusion

The difference between management information system and decision support system is that management information system supports structured decision making while decision support system provides support for unstructured or semi-structured decisions. In brief, MIS focus on operational efficiency while DSS focuses on making effective decisions.

4.4. MIS and Information Resource Management

4.4.1 Management Information System (MIS)

A management information system (MIS) is a broadly used and applied term for a three-resource system required for effective organization management. The resources are people, information and technology, from inside and outside an organization, with top priority given to people. The system is a collection of information management methods involving computer automation (software and hardware) or otherwise supporting and improving the quality and efficiency of business operations and human decision making.

As an area of study, MIS is sometimes referred to as information technology management (IT management) or information services (IS). Neither should be confused with computer science.

Notes

It is important to note that a management information system should not only indicate the status of a business's conditions, but also indicate why the conditions are improving or deteriorating. For example, an MIS should report performance relative to cost and profitable or unprofitable projects, while identifying individual accountability – both current and past. This can be done only if such reports are based on constantly updated information accessible to those in authority who are responsible for assessing and assuring it is used for timely decision-making.

Examples of the broad scope and varied contexts of MISs are:

- Decision support systems
- Enterprise resource planning (ERP)
- Supply chain management
- Customer relationship management (CRM)
- Project management
- Executive information systems (EIS)

4.4.2 Information Resources Management

Information Resources Management (IRM) is the process of managing information resources to accomplish agency missions and to improve agency performance, including the reduction of information collection burdens on the public. When standardized and controlled, these resources can be shared and re-used throughout an agency, not just by a single user or application. [1]

There are three (3) classes of information resources:

Business Resources: Enterprises, Business Functions, Positions (Jobs), Human/Machine Resources, Skills, Business Objectives, Projects, and Information Requirements.

1. **System Resources:** Systems, Sub-Systems (business processes), Administrative Procedures (manual procedures and office automation related), Computer Procedures, Programs, Operational Steps, Modules, and Subroutines.
2. **Data Resources:** Data Elements, Storage Records, Files (computer and manual), Views, Objects, Inputs, Outputs, Panels, Maps, Call Parameters, and Data Bases.

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

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

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

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

4.5. DSS and AI

4.5.1 Decision Support System (DSS)

A decision support system (DSS) is a computer program application that analyzes business data and presents it so that users can make business decisions more easily. It is an "informational application" (to distinguish it from an "operational application" that collects the data in the course of normal business operation). Typical information that a decision support application might gather and present would be:

- Comparative sales figures between one week and the next
- Projected revenue figures based on new product sales assumptions
- The consequences of different decision alternatives, given past experience in a context that is described

A decision support system may present information graphically and may include an expert system or artificial intelligence (AI). It may be aimed at business executives or some other group of knowledge_workers.

4.5.2 AI (artificial intelligence)

Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction. Particular applications of AI include expert systems, speech recognition and machine vision.

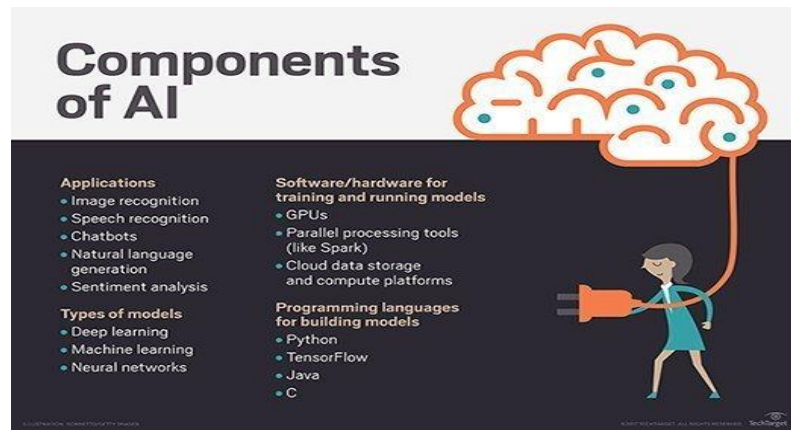
AI can be categorized as either weak or strong. Weak AI, also known as narrow AI, is an AI system that is designed and trained for a particular task. Virtual personal assistants, such as Apple's Siri, are a form of weak AI. Strong AI, also known as artificial general intelligence, is an AI system with generalized human cognitive abilities. When presented with an unfamiliar task, a strong AI system is able to find a solution without human intervention.

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Because hardware, software and staffing costs for AI can be expensive, many vendors are including AI components in their standard offerings, as well as access to Artificial Intelligence as a Service (AIaaS) platforms. AI as a Service allows individuals and companies to experiment with AI for various business purposes and sample multiple platforms before making a commitment. Popular AI cloud offerings include Amazon AI services, IBM Watson Assistant, Microsoft Cognitive Services and Google AI services.

While AI tools present a range of new functionality for businesses, the use of artificial intelligence raises ethical questions. This is because deep learning algorithms, which underpin many of the most advanced AI tools, are only as smart as the data they are given in training. Because a human selects what data should be used for training an AI program, the potential for human bias is inherent and must be monitored closely.

Some industry experts believe that the term artificial intelligence is too closely linked to popular culture, causing the general public to have unrealistic fears about artificial intelligence and improbable expectations about how it will change the workplace and life in general. Researchers and marketers hope the label augmented intelligence, which has a more neutral connotation, will help people understand that AI will simply improve products and services, not replace the humans that use them.



Types of artificial intelligence

Arend Hintze, an assistant professor of integrative biology and computer science and engineering at Michigan State University, categorizes AI into four types, from the kind of AI systems that exist today to sentient systems, which do not yet exist. His categories are as follows:

- **Type 1: Reactive machines.** An example is Deep Blue, the IBM chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on the chess board and make predictions, but it has no memory and cannot use past experiences to inform future ones. It analyzes possible moves -- its own and its opponent -- and chooses the most strategic move. Deep Blue and Google's AlphaGO were designed for narrow purposes and cannot easily be applied to another situation.

- **Type 2: Limited memory.** These AI systems can use past experiences to inform future decisions. Some of the decision-making functions in self-driving cars are designed this way. Observations inform actions happening in the not-so-distant future, such as a car changing lanes. These observations are not stored permanently.
- **Type 3: Theory of mind.** This psychology term refers to the understanding that others have their own beliefs, desires and intentions that impact the decisions they make. This kind of AI does not yet exist.
- **Type 4: Self-awareness.** In this category, AI systems have a sense of self, have consciousness. Machines with self-awareness understand their current state and can use the information to infer what others are feeling. This type of AI does not yet exist.

AI applications

Artificial intelligence has made its way into a number of areas. Here are six examples.

- **AI in healthcare**
- **AI in business**
- **AI in education**
- **AI in finance**
- **AI in law**
- **AI in manufacturing**

4.6. OVERVIEW OF AI

Artificial Intelligence (AI)

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans. Some of the activities computers with artificial intelligence are designed for include:

- Speech recognition
- Learning
- Planning
- Problem solving

Artificial intelligence is a branch of computer science that aims to create intelligent machines. It has become an essential part of the technology industry.

Research associated with artificial intelligence is highly technical and specialized. The core problems of artificial intelligence include programming computers for certain traits such as:

- Knowledge
- Reasoning
- Problem solving
- Perception
- Learning
- Planning

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- Ability to manipulate and move objects

Knowledge engineering is a core part of AI research. Machines can often act and react like humans only if they have abundant information relating to the world. Artificial intelligence must have access to objects, categories, properties and relations between all of them to implement knowledge engineering. Initiating common sense, reasoning and problem-solving power in machines is a difficult and tedious task.

Machine learning is also a core part of AI. Learning without any kind of supervision requires an ability to identify patterns in streams of inputs, whereas learning with adequate supervision involves classification and numerical regressions. Classification determines the category an object belongs to and regression deals with obtaining a set of numerical input or output examples, thereby discovering functions enabling the generation of suitable outputs from respective inputs. Mathematical analysis of machine learning algorithms and their performance is a well-defined branch of theoretical computer science often referred to as computational learning theory.

Machine perception deals with the capability to use sensory inputs to deduce the different aspects of the world, while computer vision is the power to analyse visual inputs with a few sub-problems such as facial, object and gesture recognition.

Robotics is also a major field related to AI. Robots require intelligence to handle tasks such as object manipulation and navigation, along with sub-problems of localization, motion planning and mapping.

4.7. Decision Support System Models and Software

7.1 Decision Support System Models

- 7.1.1. Behavioral Model.
- 7.1.2. Management Science Model.
- 7.1.3. Operations research Model.

4.7.1.1. Behavioral Model

- Focuses on studying and understanding the different behaviour/trends amongst the variables.
- A behavioural model is built by observing the previous behavior of an entity or a system; the resulting model can then be used to predict future behaviour and performance.
- Examples of such a model can be trend analysis, co-relation, regression etc.

4.7.1.2. Management Science Model

- Based upon the principles of the management, the management accounting and the econometrics.
- Examples of such a model can include budgetary systems, cost accounting, capital budgeting, inventory management etc.

4.7.1.3. Operations Research Model

- Based on the different mathematical formulae.
- Represent the real life problems depending on the various variables and the parameters expressed in the algebraic equations form.
- Examples of such a model can be linear programming, ABC analysis, mathematical programming techniques, material requirement planning.

4.7.2. Development of DSS

- The decision support system is determined by the type of information and the facilities required for taking decisions .
- Decision support systems are developed using programming languages or produced by packages specially incorporating decision support development tools.
- Fourth generation level language are appropriate for creating and developing DSS , that is because they are database oriented and decision making process need data retrieval and analysis.

4.7.2.1. Selection of Language

- Availability of language and support for it .
- Experience of developers with various languages.
- Amount of manipulation v/s presentation of data.
- Need to document and maintain the program .
- Frequency of use and number of users

4.7.2.2. Advantages of Using Programming Languages

- Application development is speedy
- Many are end-user orientated

4.7.3. Methods of Developing DSS

4.7.3.1. DSS Generator

- Is comprised of programs such as data management tools, electronic spreadsheets, report generators, statistical packages, Graphical packages, query languages that help in the development of DSS
- DSS generators, FOCUS, Excel and Lotus 1-2-3.

4.7.3.2. DSS Shells

- Shells eliminate the need for developing the DBMS, model management system and user interface, because skeletal versions of these modules are already available in the shell.
- Shells have become user friendly, allowing even users with little or no programming background.
- The main advantage of shells is that it may have to be customized to meet the needs of the decision make or the user may have to adopt the problem to the tool.

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4.7.3.3 Customer Made Software

- **This** is designed and developed by organization.
- The software is developed using a procedural language, such as C or fourth generation language such as FOCUS.
- Organizations may also choose to combine shells and customized software.

4.7.4 DSS Software

1	QuickScore Balanced Scorecard by Spider Strategies	Web-based balanced scorecard software. QuickScore is the only balanced scorecard software formally recommended by the Balanced Scorecard Institute. You can create informative and meaningful management dashboards. Align your business activities to your strategy and improve your internal and external communications.
2	Statgraphics By Statgraphics Technologies	Statgraphics Centurion 18 is our leading data analytics and visualization software program. Trusted by businesses across the globe, Statgraphics is a power packed tool that enables you to be an informed data-driven decision maker. On top of that, we believe you will enjoy your work when you use it. We have been delivering data analysis solutions since 1982. Control your data, improve your processes, and expand your reach! Download a 30 day free trial today in one of 5 language.
3	Riskturn byRiskturn	RISKTURN is an innovative cloud solution for risk-based capital budgeting. It presents a simple and intuitive interface to build probabilistic business forecast in just 5 steps. The powerful model integrates financial and time variables of uncertainty in a cash flow forecast. Then, running a Monte Carlo simulation, it delivers a complete set of probabilistic financial indicators for single initiative or portfolio (e.g. probability to reach profitability target, VaR, CFaR, sensitivity...).
4	Information Builders Web FOCUS by Informatio n Builders	WebFOCUS is a flexible BI and analytics platform, able to deliver governed tools and analytical applications to all user types.
5	SAP business Objects by SAP	Application to help you optimize business performance by connecting people, information, and businesses across business networks.
6	QlikView byQlik	Pulls data from disparate sources into powerful distributed analytical applications.
7	Zingtree byZingtree	Zingtree makes it easy to build interactive decision trees, call scripts, process guides, diagnostic systems, and more.

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8	Yonyx by Yonyx	Decision tree driven interactive guides for technical support & customer service.
9	TIBCO Spotfire by TIBCO Software	TIBCO Spotfire® data visualization and analytics software helps you quickly uncover insights for better decision-making. Learn more about TIBCO Spot fire
10	EIDOS by Parmenides	Visual reasoning and knowledge representation to support scenario based strategizing, problem solving and better decision making.

Check your Progress:

- 1 What is DSS?
- 2 What are the Components of MIS?
- 3 What is Data Processing?
- 4 What are the Types of data processing?
- 5 What is AI?

4.8. ANSWERS TO CHECK YOUR PROGRESS

1. A decision support system (DSS) is a computer program application that analyses business data and presents it so that users can make business decisions more easily. It is an "informational application" (to distinguish it from an "operational application" that collects the data in the course of normal business operation).
2. The major components of a typical management information system are:
 - People
 - Data
 - Business Procedures
 - Hardware
 - Software
3. Data processing is the conversion of data into usable and desired form. This conversion or "processing" is carried out using a predefined sequence of operations either manually or automatically.
4. Types of data processing on the basis of process/steps performed:
 - Batch Processing
 - Real-time processing
 - Online Processing
 - Multiprocessing
 - Time-sharing
5. Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction. Particular applications of AI include expert systems, speech recognition and machine vision

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4.9. SUMMARY

- Artificial intelligence is a branch of computer science that aims to create intelligent machines. It has become an essential part of the technology industry.
- Information Resources Management (IRM) is the process of managing information resources to accomplish agency missions and to improve agency performance, including the reduction of information collection burdens on the public. When standardized and controlled, these resources can be shared and re-used throughout an agency, not just by a single user or application.
- Decision support systems are used by top level managers to make semi-structured decisions. The output from the Management Information System is used as input to the decision support system. DSS systems also get data input from external sources such as current market forces, competition, etc.

4.10. KEYWORDS

- **Zingtree:** Zingtree makes it easy to build interactive decision trees, call scripts, process guides, diagnostic systems, and more.
- **Theory of mind:** This psychology term refers to the understanding that others have their own beliefs, desires and intentions that impact the decisions they make. This kind of AI does not yet exist.
- **Business Resources:** Enterprises, Business Functions, Positions (Jobs), Human/Machine Resources, Skills, Business Objectives, Projects, and Information Requirements.
- **Mechanical data processing:** Data processing is done by use of a mechanical device or very simple electronic devices like calculator and typewriters. When the need for processing is simple, this method can be adopted.

4.11. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What are the types of AI?
2. What is difference between MIS and DSS?
3. What is IRM?
4. What are the Methods of Data processing?
5. What is Mechanical data Processing?

Long Answer questions:

1. Explain briefly about AI and its types?
2. Difference between MIS and Data Processing?
3. Difference Between MIS and DSS?

4.12. FURTHER READINGS

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UNIT- V MIS AND OPERATIONS RESEARCH

Notes

- 5.1 Introduction to MIS
 - 5.1.1 The need for MIS
 - 5.1.2 Components of MIS
- 5.2 Operations Research
 - 5.2.1 Phases in Operation Research Study:
- 5.3 Executive Information and Decision Support Systems
 - 5.3.1 Capabilities of Decision Support Systems
 - 5.3.2 Features of DSS
 - 5.3.3 Components of DSS
 - 5.3.4 Classification of DSS
 - 5.3.5 Building a Decision Support System
- 5.4 Executive Information Systems
- 5.5 Artificial Intelligence and Expert System
 - 5.5.1 Artificial intelligence
 - 5.5.2 Expert System
- 5.6 Merits and Demerits
- 5.7 Pitfalls in MIS
- 5.8 Answers to Check Your Progress
- 5.9 Summary
- 5.10 Keywords
- 5.11 Self-Assessment Questions and Exercises
- 5.12 Further Readings

Objectives:

After Studying this lesson, you should be able to:

- ✓ Understand the meaning, purpose, and tools of Operations Research
- ✓ Describe the history of Operations Research Describe the Stages of O.R
- ✓ Explain the Applications of Operations Research
- ✓ Describe the Limitations of Operation Research
- ✓ Understand the OR specialist and Manager relationship

5.1 Introduction to MIS

MIS is the use of information technology, people, and business processes to record, store and process data to produce information that decision makers can use to make day to day decisions. MIS is the acronym for **Management Information Systems**. In a nutshell, MIS is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information that is useful to the organization.

5.1.1 The need for MIS

The following are some of the justifications for having an MIS system

- **Decision makers need information to make effective decisions.** Management Information Systems (MIS) make this possible.
- **MIS systems facilitate communication within and outside the organization** – employees within the organization are able to easily access the required information for the day to day operations. Facilitates such as Short Message Service (SMS) & Email make it possible to communicate with customers and suppliers from within the MIS system that an organization is using.
- **Record keeping** – management information systems record all business transactions of an organization and provide a reference point for the transactions.

5.1.2 Components of MIS

The major components of a typical management information system are;

- **People** – people who use the information system
- **Data** – the data that the information system records
- **Business Procedures** – procedures put in place on how to record, store and analyze data
- **Hardware** – these include servers, workstations, networking equipment, printers, etc.
- **Software** – these are programs used to handle the data. These include programs such as spreadsheet programs, database software, etc.

5.2 Operations Research

The operation research can be defined as:

(i) It is the application of scientific methods, techniques and tools to problems involving the operations of a system so as to provide those in the control of the system with optimum solutions to the problems.

(ii) Operation Research is a tool for taking decisions which searches for the optimum results in parity with the overall objectives and constraints of the organization.

(iii) O.R. is a scientific method of providing executive department with a quantitative basis of decisions regarding the operations under their control.

(iv) O.R. is a scientific approach to problem solving for management.

(v) O.R. is an aid for executive in making his decisions by providing him with the needed quantitative information's based on the scientific method of analysis.

(vi) O.R. is the application of modern methods of mathematical science to complex problems involving management of large systems of men, machines, materials, and money in industry, business, government and defense. The distinctive approach is to develop a scientific model of the system incorporating measurement of factors such as chance and risk, to

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predict and compare the outcome of alternative decisions, strategies or controls.

(vii) It is the application of the scientific methods by scientists and subject specialists to the study of the given operation. Its purpose is to give administration, a basis for predicting quantitatively the most effective results of an operation under given set of variable conditions and thereby to provide a sound basis for “decision-making”.

In fact in Operation Research, research techniques and scientific methods are employed for the analysis and also for studying the current or future problems. Thus, Operation Research offers alternative plans for a problem to the management for decisions.

5.2.1 Phases in Operation Research Study:

Since, the main objective of operation research is to provide better quantitative information’s for making decision. Now our aim is to learn how we can have better decisions.

(i) Judgment Phase:

- Determination of operation.
- Determination of objectives.
- Determination of effectiveness of measures.
- Determination of type of problem, its origin and causes.

(ii) Research Phase:

- ✓ Observation and data collection for better understanding of the problem.
- ✓ Formulation of relevant hypothesis and models.
- ✓ Analysis of available information and verification of hypothesis.
- ✓ Production and generation of results and consideration of alternatives.

(iii) Action Phase:

- ✓ Recommendations for remedial action to those who first posed the problem, this includes the assumptions made, scope and limitations, alternative courses of action and their effect.
- ✓ Putting the solution to work: implementation.

Without OR, in many cases, we follow these phases in full, but in other cases, we leave important steps out. Judgment and subjective decision-making are not good enough. Thus industries look to operation research for more objective way to make decisions. It is found that method used should consider the emotional and subjective factors also.

For example, the skill and creative labor are important factors in our business and if management wants to have a new location, the management has to consider the personal feeling of the employees for the location which he chooses.

5.3 Executive Information and Decision Support Systems

Decision support systems (DSS) are interactive information systems that assist a decision maker in approaching ill-structured problems by offering analytical models and access to databases. These systems are designed to support the decision-making process, rather than to render a decision. The hallmark of DSS is flexibility. Personal DSSs should be easy to develop: End-user oriented tools are available for the purpose. On the other hand, an

organizational DSS, used throughout an enterprise, should be developed in a well-planned, disciplined process. All DSSs should be easy to use.

The Problems that DSSs Help Solve

Problems that people in organizations face differ in terms of how structured the problems are; that is, the extent to which a solution procedure can be stated for them.

The principal domain of DSS is support of decision making for semi structured problems, where parts of the decision process itself often require very significant computer support. DSSs are also employed to assist a decision maker facing an unstructured problem, often injecting the necessary factual grounding through access to data.

Decision making to solve unstructured problems is available but within a narrow domain. An *ill-structured* problem contains elements of both semi structured and unstructured problems.

5.3.1 Capabilities of Decision Support Systems

A model is a representation of something else, developed for a specific purpose. It is usually an abstraction or a simplification of the phenomenon being modeled. A model represents the relationships among the salient aspects of the phenomenon.

Scenario Generation and Goal Seeking with a DSS

Two principal modes of analysis are available:

1. *What-if mode* - Developing scenarios for solution with the assistance of information systems (usually decision support systems).
2. *Goal-seeking mode* - Establishing the input factors necessary to achieve specified goals (usually with a decision support system).

Using DSS in the Decision-Making Process

The general decision-making process consists of four steps. These are:

1. Intelligence - a search of the environment is made to find and define the problem or an opportunity.
2. Design - several alternative solutions are developed
3. Choice - alternatives are compared to one another during the Achoice@ stage.
4. Implementation - solution is implemented and tracked, in order to be improved upon.

5.3.2 Features of DSS

DSSs have several features to offer in the general information system environment of an organization. Specifically, DSS can:

- ✓ Support decision making in ill-structured situations when problems do not lend themselves to full computerization.
- ✓ Help to rapidly obtain quantitative results needed to reach a decision.
- ✓ Operate in the ad hoc mode to suit the current needs of the user.
- ✓ Support easy modification of models
- ✓ Foster high-quality decision making
- ✓ Facilitate the implementation of decisions
- ✓ Support group decision making

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- ✓ Be user friendly
- ✓ Give managers the opportunity to gain a better understanding of their business.

Limitations of using spreadsheets as DSS models include:

- They are limited in their data-handling capabilities and thus cannot work with large databases
- They do not allow for construction of more complex models
- Modifications to spreadsheets are difficult to keep updated when numerous people use them

5.3.3 Components of DSS

The three principal DSS subsystems and their principal capabilities are:

- a) Data Management Subsystem
- b) Model Management Subsystem
- c) The Dialog Management Subsystem

The Data Management Subsystem

Data management subsystem of a DSS supplies data to which the models can be applied. It relies, in general, on a variety of internal and external databases. The power of a DSSs derives from their ability to provide easy access to data.

The database extract procedures used by DSS is generally specified by a specialist, such as a database administrator, rather than by an end user. The specialist needs to pay particular attention to data consistency across multiple decision support systems that extract data from the corporate databases. Data warehouses are used by many leading companies to support organizational DSS. Commercial data warehouses for decision support are emerging.

The Model Management Subsystem

Model management subsystems maintain the libraries of models. A particular advantage of DSS is the decision maker's ability to use a model to explore the influence of various factors on outcomes (a process known as sensitivity). Two forms of such analysis are the what-if analysis and goal-seeking.

The Dialog Management Subsystem

Dialog management model supports the user in applying models to data. The notable feature is support of multiple forms of input and output. By combining various input and output capabilities of a DSS, users can engage in the individually selected dialogs that best support their decision-making styles.

5.3.4 Classification of DSS

The principal classes of DSS are those that provide:

1. Data access systems
2. Data analysis systems
3. Forecast-oriented data analysis systems
4. Systems based on accounting models
5. Systems based on representational models

6. Systems based on optimization models
7. Systems with suggestion models

Data Access Systems

These systems can provide user-friendly ad hoc access to the database. This capability is equivalent to what is offered by most DBMSs through a query language. However, such systems A open-up a database.

Data Analysis Systems

These systems help analyze historical and current data, either on demand (ad hoc) or periodically. Data analysis systems are frequently oriented toward the consolidation (aggregation) of data, such as summarizing the performance of a firm's subunits and presenting the summaries in graphs. Only very simple models are employed in data analysis systems.

Forecast-Oriented Data Analysis Systems

These systems generally assist in developing product plans, including market segment forecasts, sales forecasts, and analyses of competitive actions. Their operation is based on access to a variety of internal and external marketing and product databases, including series of historical data. The systems in this category include only the simpler of the variety of marketing models, which show how existing trends in the marketplace will extend in the future if similar conditions prevail.

Systems Based on Representational Models

These models show the dependence between a controllable variable and an outcome. These are frequently simulation models which yield probabilistic results. Examples include representational models and risk analysis models. Systems Based on Optimization Models

Optimization models are developed by management scientists to determine optimal allocation of resources or best possible schedules.

Systems with Suggestion Models

Systems with suggestion models suggest solutions within narrow domains of knowledge and sometimes combine a DSS with an expert system.

5.3.5 Building a Decision Support System

DSS technology ranges from the specific DSS developed to solve a class of problems to the tools with which a DSS can be built. Three levels of DSS technology are:

1. Specific DSS
2. DSS Generators
3. DSS Tools

Specific DSS

A specific DSS is the actual system that a manager works with during the decision process. A specific DSS is constructed with the use of DSS

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generators or a variety of DSS tools. A variety of specific DSS are available in the software marketplace. However, they have to be customized to the actual environment in which they will be used. A DSS generally also undergoes extensive modification as it is used. Therefore, any specific DSS may be expected to evolve as time passes.

DSS Generators

A DSS generator is a software package that provides capabilities for building specific DSSs rapidly and easily. Capabilities of generators vary widely. Their common characteristic is that much of the processing and data accessing functionality needed in a specific DSS is already programmed into the generator and, therefore, building a specific DSS does not require much programming.

DSS Tools

A variety of tools may be employed as building blocks to construct a DSS generator or a specific DSS. These tools include programming languages with good capabilities for accessing arrays of data, simple spreadsheet packages, statistical packages, and DBMSs with a query facility.

How a DSS is Developed

A DSS is a collection of capabilities that support the decision-making process of a certain individual or a relatively small group of people. As the needs of these people change, the DSS should change with them - DSSs are truly built to be changed. DSS can be built by:

1. The quick-hit approach
2. Traditional life-cycle development
3. Iterative development

The Quick-Hit Approach

Characteristics of the quick-hit approach:

1. The quick-hit approach is the way most DSS come into being.
2. Most DSS's are built for the personal use of a decision maker
3. Initiative usually comes from an individual manager, so the DSS is built either by the manager or by the builders who belong to a more or less formal DSS group
4. Generally, a DSS generator is employed, frequently a spreadsheet with templates.
5. Level of investment is low and the payoff can be high

Traditional Life-Cycle Development

Characteristics of the life-cycle development approach:

- ✓ Large software systems are generally built in a disciplined fashion with the use of a life-cycle development methodology

- ✓ This process begins with detailed system planning and analysis, progresses through the design stages followed by coding and testing, and goes on to implementation.
- ✓ Process is lengthy, and there is no partial system to work with before the system is complete.
- ✓ Methodology is suitable for complex systems, in particular those that affect many users and in which informational requirements can be established early through the analysis process.

Iterative Development

Characteristics of the iterative development approach:

- ✚ Develop a prototype of the system - a simple initial version that can be used to experiment with and learn about the desired features of the system.
- ✚ Iterative development of DSS relies on the creation of such a prototype and its progressive refinement.
- ✚ The development of the system is completed jointly with the future user of the system and the DSS builder until the user has a prototype to work with.
- ✚ The iterative, repetitive process of prototype refinement follows until it eventually becomes a DSS.

5.4 Executive Information Systems

Executive information systems (EIS) provide a variety of internal and external information to top managers in a highly summarized and convenient form. EIS are becoming an important tool of top-level control in many organizations. They help an executive spot a problem, an opportunity, or a trend. Executive information systems have these characteristics:

- ✓ EIS provide immediate and easy access to information reflecting the key success factors the company and of its units.
- ✓ A User-seductive@ interfaces, presenting information through color graphics or video, allow an EIS user to grasp trends at a glance.
- ✓ EIS provide access to a variety of databases, both internal and external, through a uniform interface.
- ✓ Both current status and projections should be available from EIS.
- ✓ An EIS should allow easy tailoring to the preferences of the particular users or group of users.
- ✓ EIS should offer the capability to Adrill down@ into the data.

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Contrasting EIS and DSS:

DSS are primarily used by middle and lower level managers to project the future, EIS's primarily serve the control needs of higher level management.

- EISs primarily assist top management in uncovering a problem or an opportunity. Analysts and middle managers can subsequently use a DSS to suggest a solution to the problem.
- At the heart of an EIS lies access to the data. EISs may work on the data extraction principal, as DSSs do, or they may be given access to the actual corporate databases or data warehouses.
- EISs can reside on personal workstations or servers.

Developing EIS

EIS's should make it easy to track the *critical success factors* (CSF) of the enterprise, that is, the few vital indicators of the firm's performance. With the use of this methodology, executives may define just the few indicators of corporate performance they need. With the drill-down capability, they can obtain more detailed data behind the indicators.

Strategic business objectives methodology of EIS development takes a company-wide perspective of the strategic business objectives of the firm where the critical businesses are identified and prioritized. Then the information needed to support these processes is defined, to be obtained with the EIS that is being planned. Finally, an EIS is developed to report on the CSFs. This methodology avoids the frequent pitfall of aligning an EIS too closely to a particular sponsor.

5.5 Artificial Intelligence and Expert System

5.5.1 Artificial intelligence

Artificial intelligence is the intelligence shown by systems and machines. It is artificially created, unlike human intelligence. Now we get to see artificial intelligence in our day to day lives as well. The best example of it is the GPS on our smart phone. Robots designed to do specific jobs, self-driving cars etc. are intelligent machines. They can do the task assigned to them without the help of humans. The systems just have to be programmed in the right manner. We can say artificial intelligence is a boon when considering some factors but at the same time, it has certain disadvantages too. This article will take you through the various advantages and disadvantages AI possess.

Advantages of artificial intelligence

First, let us begin with the advantages of artificial intelligence. These machines are really a blessing and can assist and help humans in many tasks including difficult and tedious ones. They also have certain qualities which humans do not possess. Like the ability to work continuously without rest. I have explained in detail the advantages of AI.

1. Reduces human involvement in selected jobs

Artificial intelligence has proven to be successful in replacing humans in certain jobs. They can be used in almost all fields but their importance increases when it is a dangerous or tedious job. AI can be used for doing boring and repetitive jobs and the human resource can be wisely utilized for other creative purposes. Similarly, dangerous tasks can be assigned to AI, as they can adapt to circumstances and external environment, chances or damage to them are less likely. At the same time, if humans are involved, it can cause the death or serious injury. Thus human life can be saved by using AI for such tasks. Even space exploration can be done with the help of AI. It is just that they have to be created and programmed in that manner. In fact, reducing human risk in certain jobs is really an advantage to mankind.

2. Faster and minimal or no errors

Artificial intelligence is something artificially created and it is more or less a machine, robot, sometimes in the form of an app. Hence it is capable of doing whatever is instructed. Machines can work faster than humans. Hence substituting AI is advantageous when the work is to be finished faster. Similarly, there will be no errors at all but when it is humans, chances of errors are there. AI will do the assigned tasks in the manner how it is programmed, if there is an error in its creation or programming, only then chances of it making mistakes are there. AI can put forward greater efficiency when compared to humans. Also, they can work the whole day and night without rest and thereby increasing productivity. Multitasking is another ability of AI. In short, it is a competitor to humans.

3. Life and work made easier with AI

We definitely have to agree on this point. Artificial intelligence has made our life much easier. The Siri in our smart phones and the GPS system we use are of great help. Like a proper guide, GPS guides us to our desired destination. We are not worried anymore if we miss our way, or when we take the wrong route. We stay strong with the help of GPS. AI is also used in smart phones which helps us by guessing the word we are going to type or by automatically correcting our spelling errors. We actually do not have to type the entire word but can choose from the options provided. Artificial intelligence is now been used in almost all fields like medical, space exploration, mining, education, fuel, fraud detection etc. All these have helped mankind a lot and made his life easier.

4. Works 24*7 with no pay

This is the greatest advantage of artificial intelligence over humans. These machines can work continuously without break and rest. Moreover, they need not be paid for whereas the human employees are been paid salary. This feature attracts the employers as they can save on the monthly payment. Machines do not take sick leaves or annual leaves and so on. Additional expenditures like transportation cost, allowances, incentives, OT etc are not required. They have no complaints of being overloaded; they do not get tired like humans. AI is used in decision making and it is

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capable of thinking faster. These features make AI attractive and popular. In short, Artificial intelligence has all the advantages of a machine over humans.

5. Greatest advantage in the medical field

Artificial intelligence is widely used in the medical field as well. These machines can give a feedback to the researchers on the side effects of various medicines. AI can assist doctors with lengthy medical procedures. They can be an assistant as well as a tutor. It all depends upon how they are programmed. AI is used in recovering patients from depression state and to keep them active. These achievements and developments in the medical field with the help of artificial intelligence is highly appreciable. It is we humans who are getting the benefits of these.

6. Decision making cannot be influenced

Artificial intelligence can be used in decision making as well. However as machines do not have any sort of emotions, their decisions cannot be influenced. Similarly, machines will not have personal bias and favoritism. Hence the decisions taken by them will be accurate and apt. In the case of humans, there is a tendency of emotions and bias influencing their decisions. This can be avoided through artificial intelligence.

Disadvantages of artificial intelligence

Not only benefits there are some risks associated with artificial intelligence. A simple example is can a self-driving car perfectly drive like a human-driven car? No, it cannot be compared. Similarly, there are other disadvantages or flaws of AI, which are explained below.

1. Cannot fully replace humans

Machines are machines and cannot act like human brains. They are capable of doing what they are programmed for but nothing more than that. There is a limit to their creativity, understanding, and thinking ability and so on. Hence artificial intelligence is not a complete replacement for humans. However, some fear that in future robots will dominate humans.

2. Creates unemployment in certain sectors

Artificial intelligence can and has lead to unemployment in certain sectors. When a machine can do the filing and repetitive jobs, why does an employer want to pay the salary for a staff and employ them? Also, humans cannot work day and night without rest. The preferences of the management have changed which leads to unemployment issues.

3. Costs involved are too much

It is not an easy task to get a machine to do your jobs. The purchase, maintenance and repair cost requires high investment. We should even include the charges for updating software according to the changing requirements. Therefore only those organizations which can afford these will be able to go for artificial intelligence.

Can do more bad than good

Imagine if such a wonderful technology happens to be in the hands of criminals or terrorists. They will utilize artificial intelligence to commit crimes which will have a greater impact than anyone can imagine.

Notes

5.5.2 Expert System

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

Characteristics of Expert Systems

- High performance
- Understandable
- Reliable
- Highly responsive

Capabilities of Expert Systems

The expert systems are capable of –

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

They are incapable of –

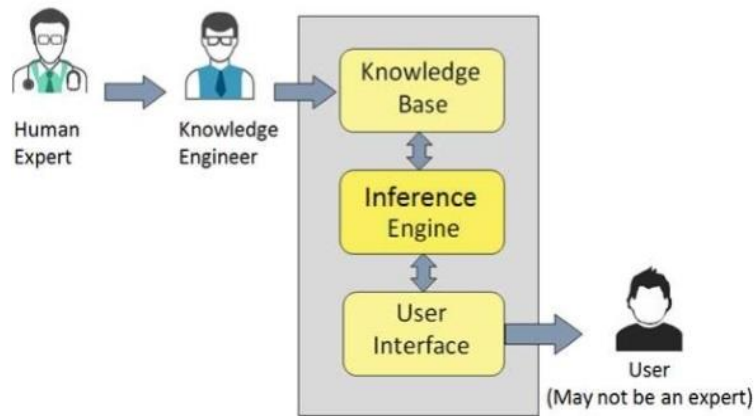
- Substituting human decision makers
- Possessing human capabilities
- Producing accurate output for inadequate knowledge base
- Refining their own knowledge

Components of Expert Systems

The components of ES include –

- Knowledge Base
- Inference Engine
- User Interface

Notes



Knowledge Base

It contains domain-specific and high-quality knowledge.

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

What is Knowledge?

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

Components of Knowledge Base

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

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

Inference Engine

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

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

In case of rule based ES, it –

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

User Interface

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

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

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

Applications of Expert System

The following table shows where ES can be applied.

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

Development of Expert Systems: General Steps

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

Identify Problem Domain

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

Design the System

- Identify the ES Technology

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

Develop the Prototype

From Knowledge Base: The knowledge engineer works to –

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

Test and Refine the Prototype

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

Develop and Complete the ES

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

Maintain the System

- Keep the knowledge base up-to-date by regular review and update.
- Cater for new interfaces with other information systems, as those systems evolve.
- a movement. It is suited for rough as well as smooth terrain where irregular or too smooth surface makes it consume more power for a wheeled locomotion. It is little difficult to implement because of stability issues.
- It comes with the variety of one, two, four, and six legs. If a robot has multiple legs then leg coordination is necessary for locomotion.

5.6 MERITS AND DEMERITS

An Expert System is a computer program coded to simulate knowledge and behavior of an individual or an organization which is expert in some particular field, usually all expert systems contains a knowledge base which is accessible by a set of rules depending on specific situations. Among the number of expert systems the best examples of they can be named as Chess Game or the medical diagnosis expert systems.

What are the advantages of them?

- ✓ The knowledge base can be updated and extended
- ✓ They can contain a large amount of information

But the disadvantages are:

- They are not able to learn from the mistakes
- They cannot creatively come with new solutions for the issues
- It's not easily achievable to mimic the exact knowledge of an Expert in Computer Programs.

5.7 Pitfalls in MIS Development

Following are the pitfalls of the MIS development:

(A) Fundamental Weaknesses: Following are the fundamental weaknesses of the MIS development:

(a) **No Management System to build Upon:** The MIS must be built on top of a management system that includes the organizational arrangements, the structure and procedures for adequate planning and control, the clear establishment of objectives, and all the other manifestations of good organization and management. The lack managerial and operational application is serious because it implies that the process not being performed well. If we can say that the information is the raw material of decision making, and if information is not generated, disseminated and used for management, then no system—manual or computer—is going to solve the problem.

(b) **What business are we in? :** Not having the clearly stated mission and purpose for the company is a common weakness. Since if it is not clearly clear what business we are in, each major challenge the company must face is a completely new challenge and must be analyzed from the ground up. If there was a mission statement, some of these problems could be dealt with routinely as opposed to their being major crises.

(c) **Company Objectives:** Written objectives are also often missing in the company. A firm without objectives is much like a company without a statement of mission and purpose.

An effective MIS requires continuous, consistent, long-range planning with involvement and commitment from the management as an institutionalized planning process involving everybody concerned. There is a need for an information steering committee and it may take more than one iteration to establish the process firmly. It has to undergo an application development cycle consisting of analysis, synthesis and implementation phases. Systems feasibility (consisting of technical, economic and operational feasibility) is a most important starting point of MIS development. In other words, the development process should take into account the rationale, definition and characteristics, economics, design, specification; schedule, implementation plan, implementation status and review. Some of the usual pitfalls and problems in developing and running effective Information System are mentioned below along with some ways of increasing effectiveness:

1. **Emphasis on Clerical System:** Just taking over an existing clerical system and modifying it without upgrading or changing it does not help. The clerical system has to be upgraded to a management system. On the other hand, computers have been put to work on those things that are best understood and easily structured and which require little management involvement.
2. **Communication gap between Computer Technologist and Manager/ User:** Ensuring maximum cooperation and coordination between computer personnel and managers is necessary. A greater degree of interaction and involvement between the systems function and the management function is required.

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3. **Lack of a Master Plan:** Systematic long ranges plan/planned approach is necessary for establishing an effective Management Information System. Increased focus on the area of problems definition is required in the systems analysis. The dramatic changes in business strategy together with changes in the top management personnel and organization structure call for a through plan.
4. **Subordination of MIS Function to EDP Accounting System:** Management Information System's function should be made an independent function so that it reports directly to top management.
5. **Lack of Managerial Participation:** This involvement and support of top management as well as participation of all managers in the design of their own management information system are necessary. If top management tends to depend upon its informally designed private information systems, development of structured, formalized and a public management information systems becomes difficult. Many top managers wrongly feel that good strategic decisions are made more by intuition than by a quantitative analysis of the available data.
6. **Overlooking Human Acceptance:** Users of Management Information System should be involved right at the early stages of design. Their cooperation by demonstrating how Management Information System will positively affect their job is a must.
7. **Lack of Resources and Trained Personnel:** Lack of trained personnel consisting of system analysts, system designers, programmers and chief information officers who are business trained and/or have a basic business prospective is a handicap.
8. **Voluminous and Unstructured Nature of Data:** Sometimes the volume of data itself can be a hurdle unless careful sifting is done. On the other hand, it may also be difficult to locate and retrieve relevant data. Often, the data required by top management is unstructured, non- programmed, future oriented. In exact and external and hence difficult to capture.
9. **Limited Use of Management Science and or Techniques:** Some of the ways of increasing the effective of Management Information System include motivating managers to participate and get involved in Management Information System, establishing consistent performance and work criteria for Management Information System, maintaining simplicity and ease of use, training systems analysts and careful consideration of basic computer feasibility criteria like volume and repetitive nature of transactions, degree of mathematical processing, quick turnaround time, accuracy and validity of data, common source documents and well understood processing logic.
10. **Enormous Time, Effort and Resources Required:** MIS budget includes data processing costs, hardware costs, personnel costs, supplies, services, etc.

Check your Progress:

1. What are the Components of DSS?
2. What is the Data Management Subsystem?
3. What is Data Access Systems?
4. What is DSS tools?
5. What are Expert Systems?

Notes

5.8. ANSWERS TO CHECK YOUR PROGRESS

1. The three principal DSS subsystems and their principal capabilities are:
 - Data Management Subsystem
 - Model Management Subsystem
 - The Dialog Management Subsystem
2. Data management subsystem of a DSS supplies data to which the models can be applied. It relies, in general, on a variety of internal and external databases. The power of a DSSs derives from their ability to provide easy access to data
3. Data Access systems can provide user-friendly ad hoc access to the database. This capability is equivalent to what is offered by most DBMSs through a query language. However, such systems an open-up a database.
4. A variety of tools may be employed as building blocks to construct a DSS generator or a specific DSS. These tools include programming languages with good capabilities for accessing arrays of data, simple spreadsheet packages, statistical packages, and DBMSs with a query facility.
5. The expert systems are the computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise.

5.9. SUMMARY

- Executive information systems (EIS) provide a variety of internal and external information to top managers in a highly summarized and convenient form. EIS are becoming an important tool of top-level control in many organizations.
- A DSS is a collection of capabilities that support the decision-making process of a certain individual or a relatively small group of people. As the needs of these people change, the DSS should change with them - DSSs are truly built to be changed.
- MIS is the use of information technology, people, and business processes to record, store and process data to produce information that decision makers can use to make day to day decisions. MIS is the acronym for Management Information Systems.

Notes

5.10. KEYWORDS

- **Intelligence:** a search of the environment is made to find and define the problem or an opportunity.
- **Implementation:** solution is implemented and tracked, in order to be improved upon.
- **Goal-seeking mode:** Establishing the input factors necessary to achieve specified goals (usually with a decision support system).

5.11. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What is Operations Research?
2. What is the phase in operation Research study?
3. When should you use the Decision Support Approach?
4. What are use of DSS in the Decision-Making Process?
5. What DSS can do for you: Classification of DSS?

Long Answer questions:

1. Explain about the Components of DSS?
2. How a DSS is Developed?
3. Explain about Executive Information Systems?
4. What are Expert Systems?

5.12 FURTHER READINGS

1. Ahituv, N. and S. Neumann. 1990. Principles of Information Systems for Management. Dubuque: Wm. C. Brown Publishers.
2. Curry, A., P. Flett and F. Hollingsworth. 2006. Managing Information and Systems: The Business Perspective. Oxford: Routledge.
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UNIT – VI MIS IN INDIAN ORGANIZATIONS

6.1 Recent Developments in Information Technology

- 6.1.1 Cloud Computing
- 6.1.2 Mobile Application
- 6.1.3 User Interfaces
- 6.1.4 Analytics

6.2 Installation of Management Information

6.3 Control System in Indian Organizations

- 6.3.1 Review
- 6.3.2 Plan
- 6.3.3 Implement
- 6.3.4 Evaluate

6.4 Answers to Check Your Progress

6.5 Summary

6.6 Keywords

6.7 Self-Assessment Questions and Exercises

6.8 Further Readings

Notes

6.1 Recent Developments in Information Technology:

Introduction

21st century has been defined by application of and advancement in information technology. Information technology has become an integral part of our daily life. According to Information Technology Association of America, information technology is defined as “the study, design, development, application, implementation, support or management of computer-based information systems.” Information technology has served as a big change agent in different aspect of business and society. It has proven game changer in resolving economic and social issues. Advancement and application of information technology are ever changing. Some of the trends in the information technology are as follows:

6.1.1 Cloud Computing

One of the most talked about concept in information technology is the cloud computing. Clouding computing is defined as utilization of computing services, i.e. software as well as hardware as a service over a network. Typically, this network is the internet.

Cloud computing offers 3 types of broad services mainly Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Some of the benefit of cloud computing is as follows:

- Cloud computing reduces IT infrastructure cost of the company.
- Cloud computing promotes the concept of virtualization, which enables server and storage device to be utilized across organization.

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- Cloud computing makes maintenance of software and hardware easier as installation is not required on each end user's computer.

Some issues concerning cloud computing are privacy, compliance, security, legal, abuse, IT governance, etc.

6.1.2 Mobile Application

- ✚ Another emerging trend within information technology is mobile applications (software application on Smart phone, tablet, etc.)
- ✚ Mobile application or mobile app has become a success since its introduction. They are designed to run on Smartphone, tablets and other mobile devices. They are available as a download from various mobile operating systems like Apple, Blackberry, Nokia, etc. Some of the mobile app are available free where as some involve download cost. The revenue collected is shared between app distributor and app developer.

6.1.3 User Interfaces

- ✚ User interface has undergone a revolution since introduction of touch screen. The touch screen capability has revolutionized way end users interact with application. Touch screen enables the user to directly interact with what is displayed and also removes any intermediate hand-held device like the mouse.
- ✚ Touch screen capability is utilized in smart phones, tablet, information kiosks and other information appliances.

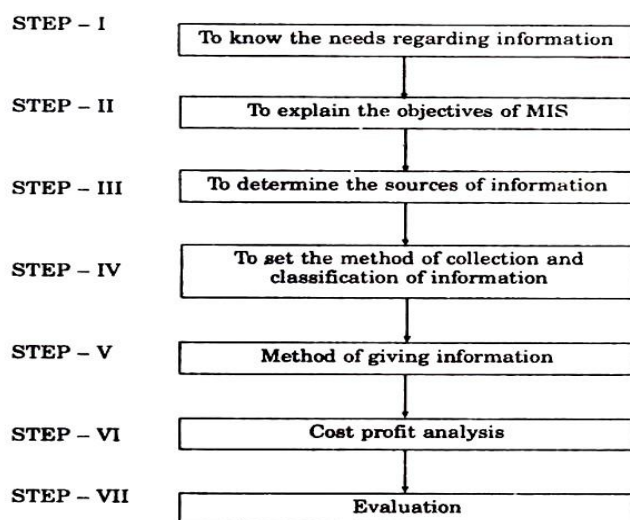
6.1.4 Analytics

- ✚ The field of analytics has grown many folds in recent years. Analytics is a process which helps in discovering the informational patterns with data. The field of analytics is a combination of statistics, computer programming and operations research.
- ✚ The field of analytics has shown growth in the field of data analytics, predictive analytics and social analytics.
- ✚ Data analytics is tool used to support decision-making process. It converts raw data into meaningful information.
- ✚ Predictive analytics is tool used to predict future events based on current and historical information.
- ✚ Social media analytics is tool used by companies to understand and accommodate customer needs.

The every changing field of information technology has seen great advancement and changes in the last decade. And from the emerging trend, it can be concluded that its influence on business is ever growing, and it will help companies to serve customers better.

6.2 Installation of Management Information

This article will throw light upon the top seven steps necessary for installing management information system. The steps are: 1. To know the needs regarding information 2. To explain the objectives of MIS 3. To determine the sources of information 4. To set the method of collection and classification of information 5. Method of giving information 6. Cost profit analysis 7. Evaluation.



Installing MIS Step 1. To know the needs regarding information:

First, an analytical study of that information is made which are needed for the external parties related to the organization viz., government, customers, suppliers, labor unions etc.

The needs of information are related with the size of organization, nature of business, financial position, state government policies and several other factors. There are two methods to judge the needs of the information. First, the users of the information may be asked as to how much information they need to accomplish their task. Secondly, they should be asked as to how they take the decision and then judge what information should be provided to them.

Installing MIS Step 2. To explain the objectives of MIS:

The second step is to clearly define the objectives. Just monitoring to increase the efficiency is not sufficient. Objective should be clear in terms of what one will do with the information received by him. The size of the objectives is related with the planning, management control and continuous flow of information.

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Installing MIS Step 3. To determine the sources of information:

After estimating the need of information and clearly defining the objectives. The third step in installation of MIS is to determine the sources of information. There are several sources. The internal sources of are accounts, files, statistical papers etc. and external sources are commercial and government publications. Information can also be collected by personal interviews and personal inspections.

Installing MIS Step 4. To set the method of collection and classification of information:

After determining the sources of information, the method of collection and classification of information is chalked out. It is decided what will be the source of information, frequency, quantity and time of information? After collection how it will be classified? Where computers are used the statistical information is feed into them, for which an outline is prepared?

Installing MIS Step 5. Method of giving information:

The next step is to determine the method of giving information. It is decided as to who the information is to be given, how many copies are to be prepared, when and what will be its frequency and in which form it is to be given. They can be communicated by reports, charts, statements or even orally.

Installing MIS Step 6. Cost profit analysis:

Finally, the cost to be incurred in information system should be assessed and the benefit should be estimated. The cost of information system includes the cost of its implementation, practicing it and its evaluation. These costs should be compared with the cost present system of giving information.

Installing MIS Step 7. Evaluation:

Three to six months after implementation of management information system, it should be evaluated, so that, it can be judged whether the cost incurred in its implementation is less than the benefits derived from it and, also if it satisfies the needs of the persons using it. If it is not satisfactory, steps should be taken to make to more effective and useful.

6.3 Control System in Indian Organizations

Installing a successful management control system in a small business requires planning and the involvement of the managers and affected employees. When managers have the financial, production, sales and personnel data they need, your company's decision-making process will improve. You can smooth the transition from an informal system to an efficient, effective control and information system by following a four-step process.

6.3.1 Review

Form a team, representative of your company's departments and activities, to review past and current records and other information requirements. Any personnel specifically assigned to handling records for others should be on the team. The review should include what categories of records your company may produce in the future. Identify what procedures your business follows to classify, store and retrieve records. Determine how you archive the records when no longer in use and how long they are kept. Include paper and digital records. Examine how each category of records is created, how records move through the various stages and who has access to them at each stage.

6.3.2 Plan

Develop a detailed operational plan that describes what record types you intend to collect. For example, some companies keep phone logs and a record of all mail received. Interview managers who expect to use the data collected to determine what they consider important information. Using information from the review, develop a list of categories. Be certain the categories do not overlap. Describe how the data is collected, processed, secured from hacking or theft, and stored. Indicate what personnel, equipment and supplies the system requires. Prepare a detailed budget and a schedule for installing the system. Obtain the required approvals for your plan and budget.

6.3.3 Implement

Conduct a training program. Smooth the transition by using the training time to go over the new procedures. Personnel, who collect, categorize and retrieve paper records for others, their supervisors and the managers need more intense training. It may be necessary, if no staff is capable; to hire expert help in designing the software needed to present the information in formats suitable to management decision-making processes. Initiate a plan for backing up all digital records at frequent, regular intervals and for scanning critical paper records for electronic storage.

6.3.4 Evaluate

Use the team members to assist you in monitoring the system for changes that will resolve issues and make it easier and more efficient to use. Give frequent attention to the managers' use of the system and to the employees responsible for the data.

Check your Progress:

1. What is Cloud computing?
2. What are the types of broad services in cloud computing?
3. Explain about Mobile Application?
4. What is the Installation of Management Information?
5. What are User Interfaces?

6.4. ANSWERS TO CHECK YOUR PROGRESS

1. Clouding computing is defined as utilization of computing services, i.e. software as well as hardware as a service over a network. Typically, this network is the internet.
2. Cloud computing offers 3 types of broad services mainly Infrastructure as a
 - Service (IaaS)
 - Platform as a Service (PaaS)
 - Software as a Service (SaaS).
3. Mobile application or mobile app has become a success since its introduction. They are designed to run on Smartphone, tablets and other mobile devices. They are available as a download from various mobile operating systems like Apple, Blackberry, Nokia, etc. Some of the mobile app are available free where as some involve download cost. The revenue collected is shared between app distributor and app developer.
4. The top seven steps necessary for installing management information system. The steps are:
 - To know the needs regarding information
 - To explain the objectives of MIS
 - To determine the sources of information
 - To set the method of collection can classification of information
 - Method of giving information
 - Cost profit analysis
 - Evaluation.
5. User interface has undergone a revolution since introduction of touch screen. The touch screen capability has revolutionized way end users interact with application. Touch screen enables the user to directly interact with what is displayed and also removes any intermediate hand-held device like the mouse. Touch screen capability is utilized in smart phones, tablet, information kiosks and other information appliances.

6.5. SUMMARY

- information technology is defined as the study, design, development, application, implementation, support or management of computer-based information systems.
- Cloud computing offers 3 types of broad services mainly Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

- The cost to be incurred in information system should be assessed and the benefit should be estimated. The cost of information system includes the cost of its implementation, practicing it and its evaluation.

Notes

6.6. KEYWORDS

- **Analytics:** The field of analytics has grown many folds in recent years. Analytics is a process which helps in discovering the informational patterns with data. The field of analytics is a combination of statistics, computer programming and operations research.
- **Mobile Application:** Another emerging trend within information technology is mobile applications (software application on Smart phone, tablet, etc.)
- **User Interfaces:** User interface has undergone a revolution since introduction of touch screen. The touch screen capability has revolutionized way end users interact with application. Touch screen enables the user to directly interact with what is displayed and also removes any intermediate hand-held device like the mouse.

6.7. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What is Installation of Management Information & Control System Indian Organizations?
2. What are Emerging Trends in Information Technology?
3. What is Information Technology?

Long Answer questions:

1. Explain about Installation of Management Information?
2. Explain about Emerging Trends in Information Technology?
3. Explain about Installation of Management Information & Control System Indian Organizations?

6.8. FURTHER READINGS

1. Ahituv, N. and S. Neumann. 1990. Principles of Information Systems for Management. Dubuque: Wm. C. Brown Publishers.
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UNIT- VII Computers and Communication

Notes

- 7.1 Information Technology
 - 7.1.1 Information Technology and Its Role in the Modern World
- 7.2 Information Technology and Global Integration
- 7.3 Information Services
- 7.4 Electronic bulletin board system
- 7.5 The Internet
- 7.6 The Electronic Mail
- 7.7 The Interactive Video
- 7.8 Answers to Check Your Progress
- 7.9 Summary
- 7.10 Keywords
- 7.11 Self-Assessment Questions and Exercises
- 7.12 Further Readings

7.1 Information Technology

Everyday knowingly or unknowingly, everyone is utilizing information technology. It has grown rapidly and covers many areas of our day to day life like movies, mobile phones, the internet, etc. Information technology can be broadly defined as integration of computer with telecommunication equipment for storing, retrieving, manipulating and storage of data. According to Information Technology Association of America, information technology is defined as “the study, design, development, application, implementation, support or management of computer-based information systems.”

Information technology greatly enhances the performance of economy; it provides edge in solving social issues as well as making information system affordable and user friendly. Information technology has brought big change in our daily life be it education, life at home, work place, communication and even in function of government.

7.1.1 Information Technology and Its Role in the Modern World

Information technology (IT) has become a vital and integral part of every business plan. From multi-national corporations who maintain mainframe systems and databases to small businesses that own a single computer, IT plays a role. The reasons for the omnipresent use of computer technology in business can best be determined by looking at how it is being used across the business world.

i) Communication between Employees, Suppliers and Customers

For many companies, email is the principal means of communication between employees, suppliers and customers. Email was one of the early

drivers of the Internet, providing a simple and inexpensive means to communicate. Over the years, a number of other communications tools have also evolved, allowing staff to communicate using live chat systems, online meeting tools and video-conferencing systems. Voice over internet protocol (VOIP) telephones and smart-phones offer even more high-tech ways for employees to communicate.

ii) Inventory Management Systems

When it comes to managing inventory, organizations need to maintain enough stock to meet demand without investing in more than they require. Inventory management systems track the quantity of each item a company maintains, triggering an order of additional stock when the quantities fall below a pre-determined amount. These systems are best used when the inventory management system is connected to the point-of-sale (POS) system. The POS system ensures that each time an item is sold, one of that item is removed from the inventory count, creating a closed information loop between all departments.

iii) Data Management Systems

The days of large file rooms, rows of filing cabinets and the mailing of documents is fading fast. Today, most companies store digital versions of documents on servers and storage devices. These documents become instantly available to everyone in the company, regardless of their geographical location. Companies are able to store and maintain a tremendous amount of historical data economically, and employees benefit from immediate access to the documents they need.

iv) Management Information Systems

Storing data is only a benefit if that data can be used effectively. Progressive companies use that data as part of their strategic planning process as well as the tactical execution of that strategy. Management Information Systems (MIS) enable companies to track sales data, expenses and productivity levels. The information can be used to track profitability over time, maximize return on investment and identify areas of improvement.

Managers can track sales on a daily basis, allowing them to immediately react to lower-than-expected numbers by boosting employee productivity or reducing the cost of an item.

v) Customer Relationship Management

Companies are using IT to improve the way they design and manage customer relationships. Customer Relationship Management (CRM) systems capture every interaction a company has with a customer, so that a more enriching experience is possible. If a customer calls a call center with an issue, the customer support representative will be able to see what the customer has purchased, view shipping information, call up the training manual for that item and effectively respond to the issue.

Notes

The entire interaction is stored in the CRM system, ready to be recalled if the customer calls again. The customer has a better, more focused experience and the company benefits from improved productivity.

7.2 Information Technology and Global Integration

MIS and GIS can be integrated at various levels, most importantly that of user interface and database. At user-interface level, the most essential for the layman, MIS and GIS are incorporated into a single application so that the user has a single interface with which to interact, whilst separate databases for MIS and GIS might be in use. Integration of the interface means MIS and GIS teams cannot work independently. Database-level integration will lead to MIS and GIS sharing a common database; data changes will be reflected in both applications. After designing tables for the common database, MIS and GIS teams have the option of developing their applications independently. If the database is designed for one, already running, application restructuring of existing data and tables becomes impossible; thus views may be created for adaptation of data and table structure for the other application. Spatial data may be saved separately and attribute data shared between GIS and MIS. Both can separately use non-shared data. The best database-level integration involves integrating all data with a single database. For example, Oracle Spatial can save both spatial and attribute data, enabling access and modification to spatial and attribute data from MIS and GIS applications. The best overall solution is full integration of both databases and user interfaces.

7.3 INFORMATION SERVICES

- IS (information system) is the collection of technical and human resources that provide the storage, computing, distribution, and communication for the information required by all or some part of an enterprise. A special form of IS is a management information system (MIS), which provides information for managing an enterprise.
- IS (information services) is a common name for an organization within an enterprise that is responsible for its data processing and information system or systems.

Information systems (IS) is an integrated set of components used for gathering, processing, storing and communicating multiple types of information for improved societal and organizational efficiency. Information system components cover academic and professional disciplines spanning the fields of business and computer science. Typical information systems include data about people, software, hardware and procedures. Collected digital data is used for study and analysis. In many organizations, IS known as information services (IS).

IS a development stage including:

- Recognizing issues, problems or required specifications
- Collecting information
- Determining new system specifications
- Designing the system
- Constructing the system
- Implementing the system
- Evaluating and maintaining the system

Like records and information management, ISs have evolved for over 30 years. Foundations were set by the manual organization of data and information in physical formats, such as paper, microfilm, photographs, negatives, and audio/video recordings.

7.4 Electronic Bulletin Board Systems

Electronic bulletin boards (also known as message boards or as computer forums) are online communication systems where one can share, request, or discuss information on just about any subject. E-mail is a way to converse privately with one or more people over the Internet; electronic bulletin boards are public. Any visitor to a message board can read and respond to any message found there, although registration of some kind is usually required before “posting” privileges are granted. A large collection of electronic bulletin boards is known as a newsgroup. Thousands of newsgroups populate the Internet, each dedicated to a single topic. Some are dedicated to roof-repair, some to obscure computer languages, some to skin defects. You name it.

Participation in bulletin boards messaging is simple. Any person can start a discussion on a topic and then wait for replies. The initial message alone—and others responding to it, if any—constitute a “thread.” Some threads continue on for days or weeks or months. Sometimes a poster with a question or a statement, however, is completely ignored. The longer threads tend to find people responding not only to the original post but to subsequent replies as well. The latecomer who happens to hit on one of the items in a long thread may have to “unwind” the thread a long way back to learn what the initial impetus was all about.

Bulletin boards provide a genuine service to the public in that they create an open forum for the discussion of issues and problems of the most diverse nature—but these discussions are easily accessible because search engines will ultimately pinpoint threads of interest to the searcher. Experts are similarly drawn to the BBs. Problems posed on a message board will draw answers from knowledgeable individuals pleased to enlighten the puzzled. To be sure, the answers may not always be correct—or, more likely, complete—but any flaw in a thread will tend to be corrected by others eventually. The initial poster may, indeed, request more detail. The ultimate judge of the received information, however, must be the individual asking the question or posing the problem.

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On the downside, the accessibility of bulletin boards also attracts those merely seeking stimulation and attention. Troublemakers delight in stirring up controversy, badmouthing everyone and everything in “virtual” sight—and they do so from behind the handy “mask” of user names (handles) which hide their actual identity. In response to such invasions by less-than-helpful visitors, many BBs use editorial functions, some automated, to filter out unwanted material. Spamming is also a bulletin board problem. Very active bulletin boards require massive computer memory resources; for this reason older messages may be scrubbed from the system. BBs therefore do not always serve archival reference purposes well.

BBS AND SMALL BUSINESS

While many electronic bulletin boards have educational or recreational aims, or serve as forums for professional discussions in arcane fields like physics or philosophy, many are designed around business functions, occupations, or activities—sometimes directly tied to vendor groups, sometimes fielded by university extension services. The small business owner or self-employed professional will find such bulletin boards frequently extremely valuable in solving specific problems, diagnosing some peculiar problem, finding a suitable vendor for an unusual product or service, and sharing experience on common issues. As Bob Wittkamp pointed out, writing for *ICS Cleaning Specialist*, growing the business is a much favored and discussed topic on bulletin boards.

Although a BB appears to exist for virtually every topic under the sun, from “Amor” in its most graphic forms to “Zen” mediation at its most quiescent, small businesses engaged in complex fields of a technical nature will probably benefit most directly from routinely using message boards. Computer programming, hardware, and wiring problems; construction issues from cesspool seepage to wallpaper hanging; the seemingly infinite issues in growing anything from vegetables to flowers; the frustrating quest for old brass fixtures in restoration work; and on, and on—are all served by bulletin boards that attract the knowledgeable. Discovering the right BB is relatively easy. Sampling a few threads rapidly reveals the character of the participants and the seriousness of their treatment of issues. Once a BB is qualified, joining it and trying it is the next step—unless the user has already obtained a useful answer just reading a few postings.

Small business owners may also discover bulletin boards that talk about their products and performance. They may be pleasantly or unpleasantly surprised. Negative posts (whether they are true or not) can, of course, seriously affect the company. As Patrick Collinson mentioned in an article that appeared in *Retail Financial Strategies*, a British company called IBNet is about to start marketing software which will alert a company each time any mention of it appears anywhere on the Internet. When the company learns that the information is false, it can request that it be removed and seek to identify who is posting the information.

Advantages:

- Students cannot complain that resources are not out in the open for their access when necessary.
- It's a great way for teachers to pin previous test answers and other useful materials without having to scatter them messily over desks. Students can then approach the board, take photos as necessary of the material, and return to their desks to prevent clusters of students rushing to get the information.
- You can post frequently requested information, such as class schedules, a daily calendar, etc.
- It's a great way to post up student art work or accomplishments if teachers run out of wall space.
- Bulletin boards can have plastic trays mounted onto them as a resource center for daily assignments that can be accessed by students who were absent. This prevents the wall paint from being torn off and keeps teachers' desks clean.

Disadvantages:

- Information on bulletin boards is often ignored (of course, teachers can jazz up the boards and put it by the classroom door to attract more attention).
- People can mess up stuff that's been pinned to the board, wasting teachers' efforts and students' ability to gather information without the chaos.
- Bulletin boards aren't necessarily necessary and can be a waste of effort. A lot of classrooms don't use them anymore, so they end up being more of décor than actual utility.

7.5 INTERNET

The internet is a globally connected network system that uses TCP/IP to transmit data via various types of media. The internet is a network of global exchanges – including private, public, business, academic and government networks – connected by guided, wireless and fiber-optic technologies.

The terms internet and World Wide Web are often used interchangeably, but they are not exactly the same thing; the internet refers to the global communication system, including hardware and infrastructure, while the web is one of the services communicated over the internet.

As computing advanced, peer-to-peer (P2P) communication was gradually delivered and enhanced. Since the 1990s, the internet has greatly influenced and upgraded networking to global standards. Billions of internet users rely on multiple application and networking technologies, including:

Internet Protocol (IP): The internet's primary component and communications backbone. Because the internet is comprised of hardware

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and software layers, the IP communication standard is used to address schemes and identify unique connected devices. Prominent IP versions used for communications include Internet Protocol version 4 (Ipv4) and Internet Protocol version 6 (Ipv6).

Communications: The internet is the most cost-effective communications method in the world, in which the following services are instantly available:

- Email
- Web-enabled audio/video conferencing services
- Online movies and gaming
- Data transfer/file-sharing, often through File Transfer Protocol (FTP)
- Instant messaging
- Internet forums
- Social networking
- Online shopping
- Financial services

7.6 ELECTRONIC MAIL

E-mail (electronic mail) is the exchange of computer-stored messages by telecommunication. (Some publications spell it email; we prefer the currently more established spelling of e-mail.) E-mail messages are usually encoded in ASCII text. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams. E-mail was one of the first uses of the Internet and is still the most popular use. A large percentage of the total traffic over the Internet is e-mail. E-mail can also be exchanged between online service provider users and in networks other than the Internet, both public and private.

Here are some other email basics:

- **Sending the email:** When the email is finished and has been addressed to the recipient's email address, sending it allows the message to reach the intended recipient, or *recipients* if you're sending a group email.
- **Email transport:** Email servers transmit messages from the sender to the recipient. SMTP is the name of the protocol used to send email messages, and POP or IMAP servers are needed to understand how to download electronic mail to the email client.
- **Fetching new mail:** If you've got new mail in your mailbox, you simply have to tap it or click it to open and read the message, as well as to view any file attachments.

What Is an Email Used For?

There are several reasons so many people use email every day:

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- **Speed:** The speed at which an email can be sent and received is a huge benefit to most people. People can communicate in minutes or seconds from anywhere, whether it be within the same building or across the world.
- **Convenience:** Emails are quicker in some instances than making a phone call, where you might be left on hold for an extended period of time or forced to engage in lengthy conversations. Instead, if you have a quick question for someone, sometimes it's easier to shoot off an email that can be answered at a speedy pace.
- **Attachments:** It's simple to attach any file to an email message. It's just as easy to email a teacher your essay as it is to send someone a group of vacation pictures or email a spreadsheet to a coworker.
- **Accessibility:** Email accounts are like large folders for not only private messages but also files and other important information. Good email clients make it easy to organize, archive, and search through your emails, so any information contained in an email is always readily accessible.
- **A Record:** Email provides a record of a conversation that you don't have if communicating verbally. It's easy to print emails for hard copies or you can utilize your email provider's large storage space to keep everything online as long as you need to.
- **Unlimited space and time:** Unlike texting, you have unlimited space to write as much as you want in an email. You can also spend as much time as you want to write an email, revising it as many times as you need to before sending it off.
- **Free communication:** Unlike some forms of communication, like long distance calling and physical mail messages, most email providers give you free access to an email account. You can pick your own email address, send and receive all the electronic mail you want, and store everything online without ever paying a dime.
- **Security:** Some email services are built specifically for privacy and security, so users can be confident that messages and files are hidden from everyone but the intended recipients.

7.7 INTERACTIVE VIDEO

Interactive video is a new form of media many top brands are using to engage consumers and reach their digital marketing goals. While new, this media has already proven to be very effective; 70% of marketers say interactive video engages audiences "well" or "very well," and 68% of marketers believe it will continue to become a more important component of modern marketing mixes.

But what is interactive video? If you've heard of this new form of video media but don't know exactly what it is or how you can use it, we've put together this simple guide to understanding it.

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7.7.1 Why use interactive video?

Interactive video has quickly become a well-established and widely used marketing tool. 20% of marketers say they've used it, and of those marketers, 78% have found it to be an effective strategy. On top of that, 28% of marketers plan to use interactive video in 2018. Those numbers will continue to increase as brands explore different tactics and figure out which resonate most with their target audience.

As you contemplate whether interactive video is right for your brand, consider the main reasons many companies are adding it to their digital media toolbox.

It's popular

The best marketing strategies incorporate media that consumers want to interface with – and right now, that's interactive video. Its popularity is shown by both brand and consumer behavior. Brands are producing interactive video at an astonishing rate; in fact, it already accounts for 36% of all video content that's produced. On the other side, consumers are responding to interactive video with increased engagement rates; viewers watch them 44% longer than linear video.

It's trackable

For a long time, the only way marketers could track a video's success was through view rates. This was a problem for many people who found it difficult to prove the value of their video efforts; without data to show a correlation between video activity and conversions, it can be hard to prove a video's impact.

Interactive video has enabled much more powerful video metric tracking. You can now track clicks within a video, analyze different paths taken with branching, collect data with video form fields, and much more. There are several tools you can use to track these metrics. Some well-known tools include:

- **WIREWAX**, a leading interactive video creation platform that tracks a wide range of metrics from the moment a video is published, including dwell time, interactions, shares and 'add to carts'.
- **Rapt**, a cloud-based interactive video creation and publishing tool with a built-in analytics dashboard to track user demographics information, plays, user paths and more
- **DilogR**, a video hosting platform that integrates with CRM and email marketing platforms to analyze how interactive video impacts the end-to-end user experience
- **Spotful**, an interactive video management tool and video player with analytics to track engagement, conversion rates and completion rates

It's more engaging

When a user is watching a linear video, it can be easy to get distracted. 87% of viewers use more than one device at a time, meaning you're already vying for your audience's attention. Interactive video makes viewing active instead of passive, creating a game-like experience that

grabs and keeps a user's attention and results in a 591% lift in user activity – a huge increase most marketers can't afford to pass up.

It converts

Interactive videos convert at significantly higher rates than many other types of digital video ads. Specifically, banner ads, Google display ads and YouTube Annotations convert at rates of less than 1%. Interactive video blows all of those out of the water, converting at a rate of more than 11%.

It's more memorable

It turns out the sheer ability to engage with content in an interactive video makes a user more likely to remember your brand. Even if a viewer doesn't interact with the video itself, interactive video ads are 32% more memorable than linear video ads.

It delights the user

On top of the hard data points above, interactive video is simply more enjoyable than linear video. It's a great way to add a moment of delight to the user experience as your viewers explore an interactive story and learn more about your brand, all while having fun.

Check your Progress:

1. What is Information Technology?
2. What are Information services?
3. What is Electronic Bulletin Boards?
4. What is Internet?
5. What is Interactive video?
6. What is Email?

7.8. ANSWERS TO CHECK YOUR PROGRESS

1. Information technology can be broadly defined as integration of computer with telecommunication equipment for storing, retrieving, manipulating and storage of data. According to Information Technology Association of America, information technology is defined as "the study, design, development, application, implementation, support or management of computer-based information systems."
2. IS (information services) is a common name for an organization within an enterprise that is responsible for its data processing and information system or systems.
3. Electronic bulletin boards (also known as message boards or as computer forums) are online communication systems where one can share, request, or discuss information on just about any subject. E-mail is a way to converse privately with one or more people over the Internet; electronic bulletin boards are public.
4. The internet is a globally connected network system that uses TCP/IP to transmit data via various types of media. The internet is a network of global exchanges – including private, public, business,

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academic and government networks – connected by guided, wireless and fiber-optic technologies.

5. Interactive video is a new form of media many top brands are using to engage consumers and reach their digital marketing goals. While new, this media has already proven to be very effective; 70% of marketers say interactive video engages audiences “well” or “very well,” and 68% of marketers believe it will continue to become a more important component of modern marketing mixes.
6. E-mail (electronic mail) is the exchange of computer-stored messages by telecommunication. (Some publications spell it email; we prefer the currently more established spelling of e-mail.) E-mail messages are usually encoded in ASCII text. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams. Email was one of the first uses of the Internet and is still the most popular use. A large percentage of the total traffic over the Internet is e-mail. E-mail can also be exchanged between online service provider users and in networks other than the Internet, both public and private.

7.9. SUMMARY

1. The internet is a network of global exchanges – including private, public, business, academic and government networks – connected by guided, wireless and fiber-optic technologies.
2. Information technology can be broadly defined as integration of computer with telecommunication equipment for storing, retrieving, manipulating and storage of data.
3. Interactive video is a new form of media many top brands are using to engage consumers and reach their digital marketing goals.

7.10. KEYWORDS

- **Accessibility:** Email accounts are like large folders for not only private messages but also files and other important information. Good email clients make it easy to organize, archive, and search through your emails, so any information contained in an email is always readily accessible.
- **Free communication:** Unlike some forms of communication, like long distance calling and physical mail messages, most email providers give you free access to an email account. You can pick your own email address, send and receive all the electronic mail you want, and store everything online without ever paying a dime.
- **Security:** Some email services are built specifically for privacy and security, so users can be confident that messages and files are hidden from everyone but the intended recipients.
- **Internet Protocol (IP):** The internet’s primary component and communications backbone.

7.11. SELF ASSESSMENT QUESTIONS AND EXERCISES:

Short Answer questions:

1. What is Information System?
2. What is Data Management System?
3. What is Management Information Systems?
4. What is Inventory Management Systems?
5. What is MIS-GIS Integration?

Long Answer questions:

1. Explain about Information Technology and its role?
2. Explain about IS (information system or information services)?
3. What Is an Email Used For?

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7.12. FURTHER READINGS

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UNIT- VIII COMMUNICATION CHANNELS

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8.1 COMMUNICATION CHANNELS

8.1.1 Introduction

In an organization, information flows forward, backwards and sideways. This information flow is referred to as communication. Communication channels refer to the way this information flows within the organization and with other organizations.

In this web known as communication, a manager becomes a link. Decisions and directions flow upwards or downwards or sideways depending on the position of the manager in the communication web.

For example, reports from lower level manager will flow upwards. A good manager has to inspire, steer and organize his employees efficiently, and for all this, the tools in his possession are spoken and written words.

For the flow of information and for a manager to handle his employees, it is important for an effectual communication channel to be in place.

8.1.2 The Working of a Communication Channel

Through a medium of communication, be it face-to-face conversations or an inter-department memo, information is transmitted from a manager to a subordinate or vice versa.

An important element of the communication process is the feedback mechanism between the management and employees.

In this mechanism, employees inform managers that they have understood the task at hand while managers provide employees with comments and directions on employee's work.

8.1.3 Importance of a Communication Channel

A breakdown in the communication channel leads to an inefficient flow of information. Employees are unaware of what the company expects of them. They are uninformed of what is going on in the company.

This will cause them to become suspicious of motives and any changes in the company. Also without effective communication, employees become department minded rather than company minded, and this affects their decision making and productivity in the workplace.

Eventually, this harms the overall organizational objectives as well. Hence, in order for an organization to be run effectively, a good manager should be able to communicate to his/her employees what is expected of them, make sure they are fully aware of company policies and any upcoming changes.

Therefore, an effective communication channel should be implemented by managers to optimize worker productivity to ensure the smooth running of the organization.

8.1.4 Types of Communication Channels

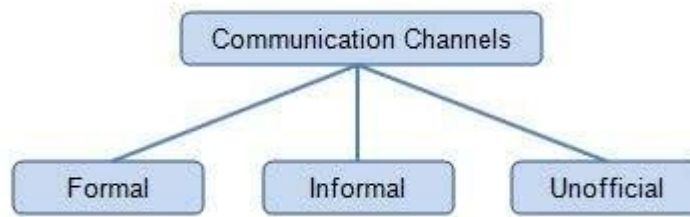
The number of communication channels available to a manager has increased over the last 20 odd years. Video conferencing, mobile technology, electronic bulletin boards and fax machines are some of the new possibilities.

As organizations grow in size, managers cannot rely on face-to-face communication alone to get their message across.

A challenge the manager's face today is to determine what type of communication channel should they opt for in order to carryout effective communication.

In order to make a manager's task easier, the types of communication channels are grouped into three main groups: formal, informal and unofficial.

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I. Formal Communication Channels

- A formal communication channel transmits information such as the goals, policies and procedures of an organization. Messages in this type of communication channel follow a chain of command. This means information flows from a manager to his subordinates and they in turn pass on the information to the next level of staff.
- An example of a formal communication channel is a company's newsletter, which gives employees as well as the clients a clear idea of a company's goals and vision. It also includes the transfer of information with regard to memoranda, reports, directions, and scheduled meetings in the chain of command.
- A business plan, customer satisfaction survey, annual reports, employer's manual, review meetings are all formal communication channels.

II. Informal Communication Channels

- Within a formal working environment, there always exists an informal communication network. The strict hierarchical web of communication cannot function efficiently on its own and hence there exists a communication channel outside of this web. While this type of communication channel may disrupt the chain of command, a good manager needs to find the fine balance between the formal and informal communication channel.
- An example of an informal communication channel is lunchtime at the organization's cafeteria/canteen. Here, in a relaxed atmosphere, discussions among employees are encouraged. Also managers walking around, adopting a hands-on approach to handling employee queries is an example of an informal communication channel.
- Quality circles, team work, different training programs are outside of the chain of command and so, fall under the category of informal communication channels.

III. Unofficial Communication Channels

- Good managers will recognize the fact that sometimes communication that takes place within an organization is interpersonal. While minutes of a meeting may be a topic of discussion among employees, sports, politics and TV shows also share the floor.

- The unofficial communication channel in an organization is the organization's 'grapevine.' It is through the grapevine that rumors circulate. Also those engaging in 'grapevine' discussions often form groups, which translate into friendships outside of the organization. While the grapevine may have positive implications, more often than not information circulating in the grapevine is exaggerated and may cause unnecessary alarm to employees. A good manager should be privy to information circulating in this unofficial communication channel and should take positive measures to prevent the flow of false information.
- An example of an unofficial communication channel is social gatherings among employees.

8.2 Advantage & Disadvantages

While old-fashioned face-to-face communication may be preferred, the fast-paced nature of some businesses makes the use of other communication channels necessary or beneficial. Your business likely uses several channels of communication for internal and external message sharing. Each channel has strengths and weaknesses that you must understand to optimize organizational communication.

Face-to-Face Communication

Face-to-face is still the preferred communication channel if clarity of message is a primary factor. Communication in person allows you to interact with the listener in a back-and-forth discussion. It also allows you to utilize nonverbal gestures, facial expressions and personal charisma to enhance the message. A drawback is the potential that a conflict could become more heated or emotional in a face-to-face channel. Tension or stress is also more likely if you have personal conflict with the other person.

Telephone Communication

Land or mobile telephones have taken up the communication slack in businesses where distance and travel prevent face-to-face conversation. The telephone still allows immediate interaction between two parties in the communication. Mobile phones also expand your ability to communicate with distant workers or offices. The lack of nonverbal or facial expressions removes those elements from the message. This can inhibit the ability to interpret the context or emotion of a message sender. The phone is also less personal than a face-to-face meeting.

E-mail Communication

E-mail is a vital communication channel in geographically dispersed companies or ones in which employees travel. E-mail allows for more flexible response times. You can send a message one day and receive a response in a few hours or the next day. It allows for conversation that isn't time-pressured, but can serve for fast turnaround times. It also allows for the inclusion of files, such as documents or images. E-mail is less personal

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than either face-to-face or phone. The missing context of the message may lead to misunderstandings or misinterpreted messages.

Discussion Forums

Many companies maintain internal discussion forums through intranet websites. These are sites with files and other resources available only to employees through personal log-ins. Internal discussion forums allow employees and managers to engage in company-wide or small-group discussions about suggestions, problems and solutions on a wide range of topics. Forums offer a low-pressure way for employees to present ideas and feedback. They allow the company to gain insights in a non-confrontational way. Lack of personal connectivity and the potential for anonymous postings are drawbacks. Similarly, delays can occur between comments and responses.

Social Media

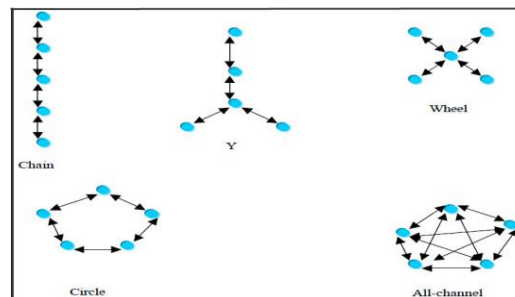
Businesses have taken advantage of social media to promote their products and services through targeted ads, interactive games, and video content that can engage audiences and drive them back to company websites. The immediacy of social media also provides businesses with valuable feedback regarding new products and services. Social media interaction, however, can be impersonal, and there is a much higher risk of miscommunication that can impact a business’s reputation. If a business fails to monitor its social media channel and doesn’t address negative comments, it can create a tidal wave of bad publicity that can take weeks or months to correct.

8.3 COMMUNICATION NETWORKS

A communication network is the pattern of directions in which information flows in the organization. Channels of communication (networks by which information flows) are either formal networks or informal networks. Formal networks follow the authority chain and are limited to task-related communications. The informal network (grapevine) is free to move in any direction, skip authority levels, and is as likely to satisfy group members' social needs as it is to facilitate task accomplishments.

8.3.1 Types of Communication Networks in Organizations

Types of Communication Networks in Organizations is shown below



Chain Network

In chain network, communication travels up and down through the hierarchy. Each person communicates with only the person directly above or below in terms of reporting relationships. The chain network rigidly follows the formal chain of command.

Y Network Communication**Y Network**

In the Y network, the flow of communication resembles an upside down Y; information flows upward and downward through the hierarchy, widening to encompass the number of employees reporting to a supervisor.

Wheel Network

In a wheel network, information flows to and from a single person. Employees in the group communicate primarily with that person rather than with each other. Such a communication network is a fast means of getting information to employees, since the person at the hub of the wheel can do so directly and efficiently. The wheel network relies on the leader to act as the central conduit (channel) for the entire group's communication.

The chain network, the Y network and the wheel network are fairly centralized in that most messages must flow through a pivotal (essential, crucial) person in the network. In the wheel network, the most centralized, all messages must flow through the individual at the centre of the wheel. In the chain network, some members can communicate with more than one member of the network, but the individual in the centre of the chain still tends to emerge as the controller of the messages. In the Y network, the member at the fork of the "Y" usually becomes the central person in the network.

Circle Network

In a circle network, employees communicate only with adjoining members of the organization. The circle network is analogous to a group working in a physical arrangement such that workers can communicate with their immediate neighbor but not with others in the group.

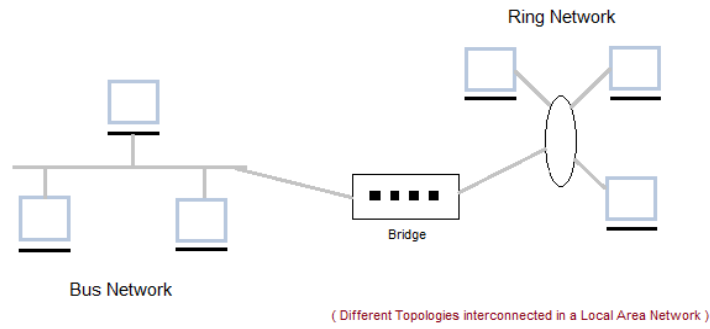
8.4 Local Area Network (LAN)

It is also called LAN and designed for small physical areas such as an office, group of buildings or a factory. LANs are used widely as it is easy to design and to troubleshoot. Personal computers and workstations are connected to each other through LANs. We can use different types of topologies through LAN, these are Star, Ring, Bus, Tree etc.

LAN can be a simple network like connecting two computers, to share files and network among each other while it can also be as complex as interconnecting an entire building.

LAN networks are also widely used to share resources like printers, shared hard-drive etc.

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8.4.1 Characteristics of LAN

- LAN's are private networks, not subject to tariffs or other regulatory controls.
- LAN's operate at relatively high speed when compared to the typical WAN.
- There are different types of Media Access Control methods in a LAN, the prominent ones are Ethernet, Token ring.
- It connects computers in a single building, block or campus, i.e. they work in a restricted geographical area.

8.4.2 Applications of LAN

- One of the computers in a network can become a server serving all the remaining computers called clients. Software can be stored on the server and it can be used by the remaining clients.
- Connecting locally all the workstations in a building to let them communicate with each other locally without any internet access.
- Sharing common resources like printers etc are some common applications of LAN.

8.4.3 Advantages of LAN

- **Resource Sharing:** Computer resources like printers, modems, DVD-ROM drives and hard disks can be shared with the help of local area networks. This reduces cost and hardware purchases.
- **Software Applications Sharing:** It is cheaper to use same software over network instead of purchasing separate licensed software for each client a network.
- **Easy and Cheap Communication:** Data and messages can easily be transferred over networked computers.
- **Centralized Data:** The data of all network users can be saved on hard disk of the server computer. This will help users to use any workstation in a network to access their data. Because data is not stored on workstations locally.

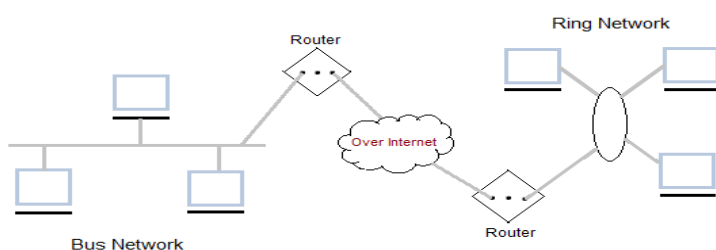
- **Data Security:** Since, data is stored on server computer centrally, it will be easy to manage data at only one place and the data will be more secure too.
- **Internet Sharing:** Local Area Network provides the facility to share a single internet connection among all the LAN users. In Net Cafes, single internet connection sharing system keeps the internet expenses cheaper.

8.4.4 Disadvantages of LAN

- **High Setup Cost:** Although the LAN will save cost over time due to shared computer resources, but the initial setup costs of installing Local Area Networks is high.
- **Privacy Violations:** The LAN administrator has the rights to check personal data files of each and every LAN user. Moreover he can check the internet history and computer use history of the LAN user.
- **Data Security Threat:** Unauthorized users can access important data of an organization if centralized data repository is not secured properly by the LAN administrator.
- **LAN Maintenance Job:** Local Area Network requires a LAN Administrator because, there are problems of software installations or hardware failures or cable disturbances in Local Area Network. A LAN Administrator is needed at this full time job.
- **Covers Limited Area:** Local Area Network covers a small area like one office, one building or a group of nearby buildings.

8.5 Wide Area Network (WAN)

It is also called WAN. WAN can be private or it can be public leased network. It is used for the network that covers large distance such as cover states of a country. It is not easy to design and maintain. Communication medium used by WAN are PSTN or Satellite links. WAN operates on low data rates.



8.5.1 Characteristics of WAN

- It generally covers large distances (states, countries, continents).
- Communication medium used are satellite, public telephone networks which are connected by routers.

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8.5.2 Advantages of WAN

- Covers a large geographical area so long distance business can connect on the one network.
- Shares software and resources with connecting workstations.
- Messages can be sent very quickly to anyone else on the network. These messages can have picture, sounds or data included with them (called attachments).
- Expensive things (such as printers or phone lines to the internet) can be shared by all the computers on the network without having to buy a different peripheral for each computer.
- Everyone on the network can use the same data. This avoids problems where some users may have older information than others.

8.5.3 Disadvantages of WAN

- Need a good firewall to restrict outsiders from entering and disrupting the network.
- Setting up a network can be an expensive, slow and complicated. The bigger the network the more expensive it is.
- Once set up, maintaining a network is a full-time job which requires network supervisors and technicians to be employed.
- Security is a real issue when many different people have the ability to use information from other computers. Protection against hackers and viruses adds more complexity and expense.

8.6 VIDEO CONFERENCING

Video conferencing is the technology by which a conference is conducted with people at multiple locations where they can see and hear each other by video and audio transmissions. It is a live conference where communication is possible in real time. It involves the exchange of video, audio and even text and images if required. It differs from videophone calls in that it can have multiple participants rather than two individuals. Now here are some of its advantages and disadvantages.

8.6.1 ADVANTAGES OF VIDEO CONFERENCING

1. LESSER TRAVELS

Video conferencing has made it easier for people who had to travel frequently for conferences. As this technology gives facility to conduct conference at the comfort of your home or office, a large number of business trips have been cut short.

2. ANYTIME CONFERENCE

There is no time constraint to conduct a video conference. It can be conducted whenever there is a requirement. Even if the members are at different parts of the world, all they have to do is login from their machines.

3. BETTER COMMUNICATION

It is possible to communicate through images, texts, audio and video in video conferencing. This gives an added advantage of better clarity of the idea being conveyed. Screen sharing is also possible in case further explanation is necessary.

4. TIME AND MONEY SAVER

As discussed above, video conferencing has reduced the need for business trips. Previously a lot of money was spent on the travel, food and accommodation. Traveling long distances just for a meeting would also mean a lot of time waste. All these have been addressed with this facility which helps you attend a meeting anywhere.

5. INCREASES PRODUCTIVITY

Fast and better communication contributes to better productivity. It creates a favorable working environment where people can conduct a conference whenever necessary. So there is no confusion about ideas since everybody can login from wherever they are and be updated.

6. INCREASED RETURN

Lesser travels and time saving would result in quick and increased return for the company. This ensures a better growth rate too.

8.6.2 DISADVANTAGES OF VIDEO CONFERENCING

1. NO PERSONAL INTERACTION

Nothing would replace a personal interaction like a smile or handshake. In business dealings it is important to win trust and respect of the other party. A video conference may prove insufficient to achieve this. It is better to meet personally in such cases.

2. TECHNICAL PROBLEMS

Working with laptops is always associated with technical problems like hardware failure, network connection issues, software issues etc. Environmental changes also affect the connectivity. It will be a loss if some problem arises at the crucial moment.

3. COSTLY SET UP

It can be costly for small companies to set up video conference in the office. There are many simple and advanced features that come with video conferencing. While the simple ones are less expensive, the advanced ones cost a little too much.

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4. MORE WORKING HOURS

Even though it is easy to conduct the conference at any time, it is practically difficult for people working in different time zones. After working the whole day in office there may be important updates to be given to the team members working in the next shift at a different location. This would mean spending the evening in conference thus making you actually work more hours than paid for.

5. DELAY IN RESPONSE

Even though participants of the conference can be from across the globe, there are some difficulties faced due to this long distance. A slight delay between responses that come from one side to the other side of the world is a common thing. You might have noticed this if you have attended international calls.

6. COVERAGE OF THE CAMERA

The entire room may not be visible to people sitting at other locations due to the lesser coverage of the camera. This becomes a problem if there are a large number of people at one location.

8.7 Relevance to MIS

Simply MIS stand For **Management Information System**. For Simply Understanding Management Information System (MIS) we can divide in to three Word and Understand Part by part

1. **Management:** - “Management is function to do the work at the Right time, by the right Person, For the Right Job.”
2. **Information:** - “Information is the Collection of Organized data which plays a Vital Role for decision making.”
3. **System:**-“System Consist for a set of elements which Provides a Framework to convert Unorganized (Data) into Organized Information.”

8.7.1 Meaning of Management Information System

Management information system refers to such system which provides accurate information to the entire level of management for decision making process. For right job at the right time, by the right person.



Management information System

Role of Management Information System

Management information system (MIS) has become Very Necessary due to Emergence of high complexity in Business Organization. It is all to know that without information no Organization can take even one step properly regarding the decision making process. Because it is matter of fact that in an organization decision plays an essential role for the achievement of its objectives and we know that every decision is based upon information. If gathered information are irrelevant than decision will also incorrect and Organization may face big loss & lots of Difficulties in Surviving as well.

- **Helps in Decision making:** - Management Information System (MIS) plays a significant Role in Decision making Process of any Organization. Because in Any organization decision is made on the basis of relevant Information and relevant information can only be Retrieving from the MSI.
- **Helps in Coordination among the Department:** - Management information System is also help in establishing a sound Relationship among the every persons of department to department through proper exchanging of Information's.
- **Helps in Finding out Problems:** - As we know that MIS provides relevant information about the every aspect of activities. Hence, If any mistake is made by the management then Management Information Systems (MIS) Information helps in Finding out the Solution of that Problem.
- **Helps in Comparison of Business Performance:** - MIS store all Past Data and information in its Database. That why management information system is very useful to compare Business organization Performance. With the help of Management information system (MIS) Organization can analyze his Performance means whatever they do last year or Previous Years and whatever business performance in this year and also measures organization Development and Growth.

8.8 Usage in Business Process

Business process management (BPM) is a systematic approach to improving those processes and it helps achieve business goals. If an organization is unable to perform certain business processes internally due to costs or resources, the company might utilize business process outsourcing (BPO). Many organizations contract specific business tasks, such as payroll, human resources (HR) or accounting, to a third-party service provider.

To measure the success of a business process, organizations track the successful completion of different steps within the process -- i.e., benchmarks -- or reaching the endpoint of the process. When a

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business process is not helping an organization reach a goal within a timeline or with the resources at hand, there are a number of strategies you can use for improvements. Organizations might focus on business process visibility to identify issues in process performance or execution.

Business process mapping provides organizations with a visual representation of how the different processes function and gives organizations better visibility into how the business works. It can also help boost the operational effectiveness of a business.

8.8.1 History and evolution

The works of economist Adam Smith, academic and author Thomas Davenport, engineer Frederick Taylor and management guru Peter Drucker have had a major influence on how organizations define and handle business processes.

Smith, the author of *The Wealth of Nations*, first recognized how the use of labor division -- dividing work into a set of tasks performed by experts -- could lead to an increase in productivity.

Taylor's innovations in industrial engineering resulted in organizational productivity improvements. He is credited with transforming the workplace with his ideas on organizing work, task fragmentation and job measurement.

Drucker -- described as the father of modern management -- focused on the simplification and decentralization of processes and introduced the concept of outsourcing.

Davenport defined the business process as a set of logically related tasks performed to achieve a defined business outcome. According to Davenport, processes make up the structure that helps organizations complete the tasks required to produce value for its customers.

Business process vs. business procedure and business function

While a business process is a series of related tasks that result in the desired output, a business procedure is a clearly stipulated way of undertaking a business process. A business procedure details teams and the people responsible for each part of the process, as well as the specifications applicable to each of these parts.

A business function is an organizational unit of a business with a specific set of responsibilities and activities that it executes to help the business carry out its overall objectives and processes.

Business processes categories

Depending on the organization, industry and nature of work, business processes are often broken up into different categories. These categories include:

Operational processes -- or primary processes: Operational or primary processes deal with the core business and value chain. These processes deliver value to the customer by helping to produce a product or service. Operational processes represent essential business activities that

accomplish business objectives, e.g., generating revenue. Some examples of this include taking customer orders and managing bank accounts.

Supporting processes -- or secondary processes: Supporting processes back core processes and functions within an organization. Examples of supporting or management processes include accounting, HR management and workplace safety. One key differentiator between operational and support processes is that support processes do not provide value to customers directly.

Management processes: Management processes measure, monitor and control the activities related to business procedures and systems. Examples of Management Processes include internal communications, governance, strategic planning, budgeting, and infrastructure or capacity management. Like supporting processes, management processes do not provide value directly to the customers.

Check your Progress:

1. What is LAN?
2. What is WAN?
3. What is Video Conferencing?
4. What are the types of communication channels?
5. What is Circle Network?

8.9. ANSWERS TO CHECK YOUR PROGRESS

1. Local Area Network is also called LAN and designed for small physical areas such as an office, group of buildings or a factory. LANs are used widely as it is easy to design and to troubleshoot. Personal computers and workstations are connected to each other through LANs. We can use different types of topologies through LAN, these are Star, Ring, Bus, Tree etc.
2. Wide Area Network is also called WAN. WAN can be private or it can be public leased network. It is used for the network that covers large distance such as cover states of a country. It is not easy to design and maintain. Communication medium used by WAN are PSTN or Satellite links. WAN operates on low data rates.
3. Video conferencing is the technology by which a conference is conducted with people at multiple locations where they can see and hear each other by video and audio transmissions. It is a live conference where communication is possible in real time. It involves the exchange of video, audio and even text and images if required. It differs from videophone calls in that it can have multiple participants rather than two individuals.
4. Communication channels refer to the way this information flows within the organization and with other organizations. In this web known as communication, a manager becomes a link. Decisions and directions flow upwards or downwards or sideways depending on the position of the manager in the communication web. the types of communication channels are grouped into three main groups: formal, informal and unofficial.

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5. In a circle network, employees communicate only with adjoining members of the organization. The circle network is analogous to a group working in a physical arrangement such that workers can communicate with their immediate neighbour but not with others in the group.

8.10. SUMMARY

- In an organization, information flows forward, backwards and sideways. This information flow is referred to as communication. Communication channels refer to the way this information flows within the organization and with other organizations.
- A breakdown in the communication channel leads to an inefficient flow of information. Employees are unaware of what the company expects of them. They are uninformed of what is going on in the company.
- A formal communication channel transmits information such as the goals, policies and procedures of an organization. Messages in this type of communication channel follow a chain of command. This means information flows from a manager to his subordinates and they in turn pass on the information to the next level of staff.
- E-mail is a vital communication channel in geographically dispersed companies or ones in which employees travel. E-mail allows for more flexible response times.

8.11. KEYWORDS

- **Y Network:** the flow of communication resembles an upside-down Y; information flows upward and downward through the hierarchy, widening to encompass the number of employees reporting to a supervisor.
- **Wheel Network:** In a wheel network, information flows to and from a single person. Employees in the group communicate primarily with that person rather than with each other. Such a communication network is a fast means of getting information to employees, since the person at the hub of the wheel can do so directly and efficiently.
- **Circle Network:** In a circle network, employees communicate only with adjoining members of the organization. The circle network is analogous to a group working in a physical arrangement such that workers can communicate with their immediate neighbour but not with others in the group.
- **Drucker:** described as the father of modern management -- focused on the simplification and decentralization of processes and introduced the concept of outsourcing.

8.12. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. Explain shortly about the Characteristics of LAN
2. Write short note on application of LAN.
3. Write short note on WAN.
4. What is Management Process?
5. What is usage of Business Process?

Long Answer questions:

1. Explain briefly about the Advantages and Disadvantages of The Different Types of Communication Channels?
2. Explain and illustrate the Types of Communication Network in Organization?
3. Explain the advantages and Disadvantages of LAN?

8.13. FURTHER READINGS

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UNIT- IX FUNCTIONAL INFORMATION SYSTEMS

- 9.1 Introduction
- 9.2 MIS for research production
 - 9.2.1 Characteristics of Production Information System
- 9.3 MIS for Marketing
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9.1 Introduction:

A **management information system (MIS)** is an information system used for decision-making, and for the coordination, control, analysis, and visualization of information in an organization.

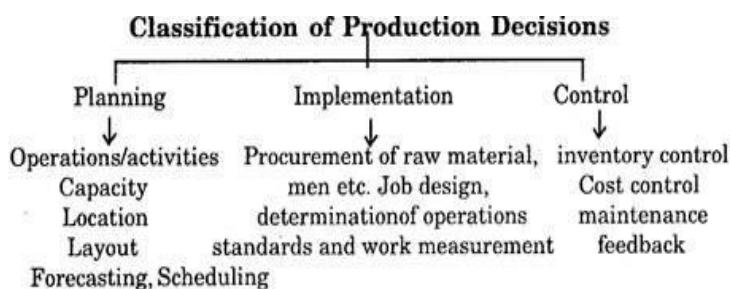
The study of management information systems examines people, processes and technology in an organizational context.

The following are some of the benefits that can be attained using MIS:

- Improve an organization's operational efficiency, add value to existing products, engender innovation and new product development, and help managers make better decisions Companies are able to identify their strengths and weaknesses due to the presence of revenue reports, employees' performance record etc. Identifying these aspects can help a company improve its business processes and operations.
- Giving an overall picture of the company.
- Acting as a communication and planning tool.
- The availability of customer data and feedback can help the company to align its business processes according to the needs of its customers. The effective management of customer data can help the company to perform direct marketing and promotion activities.
- MIS can help a company gain a competitive advantage.
- MIS reports can help with decision-making as well as reduce downtime for actionable items. MIS system advantages heavily outweigh the disadvantages:
- Retrieval and dissemination is dependent on technology hardware and software.

9.2 MIS for Research Production:

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



Production information system is a network to generate necessary information and process it to make various decisions related to some production system. It consists of communication channels and information processing centers collecting information from its sources of origin, storing, updating, collating and processing it and then supplying the processed information to the various users of the system.

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

9.2.1 Characteristics of Production Information System:

1. It should always be tailored to the need of a particular Organisation. It can never be specific or general.
2. The involvement of top management in the formulation of production information system is essential.
3. Data base should be wide.
4. It must be flexible and should be supplied timely.
5. Data should be capable of easy interpretation & presentation.
6. The cost of procuring the information must not over-ride the relative advantage accrued.

9.3 MIS for Marketing

A set of efficient procedures and techniques that help organization to collect, evaluate, sort and generate reports for making effective marketing

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decisions. It helps to provide an organized flow of information and support marketing activities of an organization.

Market Intelligence- It represents information that flows into the firm from the environment.

Internal Marketing information- It is information that is gathered within the firm.

Marketing Communications- It is information that flows from the firm outward to the environment.

Types of Information

Recurrent: Information required by an organization on day-to-day basis. Customer expectations, changing needs and market share of the product

Monitoring: Market-related information collected by scanning information sources on a regular basis such as Magazines, articles, government reports, annual reports

Requested: Such information generates in response to explicit request by marketing department. For example Competition strategies and market share.

Marketing information system can be defined as a computer based system that works in conjunction with other functional information systems to support the firm's management in solving problems that relate to marketing the firm's products. During the period of 1967-1974, no fewer than five models of MKISs were described in the literature. Brien and Stafford were among the first modelers, basing their design on four Ps and emphasizing the development of strategic marketing programs. King and Cleland stressed strategic planning; whereas Kotler, Montgomery and Urban, and Crissy and Mossman emphasized decision support. These modeling efforts began in the 1960s and continued into the 1970s, laying a strong theoretical foundation for functional information systems that followed in the all areas.

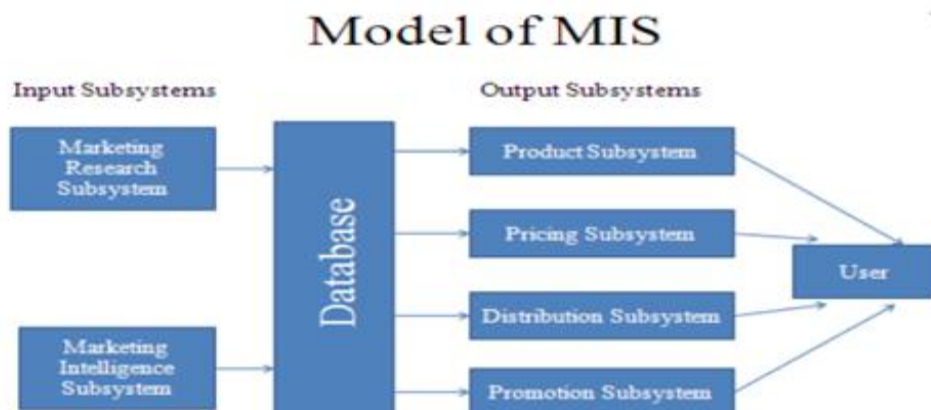
Marketing Information System Model- It consists of a combination of input and output subsystems connected by a database.

Input Subsystems- The marketing research subsystem conducts special studies of marketing operations for the purpose of learning customer needs and improving marketing efficiency. Marketing intelligence subsystem gathers information from the firm's environment that has a bearing on marketing operations.

Marketing Research Subsystem- In this subsystem a systematic gathering, recording and analyzing data relevant to marketing of goods and services takes place. Data can be collected from internal sources, government publications, periodicals and books, marketing research agencies and conducting field research, both primary data and secondary data collected for the purpose.

Marketing Intelligence Subsystem- It is a Set of procedures and sources used by managers to obtain everyday information about development in marketing environment. By reading books, trade publications, business newspapers: talking to customers, suppliers and distributors. The term marketing intelligence may bring to mind visions of one firm spying on other- industrial espionage. There is really no reason to

break the law to obtain the information, because it is so easy to obtain legally



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Database- The data used by the output subsystems come from the database. Some of the data in the database is unique to the marketing functions, but much is shared with other functional Areas.

Output Subsystems- Each output subsystem provides information about its part of mix.

Product Sub System- To assess whether different products or product lines are contributing to objectives of organization; SFA: Sales force automation software provides information relating to performance of each product. Market segmentation and Product positioning related information are also provided by product subsystem.

Pricing Sub System- Information related to Price fixation, Value for money, Competitors' price, Cost plus price, Price change, upward revision and downward revision are part of pricing subsystem.

Distribution Sub System- Identification of channels, Evaluation of channels and Channel selection related important information is provided by this subsystem.

Promotion Sub System- Promotion mix (Advertising, Sales promotion and Personal selling) and Promotion budget related information could be obtained through this output subsystem.

Integrated-Mix Subsystem- The integrated mix subsystem supports the manager as the ingredients of the marketing mix are combined to form a particular strategy. This goal is accomplished by projecting the possible outcomes of various mixes. Descriptions of integrated mix subsystems in the literature are rare. The integrated mix model receiving the most publicity is BRANDAID, developed by MIT professor John D.C. Little. BRANDAID includes sub models for advertising, promotion, price, personal selling and retail distribution. The basic approach of this model is to estimate the effect of various influences on the manufacturer's sale.

9.4 MIS for Personnel

Human resources MIS is concerned with managing all the information related to employees of the organization, including previous, current and potential employees. It is also called a **personnel MIS**.

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Different terms used to denote personnel management. They are: labor management, labour administration, labour management relations, employee-employer relations, Industrial relations, Personnel administration, Personnel management, human capital management, human asset management, human resource management and the like. Though these terms can be differentiated widely, the basic distinction lies in the scope or coverage and evolutionary stage. In simple sense; human resource management means employing people, developing them, utilizing, maintaining and compensating their services in tune with the job and organizational requirements.

Personnel management as defined by the institute if personnel management in UK and subsequently adopted by Indian Institute of Personnel management is as follows. "Personnel management is a responsibility of all those who manage people as well as being a description of the work of those who are employed as specialists. It is that part of management which is concerned with people at work and with their relationship within an enterprise. It applies not only to industry and commerce but to all fields of employment"

Recruitment:

It is the activity of selecting the right people for the right job. A selection process is used to select right kind of people from a multitude of interest's people, for a job in the organization. The recruitment activity is a regular activity in an organization, as the organization being growing entity requires more and more people to run its business and also because people leave an organization for various reason. This loss of personal is collectively called attrition. Recruitment is the process to neutralize this attrition effect t and ensure that there are enough people to manage the growth activities of the organization. →**Training and Development:**

It is the activity, which involves the development of employees in terms of skills, personality, behavior etc. this activity is an ongoing activity within an organization, as most organization believe in an continuous improvement and in order to improve the constantly, training is essential. Some organization considers this activity is not very important. However most good companies take this activity very seriously as it holds the key to developing human capital of an organization, which in turn results in improved performance of the organization.

Compensation and Benefits management:

This activity is required to fix the compensation and benefits of employees, so that the employees are satisfied in terms of salary and benefits. This is very crucial activity, as many things have to be taken into consideration in order to do justice this kind of work. Issues like seniority, fairness, performance etc. are very important in conducting this activity properly.

Performance Management:

This is primarily controlling activity. It is required to understand the level of performance of the employees in an organization. The lesser performing employees are normally put through the training process and the high performance employees are rewarded so that they feel good and continue to serve the organization in future with the same performance.

Human Resource Information System

Human Resource MIS helps managers to administrator the HR of the organizations in an improved manner. HR MIS sometimes called HRIS, is an integrated stream and has the following modules: **Recruitment Subsystem:**

It has already been explained earlier that recruitment is a regular activity in an organization and involves the selection of suitable people for suitable job. Recruitment activity tends to increase with the expansion of the organization. It is an ongoing process because people leave an organization for various reasons. Therefore as mentioned earlier, recruitment neutralizes the effect of attrition and ensures that sufficient staff is always present to handle the growth activities of the organization.

Training and Development Subsystem : HRIS helps the ongoing training and development activities in organization by giving a detailed information about the training need of employees, trainer details, training modules and content etc, to help the HR department take improved training and development-related decision.

Compensation and Benefits Management Subsystem: Compensation management involves fixing compensation and benefits of employees to ensure that the employees are satisfied in terms of the remuneration they receive and the facilities and benefits they are provided. Compensation-related decisions depend on issues such as performance, seniority, fairness etc. HRIS provide information on current market rates for the type of skill and competence that an individual possesses to help managers take a decision on compensation. Other related information like pay parity information of similar ranking people in the organization, the historical compensation structure of the organizations are also available in the HRIS to help the HR department in deciding compensation packages.

Performance Management Subsystem: As discussed earlier, performance management is a controlling activity wherein the weak performers are recommended for training and the strong performers are appropriate rewarded.

9.5 MIS for Finance

Cash flow management is an important use of **MIS in Finance**. Cash Management refers to the control, monitoring and forecasting of cash for **financing** needs. Use of **MIS in Finance** helps companies track the flow of cash through accounts receivable and accounts payable accurately.

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

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General Ledger

The main use of a management information System (MIS) in finance is that it automatically updates all the transactions in the General Ledger. The General Ledger is the core component of all financial information systems. Financial transactions are simultaneously posted on the various accounts that comprise the organization's "Chart of Accounts". Simultaneous updating of accounts such as sales, inventory and accounts receivable, reduces errors. It also provides an accurate and permanent record of all historical transactions.

Cash Management

Cash flow management is an important use of MIS in Finance. Cash Management refers to the control, monitoring and forecasting of cash for financing needs. Use of MIS in Finance helps companies track the flow of cash through accounts receivable and accounts payable accurately. Accurate records also help in monitoring cost of goods sold. This can help pin point areas that eat up cash flow such as inventory costs, high raw material costs or unreliable sales.

Budget Planning

Financial budget planning uses proforma or projected financial statements that serve as as formal documents of management's expectations regarding sales, expenses and other financial transactions. Thus financial budgets are tools used both for planning as well as control. MIS in finance helps organizations evaluate "what if" scenarios. By modifying the financial ratios, management can foresee the effects of various scenarios on the financial statements. MIS thus serves as a decision making tool, helping in choosing appropriate financial goals.

Financial Reporting

The use of MIS systems in Finance enables companies to generate multiple financial reports accurately and consistently. Generation of financial statements both for internal reports as well as for shareholder information takes less effort because of the automatic updating of the General Ledger. Compliance with Government regulations as well as auditing requirements is also easier because the records are accurate and provide a permanent historical map of transactions that can be verified.

Financial Modeling

A financial model is a system that incorporates mathematics, logic and data in the form of a large database. The model is used to manipulate the financial variables that affect earnings thus enabling planners to view the implications of their planning decisions. MIS in Finance enables organizations to store a large amount of data. This helps managers develop accurate models of the external environment and thus incorporate realistic "what if" scenarios into their long-range planning goals.

Advantages of FMIS

There are many advantages of implementing an FMIS. A few of them are listed below:

- Integrated financial information
- Flexibility of reporting and additional control over expenditure
- Less administration required within the business

9.6 MIS for inventory

An inventory management system is a tool that allows you to track goods across your business's supply chain. It optimizes the entire spectrum spanning from order placement with your vendor to order delivery to your customer, mapping the complete journey of a product.

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9.6.1 Inventory management software features

The software you choose (in addition to any bells and whistles) should offer all the features that are essential for effective inventory management operations.

Here's a quick overview of what to look out for:

Barcode scanning: Easily identify and track your products; inventory management software integrates with barcode scanners for instant product identification and labeling.

Inventory optimization: Maintain just the right amount of inventory for each product, without over- or under-stocking any item. It's especially useful if you deal in products that experience a seasonal rise and fall in demand.

Stock notifications: Receive alerts and notifications when there's over- or under-stocking beyond a defined threshold. This helps you to place orders or offer promotional discounts to clear out extra stock.

Report generation: View sales history in the form of a list of your most popular products. This feature also enables you to manage items in your inventory that have not reached the sales levels you expected, for example, by offering discounts on them.

Multiplication management: Manage multiple warehouses and points-of-sale (POS). All locations can be integrated within a single inventory management system.

Stock returns handling: Manage returns more effectively by reducing time-to-return through automation of the entire process.

Material grouping: Group inventory into predefined categories and ensure you're always updated about quantities of components and specifications that make up your product stock, and manage their reordering schedules as required.

Purchase order records: Create a single view of purchase order records. You can easily identify which products are in demand, both perpetually and seasonally, and prepare to meet your customers' needs.

Role of MIS in an Inventory System

A management information system organizes all company data in a computerized database. As a business owner, you can retrieve data from all

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sections of your company including sales, manufacturing and inventory to see how efficiently each department is operating. This can tell you how well your inventory system works with manufacturing and sales.

Reports on Inventory Costs

Your management information system can tie your inventory costs to sales. In other words, each unit that sells can have a price assigned to it that is based on what you paid for it. This tells you if your purchase prices for inventory are leaving you enough room for profit.

Reports on Inventory Levels

You can monitor your inventory levels with a management information system by asking the database for reports from manufacturing or purchasing, inventory and sales. This will show you how quickly products move through your company. If you discover that products sit in your warehouse for extended periods, you know you need to find ways to move them, either through putting them on sale or advertising them to your customers.

Value of Inventory

The value of your inventory is not what you paid for it. It's what you could sell it for. A management information system can calculate the sales value of your existing inventory. This counts as an asset for your company, and this figure can be useful when determining what you can offer as collateral for a loan.

Increasing Your Inventory Levels

A management information system can show you an increase in sales because it monitors sales on a daily basis. If you see an upward trend, you can stock up on items that sell faster than other items.

9.7 MIS for Logistics

A logistics management information system (LMIS) is a system of records and reports – whether paper-based or electronic – used to aggregate, analyze, validate and display data (from all levels of the logistics system) that can be used to make logistics decisions and manage the supply chain.

LMIS data elements include stock on hand, losses and adjustments, consumption, demand, issues, shipment status, and information about the cost of commodities managed in the system.

LMIS in the supply chain

Links the different levels in the system through information. Provides information each needs to perform their supply chain role.

Common challenges:

Poor recordkeeping: incomplete or not updated stock and consumption records

Poor reporting: late, incomplete and poor quality reports

Data not moving up or down the system: facilities not submitting to districts, districts not sending reports to central, central not providing feedback to districts and facilities

Data not used for decision making

Open LMIS

Specific objectives are to:

Provide a repository of tools, product and project assessments, and other information to promote a collaborative approach for LMIS solutions;

Encourage the reuse of proven components and methods;

Encourage the use of international standards in supply chain and health informatics;

Encourage seamless interoperability and flow of information between supply chain layers;

Create LMIS applications that are integrated with other health information system domains; and

Improve critical decision-making in order to address the dynamic health service requirements of low-income communities.

9.8 MIS for Product Development

Product development is the process of building products that will be consumed or used by others. Product managers often work collaboratively with engineers, designers, and other stakeholders to accomplish tasks, such as:

- Testing products
- Identifying new product candidates
- Considering new candidates
- Gathering the voice of customers
- Defining product requirements
- Determining business-case and feasibility
- Scoping and defining new products at high level
- Evangelizing new products within the company
- Building product roadmaps, particularly technology roadmaps
- Developing all products on schedule, working to a critical path
- Ensuring products are within optimal price margins and up to specifications
- Ensuring products are manufacturable and optimizing cost of components and procedures.

9.9 MIS for Market Development

A marketing information system (MKIS) is a management information system (MIS) designed to support marketing decision making. Jobber (2007) defines it as a "system in which marketing data is formally gathered, stored, analyzed and distributed to managers in accordance with their informational needs on a regular basis." In addition, the online business dictionary defines Marketing Information System (MKIS) as "a

Notes

system that analyzes and assesses marketing information, gathered continuously from sources inside and outside an organization or a store. Furthermore, "an overall Marketing Information System can be defined as a set structure of procedures and methods for the regular, planned collection, analysis and presentation of information for use in making marketing decisions.

Marketing Information System (MIS) is a permanent arrangement (system or setup) for provision of regular availability of relevant, reliable, adequate, and timely information for making marketing decisions.

Information is like a life-blood of business. Quality of decisions depends on the right type of information. The right information implies the right quality, the right quantity, and the right timing of information. Circulation of needed information is as important as the circulation of blood in human being.

Information keeps the organization actively functioning, alive, and connected with internal and external marketing participants. It is a valuable asset for a firm as it is a base to manage other valuable assets. The firm fails to manage information (i.e., collecting, analyzing, interpreting, storing, and disseminating of information) will definitely fail to attain goals.

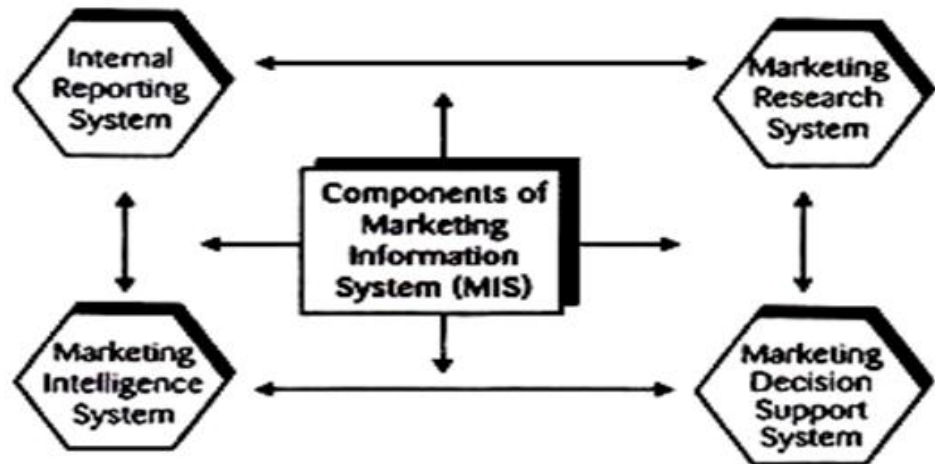


Figure 9.2: Components of Marketing Information System.

Consumer Databases in Market Research

Researchers keep consumer databases up-to-date with as much available data as possible regarding consumer behavior and product consumption. This customer information oftentimes includes, but is not limited to, a variety of data, including name and address, history of shopping and purchases, demographics, and brand and product consumption. When companies want to conduct consumer market research, they call on these research facilities to request consumers who fit a specific demographic and behavioral profile so that these prospective respondents can then be contacted to participate in research studies.

Companies may also acquire prospect data directly through the use of sweepstakes, contests, online registrations, and other lead generation activities.

Check your Progress:

1. What is an MIS?
2. What is MIS for Finance?
3. What are Advantages of FMIS?
4. What are The Role of MIS in an Inventory System?
5. What is MIS for Logistics?

Notes

9.10 ANSWERS TO CHECK YOUR PROGRESS:

1. A **management information system (MIS)** is an information system used for decision-making, and for the coordination, control, analysis, and visualization of information in an organization. The study of management information systems examines people, processes and technology in an organizational context.

2. Cash flow management is an important use of **MIS in Finance**. Cash Management refers to the control, monitoring and forecasting of cash for **financing** needs. Use of **MIS in Finance** helps companies track the flow of cash through accounts receivable and accounts payable accurately. **Management Information Systems (MIS) in Finance** have been widely adopted both by corporations as well as governments.

3. There are many advantages of implementing an FMIS. A few of them are listed below:

- Integrated financial information
- Flexibility of reporting and additional control over expenditure
- Less administration required within the business

4. A management information system organizes all company data in a computerized database. As a business owner, you can retrieve data from all sections of your company including sales, manufacturing and inventory to see how efficiently each department is operating. This can tell you how well your inventory system works with manufacturing and sales.

5. A logistics management information system (LMIS) is a system of records and reports – whether paper-based or electronic – used to aggregate, analyses, validate and display data (from all levels of the logistics system) that can be used to make logistics decisions and manage the supply chain.

9.11 SUMMARY:

- A management information system (MIS) is an information system used for **decision-making**, and for the coordination, control, analysis, and visualization of information in an organization.
- Marketing Information System Model consists of a combination of input and output subsystems connected by a database.
- The data used by the output subsystems come from the database. Some of the data in the database is unique to the marketing functions, but much is shared with other functional Ares.

- Human resources **MIS** is concerned with managing all the information related to employees of the organization, including previous, current and potential employees. It is also called a **personnel MIS**.

9.12 KEYWORDS:

- **Poor recordkeeping:** incomplete or not updated stock and consumption records
- **Poor reporting:** late, incomplete and poor-quality reports. Data not moving up or down the system: facilities not submitting to districts, districts not sending reports to central, central not providing feedback to districts and facilities. Data not used for decision making.
- **Inventory optimization:** Maintain just the right amount of inventory for each product, without over- or under-stocking any item. It's especially useful if you deal in products that experience a seasonal rise and fall in demand.
- **Material grouping:** Group inventory into predefined categories and ensure you're always updated about quantities of components and specifications that make up your product stock, and manage their reordering schedules as required.
- **Distribution Sub System:** Identification of channels, Evaluation of channels and Channel selection related important information is provided by this subsystem.

9.13 SELF ASSESSMENT QUESTIONS AND EXERCISES:

Short Answer questions:

1. What is MIS for Research Production?
2. What is Characteristics of Production Information System?
3. What is MIS for Marketing?
4. What is Marketing Intelligence Subsystem?
5. What is MIS for Personnel?

Long Answer questions:

1. Explain briefly about MIS?
2. Explain briefly about Model of MIS for Marketing?
3. Explain about MIS for Personnel?

9.14. FURTHER READINGS

1. Ahituv, N. and S. Neumann. 1990. Principles of Information Systems for Management. Dubuque: Wm. C. Brown Publishers.
2. Curry, A., P. Flett and F. Hollingsworth. 2006. Managing Information and Systems: The Business Perspective. Oxford: Routledge.
3. Haag, S., M. Cummings and D.J. McCubbrey. 2004. Management Information Systems for the Information Age. New Delhi: Tata McGraw-Hill.
4. Madnick, S.E. (ed). 1987. The Strategic Use of Information Technology. New York: Oxford University Press.

Notes

UNIT - X CLIENT/SERVER COMPUTING

Notes

- 10.1 Client / Server Computing
 - 10.1.1 Characteristics of Client Server Computing
 - 10.1.2 Difference between Client Server Computing and Peer to Peer Computing
 - 10.1.3 Advantages of Client Server Computing
 - 10.1.4 Disadvantages of Client Server Computing
- 10.2 Communication Servers
- 10.3 Digital Networks
 - 10.3.1 Local Area Network
 - 10.3.2 Wide Area Network
 - 10.3.3 The Digital Networking Process
- 10.4 Electronic Data Interchange and Its Applications
 - 10.4.1 EDI Documents
 - 10.4.2 Steps in an EDI System
 - 10.4.3 Advantages of an EDI System
- 10.5 Enterprise Resource Planning System
 - 10.5.1 ERP is an Enterprise Application
- 10.6 Inter-Organizational information Systems
 - 10.6.1 Inter-Organisational Information Systems Process Integration and Functions.
- 10.7 Value added Networks
- 10.8 Networks
- 10.9 Answers to Check Your Progress
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- 10.11 Keywords
- 10.12 Self-Assessment Questions and Exercises
- 10.13 Further Readings

10.1 CLIENT/SERVER COMPUTING

Client/server computing, a server takes requests from client computers and shares its resources, applications and/or data with one or more client computers on the network, and a client is a computing device that initiates contact with a server in order to make use of a shareable resource.

10.1.1 Characteristics of Client Server Computing

The salient points for client server computing are as follows:

An example of a client server computing system is a web server. It returns the web pages to the clients that requested them.

The client server computing works with a system of request and response. The client sends a request to the server and the server responds with the desired information. The client and server should follow a common communication protocol so they can easily interact with each other. All the communication protocols are available at the application layer.

- ✓ A server can only accommodate a limited number of client requests at a time. So it uses a system based to priority to respond to the requests.
- ✓ Denial of Service attacks hinder server's ability to respond to authentic client requests by inundating it with false requests.

Notes**10.1.2 Difference between Client Server Computing and Peer to Peer Computing**

The major differences between client server computing and peer to peer computing are as follows:

- ✓ In client server computing, a server is a central node that services many client nodes. On the other hand, in a peer to peer system, the nodes collectively use their resources and communicate with each other.
- ✓ In client server computing the server is the one that communicates with the other nodes. In peer to peer to computing, all the nodes are equal and share data with each other directly.
- ✓ Client Server computing is believed to be a subcategory of the peer to peer computing.

10.1.3 Advantages of Client Server Computing

The different advantages of client server computing are:

- ✓ All the required data is concentrated in a single place i.e. the server. So it is easy to protect the data and provide authorization and authentication.
- ✓ The server need not be located physically close to the clients. Yet the data can be accessed efficiently.
- ✓ It is easy to replace, upgrade or relocate the nodes in the client server model because all the nodes are independent and request data only from the server.
- ✓ All the nodes i.e. clients and server may not be built on similar platforms yet they can easily facilitate the transfer of data.

10.1.4 Disadvantages of Client Server Computing

The different disadvantages of client server computing are:

- ✓ If all the clients simultaneously request data from the server, it may get overloaded. This may lead to congestion in the network.
- ✓ If the server fails for any reason, then none of the requests of the clients can be fulfilled. This leads of failure of the client server network.
- ✓ The cost of setting and maintaining a client server model are quite high.

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10.2 COMMUNICATION SERVERS

Maintains an environment needed for one communication endpoint (user or devices) to find other endpoints and communicate with them. It may or may not include a directory of communication endpoints and a presence detection service, depending on the openness and security parameters of the network

A communications server is the foundation for equipment vendors or suppliers that build the network infrastructure used to deploy communication systems, such as wireless, broadband or IP-multimedia. The communications and IT industries are strong supporters of communications servers.

Communications servers include the following primary characteristics:

- **Flexibility:** Communications server architecture is scalable, multilevel, and highly flexible, is designed to easily support added values at any level and has multiple server repurposing options.
- **Openness:** Communications servers are based on industry standards. Different tools and services may be further integrated on an as-needed basis.
- **Carrier Grade:** Communications server upgrades and updates are non-disruptive. Each associated system aspect and feature follows and fulfils network-building regulations.

A communication server is a dedicated system that provides communication services for users on a network who need to transfer files or access information on systems or networks at remote locations over telecommunication links. The communication server provides communication channels for one or more users simultaneously, depending on the software and the hardware capabilities. Communication servers may provide one or more of the following functions:

- **Gateway functions** These provide users with connections to host computers by translating between data formats, communication protocols, and cable signals.
- **Modems** Communication servers provide banks of modems that internal users access for dial-out sessions or remote users access for dial-in sessions.
- **Access services** These enable remote users to dial into the network from their home or other remote locations and obtain "remote node" or "remote control" access. With the remote node method, all processing takes place at the remote workstation. With the remote control method, the user connects to a dedicated workstation on the LAN (local area network) and all processing takes place at the LAN-attached dedicated workstation.
- **Bridge and router functions** A communication server with these features maintains a dedicated or dial-up (intermittent) link with

remote LANs and automatically transfers data packets between the LANs as necessary.

- **Electronic mail servers** these automatically connect with other LANs or electronic "post offices" to pick up and deliver e-mail. The systems may call at timed intervals or whenever there is enough outgoing mail to make the call worthwhile.

10.3 DIGITAL NETWORKS

In recent decades, man has invented newer means through which can communicate, meet new people, and build relationships. There are now over 1 billion of us using WhatsApp on a daily basis alone. We have created digital technologies which enable us to overcome great distance whilst connecting with others in real time, and expanded the reach of our networks beyond the confines of our immediate environment. Our modern worlds have effectively become larger, not smaller; interacting with more and more people, and with that, finding new and undiscovered relationships, beliefs, cultures, challenges and opportunity. While we can appreciate there has always been many benefits to effective networking, our ability to master effective digital networking can take these benefits and opportunities to another level.

Effective networking can provide us all with an abundance of opportunities all enabled through building meaningful relationships with others, from opportunities for personal and professional growth to commercial success.

Now, by leveraging the power of our networks through digital technology, we can further discover, build, support and manage the relationships which create these opportunities more flexibly and at greater scale. In short, taking our networking activity online can help create more of these opportunities - more learning, more growth, and more success.

Two very common types of networks include:

- **Local Area Network (LAN)**
- **Wide Area Network (WAN)**

10.3.1 Local Area Network

- A Local Area Network (LAN) is a network that is confined to a relatively small area. It is generally limited to a geographic area such as a writing lab, school, or building.
- Computers connected to a network are broadly categorized as servers or workstations. Servers are generally not used by humans directly, but rather run continuously to provide "services" to the other computers (and their human users) on the network. Services provided can include printing and faxing, software hosting, file storage and sharing, messaging, data storage and retrieval, complete access control (security) for the network's resources, and many others.
- Workstations are called such because they typically do have a human user which interacts with the network through them.

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Workstations were traditionally considered a desktop, consisting of a computer, keyboard, display, and mouse, or a laptop, with integrated keyboard, display, and touchpad. With the advent of the tablet computer, and the touch screen devices such as iPad and iPhone, our definition of workstation is quickly evolving to include those devices, because of their ability to interact with the network and utilize network services.

- Servers tend to be more powerful than workstations, although configurations are guided by needs. For example, a group of servers might be located in a secure area, away from humans, and only accessed through the network. In such cases, it would be common for the servers to operate without a dedicated display or keyboard. However, the size and speed of the server's processor(s), hard drive, and main memory might add dramatically to the cost of the system. On the other hand, a workstation might not need as much storage or working memory but might require an expensive display to accommodate the needs of its user. Every computer on a network should be appropriately configured for its use.
- On a single LAN, computers and servers may be connected by cables or wirelessly. Wireless access to a wired network is made possible by wireless access points (WAPs). These WAP devices provide a bridge between computers and networks. A typical WAP might have the theoretical capacity to connect hundreds or even thousands of wireless users to a network, although practical capacity might be far less.
- Nearly always servers will be connected by cables to the network, because the cable connections remain the fastest. Workstations which are stationary (desktops) are also usually connected by a cable to the network, although the cost of wireless adapters has dropped to the point that, when installing workstations in an existing facility with inadequate wiring, it can be easier and less expensive to use wireless for a desktop.
- See the Topology, Cabling, and Hardware sections of this tutorial for more information on the configuration of a LAN.

10.3.2 Wide Area Network

- Wide Area Networks (WANs) connect networks in larger geographic areas, such as Florida, the United States, or the world. Dedicated transoceanic cabling or satellite uplinks may be used to connect this type of global network.
- Using a WAN, schools in Florida can communicate with places like Tokyo in a matter of seconds, without paying enormous phone bills. Two users a half-world apart with workstations equipped with microphones and a webcam might teleconference in real time. A WAN is complicated. It uses multiplexers, bridges, and routers to connect local and metropolitan networks to global communications

networks like the Internet. To users, however, a WAN will not appear to be much different than a LAN.

10.3.3 The Digital Networking Process

The art of digital networking' can often seem quite broad and unending. In order to better understand the key steps or action involved in effective digital networking, we have broken the process into 4 key activity stages; discover, build, support & manage.

Discover: Identifying new prospective contacts who can add value to your network and instigating 2-way interaction with them online.

Build: Developing interactions with newer members of your network to better understand their personality, background, interests and more in order to drive rapport at a personal level.

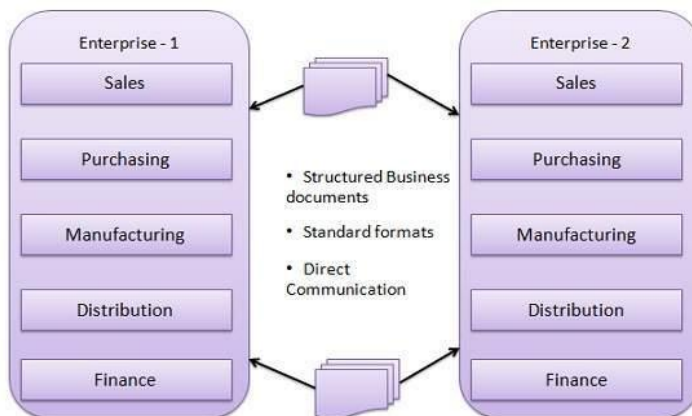
Support: Maintaining positive rapport through continued regular interaction and sharing in line with each party's social relationship expectations.

Manage: Developing and organizing an effective communication cadence for supporting existing relationships and simultaneously expanding your network.

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10.4 ELECTRONIC DATA INTERCHANGE AND ITS APPLICATIONS

Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.



10.4.1 EDI Documents

Following are the few important documents used in EDI –

- Invoices
- Purchase orders

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- Shipping Requests
- Acknowledgement
- Business Correspondence letters
- Financial information letters

10.4.2 Steps in an EDI System

Following are the steps in an EDI System.

- A program generates a file that contains the processed document.
- The document is converted into an agreed standard format.
- The file containing the document is sent electronically on the network.
- The trading partner receives the file.
- An acknowledgement document is generated and sent to the originating organization.

10.4.3 Advantages of an EDI System

Following are the advantages of having an EDI system.

- **Reduction in data entry errors.** – Chances of errors are much less while using a computer for data entry.
- **Shorter processing life cycle** – Orders can be processed as soon as they are entered into the system. It reduces the processing time of the transfer documents.
- **Electronic form of data** – It is quite easy to transfer or share the data, as it is present in electronic format.
- **Reduction in paperwork** – As a lot of paper documents are replaced with electronic documents, there is a huge reduction in paperwork.
- **Cost Effective** – As time is saved and orders are processed very effectively, EDI proves to be highly cost effective.
- **Standard Means of communication** – EDI enforces standards on the content of data and its format which leads to clearer communication.

10.5 ENTERPRISE RESOURCE PLANNING SYSTEMS (ERP Systems)

Enterprise resource planning(ERP) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.

ERP software typically integrates all facets of an operation — including product planning, development, manufacturing, sales and marketing — in a single database, application and user interface.

10.5.1 ERP is an Enterprise Application

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ERP software is considered to be a type of enterprise application, that is software designed to be used by larger businesses and often requires dedicated teams to customize and analyze the data and to handle upgrades and deployment. In contrast, Small business ERP applications are lightweight business management software solutions, often customized for a specific business industry or vertical.

Today most organizations implement ERP systems to replace legacy software or to incorporate ERP applications because no system currently exists. In fact, a 2016 study by Panorama Consulting Solutions, LLC., indicates that organizations implement ERP for the following reasons:

- To replace out-of-date ERP software (49%)
- To replace homegrown systems (16%)
- To replace accounting software (15%)
- To replace other non-ERP systems / had no system (20%)

Top ERP Systems

Company	Description	Features	Pricing
Netsuite ERP	Market-leading cloud EPR solution. Modern and scalable implementation across all critical back office functions.	Accounting, Inventory Management, Reporting & Analytics, Functionality across enterprises of all sizes.	Starting at \$999/month
SAP ERP	Trusted EPR provider with 40 years of market history and more than 50,000 customers worldwide.	Accounting, Inventory & Warehouse Management, Purchasing, Reporting & Analytics Functionality across enterprises of all sizes.	Variable (\$20k+)
Sage ERP	Fully-integrated, comprehensive suite of EPR buisness tools and capacity across all back office functions.	Financial Cloud, Accounting, Inventory & Warehouse Management, Procurement, Reporting & Analytics, Functionality across enterprises of all functions.	Variable (\$15k+)

a) Enterprise ERP Trends

The ERP field can be slow to change, but the last couple of years have unleashed new technology trends which are fundamentally shifting the entire area. The following new and continuing computing trends have an impact on the growth of enterprise ERP software:

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b) Mobile ERP

Executives and employees want real-time access to information, regardless of where they are. It is expected that businesses will embrace mobile ERP for the reports, dashboards and to conduct key business processes.

c) Cloud ERP

The cloud has been advancing steadily into the enterprise for some time, but many ERP users have been reluctant to place data in the cloud. Those reservations have gradually been evaporating, however, as the advantages of the cloud become apparent.

d) Social ERP

There has been much hype around social media and how important —or not — it is to add to ERP systems. Certainly, vendors have been quick to seize the initiative, adding social media packages to their ERP systems with much fanfare. But some wonder if there is really much gain to be had by integrating social media with ERP.

e) Two-tier ERP

Enterprises once attempted to build an all-encompassing ERP system to take care of every aspect of organizational systems. But some expensive failures have gradually brought about a change in strategy – adopting two tiers of ERP.

10.6. INTER ORGANIZATIONAL INFORMATION SYSTEM

An inter **organizational system** (IOS) is a **system** between **organizations**, or "shared **information system** among a group of companies." The most common form of **inter organizational system** is electronic data interchange, which permits instantaneous computer-to-computer transfer of **information**.

Organizations might pursue an inter organizational system for the following reasons:

- ✓ Reduce the risk in the organization
- ✓ Pursue economies of scale
- ✓ Benefit from the exchange of technologies
- ✓ Increase competitiveness
- ✓ Overcome investment barriers
- ✓ Encourage global communication

10.6.1 Inter-Organisational Information Systems Process Integration and Functions –

Direction of inter – organizational information systems in the role of system to human and system to system in the process of effective system function for the various process carried on by the instructions from the

computer to computer and then to the process of the human understanding interface. This can be understood by the following –

Mainly there are 2 most important parts in an inter – organizational information systems that determines the correct and effective functioning of the programmed automated information dispensation in field of system integrations are broadly classified into 2 parts they are system to system and system to human incorporation.

The system to system incorporation mainly causes the transformation of data between the inside of the information systems of the executing data for an organization is fully automatically done, there is no need for the human mind to be applied or not needed to input computerized functions to processes the information systems. It is designed to make the process outcome automatically with accurate results with – in a less period of time. For example as the electronic data interchange carries out the main classical automated data to compile and execute the data for the user for the directed desired outcome of result by the various amounts of transactions done and carried out by the implementation of EDI. (“Matthew K. McGowan, 1996”)

Now let’s pass on to system to human incorporation. Under this the data which is been transacted is semiautomatic by this term we come to know that the human intervention is included as well as the system process the data from one person through the inner information systems to and is send in a form of electronic system design layout to another person and then the receiving person collects the data and then processes it physically or by hand. Mainly this type of method is done in supply chain electronic incorporation where the internet based technologies have provided this in order to avoid very expensive system to system functioning costs this is done by even providing web gateway most commonly known as web portal. In order to gain fast functions to be carried on and less errors to be caused and more of accuracy in short period of time that would cause in best time management in information systems then the implementation of inter – organizational information systems should be done.

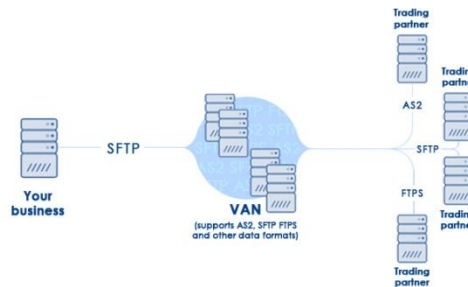
10.7 VALUE ADDED NETWORKS

DEFINITION of Value-Added Network (VAN)

A value-added network (VAN) is a private, hosted service that provides companies with a secure way to send and share data with its counterparties. Value-added networks were a common way to to facilitate electronic data interchange (EDI) between companies. As the internet created competition for this service with the advent of secure email, VANs responded by expanding their service offerings to include things like message encryption, secure email and management reporting. A value-added network simplifies the communications process by reducing the number of parties with which a company needs to communicate. The VAN accomplishes this by acting as an intermediary between business partners that share standards based or proprietary data. VANs are set up with audit capabilities so that the data being exchanged is formatted correctly and

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validated before it is transferred to the next party. VANs are sometimes referred to as added-value networks or turnkey communications line.



Value added networks working methodology as follows;

Some of the key advantages and benefits to using an EDI VAN (Value Added Network) as the preferred mode of electronic business communication!

Data Integrity- EDI VANs typically audit both incoming, as well as outgoing data, to detect errors. There are checks and balances in place and, in some cases, EDI VANs (Value Added Networks) may provide corrections and adjustments services to enable successful transmissions and receipt of data.

Improved B2B (business to business) exchanges– VANs (Value Added Networks) allow for the use of multiple protocols to send data and for each trading partner to employ the data format best suited for their organization.

Speedy business communication– the exchange of documents through a VAN (Value Added Network) is significantly faster than other means of data transfer as data is exchanged directly from one business software to another. Manual processing is typically eliminated which therefore significantly reduces the risks associated with errors and consequent time delays.

Secure and reliable communication channels– VANs (Value Added Networks) are highly secure and meet government and HIPAA security standards.

Unrestricted accessibility– with a 24/7 accessibility of the VAN (Value Added Network), the exchange of data is secure to anywhere in the world, with no time constraints or disruption to your daily business operations.

Simpler EDI compliance– EDI testing and compliance are required by most retailers, to be met and complied with by their supply chain vendor community. Furthermore, retailers often require to do so through the use of an EDI VAN (Value Added Network), their preferred EDI method of communication. Consequently, going through a VAN (Value Added Network) will facilitate and simplify, to some degree, the EDI

Visibility tools– A handful of VAN (Value Added Network) providers, such as EDI Gateway Inc, offer a monitoring web tool and corresponding reports to allow you to track the data you exchange and with your trading partners and its delivery status. Such ‘values add’, multi –user visibility tools have unrestricted and unlimited accessibility- from anywhere, at any time.

10.8. NETWORKING

A computer network can be defined as a set of computers connected together for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Examples of other shared resources can include a printer or a file server. The Internet itself can be considered as a huge computer network. This tutorial will teach you basics of Data Communication and Computer Network (DCN) and will also take you through various advanced concepts related to Data Communication and Computer Network.

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10.8.1 BASICS OF COMPUTER NETWORKING

Open system

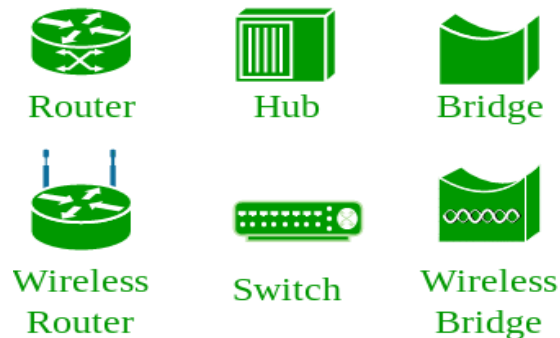
A system which is connected to the network and is ready for communication.

Closed system:

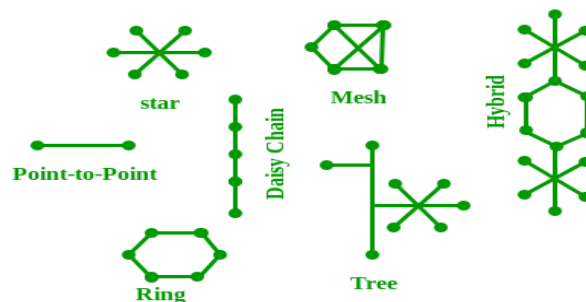
A system which is not connected to the network and can't be communicated with.

Computer Networks

It is the interconnection of multiple devices, generally termed as Hosts connected using multiple paths for the purpose of sending/receiving data or media. There are also multiple devices or mediums which helps in the communication between two different devices which are known as **Network devices**. Ex: Router, Switch, Hub, Bridge.



The layout pattern using which devices are interconnected is called as network topology. Such as Bus, Star, Mesh, Ring, Daisy chain.



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OSI:

OSI stands for **Open Systems Interconnection**. It is a reference model that specifies standards for communications protocols and also the functionalities of each layer.

Protocol:

A protocol is the set of rules or algorithms which define the way how two entities can communicate across the network and there exists different protocol defined at each layer of the OSI model. Few of such protocols are TCP, IP, UDP, ARP, DHCP, FTP and so on.

IP Address (Internet Protocol address):

Also, known as the Logical Address, is the network address of the system across the network.

To identify each device in the world-wide-web, Internet Assigned Numbers Authority (IANA) assigns IPV4 (Version 4) address as a unique identifier for each device on the Internet.

Length of the IP address is 32-bits. (Hence we have 2³² IP addresses available.)

Type “ipconfig” in the command prompt and press ‘Enter’, this gives us the IP address of the device.

MAC Address (Media Access Control address):

Also known as physical address, is the unique identifier of each host and is associated with the NIC (Network Interface Card).

MAC address is assigned to the NIC at the time of manufacturing. Length of the MAC address is: 12-nibble/ 6 bytes/ 48 bits

Type “ipconfig/all” in the command prompt and press ‘Enter’, this gives us the MAC address. Port can be referred as a logical channel through which data can be sent/received to an application. Any host may have multiple applications running, and each of this application is identified using the port number on which they are running. Port number is a 16-bit integer; hence we have 2¹⁶ ports available which are categorized as shown below:

PORT TYPES	RANGE
Well known Ports	0 – 1023
Registered Ports	1024 – 49151
Ephemeral Ports	49152 – 65535

Socket:

The unique combination of IP address and Port number together are termed as Socket.

Few more concepts**DNS Server:**

DNS stands for **Domain Name system**.

DNS is basically a server which translates web addresses or URL (ex: www.google.com) into their corresponding IP addresses. We don't have to remember all the IP addresses of each and every website.

The command '**nslookup**' gives you the IP address of the domain you are looking for. This also provides the information of our DNS Server.

Check your Progress:

1. Define Characteristics of Client Server Computing?
2. What is the Difference between Client Server Computing and Peer to Peer Computing?
3. Define Characteristics of Communication Servers?
4. What are the two common Types of network?
5. What is the Reason to pursue interorganizational System in Organizations?

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10.9. ANSWERS TO CHECK YOUR PROGRESS

1. Some of the characteristics are

✓ The client server computing works with a system of request and response. The client sends a request to the server and the server responds with the desired information.

✓ The client and server should follow a common communication protocol so they can easily interact with each other. All the communication protocols are available at the application layer.

✓ A server can only accommodate a limited number of client requests at a time. So it uses a system based to priority to respond to the requests.

✓ Denial of Service attacks hinder server's ability to respond to authentic client requests by inundating it with false requests.

2. The differences are

✓ In client server computing, a server is a central node that services many client nodes. On the other hand, in a peer to peer system, the nodes collectively use their resources and communicate with each other.

✓ In client server computing the server is the one that communicates with the other nodes. In peer to peer to computing, all the nodes are equal and share data with each other directly.

✓ Client Server computing is believed to be a subcategory of the peer to peer computing.

3. Some of the characteristics are

- Flexibility: Communications server architecture is scalable, multilevel, and highly flexible, is designed to easily support added values at any level and has multiple server repurposing options.
- Openness: Communications servers are based on industry standards. Different tools and services may be further integrated on an as-needed basis.

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- Carrier Grade: Communications server upgrades and updates are non-disruptive. Each associated system aspect and feature follows and fulfils network-building regulations.
- 4. The two types of network are Local Area Network (LAN) and Wide Area Network (WAN)
- 5. The reasons are
 - ✓ Reduce the risk in the organization
 - ✓ Pursue economies of scale
 - ✓ Benefit from the exchange of technologies
 - ✓ Increase competitiveness
 - ✓ Overcome investment barriers
 - ✓ Encourage global communication

10.10. SUMMARY:

- A communication server is a dedicated system that provides communication services for users on a network who need to transfer files or access information on systems or networks at remote locations over telecommunication links. The communication server provides communication channels for one or more users simultaneously, depending on the software and the hardware capabilities.
- The art of digital networking' can often seem quite broad and unending. In order to better understand the key steps or action involved in effective digital networking, we have broken the process into 4 key activity stages; discover, build, support & manage.
- Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.
- Enterprise resource planning (ERP) is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back-office functions related to technology, services and human resources.
- An interorganizational system (IOS) is a system between organizations, or "shared information system among a group of companies." The most common form of interorganizational system is electronic data interchange, which permits instantaneous computer-to-computer transfer of information.

10.11. KEYWORDS:

- **Flexibility:** Communications server architecture is scalable, multilevel, and highly flexible, is designed to easily support added values at any level and has multiple server repurposing options.

- **Openness:** Communications servers are based on industry standards. Different tools and services may be further integrated on an as-needed basis.
- **Carrier Grade:** Communications server upgrades and updates are non-disruptive. Each associated system aspect and feature follows and fulfils network-building regulations.

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10.12. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer questions:

1. What is VAN?
2. Define Computer Network?
3. Define OSI?
4. Define DNS?
5. What are network Devices?

Long Answer questions:

1. Explain briefly about LAN and WAN?
2. Define EDI. Explain the working process of EDI System and its advantages?
3. Explain briefly about ERP?

10.13. FURTHER READINGS

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UNIT - XI ELECTRONIC-COMMERCE AND INTERNET

Notes

- 11.1 E-Commerce Bases
- 11.2 E-Commerce and internet
 - 11.2.1 Benefits of e-commerce
- 11.3 M-Commerce
 - 11.3.1 Types of M-commerce
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- 11.5 Applications of internet and Website management
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- 11.10 Keywords
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- 11.12 Further Readings

Introduction to E Commerce and Internet

We are living in the age of technological advances. Development in our society began to happen post the World Wars, where in Industrial revolution started changing the face of economies. With evolution of Information Technology we first heard the Radio and later the TV that could capture pictures from the air and show it on the TV box. Then technology came as the 'Computer' which was aptly the magic box. Computers and advancement of information and communication technology heralded the arrival of 'Internet' or 'World Wide Web' technology.

Take a look at our lives today. There is no aspect of our life that is not interfaced with internet in one way or the other. From an individual's need to find a date or a suitable life partner to one's banking, insurance and other payments as well as dining out and not to forget the online shopping, internet has managed to become the mainstream facilitator to each and every individual.

Today millions of users access and use the internet for various purposes throughout the day. They use the internet for searching, browsing, writing & communication, listening, watching news, videos, publishing copying, printing, discussions, trading and selling etc. The list of activities and choices that the internet has got to offer to individuals is ever expanding. With millions of users actively looking for various products, information and services, there is a huge opportunity for the businesses to jump on to the internet bandwagon and cash in on the business opportunity that is presenting itself every minute.

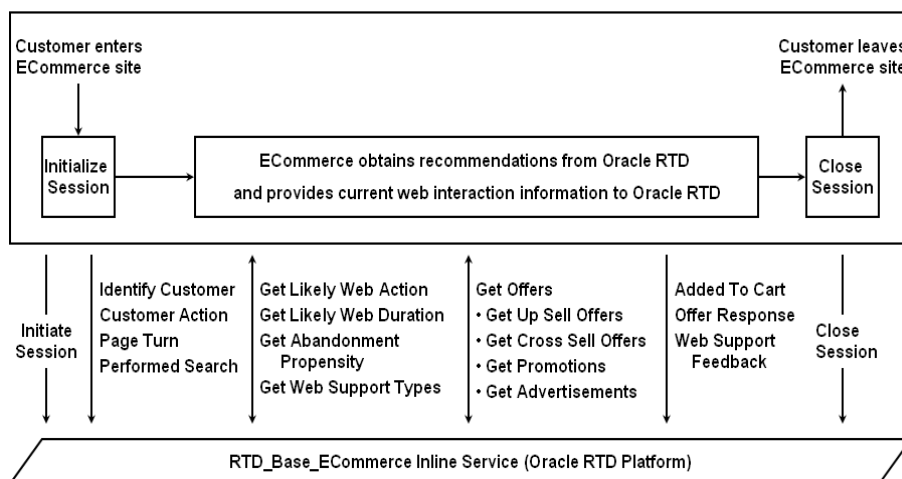
Technology has helped build a platform that has enabled the businesses to cash in on the huge population and market that is now accessible over the internet and sell to them. Take the case of Online

Banking, Mobile Banking, Debit| Credit Cards, ATMs as well as online trading and other business transactions, all these have grown and happened as a result of technological advancement in terms of communication, software as well as hardware technologies. From the time that one connected to Internet using a desktop, model and a telephone line to the Wi-Fi technology of today, we have graduated very fast making it possible to buy and sell at the click of a button. At another level the Business Processes as well as ERP coupled with various software and applications besides EDI, have enabled businesses to go 'On Line' with their business models.

Today no business, be it Business to Business or Business to Consumer, can ignore the huge 'Online Market' that exists on the internet. E Commerce was inevitable. Physical markets have literally been replaced with 'Virtual Markets'. E Commerce has had far reaching impact on business organizations for it has redefined 'Market'. E Commerce has made it possible for sellers to reach out to planet wide markets and consumers, thus changing the way business is conducted. For every prospective Management Professional, the in depth understanding of 'Online Marketing' and 'E Commerce' have become very important. Marketing managers have got to go back to the class rooms to learn the new rules of game in handling Online Marketing which is drastically and totally different from the traditional marketing, selling, distribution and advertising strategies. Understanding all about Internet, E Commerce mechanisms, technologies, learning how to market online, understanding E Customer and learning to identify, build and nurture a relationship with the E Customer become the building blocks of one's new learning.

The following diagram shows an overview of the stages of a typical E-Commerce application and its possible interactions with the Inline Service RTD-Base-E-Commerce.

11.1 E-COMMERCE BASES:



The RTD-Base-E-Commerce Inline Service serves as a general E-Commerce framework for customers to adapt to their business processes.

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The RTD-Base-E-Commerce Inline Service provides pre-defined entities, choices, decisions, models, and integration points.

From an end user perspective, the RTD-Base-E-Commerce Inline Service is designed on the assumption that customers will perform additional configuration and further customization to fulfil their business requirements.

Additional tasks involve mapping the logical entity attributes to a customer's physical data sources and to develop the front-end environment for the presentation of any Oracle RTD recommendations.

11.2 E-COMMERCE AND INTERNET

E-commerce (electronic commerce) is the buying and selling of goods and services, or the transmitting of funds or data, over an **electronic** network, primarily the **internet**. These business transactions occur either as business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer or consumer-to-business.

11.2.1 Benefits of e-commerce

The benefits of e-commerce include its around-the-clock availability, the speed of **access**, the wide availability of goods and services for the consumer, easy accessibility and international reach.

Availability: Aside from outages or scheduled maintenance, e-commerce sites are available 24x7, allowing visitors to browse and shop at any time. Bricks and mortar businesses tend to open for a fixed amount of hours and may even close entirely on certain days.

Speed of access: While shoppers in a physical store can be slowed by crowds, e-commerce sites run quickly, which is determined by compute and bandwidth considerations on both consumer device and e-commerce site. Product pages and shopping cart pages load in a few seconds or less. An e-commerce transaction can comprise a few clicks and take less than five minutes.

Wide availability: Amazon's first slogan was "Earth's Biggest Bookstore." They could make this claim because they were an e-commerce site and not a physical store that had to stock each book on its shelves. E-commerce enables brands to make a wide array of products available, which are then shipped from a warehouse after a purchase is made.

Easy accessibility: Customers shopping a physical store may have a hard time determining which aisle a particular product is in. In e-commerce, visitors can browse product category pages and use the site search feature to find the product immediately.

International reach: Bricks and mortar businesses sell to customers who physically visit their stores. With e-commerce, businesses can sell to any customer who can access the web. E-commerce has the potential to extend a business' customer base globally.

Lower cost: Pureplay e-commerce businesses avoid the cost associated with physical stores, such as rent, inventory and cashiers, although they may incur shipping and warehouse costs.

Personalization and product recommendations: E-commerce sites can track visitors' browse, search and purchase history. They can leverage this data to present useful and personalized product recommendation. Examples include the sections of Amazon product pages labelled "Frequently bought together" and "Customers who viewed this item also viewed."

Disadvantages of e-commerce

The perceived downside of e-commerce include sometimes limited **customer service**, consumers not being able to see or touch a product prior to purchase and the wait time for product shipping.

Limited customer service: If a customer has a question or issue in a physical store, he or she can see a clerk, cashier or store manager for help. In an e-commerce store, customer service may be limited: the site may only provide support during certain hours of the day, or a call to a customer service phone number may keep the customer on hold.

Not being able to touch or see: While images on a web page can provide a good sense about a product, it's different from experiencing it "directly," such as playing music on speakers, assessing the picture quality of a television or trying on a shirt or dress. E-commerce can lead consumers to receive products that differ from their expectations, which leads to returns. In some scenarios, the customer bears the burden for the cost of shipping the returned item to the retailer.

Wait time: If a customer sees an item that he or she likes in a store, the customer pays for it and then goes home with it. With e-commerce, there is a wait time for the product to be shipped to the customer's address. Although shipping windows are decreasing as next day delivery is now quite common, it's not instantaneous.

Security: Skilled hackers can create authentic-looking websites that claim to sell well-known products. Instead, the site sends customers forfeit or imitation versions of those products -- or, simply collects customers' credit card information. Bonafide e-commerce sites also carry risk, especially when customers store their credit card information with the retailer to make future purchases easier. If the retailer's site is hacked, hackers may come into the possession of customers' credit card information.

E-commerce applications

E-commerce is conducted using a variety of applications, such as email, online catalogues and shopping carts, EDI, the File Transfer Protocol, web services, and mobile devices. This includes business-to-business activities and outreach, such as using email for unsolicited ads, usually viewed as spam, to consumers and other business prospects, as well as sending out e-newsletters to subscribers and SMS texts to mobile devices. More companies now try to entice consumers directly online, using tools

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such as digital coupons, social media marketing and targeted advertisements.

The rise of e-commerce has forced IT personnel to move beyond infrastructure design and maintenance to consider numerous customer-facing aspects, such as consumer data privacy and security. When developing IT systems and applications to accommodate e-commerce activities, data governance–related Regulatory Compliance mandates, personally identifiable information privacy rules and information protection protocols must be considered.

Role of internet in E-commerce

Internet provides a worldwide collection of networks, linked with each other to share information by using a common set of protocols. The Internet opens up the opportunity for people all over the world to get linked inexpensively and consistently. Since it is a large network of people and information around the world, the Internet is an enabler for e-commerce as because it allows businesses to showcase and sell their products and services online. It gives potential customers, prospects and business partners access to information about these business houses and their products and services which might lead to purchase.

Earlier companies used private networks, such as – Electronic Data Interchange (EDI), to execute business transactions. Such was the premature form of e-Commerce. But the maintenance cost of such private networks was very high. With the rapid growth of low-cost high-speed internet, e-Commerce industry has grown multifold times.

11.3 M-COMMERCE

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as smartphones and tablets. As a form of e-commerce, m-commerce enables users to access online shopping platforms without needing to use a desktop computer. Examples of m-commerce include in-app purchasing, mobile banking, virtual marketplace apps like the Amazon mobile app or a digital wallet such as Apple Pay, Android Pay and Samsung Pay.

M-commerce includes:

- Financial services, which includes mobile banking (when customers use their handheld devices to access their accounts and pay their bills) as well as brokerage services, in which stock quotes can be displayed and trading conducted from the same handheld device.
- Telecommunications, in which service changes, bill payment and account reviews can all be performed from the same handheld device.
- Service and retail, as consumers are given the ability to place and pay for orders on-the-fly.

- Information services, which include the delivery of financial news, sports figures and traffic updates to a single mobile device.

11.3.1 Types of M-commerce

M-commerce can be categorized by function as mobile shopping, mobile banking or mobile payments. Mobile shopping allows for a customer to purchase a product from a mobile device, using an application such as Amazon, or over a web app. A subcategory of mobile shopping is app commerce, which is a transaction that takes place over a native app. Mobile banking includes any handheld technology that enables customers to conduct financial transactions. This is typically done through a secure, dedicated app provided by the banking institution. Mobile payments enable users to buy products in-person using a mobile device. Digital wallets, such as Apple Pay, allow a customer to buy a product without needing to swipe a card or pay with physical cash.

11.3.2 Advantages and disadvantages of mobile commerce

The **advantages** of m-commerce include:

- Added customer retention by being more easily accessible.
- More convenience for customers in comparing prices, reading reviews and making purchases without the need of a desktop computer.
- Wider variety of products and services.
- Automates a businesses' point of customer contact and sales.

Disadvantages of m-commerce include:

- A poorly executed mobile experience can deter customers from making purchases.
- Mobile payment options are not available in every geographic location and may not support every type of digital wallet.
- Businesses must know and comply with tax laws and regulations of all countries they ship to (some businesses will avoid this by only allowing purchases and shipping from their country of origin).

11.4 ELECTRONIC DATA INTERCHANGE

Electronic Data Interchange (EDI) is the electronic interchange of business information using a standardized format; a process which allows one company to send information to another company electronically rather than with paper. Business entities conducting business electronically are called trading partners.

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Many business documents can be exchanged using EDI, but the two most common are purchase orders and invoices. At a minimum, EDI replaces the mail preparation and handling associated with traditional business communication. However, the real power of EDI is that it standardizes the information communicated in business documents, which makes possible a "paperless" exchange.

The traditional invoice illustrates what this can mean. Most companies create invoices using a computer system, print a paper copy of the invoice and mail it to the customer. Upon receipt, the customer frequently marks up the invoice and enters it into its own computer system. The entire process is nothing more than the transfer of information from the seller's computer to the customer's computer. EDI makes it possible to minimize or even eliminate the manual steps involved in this transfer.

Some Major Sets of EDI Standards

- **UN/EDIFACT:** This is only internationally recognized standard and is predominant outside of North America.
- **ANSI ASC X12 (X12):** This is the standard predominant in North America.
- **TRADACOM:** – This standard is developed by the ANA (Article Numbering Association now known as GS1) which is used by British retail companies.
- **ODETTE:** – This standard is used by European automotive industry.

EDI Terminology

- **Trading Partners:** Organizations that send or receive documents between each other are referred to as trading partners. The trading partners agree on the specific information to be transmitted and how it should be used.
- **Mapping:** This term is typically reserved for specific machine-readable instructions given to the translation software. Often in a large company these EDI guidelines will be written to be generic enough to be used by different branches or divisions and therefore will contain information not needed for a particular business document exchange. For other large companies, they may create separate EDI guidelines for each branch/division.
- **Transmission:** The sending and receiving party involved in the exchange of EDI transmissions. VAN is mostly used prominent transmission method for EDI, Though some organization have used direct modem to modem connections and bulletin board systems (BBS) and more popular internet protocols.
- **VAN (Value added Network):** A third party network that acts as an intermediary between trading partners .this service apart of receiving , storing , receiving and delivering the EDI messages also add audit data

and modify data for automatic error detection, correction or conversion between communication protocols.

- **Translator:** An EDI translator has traditionally been used to take data from a business application and map it into EDI standard formats. The process of developing a map is called EDI mapping and the EDI software is sometimes referred to as an EDI Mapper. Some EDI translators (mappers) come with the ability for the user to generate the maps and some do not, requiring the user to purchase maps from the vendor.
- **EDI Processes:** A typical EDI exchange involves the following processes: Inbound Process and Outbound process. The **outbound process** includes, generating and sending of EDI files. Below are the steps of an outbound process.
 - Obtain data from existing system.
 - Generate EDI file.
 - Validate EDI file.
 - Send EDI file to trading partner.Some common methods of transmission are FTP, HTTP and AS2. The **inbound process** is the receiving and translating of EDI files. Below are the steps of an inbound process.
 - Get EDI file
 - Validate and acknowledge EDI file by sending back a TA1, 997 or CONTRL EDI file.
 - Translate EDI file.
 - Save data to a database.

Benefits of using EDI

Economy: Research has consistently shown that EDI costs only one third of its paper-based equivalent. Expenses associated with paper, printing, reproduction, storage, filing, postage and document retrieval are all reduced or eliminated when we switch to EDI transactions.

Speed: Information moving between computers moves more rapidly, and with little or no human intervention. EDI can speed up our business cycles by 61%. It can reduce the order-to-cash cycle time by more than 20%, improving business partner transactions and relationships. Transactions that used to take 5 days by paper can be completed in under an hour.

Accuracy: Information that passes directly between computers without having to be re-entered eliminates the chance of data entry errors. There is almost no chance that the receiving computer will invert digits or add an extra digit. It improves data quality, delivering at least a 30—40% reduction in transactions with errors by eliminating errors from illegible handwriting, lost faxes/mail and keying and re-keying errors.

Efficiency: Automating paper-based tasks allows our staff to concentrate on higher-value tasks and provides them with the tools to be more productive. Shortening the order processing and delivery times means that

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organizations can reduce their inventory levels. Research reports as much as a 50% savings on human resources from the use of EDI.

Strategic Business Level: Enables real-time visibility into transaction status. This in turn enables faster decision-making and improved responsiveness to changing customer and market demands, and allows businesses to adopt a demand-driven business model rather than a supply-driven one. It shortens the lead times for product enhancements and new product delivery.

11.5 Applications of internet and website management

Internet: Applications

The Internet has many important applications. Of the various services available via the Internet, the three most important are e-mail, web browsing, and **peer-to-peer services**. E-mail, also known as electronic mail, is the most widely used and successful of Internet applications. Web browsing is the application that had the greatest influence in dramatic expansion of the Internet and its use during the 1990s. Peer-to-peer networking is the newest of these three Internet applications, and also the most controversial, because its uses have created problems related to the access and use of copyrighted materials.

E-Mail

Whether judged by volume, popularity, or impact, e-mail has been and continues to be the principal Internet application. This is despite the fact that the underlying technologies have not been altered significantly since the early 1980s. In recent years, the continuing rapid growth in the use and volume of e-mail has been fueled by two factors. The first is the increasing numbers of **Internet Service Providers (ISPs)** offering this service, and secondly, because the number of physical devices capable of supporting e-mail has grown to include highly portable devices such as **personal digital assistants (PDAs)** and cellular telephones.

The volume of e-mail also continues to increase because there are more users, and because users now have the ability to attach documents of various types to e-mail messages. While this has long been possible, the formulation of Multipurpose Internet Mail Extensions (MIME) and its adoption by software developers has made it much easier to send and receive attachments, including word-processed documents, spreadsheets, and graphics. The result is that the volume of traffic generated by e-mail, as measured in terms of the number of data **packets** moving across the network, has increased dramatically in recent years, contributing significantly to network congestion.

E-mail has become an important part of personal communications for hundreds of millions of people, many of whom have replaced it for letters or telephone calls. In business, e-mail has become an important

advertising medium, particularly in instances where the demand for products and services is time sensitive. For example, tickets for an upcoming sporting event are marketed by sending fans an e-mail message with information about availability and prices of the tickets. In addition, e-mail serves, less obviously, as the basis for some of the more important collaborative applications that have been developed, most notably Lotus Notes.

Web Browsing

The web browser is another Internet application of critical importance. The web browser was developed in a highly commercialized environment dominated by such corporations as Microsoft and Netscape, and heavily influenced by the World Wide Web Consortium (W3C). While Microsoft and Netscape have played the most obvious parts in the development of the web browser, particularly from the public perspective, the highly influential role of the W3C may be the most significant in the long term.

Peer-To-Peer Computing

One of the fastest growing, most controversial, and potentially most important areas of Internet applications is peer-to-peer (P2P) networking. Peer-to-peer networking is based on the sharing of physical resources, such as hard drives, processing cycles, and individual files among computers and other intelligent devices. Unlike client-server networking, where some computers are dedicated to serving other computers, each computer in peer-to-peer networking has equivalent capabilities and responsibilities.

Applications of Internet

Communication

Computer users around the world extensively use the email service on internet to communicate with each other. Pictures, documents and other files are sent as email attachments. Emails can be cc-ed to multiple email addresses.

Internet telephony is another common communications service made possible by the creation of the Internet. VoIP stands for Voice-over-Internet Protocol, referring to the protocol that underlies all Internet communication.

Job search

Nowadays, many people search for their jobs online as it is quicker and there is a larger variety of job vacancies present. People can publish resume online for prospective job. Some of the web sites providing this service are naukri.com, monster.com, summerjob.com, recuritmentindia.com etc.

Online Shopping

The internet has also facilitated the introduction of a new market concept consisting of virtual shops. They provide information about products or

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services for sale through www servers. Using the internet services customers can submit specific product queries and request specific sales quotes. For example amazon.com is a www based bookshop on the internet where information on all types of international books can be found and books can be ordered online.

Stock market updates

You can sell or buy shares while sitting on computer through internet. Several websites like ndtvprofit.com, moneypore.com, provide information regarding investment

Travel

One can use internet to gather information about various tourist place .it can be used for booking Holiday tours, hotels, train, bus, flights and cabs. Some of the web sites providing this service are goibibo.com, makemytrip.com, olacabs.com.

Research

Research papers are present online which helps in the researcher doing a literature review

Video Conferencing:

It enables direct face-to-face communication across networks via web cameras, microphones, and other communication tools. Video conferencing can enable individuals in distant locations to participate in meetings on short notice, with time and money savings. The technology is also used for telecommuting, in which employees work from home. When video Conferencing is used in education, it is easier to have interactive communications between teacher to teacher, teacher to classroom, or classroom to classroom with students in different places.

E-Commerce

E-commerce (electronic **commerce** or EC) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet. These business transactions occur either business-to-business, business-to-consumer, consumer-to-consumer or consumer-to-business. Largest e-commerce companies in India are Flipkart, Snapdeal, Amazon India, Paytm.

On-line payments

The rising boom of online payments in India has given way to many new entrants in the industry such as Paytm, Mobikwik, oxigenetc who are majorly wallet driven payment companies. This growth has been driven by rapid adoption led by the increasing use of smartphones, tablets and speedy access to internet through broadband, 3G etc

Social networking

Social networking is the use of internet-based social media programs to make connections with friends, family, classmates, customers and clients. Social networking can be done for social purposes, business purposes or

both. The programs show the associations between individuals and facilitate the acquisition of new contacts. Examples of social networking have included Facebook, LinkedIn, Classmates.com and Yelp.

WEBSITE MANAGEMENT

Website management is a service involving the updating, analyzing, promoting and developing of a website. Some website owners were of the impression that once you have a website designed and accessible on the internet that the job was finished.

Daily Website Management steps:

One of the most important tasks when it comes to website management is to make sure your site remains safe and continues to load fast to deliver the best possible user experience. As such, you'll need to keep up with the following daily tasks.

1. Backup Website

Backing up your website is crucial because it allows you to quickly get back online in the event your website or your host is compromised. A good practice is to perform a daily offsite backup of both WordPress files and the database. With ManageWP, you can easily schedule incremental backups to ensure your site is protected as well as download the backup to your computer or upload it to your own external destination such as Dropbox or Google Drive.

2. Monitor uptime

Downtime can not only portray your brand in a negative light, it can also hurt your sales and conversions. If you use ManageWP, you can use the Uptime Monitor tool to notify you about your website's downtime. If you start noticing a lot of downtime, then it's definitely time to consider upgrading your hosting plan or switching hosting companies.

3. Perform a Daily Security Report

With the rise of online security threats and malware, you don't want to leave anything to chance. Consider using a service like Secure to ensure websites you manage are malware free. If you use our plugin, you can perform a check anytime you like or if you want a set-it-and-forget-it solution, you can enable the premium version and use Automated Security Checks which will notify you about anything suspicious via email or Slack.

Weekly Website Management Steps

The tasks below should be done on a weekly basis but keep in mind that some of them, like updating WordPress, themes, and plugins depend on external factors so you'll need to adjust accordingly.

1. Check for WordPress, Theme, and Plugin Updates

As mentioned above, this task depends on external factors but make sure to apply the updates when they are released. This will help protect your website from potential security vulnerabilities.

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2. Test the Site across Browsers

Testing your site across browsers and checking there are no issues with layout or the formatting is another step toward ensuring an optimal user experience. After all, if the layout is broken, website visitors won't be able to understand what the website is about nor will they be able to follow a clear path toward becoming clients or customers.

Check your site in major browsers as well as how it performs on mobile devices to make sure it's responsive.

Monthly and Quarterly Website Management Steps

Next on the list are monthly and quarterly website management tasks.

1. Review Analytics

Checking website analytics will help you analyse which traffic sources visitors are coming from, how long they stay on the website, and which pages are the most viewed. This will allow you to gauge the website's growth and optimize pages that bring in the most conversions as well as tweak those that show visitors dropping off.

2. Check Loading Times

Make a point to test the website's loading times once a month. As your clients begin to add more media files and potentially more plugins, their website may experience a decrease in speed. You'll want to make sure to optimize the site to maintain fast loading times so you don't have to worry about users abandoning it and your clients complaining that they are losing business.

3. Test the Forms

Once a month, go through the website and fill out and test each and every form to ensure no inquiry, contact, or sale gets lost due to a non-working form.

4. Remove Unused Themes and Plug-in

Once every three months, remove unused themes and plugins. Be sure to deactivate and delete them to prevent vulnerability and security issues.

5. Verify Backups

Backups are crucial when it comes to site management but you have to make sure the backups you take are properly stored at the location you specified. You also want to check that you can easily perform a website restore in the event the worst happens instead of finding out your backup strategy doesn't work.

6. Optimize the Database

With time, the Word Press database can become rather large due to drafts, post revisions, spam comments, and more. Schedule in a regular database optimization once every three months to ensure the websites you manage continue to operate at their peak performance.

Yearly Website Management Steps

Lastly, the following are tasks that should be done on a yearly basis.

1. Update Copyright Information in the Footer

Make sure to update the copyright information in the footer to reflect the current year. Otherwise, potential clients won't know if you're still in business and may be less inclined to contact you.

2. Review and Evaluate Plug-in and Themes

Lastly, you'll want to go through the installed and active plugins and evaluate how well they performed. Make sure they are still actively developed and maintained and find replacements if you discover a plug-in have been abandoned. At the same time, you'll also want to make sure that the theme you've developed for your client follows Word Press best practices and update the code if needed.

Manage Your Website like a Pro

Managing your website can seem daunting but once you know which tasks are involved and how often you should do them, it becomes a lot easier. Use the tips in this article to manage your website like a pro and ensure it's always performing at its best.

11.6 Types of Social Media

Social Media:

Websites and applications that enable the users to create and share contents or to participate in the social networking. Social media refers to websites and applications that are designed to allow people to share content quickly, efficiently, and in real-time. Many people define social media as apps on their Smartphone or tablet, but the truth is, this communication tool started with computers. This misconception stems from the fact that most social media users access their tools via apps.

List of 10 types of social media:

Social networks—Connect with people

Media sharing networks—Share photos, videos, and other media

Discussion forums—Share news and ideas

Bookmarking and content creation networks—Discover, save, and share new content

Consumer review networks—Find and review businesses

Blogging and publishing networks—Publish content online

Interest-based networks—Share interests and hobbies

Social shopping networks—Shop online

Sharing economy networks—Trade goods and services

Anonymous social networks—communicate anonymously

1. Social networks

Examples: Facebook, Twitter, LinkedIn

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Why people use these networks: To connect with people (and brands) online.

How they can benefit your business: Let us count the ways. Market research, brand awareness, lead generation, relationship building, customer service... the list is pretty much endless.

Social networks, sometimes called “relationship networks,” help people and organizations connect online to share information and ideas.

While these networks aren’t the oldest type of social media, they certainly define it now. These channels started as relatively simple services—for example, Twitter was the place to answer the question “what are you doing?” and Facebook was where you might check the relationship status of that cute Economics 101 classmate.

Now, and especially since the rise of the mobile internet, these networks have become hubs that transform nearly every aspect of modern life—from reading news to sharing vacation photos to finding a new job—into a social experience.

If you’re not using these core networks yet as part of your social media marketing plan—or if you’re looking for ideas to improve your existing strategy—you’ll find a wealth of usable information in our guides to Facebook, Twitter, and LinkedIn.

2. Media sharing networks

Examples: Instagram, Snapchat, YouTube

Why people use these networks: To find and share photos, video, live video, and other media online.

How they can benefit your business: Like the major relationship networks, these sites are invaluable for brand awareness, lead generation, audience engagement, and most of your other social marketing goals.

Media sharing networks give people and brands a place to find and share media online, including photos, video, and live video.

The lines between media sharing networks and social networks are blurring these days as social relationship networks like Facebook and Twitter add live video, augmented reality, and other multimedia services to their platforms. However, what distinguishes media sharing networks is that the sharing of media is their defining and primary purpose.

While the majority of posts on relationship networks contain text, posts on networks like Instagram and Snapchat start with an image or video, to which users may decide to add content like captions, mentions of other users, or filters that make you look like a bunny. Similarly, on sites such as YouTube and Vimeo, video is the primary mode of communication. When determining whether or not your business needs to establish a presence on a media sharing network, it’s important to consider your available resources. If there’s one thing the most successful brands on platforms like YouTube or Instagram have in common, it’s a thoroughly planned mission and carefully designed media assets, usually following a specific

theme. To increase your business's chances of success on media sharing networks, see our guides to marketing on Instagram, Snapchat, YouTube, and Vimeo.

3. Discussion forums

Examples: reddit, Quora, Digg

Why people use these networks: To find, discuss, and share news, information, and opinions.

How they can benefit your business: These networks can be excellent resources for market research. Done right, you can also advertise on them, though you'll need to be careful to keep your ads and posts separate.

Discussion forums are one of the oldest types of social media.

Before we connected to our first university friends on The Face book, we discussed pop culture, current affairs, and asked for help on forums. Take a look at the wide reach and massive user numbers on forums such as reddit, Quora, and Digg and you'll see that the public's thirst for collective knowledge and wisdom remains unquenchable.

4. Bookmarking and content curation networks

Examples: Pinterest, Flip board

Why people use these networks: To discover, save, share, and discuss new and trending content and media.

How they can benefit your business: These networks can be highly effective for driving brand awareness, customer engagement, and website traffic. Bookmarking and content curation networks help people discover, save, share, and discuss new and trending content and media.

These networks are a hotbed of creativity and inspiration for people seeking information and ideas, and by adding them to your social media marketing plan, you'll open up new channels for building brand awareness and engaging with your audience and customers. Bookmarking networks like Pinterest help people discover, save, and share visual content. An easy first step for getting started with Pinterest is to make your website bookmark-friendly. This entails headlines and images on your blog and/or website for the feeds these networks use to optimizing access and share your content. You should also pay close attention to the images featured on your site or blog—these are the window displays of Pins, so you want them to be good representations of your content.

Content curation networks like Flipboard are similar to bookmarking networks, but with a focus on finding and sharing articles and other text content. You can create your own Flipboard magazine to sort through the most engaging content on your topic of choice from third-party sources, and to showcase your own content.

Other types of networks are also adding bookmarking and curation features. For example, Instagram now offers features for users to save content and create private collections. To start planning your strategy for bookmarking and content curation networks, see our guides on

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using Pinterest and Flip board. And if you're looking for inspiration, check out these 10 Pinterest accounts that will make you a better social media marketer.

5. Consumer review networks

Examples: Yelp, Zomato, Trip Advisor

Why people use these networks: To find, review, and share information about brands, products, and services, as well as restaurants, travel destinations, and more.

How they can benefit your business: Positive reviews bring social proof to your claims. Handled well, you can resolve issues with unhappy customers.

Consumer review networks give people a place to review brands, businesses, products, services, travel spots, and just about anything else.

Reviews are a type of content that adds a lot of value to many websites and online services—think about the buying experience on Amazon, or the experience of searching for a local business on Google Maps. Consumer review networks take it one step further by building networks around the review as a core part of the value they provide.

Location-based review services such as Yelp and Zomato continue to grow as personal social networks adopt geolocation and more users choose to consult the internet along with their friends for recommendations of best dining spots. There are sites to review anything from hotels and restaurants to the business where you're thinking of applying for a job—and user reviews have more weight than ever before. In fact, according to a survey by Bright Local, 88 percent of consumers trust online reviews as much as a personal recommendation. It's vital for your brand to have the ability to attract positive user reviews and handle negative ones. To do this, you can select a customer success team member to address reviews on sites relevant for your business. Entrust them with answering any questions or concerns from clients with average or negative experiences, and see if there is anything that can be done on your end to turn a possible detractor into a fan. For more on this topic, read our blog posts on how to respond to negative reviews and online reputation management.

6. Blogging and publishing networks

Examples: Word Press, Tumblr, Medium

Why people use these networks: To publish, discover, and comment on content online.

How they can benefit your business: Content marketing can be a highly effective way to engage with your audience, build your brand, and generate leads and sales.

Blogging and publishing networks give people and brands tools to publish content online in formats that encourage discovery, sharing, and commenting. These networks range from more traditional blogging

platforms like Word Press and Blogger to micro blogging services like Tumblr and interactive social publishing platforms like Medium.

Your promotion strategy includes content marketing (and if it doesn't, you might want to consider it), your business can gain visibility by keeping a blog. A blog doesn't just help increase awareness of your business and generate more engaging content for your social channels such as Facebook; it can also help carve out a niche for your brand as a thought leader in your industry. If you're getting started with blogging and content marketing, see our guides to starting a blog, promoting If your blog, content marketing strategy, and creating great content.

7. Social shopping networks

Examples: Polyvore, Etsy, Fancy

Why people use these networks: To spot trends, follow brands, share great finds, and make purchases.

How they can benefit your business: Brands can build awareness, increase engagement, and sell products via new channels.

Social shopping networks make ecommerce engaging by adding a social element. Of course, elements of ecommerce appear in many other types of social networks—for example, Pinterest features Buyable Pins, and Instagram provides call-to-action tools in the form of “shop now” and “install now” buttons. Social shopping networks take it one step further by building their site around a focused integration between the social experience and the shopping experience.

Services like Etsy allow small businesses and individual crafters to sell their products without an existing brick-and-mortar location, and networks such as Polyvore aggregate products from different retailers in a single online marketplace, and. Polyvore is one of the largest social style communities on the internet, and it's a good example of a network designed to integrate the social experience with the buying experience. Most of the content is generated by users, who choose products they like, create collages, publish them as a set, and then share sets with other users.

8. Interest-based networks

Examples: Goodreads, Houzz, Last.fm

Why people use these networks: To connect with others around a shared interest or hobby.

How they can benefit your business: If there's a network devoted to the kind of products or services you provide, these networks can be a great place to engage with your audience and build brand awareness.

Interest-based networks take a more targeted approach than the big social networks do by focusing solely on a single subject, such as books, music, or home design. While there are groups and forums on other networks that are devoted to these interests, focusing solely on a single area of interest allows these networks to deliver an experience tailor-made for the wants

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and needs of the people and communities who share that interest. For example, on Houzz, home designers can browse the work of other designers, create collections of their own work, and connect with people looking for their services.

9. ‘Sharing economy’ networks

Examples: Airbnb, Uber, Taskrabbit

Why people use these networks: To advertise, find, share, buy, sell, and trade products and services between peers.

How they can benefit your business: If you happen to offer the kind of products or services traded here, these networks can be another channel for bringing in business. (For example, if you operate a bed-and-breakfast, Airbnb could help you find customers.)

“Sharing economy” networks, also called “collaborative economy networks,” connect people online for the purpose of advertising, finding, sharing, buying, selling, and trading products and services.

And while you’re probably already familiar with big-name networks like Airbnb and Uber, there are a growing number of niche networks you can use to find a dogsitter, a parking spot, a home-cooked meal, and more.

This online model for peer commerce has become viable and popular in recent years as people started trusting online reviews and feeling comfortable using them to gauge the reputation and reliability of sellers and service providers. According to a report by digital research firm Vision Critical, “The collaborative economy today works because trust can be verified electronically through social networks... social media lets the collaborative economy run smoothly.”

While most marketers will find these networks too specifically targeted or restrictive, if you happen to provide the kind of product or service that’s traded on a particular network, you might want to look into it as another channel to generate leads and sales.

10. Anonymous social networks

Examples: Whisper, Ask.fm, After School

Why people use these networks: To gossip, vent, snoop, and sometimes bully.

How they can benefit your business: They almost certainly can’t. Steer clear.

Last—and least—are anonymous social networks. While major social networks are making increasing efforts to hold users accountable for their social activity, these sites go the other way and allow users to post content anonymously. CBS New York described Whisper as “the place to go these days to vent, come clean, or peer into other people’s secrets,” saying the site focuses on “turning confessions into content.”

These networks might sound like a fun place to blow off steam (for example, if you’re a teen and want to complain about your parents, teachers, boyfriend, and so on). However, they’ve been shown to provide a

consequence-free forum for cyberbullying and have been linked to teen suicides.

In our opinion, anonymous social networks are a step back toward the wild-west early days of the internet in a time when we've learned the importance of keeping the internet a safe place for everyone. If it's worth saying, it's worth standing behind. Whether you're exploring new potential markets for your business or just looking for new channels to connect with your customers, there are many types of social media you can use. Some are pretty much mandatory for any business; others are useful for a smaller subset of niche businesses; and some you should steer clear of entirely. Whatever your needs and your goals, it's a safe bet you'll find what you're looking for somewhere on social.

11.7 USES OF SOCIAL MEDIA IN BUSINESS ORGANIZATION

Social media has had an enormous impact on businesses. Platforms such as *Twitter*, *YouTube* and *Facebook* are used to not only promote brands and advertise new products but also are effective media that provide customer service and resolve disputes. While a small business owner does not always need to hire a separate social media team, some staff members should be adept in selecting and using one or more platforms. In addition, these team members will need to be flexible enough to balance off-line work responsibilities with tasks related to the 24/7 nature of online culture.

Importance of Social Media Branding

For many companies, social media and business come together to provide unparalleled branding opportunities. Brands both old and new can establish or reinvent themselves online through social media profiles, sharing of content and platform based advertising. In recent years, many companies have primarily built their following, and their revenue, through social media posts and ads.

1. Small Business
2. Business Models & Organizational Structure
3. Organizations

Content sharing: The key to social media success is sharing quality content that enhances a brand, provides needed information or entertainment, and that establishes a brand as credible. The types of content shared depend on the platform, but typically includes links to industry articles, photographs and videos.

Advertising: Most social media platforms offer the opportunity to pay for advertising. While not all businesses opt to purchase ads, many have had a great deal of success in doing so.

Influencers: There are many bloggers, podcasters, and video producers who choose to focus on specific niche interests in the production of their content. Several of these creators become very well known in specific industries not because they have industry work experience, but because their content is influential. These "*influencers*" are often targeted by businesses for promoting products.

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Small Business Content-sharing Example

Sharon is the owner of Sparkle Stars, a new cosmetics company that features mineral-based cosmetics. Along with her director of marketing, Sharon begins a comprehensive social media content sharing campaign.

Each day, Sharon and her team comb the web and news outlets for information that may be of interest to Sparkle Stars' customers and potential customers. Because Sharon has done some market research, she knows that her clientele is concerned about the environment, self-care and, at least in some cases, avoiding irritating skin products.

While the Sparkle Stars team shares its own company's content, such as blog posts, news of new products, video demonstrations and recent media mentions, it is careful to balance self-promoting content with that by third-parties. In fact, the team has established a ratio of sharing four pieces of third-party content to every one piece of Sparkle Stars' content.

With every piece of content shared, the marketing team adds appropriate hash tags that indicate the topic under consideration. In addition, when possible, the marketing team also adds the username of the personality or company referenced in the content such that the person or business being referenced get a notification that the content has been shared.

Over time, Sparkle Stars began to get content "likes" and other forms of attention from the businesses and personalities that it showcased in its content. This led to greater recognition for Sparkles Stars, as well as added credibility.

Online Customer Service

Social media has given rise to a new channel for customer service. Not long ago, customers who had a complaint or needed assistance with their products typically had to reach businesses by phone, email, or website based chat. However, some companies have dedicated social media customer service teams that specialize in addressing customer complaints and concerns within specific platforms.

The decision to offer social media-based customer service arose after frustrated customers began taking their complaints to social media when other channels failed. In some cases, these "*callouts*" resulted in embarrassment for companies, so addressing problems directly so that other platform users could see the correspondence, made sense.

Small Business Hiring Example

Darren is the owner of a small tech startup that produces a personal styling app. He is looking to hire a team of personal stylists who are willing to provide fashion guidance to app users. When he places a job ad, he finds himself deluged with email responses.

While such a large response means that Darren has his pick of workers, he is also concerned about selecting the right styles for his business. He begins checking out the social media profiles of his most promising applicants. He notices that several of the applicants demonstrate a unique style photographs that have been posted in their social media accounts.

In addition, he also notices that three applicants, in particular, have developed beautifully curated fashion boards on Pinterest. He realizes that these individuals have a good eye for fashion and should be able to identify pieces that will work for their online clients. Darren schedules interviews and ends up hiring all three for his new team.

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Social Media Marketing Can Help You Meet Your Marketing Goals

Social media marketing can help with a number of goals, such as:

- Increasing website traffic
- Building conversions
- Raising brand awareness
- Creating a brand identity and positive brand association
- Improving communication and interaction with key audiences

Best Social Media Marketing Tips

Ready to get started with marketing on social media Here are a few social media marketing tips to kick off your social media campaigns.

- **Social Media Content Planning** — As discussed previously, building a social media marketing plan is essential. Consider keyword research and competitive research to help brainstorm content ideas that will interest your target audience. What are other businesses in your industry doing to drive engagement on social media?
- **Great Social Content** — Consistent with other areas of online marketing, content reigns supreme when it comes to social media marketing. Make sure you post regularly and offer truly valuable information that your ideal customers will find helpful and interesting. The content that you share on your social networks can include social media images, videos, info graphics, how-to guides and more.
- **A Consistent Brand Image** — using social media for marketing enables your business to project your brand image across a variety of different social media platforms. While each platform has its own unique environment and voice, your businesses core identity, whether it's friendly, fun, or trustworthy, should stay consistent.
- **Social Media for Content Promotion** — Social media marketing is a perfect channel for sharing your best site and blog content with readers. Once you build a loyal following on social media, you'll be able to post all your new content and make sure your readers can find new stuff right away. Plus, great blog content will help you build more followers. It's a surprising way that content marketing and social media marketing benefit each other.
- **Sharing Curated Links** — while using social media for marketing is a great way to leverage your own unique, original content to gain followers, fans, and devotees, it's also an opportunity to link to outside articles as well. If other sources provide great, valuable

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information you think your target audience will enjoy, don't be shy about linking to them. Curating and linking to outside sources improves trust and reliability, and you may even get some links in return.

- **Tracking Competitors** — it's always important to keep an eye on competitors—they can provide valuable data for keyword research and other social media marketing insight. If your competitors are using a certain social media marketing channel or technique that seems to be working for them, considering doing the same thing, but do it better!
- **Measuring Success with Analytics** — you can't determine the success of your social media marketing strategies without tracking data. Google Analytics can be used as a great social media marketing tool that will help you measure your most triumphant social media marketing techniques, as well as determine which strategies are better off abandoned. Attach tracking tags to your social media marketing campaigns so that you can properly monitor them. And be sure to use the analytics within each social platform for even more insight into which of your social content is performing best with your audience.
- **Social Media Crisis Management** — Things don't always go swimmingly for brands on social media. It's best to have a playbook in place so your employees know how to handle a snafu. Check out our guide to social media crisis management to see examples of the worst social media disasters, plus tips on how they *should* have been handled.

Check your Progress:

1. What are the Benefits of Using EDI?
2. Write short notes on Web Browsing.
3. What is the application of Internet?
4. What is Social Networking?
5. What is Website Management?

11.8. ANSWERS TO CHECK YOUR PROGRESS:

1. Some of the Benefits of Using EDI are:
 - Economy
 - Speed
 - Accuracy
 - Efficiency
 - Strategic Business Level
2. The web browser is another Internet application of critical importance. The web browser was developed in a highly commercialized environment dominated by such corporations as Microsoft and Netscape, and heavily influenced by the World Wide

Web Consortium (W3C). While Microsoft and Netscape have played the most obvious parts in the development of the web browser, particularly from the public perspective, the highly influential role of the W3C may be the most significant in the long term.

3. Some of Application are:
 - Communication
 - Job Search
 - Online Shopping
 - Stock market updates
 - Travel
 - Research
 - Video Conferencing.
4. Social networking is the use of internet-based social media programs to make connections with friends, family, classmates, customers and clients. Social networking can be done for social purposes, business purposes or both. The programs show the associations between individuals and facilitate the acquisition of new contacts. Examples of social networking have included Facebook, LinkedIn, Classmates.com and Yelp.
5. Website management is a service involving the updating, analyzing, promoting and developing of a website. Some website owners were of the impression that once you have a website designed and accessible on the internet that the job was finished.

11.9. SUMMARY:

- Development in our society began to happen post the World Wars, where in Industrial revolution started changing the face of economies.
- Computers and advancement of information and communication technology heralded the arrival of 'Internet' or 'World Wide Web' technology.
- E-commerce is conducted using a variety of applications, such as email, online catalogues and shopping carts, EDI, the File Transfer Protocol, web services, and mobile devices.
- M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as smartphones and tablets. As a form of e-commerce
- Electronic Data Interchange (EDI) is the electronic interchange of business information using a standardized format; a process which allows one company to send information to another company electronically rather than with paper.

11.10. KEYWORDS:

- **VAN (Value added Network):** A third party network that acts as an intermediary between trading partners. this service apart of receiving, storing, receiving and delivering the EDI messages also

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add audit data and modify data for automatic error detection, correction or conversion between communication protocols.

- **Content sharing:** The key to social media success is sharing quality content that enhances a brand, provides needed information or entertainment, and that establishes a brand as credible. The types of content shared depend on the platform, but typically includes links to industry articles, photographs and videos.
- **Influencers:** There are many bloggers, podcasters, and video producers who choose to focus on specific niche interests in the production of their content. Several of these creators become very well known in specific industries not because they have industry work experience, but because their content is influential. These "influencers" are often targeted by businesses for promoting products.
- **Sharing Economy:** "Sharing economy" networks, also called "collaborative economy networks," connect people online for the purpose of advertising, finding, sharing, buying, selling, and trading products and services.

11.11. SELF ASSESSMENT QUESTIONS AND EXERCISES:

Short Answer questions:

1. What is Collaborative Economy?
2. What are the types of Social Media?
3. What is M-Commerce?
4. What are the Types of M-commerce?
5. What is EDI?

Long Answer questions:

1. Explain briefly about EDI?
2. Explain briefly about M-Commerce?
3. Explain about E-commerce and Internet?
4. Explain about uses of social media in business organization?

11.12. FURTHER READINGS

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UNIT - XII COMPUTER SYSTEMS AND RESOURCES

Notes

- 12.1 Computers systems
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12.1 COMPUTERS SYSTEMS

INTRODUCTION

We are all aware of what computers are and their immense importance in our daily lives. It is an electronic device that not only stores data but also processes and manipulates data to carry out functions. Upon receiving valid instructions, a computer can perform a variety of operations. What allows us to perform such tasks on the computer is a computer system. A computer system is the sum total of all the components (hardware and software) that makes up a fully functional computer.

12.1.1 Elements of a Computer System

There are six main elements that make up a computer system. They all interact with each other and perform the task at hand. Let us take a look at all of them.

Hardware

These are all the physical aspects of a computer system. They are tangible, i.e. you can see and touch them. Hardware components are the electronic or mechanical instruments, like keyboard, monitor, printer etc. They help the users interface with the software, and also display the result of the tasks being performed. Hardware can actually be of four types, depending on which function they perform. The four types of hardware are,

- **Input Hardware:** For users to input data into the computer system.
Examples: Keyboard, mouse, Scanner

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- **Output Hardware:** To translate and display the result of the data processing =. Example: Monitor Screen, Printer etc.,
- **Processing and Memory Hardware:** Where data and information are processed and manipulated to perform the task at hand. It is also the workspace of the computer, where it temporarily stores data. Examples: Central Processing Unit (CPU), Read Only Memory (RAM)
- **Secondary Storage Hardware:** Where the computer system stores data permanently. Example: Hard disk, Pen drive etc

Software

Software is nothing but a set of programs (computer instructions), which helps the user to do a set of specific tasks. It helps the user interact with the computer system with the help of hardware. Software, as you can imagine, is the intangible aspect of the computer system. Basically, there are six main types of software, which are as follows,

- **Operating System:** These specialized programs allow the communication between software and hardware. The operating systems run all the other computer programs, and even regulate the startup process of the computer. Examples: Windows XP, Macintosh etc.,
- **Application Software:** These are designed to perform a specific task or a bunch of tasks. They can be user-designed (specific to the user's needs) or readymade application software. Example: PowerPoint, Tally etc.
- **Utility Software:** Like operating systems, it is a system software. It helps maintain and protect the computer system. For example, Anti-virus software is utility software.
- **Language Processors:** Software that interprets computer language and translates it into machine language. It also checks for errors in language syntax and fixes the problems.
- **System Software:** These types of software control the hardware, the reading of the data and other such internal functions.
- **Connectivity Software:** The special software that facilitates the connection between the computer system and the server. This allows the computer to share information and communicate with each other.

People

The people interacting with the computer system are also an element of it. We call this element the Livewire. They are the ultimate "users" of the computer systems. There are three types of people that interact with the system, namely

- **Programmers:** Professionals who write the computer programs that allow users to interact with the computer. They must have technical knowledge of computers and computer languages.

- **System Analyst:** They mainly design data processing systems, and solve problems that arise in data processing
- **End-Users:** Also known as operators, they are the people who interact with the computer system.

Procedures

These are a set of instructions, written in code, to instruct a computer on how to perform a task, run a software, do calculations etc. There are three types of procedures in a computer they are,

- **Hardware-Oriented Procedure:** Instructs the hardware components of the system, ensures they work smoothly
- **Software Oriented Procedure:** Provides instructions to launch and run software programs
- **Internal Procedures:** Directs the flow of information and sequences the data

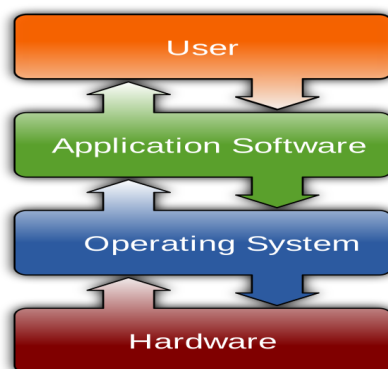
Data

Data is essentially the raw facts and figures that we input in the computer. The data gets processed via the computer system and becomes information, which is processed and organized data. Information can then be used for decision-making purposes.

The measurement of data is done in terms of “bytes”. One kilobyte (KB) is approximately 1000 bytes, 1 megabyte (MB) is 1 million bytes and finally, 1 gigabyte (GB) is approximately 1 billion bytes.

Connectivity

This is when the computers are linked to a network. It facilitates sharing of information, files, and other facilities. Computers can connect to a network via LAN cables, Bluetooth, Wi-Fi, satellites etc. The internet is the most obvious example of connectivity in a computer system.



12.2 TYPES AND TYPES OF COMPUTER SYSTEM PROCESSING

Data processing can be defined by the following steps

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- Data capture, or data collection.
- Data storage.
- Data conversion (changing to a usable or uniform format).
- Data cleaning and error removal.
- Data validation (checking the conversion and cleaning).
- Data separation and sorting (drawing patterns, relationships, and creating subsets).
- Data summarization and aggregation (combining subsets in different groupings for more information).
- Data presentation and reporting.

There are different types of data processing techniques, depending on what the data is needed for. Types of data processing at a bench level may include statistical, algebraically, mapping and plotting, forest and tree method, machine learning, linear models, non-linear models, relational and non-relational processing. These are methodology and techniques which can be applied within the key types of data processing.

What we're going to discuss in this article is the five main hierarchical types of data processing. That is the overarching types of systems in data analytics.

12.2.1 Data Processing by Application Type

The first two key types of data processing I'm going to talk about are scientific data processing and commercial data processing.

1. Scientific Data Processing



When used in scientific study or research and development work, data sets can require quite different methods than commercial data processing.

Scientific data is a special type of data processing that is used in academic and research fields.

It's vitally important for scientific data that there are no significant errors that contribute to wrongful conclusions. Because of this, the cleaning and validating steps can take a considerably larger amount of time than for commercial data processing. Scientific data processing needs to draw conclusions, so the steps of sorting and summarization often need to be performed very carefully, using a wide variety of processing tools to ensure no selection biases or wrong relationships are produced. Scientific

data processing often needs a topic expert additional to a data expert to work with quantities.

2. Commercial Data Processing



Commercial data processing has multiple uses, and may not necessarily require complex sorting. It was first used widely in the field of marketing, for customer relationship management applications, and in banking, billing, and payroll functions. Most of the data caught in these applications are standardized, and somewhat error proofed. That is capture fields eliminate errors, so in some cases raw data can be processed directly, or with minimum and largely automated error checking.

Commercial data processing usually applies standard relational databases, and uses batch processing, however some, in particular technology applications may use non-relational databases.

There are still many applications within commercial data processing that lean towards a scientific approach, such as predictive market research. These may be considered a hybrid of the two methods.

Data Processing Types by Processing Method

Within the main areas of scientific and commercial processing, different methods are used for applying the processing steps to data. The three main types of data processing we're going to discuss are automatic/manual, batch, and real-time data processing.

3. Automatic versus Manual Data Processing

It may not seem possible, but even today people still use manual data processing. Bookkeeping data processing functions can be performed from a ledger, customer surveys may be manually collected and processed, and even spreadsheet-based data processing is now considered somewhat manual. In some of the more difficult parts of data processing, a manual component may be needed for intuitive reasoning.

The first technology that led to the development of automated systems in data processing was punch cards used in census counting. Punch cards were also used in early days of payroll data processing.

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Computers started being used by corporations in the 1970's when electronic data processing began to develop. Some of the first applications for automated data processing in the way of specialized databases were developed for customer relationship management (CRM), to drive better sales.

Electronic data management became widespread with the introduction of the personal computer in the 1980s. Spreadsheets provided simple electronic assistance for even everyday data management functions such as personal budgeting and expense allocations.

Database management provided more automation of data processing functions, which is why I refer to spreadsheets as a now rather manual tool in data management. The user is required to manipulate all the data in a spreadsheet, almost like a manual system, only calculations are aided. Whereas in a database, users can extract data relationships and reports relatively easily, providing the setup and entries are correctly managed.

Autonomous databases now look to be a data processing method of the future, especially in commercial data processing. Oracle and Peloton are poised to offer users more automation with what is termed a "self-driving" database. This development in the field of automatic data processing, combined with machine learning tools for optimizing and improving service, aims to make accessing and managing data easier for end users, without the need for highly specialized data professionals in-house.

4. Batch Processing

To save computational time, before the widespread use of distributed systems architecture, or even after it, stand-alone computer systems apply batch processing techniques. This is particularly useful in financial applications or where data was secure such as medical records.

Batch processing completes a range of data processes as a batch, by simplifying single commands to provide actions to multiple data sets. This is a little like the comparison of a computer spreadsheet to a calculator in some ways. A calculation can be applied with one function that is one step, to a whole column or series of columns, giving multiple results from one action. The same concept is achieved in batch processing for data. A series of actions or results can be achieved by applying a function to a whole series of data. In this way, the computer processing time is far less.

Batch processing can complete a queue of tasks without human intervention, and data systems may program priorities to certain functions or set times when batch processing can be completed.

Banks typically use this process to execute transactions after the close of business, where computers are no longer involved in data capture and can be dedicated to processing functions.

5. Real Time Data Processing



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For commercial uses, many large data processing applications require real-time processing. That is they need to get results from data exactly as it happens. One application of this that most of us can identify with is tracking stock market and currency trends. The data needs to be updated immediately since investors buy in real time and prices update by the minute. Data on airline schedules and ticketing and GPS tracking applications in transport services have similar needs for real-time updates.

The most common technology used in real time processing is stream processing. The data analytics are drawn directly from the stream, that is, at the source. Where data is used to draw conclusions without uploading and transforming, the process is much quicker.

Data virtualization techniques are another important development in real-time data processing, where the data remains in its source form, the only information is pulled for the data processing. The beauty of data virtualization is that where transformation is not necessary, so the error is reduced.

Data virtualization and stream processing mean that data analytics can be drawn in real time much quicker, benefiting many technical and financial applications, reducing processing times and errors.

Other than these popular Data processing Techniques there are three more processing techniques which are mentioned below-

6. Online processing

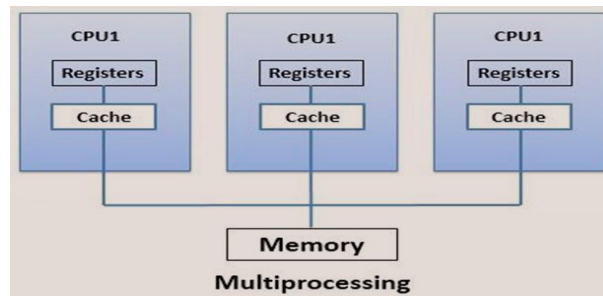
This data processing technique is derived from Automatic data processing. This technique is now known as immediate or irregular access handling. Under this technique, the activity by the framework is prepared at the time of operation/processing. This can be viewed easily with continuous preparing of data sets. This processing method highlights the fast contribution of exchange of data and connects directly with the databases.

7. Multi-processing

This is the most commonly used data processing technique. However, it is used all over the globe where we have the computer-based setups for Data capture and processing. As the name suggests – Multiprocessing is not bound to one single CPU, With this, it has a collection of several CPU's. As the various set of processing devices are included in this method, therefore the outcome efficiency is very useful. The jobs are broken into frames and then sent to the multiprocessors for processing. The result

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obtained is expected to be in less time and the output is increased. The additional benefit is every Processing unit is independent thus failure of any will not impact the working of other processing units.



8. Time Sharing

This kind of Data processing is entirely based on Time. In this, one unit of processing data is used by several users. Each user is allocated with the set timings on which they need to work on the same CPU/processing Unit. Intervals are divided into segments and thus to users so there is no collapse of timings which makes it as a multi-access system. This processing technique is also widely used and mostly entertained in startups.

12.2.2 Quick Tips to Analyze Best Processing Techniques

1. Understanding your requirement is a major point before choosing the best processing techniques for your Project.
2. Filter out your data in a much more precise manner so you can apply processing techniques.
3. Recheck your filter data again in a way that it still represents the first requirement and you don't miss out any important fields in it.
4. Think about the OUTPUT which you would like to have so you can follow your idea.
5. Now you have the filter data and the output you wish to have, Check the best and most reliable processing technique.
6. Once you choose your technique as per your requirement it will be easy to follow up for the end result.
7. The chosen technique must be checked simultaneously so there are no loopholes in order to avoid mistakes.
8. Always apply ETL functions to recheck your datasets.
9. With this don't forget to apply a timeline to your requirement as without a specific timeline it is useless to apply energy.
10. Test your OUTPUT again with the initial requirement for a better delivery.

12.3 SECONDARY STORAGE MEDIA AND DEVICES:

Secondary Storage Devices are essential as the size of Primary storage or main memory in every computer is limited. With this, the computer can only accommodate a limited sized program and data. To carry out big jobs like commercial data processing, it becomes essential that data be held in some expansive form of storage. This is achieved through secondary storage Devices. It is also called as external storage, and can hold data either sequentially or at random. You should always keep in mind that data in secondary storage devices is not directly accessible and has to be routed through the main storage for processing.

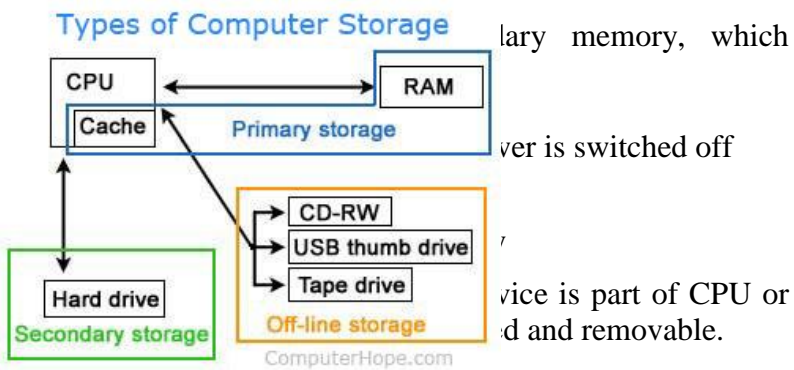
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12.3.1 Characteristics of Secondary Memory

These distinguish it

- It is non-volatile
- It is large
- It is cheap

Depending on, there are

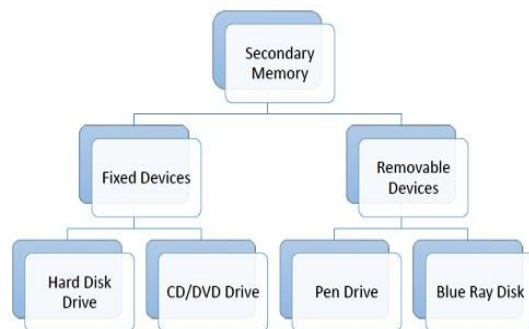


Secondary memory, which

is never switched off

because the device is part of CPU or hard disk and removable.

Hard Disk Drive



HARD DISK

Hard disk drive is made up of a series of circular disks called **platters** arranged one over the other almost 1/2 inches apart around a **spindle**. Disks are made of non-magnetic material like aluminum alloy and coated with 10-20 nm of magnetic material.



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Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers. Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

CD Drive

CD stands for **Compact Disk**. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap as you can get 700 MB of storage space for less than a dollar. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs –

- **CD-ROM (Compact Disk – Read Only Memory)** – The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- **CD-R (Compact Disk – Recordable)** – Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- **CD-RW (Compact Disk – Rewritable)** – Data can be written and deleted on these optical disks again and again.

DVD Drive

DVD stands for **Digital Video Display**. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable.



Pen Drive

Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is nonvolatile. It is also called USB drive, key drive or flash memory.



Blu Ray Disk

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia files. BD uses shorter

wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.

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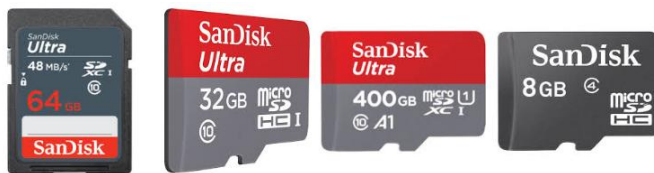
Floppy Disk

They are flexible plastic discs which can bend, coated with magnetic oxide and are covered with a plastic cover to provide protection. Floppy disks are also known as 3.5-inch floppy disks.



Memory Card

This has similar functionality to a flash drive but is in a card shape. It can easily plug into a port and be removed after its work is done. A memory card is available in various sizes such as 8MB, 16MB, 64MB, 128MB, 256MB etc.



Flash Drive

This is also known as a pen drive. It helps in easy transportation of data from one system to another. A pen drive is quite compact and comes with various features and designs.



Image Credit: HP

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12.4 INPUT AND OUTPUT DEVICES:

12.4.1 Input Devices

The devices which are used to give data and instructions to the computer are called **Input Devices**. Various types of input devices can be used with the computer depending upon the type of data you want to enter in the computer, e.g., keyboard, mouse, joystick, light pen, etc.

Keyboard

It is the most commonly used input device. It is used to enter data and instructions directly into the computer. There are 104 buttons on the keyboard which are called keys.



Mouse

Mouse is another input device which is commonly found connected with the computers. It is basically a pointing device which works on the principle of Point and Click. When the mouse is moved on the mouse pad, a light beam underneath reflect to give motion to the pointer on the screen.



Scroll Mouse



Cordless Mouse



Optical Mouse

The mouse is used in windows based programs, where the user can run the commands by pointing the objects with the help of pointer and clicking the buttons on the mouse. We also use mouse for drawing in paint and kid pix.

Most of the latest mouse, these days, includes a wheel in the middle of two buttons that help us to scroll through documents more easily. we use our forefinger to move the wheel to scroll up or down in a document. Optical mouse uses red light to track the movement of mouse for moving the pointer on the computer screen. This type of mouse is more accurate and reliable than the traditional mouse.

Nowadays cordless mouse is very popular. It does not have wires. it either uses Bluetooth technology to sends the data through the air to a receiver, usually plugged in USB port of the computer.

Joystick and Game-pad



Joystick



Gamepad

Joystick and game-pad are also input devices which are also input devices which are used to control the movement of object on the screen. Just like mouse, these are also pointing devices. Mostly they are used for playing games on the computer. The joystick has a vertical stick with a track ball at its bottom. While playing the games on the computer, the user needs to move the objects quickly on the screen. With the movement of this vertical stick the objects can be moved in all the directions easily. A game-pad is a type of game controller held in two hands, where the fingers (especially thumbs) are used to provide input by pressing buttons on it. It is also known as Control Pad.

Light Pen

Light pen is another pointing type input device. It is a pen shaped device which can be used by directly pointing the objects on the screen. It can also be used for making drawings directly on the monitor screen.



Light Pen

Scanner



We can store pictures, photographs, diagrams into the computer with the help of scanner. The scanner reads the image and saves it in the computer as a file.

Touch screen

Touch screen is a special computer screen that takes the input by sensing the touch of a human finger, gloved hand, stylus, pen or any other pointing device. The user gives instructions to the computer just by touching the screen.



Touch Screen

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Microphone



This is an input device which is used to record sound or voice into the computer system. You can store voice data in the computer by speaking in front of this device.

Trackball



A trackball is similar to a mouse but is mounted in a fixed position. The user spins the ball with fingers to move the pointer on the screen. A Trackball technology was used in earlier laptop computer which is now replaced with track-pad.

12.4.2 Output Devices

The devices which are used to display the results or information are called **Output Devices**. You can view the output on the monitor or you can print it on a paper using a printer. Monitor and the printer are the commonly used output devices.



LCD Monitor



CRT Monitor

Monitor

This is the most common output device connected with the computer to display the processed

information. It looks like a TV and is also known as **VDU (Visual Display Unit)**. Pictures are displayed by using a large number of very small dots on screen called pixels. The number of pixels that a monitor can show on its screen is referred to as the resolution of the screen.

The two commonly used monitor types are:

1. Cathode Ray Tube(CRT)Monitor
2. Liquid crystal Display(LCD)Monitor

The output produced on the screen is called Soft Copy Output because it cannot be retained for a long time. Nowadays LCD monitors are more popular as their sharp picture quality. They are light weighted and flat screen monitors.

Printer

This is an important output device of the computer system. It gives a printed output of the results that appears on the monitor screen. Printed output is also called Hard Copy output because unlike monitor, this output can be preserved even if the computer is switched off.

Printers are of different types. On the basis of their printing techniques, printers are grouped as follows:

- 1.Character printer
- 2.Line printer
- 3.Page printer



Character Printer

Character printer prints one character at a time; it prints at the speed of around 30 to 600 characters per second. Dot Matrix printer is an example of a character printer.

Dot Matrix Printer

This type of printer works like a typewriter. It creates an impression on the paper by pressing the end of pins fixed in its print heads, against an inked ribbon. This printer is noisy with a low print quality. Its speed is measured in CPS (Characters per Second).

Line Printer

This is high speed printer that prints one line at a time. It is used when large quantity of output is required as it produces the quick output. Examples of a Line printer are Drum printer and the Chain printer. The noise level of these printers is high and speed ranges from 200 to 2000 LPM (Lines per Minute).

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Page Printer

Page Printer prints a whole page at a time. Examples of these printers are inkjet printer or a Line printer because it has to store each page in memory before printing it.

Inkjet Printer

This type of printer prints by spraying tiny ink droplets on the paper. It can print in both, color as well as black and white. The print quality of this printer is better than that of Dot Matrix Printer and it prints without making any noise. Its speed is measured in PPM(Pages Per Minute).

Laser printer

In this type of printer, laser beam technology is used to print the text or graphics on the paper. The speed of this printer is very fast and it gives out very fine quality prints. It's speed is also measured in PPM.

Speaker



Speakers are categorized as output devices. These are used to listen to the music and sounds played by the computer. Normally they come in a pair and have different shapes and sizes.

Plotter



We can get the print of a photograph, drawing, image stored in the computer, by using a plotter. It is an output device which provides a high quality of printed output. It is generally used by engineers and architects.

12.5 HARDWARE STANDARDS

With estimates of 12,000 desktop and laptop computers, the University has a considerable asset base. To allow flexibility for staff and students while still maintaining a degree of consistency across the

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University, the Workspace Program Working Party has developed a list of end user computing standards. These standards are not meant to fulfil every computing requirement, but to cater for the majority of staff and students everyday computing needs.

The list will be updated and reviewed on a regular basis. Requests for purchasing end user hardware outside this Standard List should follow the exemption procedure where a demonstrated business, research or academic requirement is necessary.

Both the Standards and the Exemption Procedure are draft policies and are subject to approval. They are currently out for consultation.

The End User Computer Hardware Standards are grouped in three categories:

- Desktop: Standard Performance
- Monitors: Standard Performance, High Performance and Large Performance
- Laptops: Standard Performance

Standard Desktop (for general use)

General-purpose computing functionality will be provided by this hardware type and it is expected that this will represent suitable capability for a large number of university staff and students. The following use cases comprise a non-exhaustive list of day-to-day computing functionality required:

- word processing;
- spreadsheet operation;
- simple desktop database operations;
- web browsing;
- electronic messaging;
- desktop publishing;
- basic graphics and multimedia work; and
- Access to administrative systems.

High Performance Desktop (for high-end/intensive use)

Enhanced desktop computing functionality will be provided by this hardware type for users with specialist requirements. The following use cases comprise a non-exhaustive list of the computing functionality required:

- application development;
- network / system performance analysis;
- complex desktop database operations;
- use of spatial information systems;
- high-end desktop publishing;

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- multimedia authoring;
- highly complex 3D modeling and simulation

Standardization lowers the total cost of ownership through reduced support costs and encourages collaboration and efficiency between all SCU technology support staff. By leveraging the buying power of the University, we also are able to receive significant cost savings for our purchases. SCU's recommended vendors for all desktop and laptop purchases are Dell and Apple.

There are many reasons why institutions standardize on computer vendors, and why we have standardized on Dell and Apple here at SCU. Among these are:

- the ability to provide higher quality support to the user community
- the ability to provide a higher quantity of support to the user community
- the ability to quickly troubleshoot computer problems that our users may be experiencing
- the ability to ensure that the computers are configurable for use on our network
- the ability to ensure consistently high quality hardware components (computers purchased at discount stores have lower quality components)
- cost savings through negotiated pricing on select models
- extended warranty support
- ensuring that computers are compatible with our SCU campus image

SUPPORT LEVELS

Support levels for Santa Clara University owned computers are as follows:

Computers - Full Support

Vendor	Desktop	Laptop
Apple	iMac (Mid 2014 model and newer)	MacBook Air (Early 2015 model and newer)
	Mac mini (Late 2014 model and newer)	MacBook Pro (Early 2015 model and newer)
Dell	OptiPlex 7020	Latitude 3340
	OptiPlex 7040	Latitude E6440
	OptiPlex 7050	Latitude E5450
	OptiPlex 7060	Latitude E5470
	Precision 3430	Latitude 5480

Vendor	Desktop	Laptop
	Precision 3630	Latitude 5490 Precision 5510 Precision 5520 Precision 5530

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Full Support: Academic Technology will ensure the working order of the computer, using reasonable staff time and support resources, and will facilitate any hardware repairs if the computer is under warranty. This includes:

- Pre-configuration of all new hardware and software to SCU's standard image.
- On-site setup of all new computers meeting SCU's requirements. This includes ensuring the new computer is fully functional, and the user can access all resources needed to perform job responsibilities.
- Evaluate service requests to determine the best solution. This may include consultation with other Academic Technology and Cyber infrastructure Technologies support staff to fully diagnose the issue and determine if the cause is within the computer or caused by external factors.
- If the computer is covered under the manufacturer's hardware warranty, Academic Technology will process all warranty claims with Apple or Dell. If the computer is no longer under a hardware warranty, Academic Technology will provide the client a quote for replacement parts. If the client does not wish to purchase the parts, then the computer will fall under the "End of Support" category (below).

Computers - End of Support

Vendor	Desktop	Laptop
Apple	iMac (Late 2013 and older) Mac mini (Late 2012 and older)	MacBook Air (Early 2014 and older) MacBook Pro (Mid 2014 and older)
Dell	De OptiPlex 7010 and older	Latitude D-series Latitude Exx00 series Latitude Exx00 series Latitude Exx10 series Latitude Exx10 series Latitude Exx20 series

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Vendor	Desktop	Laptop
		Latitude Exx30 series Latitude 3330
<p><i>Some models may technically still run a supported operating system but performance may be poor and the hardware warranty has expired.</i></p> <p>End of Support: Academic Technology will facilitate the recovery / transfer of data to a customer-provided external device (USB hard drive or USB flash drive), but will not attempt to resolve technical issues. Academic Technology will work with the client to provide a recommendation for a replacement computer if necessary.</p> <p>Limited Support: Academic Technology will offer limited support for University owned Dell and Apple computers that are out of warranty (often 4 years), compatible with the current operating system, and the computer hardware drivers are still available from the manufacturer. Proof of University ownership is required. Hardware support for these computers will be on a time-and-materials basis.</p> <p>Unsupported: All computers which are NOT from Dell or Apple are considered unsupported. Academic Technology will not provide technical assistance for the computer other than decommissioning it for disposal. Academic Technology will work with the client to provide a recommendation for a replacement computer if necessary.</p>		

12.6 OTHER ACQUISITION ISSUES

12.6.1 Computer Hardware Acquisitions

The purpose of the computer acquisition procedures is to formalize a uniform standard for computer hardware acquisitions throughout the district. This procedure mandates the endorsement and support by the Superintendent.

The computer hardware acquisition procedure covers all computers, computer-related hardware, and supply items used by the District. The District is composed of departments that are under the authority of the person that mandates the computer acquisition procedures.

This procedure objective is to provide the guidelines for: proposing and recommending benchmarks, maintaining uniform standards, vendor contacting, vendor selection, vendor communications, and issuing purchase orders. This also covers receiving the hardware, testing, and approval for payment to the vendor. It will be the responsibility of the Information Systems Services (ISS) generating the procedures to provide this information and subsequent changes to all school/department heads within

the District. School/Department heads that currently do not have any computer equipment shall also receive a copy of this procedure.

A Technology Committee will be chaired by the ISS Operations Manager to assist in the monitoring of this process. All schools/departments will comply fully with the procedures. Current acquisitions are required to be on the Approved Computer Hardware List. In cases of special hardware needs not on the list, a waiver may be granted by the Assistant Superintendent of ISS.

Inventory Process

The Office of Internal Audit is responsible for maintaining and enforcing a District-wide computer hardware inventory program. The Associate Superintendent of Financial Services will assign the computer hardware inventory responsibility to the Office of Internal Audit. All schools/departments will comply fully with the District's procedures for transfer and disposal of property.

12.6.2 Needs Analysis for Major Systems Acquisitions

Definition of Major Hardware Acquisitions

Any projects that affect more than one school/department, and/or do not have any budgeted funds allocated for such a system, are identified as major computer systems acquisitions by the Assistant Superintendent of ISS. User managers will send a memo to the Assistant Superintendent of ISS and a copy to the Superintendent. This memo will address the needs for a major computer system acquisition. The memo can originate from one or more user management person(s) or the school/department head. The memo will cover the following issues:

- . The District's area(s) that will be affected by the new system.
- . A defined need for the acquisition.
- . Estimated costs, savings expected, and the anticipated life span of the proposed system.
- . The maximum calendar time allowed for the expected system to be operational.
- . A priority ranking will be provided for this project as compared to others under study or development.

Evaluating Hardware Acquisition, Installation, and Maintenance

A significant part of the information architecture is the computing hardware. These systems include the following:

- **Processing components**—the central processing unit (CPU). The CPU contains the electrical/electronic components that control or

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direct all operations in the computer system. A majority of devices within the information architecture are CPUs (supercomputers, mainframes, minicomputer, microcomputer, laptops, and PDAs).

- **Input/output components**—The I/O components are used to pass instructions or information to the computer and to generate output from the computer. These types of devices include the keyboard, the mouse (input), and monitors/terminal displays.

Computers logically fall into categories and differ depending on the processing power and size for the organization. The following are the basic categories for computers:

- **Supercomputers**—these types of computers have a large capacity of processing speed and power. They are generally used for complex mathematical calculations. Supercomputers generally perform a small number of very specific functions that require extensive processing power (decryption, modeling, and so on). Supercomputers differ from mainframes in that mainframes can use diverse concurrent programs.
- **Mainframes**—Mainframes are large general-purpose computers that support large user populations simultaneously. They have a large range of capabilities that are controlled by the operating system. A mainframe environment, as opposed to a client/server environment, is generally more controlled with regard to access and authorization to programs; the entire processing function takes place centrally on the mainframe. Mainframes are multiuser, multithreading, and multiprocessing environments that can support batch and online programs.
- **Minicomputer**—Minicomputers are essentially smaller mainframes. They provide similar capabilities but support a smaller user population (less processing power).
- **Microcomputer (personal computers)**—Microcomputers are primarily used in the client/server environment. Examples include file/print servers, email servers, web servers, and servers that house database-management systems. Individual workstations also fall into the microcomputer category and are used for word processing, spreadsheet applications, and individual communications (email). Microcomputers are generally inexpensive because they do not have the processing power of larger minicomputers or mainframes.
- **Notebook/laptop computers**—Notebook and laptop computers are portable and allow users to take the computing power, applications, and, in some cases, data with them wherever they travel. Notebooks and laptops today have as much computing power as desktop workstations and provide battery power when traditional power is not available. Because of the mobile nature of notebook and laptop computers, they are susceptible to theft. Theft of a laptop computer is certainly the loss of a physical asset, but it also can include the loss of

data or unauthorized access to the organization's information resources.

- **Personal digital assistants (PDAs)**—PDAs are handheld devices and generally have significantly less processing power, memory, and applications than notebook computers. These devices are battery powered and very portable (most can fit into a jacket pocket). Although the traditional use of a PDA is for individual organization, including the maintenance of tasks, contacts lists, calendars, and expense managers, PDAs are continually adding functionality. As of this writing, a significant number of PDAs provide wireless network access and have either commercial off-the-shelf software or custom software that enables users to access corporate information (sales and inventory, email, and so on). Most PDAs use pen (stylus)–based input instead of the traditional keyboard, affected by using either an onscreen keyboard or handwriting recognition. PDAs are synchronized with laptop/desktop computers through serial interfaces through the use of a cradle or wireless networking (802.11 or Bluetooth). The synchronization can be user initiated or automated, based on the needs of the user.

Earlier in this section, we discussed some of the attributes of computing systems, including multiprocessing, multitasking, and multithreading. These attributes are defined as follows:

- **Multitasking**—Multitasking allows computing systems to run two or more applications concurrently. This process enables the systems to allocate a certain amount of processing power to each application. In this instance, the tasks of each application are completed so quickly that it appears to multiple users that there are no disruptions in the process.
- **Multiprocessing**—Multiprocessing links more than one processor (CPU) sharing the same memory, to execute programs simultaneously. In today's environment, many servers (mail, web, and so on) contain multiple processors, allowing the operating system to speed the time for instruction execution. The operating system can break up a series of instructions and distribute them among the available processors, effecting quicker instruction execution and response.
- **Multithreading**—Multithreading enables operating systems to run several processes in rapid sequence within a single program or to execute (run) different parts, or threads, of a program simultaneously. When a process is run on a computer that process creates a number of additional tasks and subtasks. All the threads (tasks and subtasks) can run at one time and combine as a rope (entire process). Multithreading can be defined as multitasking within a single program.

Check your Progress:

1. What are the main elements of a Computer System?

2. Define Data Processing?
3. What is Batch Processing?
4. What is multi-processing?
5. What is time sharing?

12.7. ANSWERS TO CHECK YOUR PROGRESS:

1. Some of the Elements of Computer System are:
 - *Hardware*
 - *Software*
 - *People*
 - *Procedures*
 - *Data*
 - *Connectivity*
2. The data processing includes
 - Data capture, or data collection
 - □Data storage.
 - Data conversion (changing to a usable or uniform format).
 - Data cleaning and error removal.
 - Data validation (checking the conversion and cleaning).
 - Data separation and sorting (drawing patterns, relationships, and creating subsets).
 - Data summarization and aggregation (combining subsets in different groupings for more information).
 - Data presentation and reporting.
3. To save computational time, before the widespread use of distributed systems architecture, or even after it, stand-alone computer systems apply batch processing techniques. This is particularly useful in financial applications or where data was secure such as medical records. Batch processing completes a range of data processes as a batch, by simplifying single commands to provide actions to multiple data sets. This is a little like the comparison of a computer spreadsheet to a calculator in some ways.
4. This is the most commonly used data processing technique. However, it is used all over the globe where we have the computer-based setups for Data capture and processing. As the name suggests – Multiprocessing is not bound to one single CPU, With this, it has a collection of several CPU's. As the various set of processing devices are included in this method, therefore the outcome efficiency is very useful. The jobs are broken into frames and then sent to the multiprocessors for processing. The result obtained is

expected to be in less time and the output is increased. The additional benefit is every Processing unit is independent thus failure of any will not impact the working of other processing units.

5. This kind of Data processing is entirely based on Time. In this, one unit of processing data is used by several users. Each user is allocated with the set timings on which they need to work on the same CPU/processing Unit. Intervals are divided into segments and thus to users so there is no collapse of timings which makes it as a multi-access system. This processing technique is also widely used and mostly entertained in startups.

12.8. SUMMARY:

1. A computer system is the sum total of all the components (hardware and software) that makes up a fully functional computer.
2. Commercial data processing has multiple uses, and may not necessarily require complex sorting. It was first used widely in the field of marketing, for customer relationship management applications, and in banking, billing, and payroll functions.
3. This data processing technique is derived from Automatic data processing. This technique is now known as immediate or irregular access handling. Under this technique, the activity by the framework is prepared at the time of operation/processing. This can be viewed easily with continuous preparing of data sets.
4. Secondary Storage Devices are essential as the size of Primary storage or main memory in every computer is limited. With this, the computer can only accommodate a limited sized program and data.
5. Hard disk drive is made up of a series of circular disks called platters arranged one over the other almost $\frac{1}{2}$ inches apart around a spindle. Disks are made of non-magnetic material like aluminum alloy and coated with 10-20 nm of magnetic material.

12.9. KEYWORDS:

- **Programmers:** Professionals who write the computer programs that allow users to interact with the computer. They must have technical knowledge of computers and computer languages.
- **System Analyst:** They mainly design data processing systems, and solve problems that arise in data processing.
- **Supercomputers:** these types of computers have a large capacity of processing speed and power. They are generally used for complex mathematical calculations.
- **Mainframes:** Mainframes are large general-purpose computers that support large user populations simultaneously. They have a large range of capabilities that are controlled by the operating system

12.10. SELF ASSESSMENT QUESTIONS AND EXERCISES:

Short Answer questions:

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1. What is Commercial Data Processing?
2. What is Batch Processing?
3. What is Real Time Data Processing?
4. What is Processing components?
5. What are Personal digital assistants (PDAs)?

Long Answer questions:

1. Explain briefly about types of computer system processing?
2. Explain about Secondary storage media and devices?
3. Explain about Input and Output devices?

12. 11. FURTHER READINGS

1. Ahituv, N. and S. Neumann. 1990. Principles of Information Systems for Management. Dubuque: Wm. C. Brown Publishers.
2. Curry, A., P. Flett and F. Hollingsworth. 2006. Managing Information and Systems: The Business Perspective. Oxford: Routledge.
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UNIT – XIII MANAGING INFORMATION TECHNOLOGY

Notes

- 13.1 Managing Information Resources and technologies
- 13.2 Information System Architecture and management
- 13.3 Centralized, Decentralized and Distributed
 - 13.3.1 Centralization
 - 13.3.2 Decentralization
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- 13.4 EDI
- 13.5 Supply Chain Management & Global Information Management Technology
 - 13.5.1 Objectives of SCM
 - 13.5.2 Features of SCM
 - 13.5.3 Scope of the SCM
 - 13.5.4 SCM process
 - 13.5.5 Advantages of the SCM
- 13.6 Answers to Check Your Progress
- 13.7 Summary
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- 13.10 Further Readings

13.1 Managing Information Resources and technologies

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

There are three (3) classes of information resources:

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

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

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sharing. Control is required to collect, inventory and retrieve resources as required by the business.

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

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

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

13.2 Information System Architecture and management

Information system architecture is a formal definition of the business processes and rules, systems structure, technical framework, and product technologies for a business or organizational information system.

Information system architecture usually consists of four layers:

- Business process architecture,
- Systems architecture,
- Technical architecture,
- Product delivery architecture.

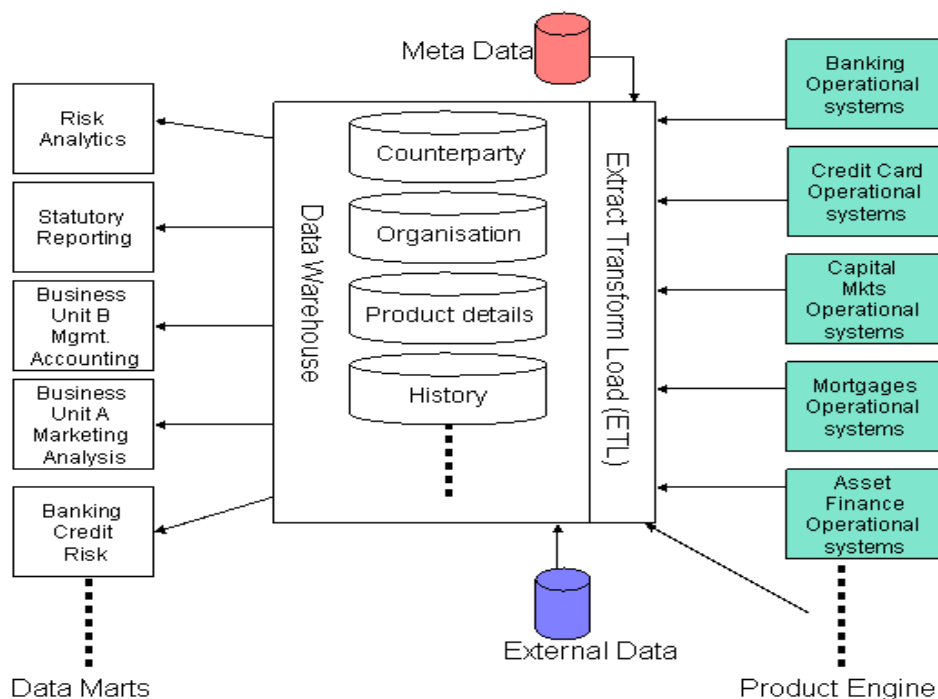
The architecture of an information system encompasses the hardware and software used to deliver the solution to the final consumer of services. The architecture is a description of the design and contents of a computerized system. If documented, the architecture may include information such as a detailed inventory of current hardware, software and networking capabilities; a description of long-range plans and priorities for future purchases, and a plan for upgrading and/or replacing dated equipment and software.

The architecture should document: What data is stored? How does the system function?, Where are components located?, When do activities and events occur in the system?, and Why does the system exist? Information system architecture is a blue print used to develop, implement, and maintain the elements in the organization.

Business architecture is a blue print of enterprise that provides a common understanding of the organization and is used to align objectives and demands. System architecture is the conceptual model that defines the structure, behavior and more views of the systems. Here we set the conventions, rules and standards employed in a system. A Technical architecture defines all the Technical requirements like operational, performance, etc. Product delivery architecture as the information regarding the delivery of the product, maintenance, etc.

Example for the system Architecture:

This is for the architecture for the banking services.



13.3 Centralized, Decentralized and Distributed

13.3.1 Centralization

Centralization is said to be a process where the concentration of decision making is in a few hands. All the important decision and actions at the lower level, all subjects and actions at the lower level are subject to the approval of top management. According to Allen, “Centralization” is the systematic and consistent reservation of authority at central points in the organization. The implication of centralization can be :-

1. Reservation of decision making power at top level.
2. Reservation of operating authority with the middle level managers.

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3. Reservation of operation at lower level at the directions of the top level.

Under centralization, the important and key decisions are taken by the top management and the other levels are into implementations as per the directions of top level. For example, in a business concern, the father & son being the owners decide about the important matters and all the rest of functions like product, finance, marketing, personnel, are carried out by the department heads and they have to act as per instruction and orders of the two people. Therefore in this case, decision making power remain in the hands of father & son.

Centralization of authority means the power of planning and decision making are exclusively in the hands of top management. It alludes to the concentration of all the powers at the apex level.

A pivot location or group of managerial personnel for the planning and decision-making or taking activities of the organization is known as Centralization. In this type of organization, all the important rights and powers are in the hands of the top level management.

In earlier times, centralization policy was the most commonly practiced in every organization to retain all the powers in the central location. They have full control over the activities of the middle or low-level management. Apart from that personal leadership and coordination can also be seen as well as work can also be distributed easily among workers.

However, due to the concentration of authority and responsibility, the subordinate employee's role in the organization is diminished because of all the right vests with the head office. Therefore, the junior staff is only to follow the commands of the top managers and function accordingly; they are not allowed to take an active part in the decision-making purposes. Sometimes hotchpotch is created due to excess workload, which results in hasty decisions. Bureaucracy and Red-tapism are also one of the disadvantages of centralization.

13.3.2 Decentralization

The assignment of authorities and responsibilities by the top level management to the middle or low-level management is known as Decentralization. It is the perfect opposite of centralization, in which the decision-making powers are delegated to the departmental, divisional, unit or center level managers, organization-wide. Decentralization can also be said as an addition to Delegation of authority.

At present, due to the increase in competition, managers take the decision regarding for the delegation of authority to the subordinates. Due to which the functional level managers get a chance to perform better, as well as freedom of work, is also there. Moreover, they share the responsibility of the high-level managers which results in quick decision making and saving of time. It is a very effective process for the expansion of the business organization, like for mergers and acquisitions.

Implications of Decentralization

1. There are fewer burdens on the Chief Executive as in the case of centralization.
2. In decentralization, the subordinates get a chance to decide and act independently which develops skills and capabilities. This way the organization is able to process reserve of talents in it.
3. In decentralization, diversification and horizontal can be easily implanted.
4. In decentralization, concern diversification of activities can place effectively since there is more scope for creating new departments. Therefore, diversification growth is of a degree.
5. In decentralization structure, operations can be coordinated at divisional level which is not possible in the centralization set up.
6. In the case of decentralization structure, there is greater motivation and morale of the employees since they get more independence to act and decide.
7. In a decentralization structure, co-ordination to some extent is difficult to maintain as there are lot many department divisions and authority is delegated to maximum possible extent, i.e., to the bottom most level delegation reaches. Centralization and decentralization are the categories by which the pattern of authority relationships became clear. The degree of centralization and decentralization can be affected by many factors like nature of operation, volume of profits, number of departments, size of a concern, etc. The larger the size of a concern, a decentralization set up is suitable in it.

13.3.3 DISTRIBUTED SYSTEMS

This is the last type of system that we are going to discuss. Let's head right into it!

In decentralized systems, every node makes its own decision. The final behavior of the system is the aggregate of the decisions of the individual nodes. Note that there is no single entity that receives and responds to the request.



○ — Node/Computer

Figure – Distributed system visualization

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Example

Google search system. Each request is worked upon by hundreds of computers which crawl the web and return the relevant results. To the user, the Google appears to be one system, but it actually is multiple computers working together to accomplish one single task (return the results to the search query).

Characteristics of Distributed System

- **Concurrency of components:** Nodes apply consensus protocols to agree on same values/transactions/commands/logs.
- **Lack of a global clock:** All nodes maintain their own clock.
- **Independent failure of components:** In a distributed system, nodes fail independently without having a significant effect on the entire system. If one node fails, the entire system sans the failed node continues to work.

Scaling –

Horizontal and vertical scaling is possible.

Components of Distributed System –

Components of Distributed System are,

- Node (Computer, Mobile, etc.)
- Communication link (Cables, Wi-Fi, etc.)

Architecture of Distributed System –

- peer-to-peer – all nodes are peer of each other and work towards a common goal
- Client-server – some nodes are become server nodes for the role of coordinator, arbiter, etc.
- n-tier architecture – different parts of an application are distributed in different nodes of the systems and these nodes work together to function as an application for the user/client

Limitations of Distributed System –

- Difficult to design and debug algorithms for the system. These algorithms are difficult because of the absence of a common clock; so no temporal ordering of commands/logs can take place. Nodes can have different latencies which have to be kept in mind while designing such algorithms. The complexity increases with increase in number of nodes. Visit [this link](#) for more information
- No common clock causes difficulty in the temporal ordering of events/transactions
- Difficult for a node to get the global view of the system and hence take informed decisions based on the state of other nodes in the system

Advantages of Distributed System –

- Low latency than centralized system – Distributed systems have low latency because of high geographical spread, hence leading to less time to get a response

Disadvantages of Distributed System –

- Difficult to achieve consensus
- Conventional way of logging events by absolute time they occur is not possible here

Applications of Distributed System –

- Cluster computing – a technique in which many computers are coupled together to work so that they achieve global goals. The computer cluster acts as if they were a single computer
- Grid computing – All the resources are pooled together for sharing in this kind of computing turning the systems into a powerful supercomputer; essentially.

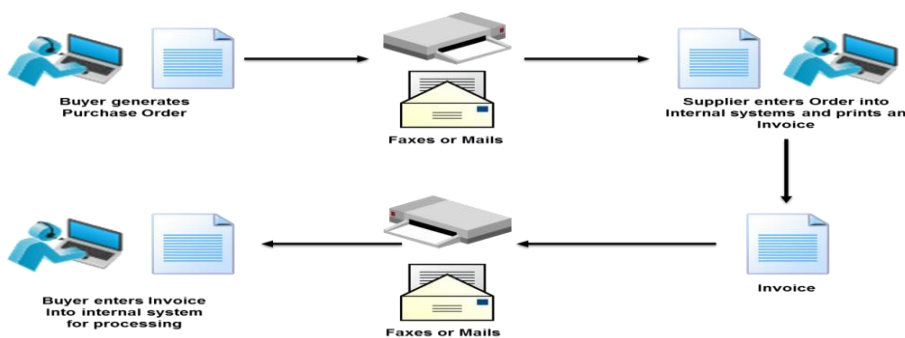
13.4 EDI

Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.

By moving from a paper-based exchange of business document to one that is electronic, businesses enjoy major benefits such as reduced cost, increased processing speed, reduced errors and improved relationships with business partners. Learn more about the benefits of EDI here. »

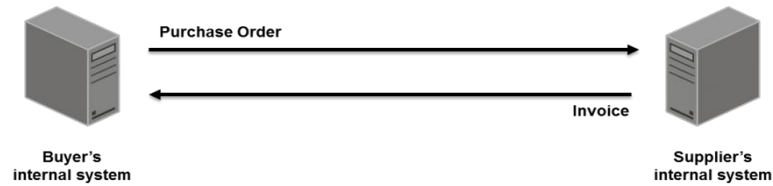
Each term in the definition is significant:

Computer-to-computer– EDI replaces postal mail, fax and email. While email is also an electronic approach, the documents exchanged via email must still be handled by people rather than computers. Having people involved slows down the processing of the documents and also introduces errors. Instead, EDI documents can flow straight through to the appropriate application on the receiver's computer (e.g., the Order Management System) and processing can begin immediately. A typical manual process looks like this, with lots of paper and people involvement:



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The EDI process looks like this — no paper, no people involved:



- **Business documents** – These are any of the documents that are typically exchanged between businesses. The most common documents exchanged via EDI are purchase orders, invoices and advance ship notices. But there are many, many others such as bill of lading, customs documents, inventory documents, shipping status documents and payment documents.
- **Standard format**– Because EDI documents must be processed by computers rather than humans, a standard format must be used so that the computer will be able to read and understand the documents. A standard format describes what each piece of information is and in what format (e.g., integer, decimal, mmddyy). Without a standard format, each company would send documents using its company-specific format and, much as an English-speaking person probably doesn't understand Japanese, the receiver's computer system doesn't understand the company-specific format of the sender's format.
 - There are several EDI standards in use today, including ANSI, EDIFACT, TRADACOMS and ebXML. And, for each standard there are many different versions, e.g., ANSI 5010 or EDIFACT version D12, Release A. When two businesses decide to exchange EDI documents, they must agree on the specific EDI standard and version.
 - Businesses typically use an EDI translator – either as in-house software or via an EDI service provider – to translate the EDI format so the data can be used by their internal applications and thus enable straight through processing of documents.
- **Business partners** – The exchange of EDI documents is typically between two different companies, referred to as business partners or trading partners. For example, Company A may buy goods from Company B. Company A sends orders to Company B. Company A and Company B are business partners.

13.5 Supply Chain Management

Supply chain management is the systemic, strategic coordination of the traditional business functions and tactics across these business functions - both within a particular company and across businesses within the supply

chain- all coordinated to improve the long-term performance of the individual companies and the supply chain as a whole.

In a traditional manufacturing environment, supply chain management meant managing movement and storage of raw materials, work-in-progress inventory, and finished goods from point of origin to point of consumption.

It involves managing the network of interconnected smaller business units, networks of channels that take part in producing a merchandise of a service package required by the end users or customers.

With businesses crossing the barriers of local markets and reaching out to a global scenario, SCM is now defined as –

Design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally.

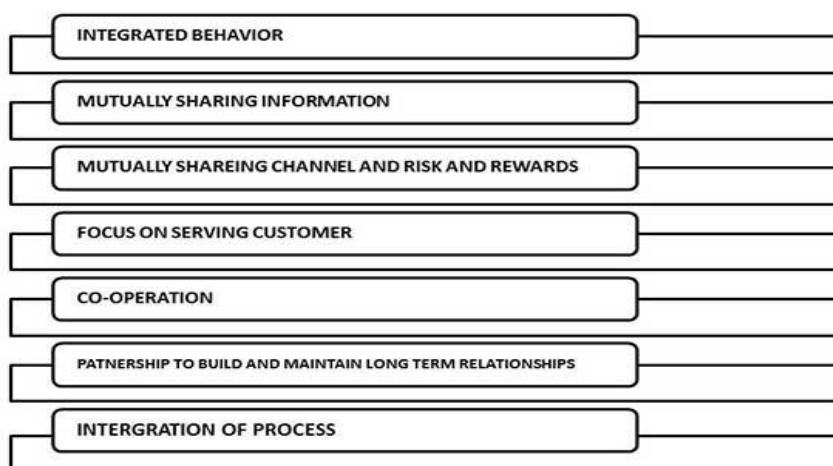
SCM consists of –

- operations management
- logistics
- procurement
- information technology
- integrated business operations

13.5.1 Objectives of SCM

- To decrease inventory cost by more accurately predicting demand and scheduling production to match it.
- To reduce overall production cost by streamlining production and by improving information flow.
- To improve customer satisfaction.

13.5.2 Features of SCM



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13.5.3 Scope of SCM



13.5.4 SCM Processes

- Customer Relationship Management
- Customer Service Management
- Demand Management
- Customer Order Fulfillment
- Manufacturing Flow Management
- Procurement Management
- Product Development and Commercialization
- Returns Management

13.5.5 Advantages of SCM

SCM have multi-dimensional advantages –

- To the suppliers –
 - Help in giving clear-cut instruction
 - Online data transfer reduce paper work
- Inventory Economy –
 - Low cost of handling inventory
 - Low cost of stock outage by deciding optimum size of replenishment orders
 - Achieve excellent logistical performance such as just in time
- Distribution Point –
 - Satisfied distributor and whole seller ensure that the right products reach the right place at right time
 - Clear business processes subject to fewer errors
 - Easy accounting of stock and cost of stock
- Channel Management –
 - Reduce total number of transactions required to provide product assortment
 - Organization is logically capable of performing customization requirements
- Financial management –

- Low cost
- Realistic analysis
- Operational performance –
 - It involves delivery speed and consistency.
- External customer –
 - Conformance of product and services to their requirements
 - Competitive prices
 - Quality and reliability
 - Delivery
 - After sales services
- To employees and internal customers –
 - Teamwork and cooperation
 - Efficient structure and system
 - Quality work
 - Delivery

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Check your Progress:

1. Write the classes of information resources?
2. Define Centralization?
3. What are distributed systems?
4. Write the characteristics of Distributed Systems?
5. What are objectives of SCM?

13.6. ANSWERS TO CHECK YOUR PROGRESS:

1. Some of classes in information resources are:
 - **Business Resources**
 - **System Resources**
 - **Data Resources**
2. **Centralization** is said to be a process where the concentration of decision-making is in a few hands. All the important decision and actions at the lower level, all subjects and actions at the lower level are subject to the approval of top management.
3. In decentralized systems, every node makes its own decision. The final behaviour of the system is the aggregate of the decisions of the individual nodes. Note that there is no single entity that receives and responds to the request. **Example** – Google search system. Each request is worked upon by hundreds of computers which crawl the web and return the relevant results. To the user, the Google appears to be one system, but it actually is multiple computers working together to accomplish one single task (return the results to the search query).
4. The characteristics are
 - **Concurrency of components:** Nodes apply consensus protocols to agree on same values/transactions/commands/logs.

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- **Lack of a global clock:** All nodes maintain their own clock.
 - **Independent failure of components:** In a distributed system, nodes fail independently without having a significant effect on the entire system. If one node fails, the entire system sans the failed node continues to work.
5. The objectives are
- To decrease inventory cost by more accurately predicting demand and scheduling production to match it.
 - To reduce overall production cost by streamlining production and by improving information flow.
 - To improve customer satisfaction.

13.7. SUMMARY:

- Information Resources Management (IRM) is the process of managing information resources to accomplish agency missions and to improve agency performance, including the reduction of information collection burdens on the public.
- Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.
- Supply chain management is the systemic, strategic coordination of the traditional business functions and tactics across these business functions - both within a particular company and across businesses within the supply chain- all coordinated to improve the long-term performance of the individual companies and the supply chain as a whole.

13.8. KEYWORDS:

- **Business Resources:** Enterprises, Business Functions, Positions (Jobs), Human/Machine Resources, Skills, Business Objectives, Projects, and Information Requirements.
- **System Resources:** Systems, Sub-Systems (business processes), Administrative Procedures (manual procedures and office automation related), Computer Procedures, Programs, Operational Steps, Modules, and Subroutines.
- **Data Resources:** Data Elements, Storage Records, Files (computer and manual), Views, Objects, Inputs, Outputs, Panels, Maps, Call Parameters, and Data Bases.
- **Independent failure of components:** In a distributed system, nodes fail independently without having a significant effect on the entire system. If one node fails, the entire system sans the failed node continues to work.
- **Concurrency of components:** Nodes apply consensus protocols to agree on same values/transactions/commands/logs.

13.9. SELF ASSESSMENT QUESTIONS AND EXERCISES:

Short Answer questions:

1. What is EDI?
2. What is Decentralization?
3. What are Data Resources?
4. What are the SCM Processes?
5. What are the Applications of Distributed System?

Long Answer questions:

1. Explain about Distributed Systems and its characteristics?
2. Explain about SCM and its processes?
3. Explain about EDI?

13.10. FURTHER READINGS

1. Ahituv, N. and S. Neumann. 1990. Principles of Information Systems for Management. Dubuque: Wm. C. Brown Publishers.
2. Curry, A., P. Flett and F. Hollingsworth. 2006. Managing Information and Systems: The Business Perspective. Oxford: Routledge.
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UNIT - XIV SECURITY AND ETHICAL CHALLENGES

- 14.1 Introduction of security and ethical challenges
- 14.2 Information System Control
 - 14.2.1 Input Control
 - 14.2.2 Processing Control
 - 14.2.3 Output control
 - 14.2.4 Storage Control
 - 14.2.5 Procedural Control
- 14.3 Facility and Procedural control
 - 14.3.1 Physical Facility Control
 - 14.3.2 Procedural control
- 14.4 Risks to Online Operations
- 14.5 Denial of service
- 14.6 Spoofing
- 14.7 Ethics for IS Professionals
- 14.8 Societal Challenges of information technology
- 14.9 Answers to Check Your Progress
- 14.10 Summary
- 14.11 Keywords
- 14.12 Self-Assessment Questions and Exercises
- 14.13 Further Readings

14.1 INTRODUCTION OF SECURITY AND ETHICAL CHALLENGES

Information system security relates to the way the system is protected against unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction.

There are two major aspects of information system security:

Security of the information technology used - securing the system from malicious cyber-attacks that tend to break into the system and can access critical private information or gain control of the internal systems.

Security of data – when critical issues are faced such as natural disasters, computer/server malfunction, physical theft etc, it is suggested to ensure the integrity of data. Generally an off-site backup of data is kept for such problems. Guaranteeing effective information security has the following key aspects:

Need to prevent the unauthorized individuals or systems from accessing the information.

Maintaining and assuring the accuracy and consistency of data over its entire life-cycle.

Ensuring that the computing systems, the security controls used to protect it and the communication channels used to access it, functioning correctly all the time, thus making information available in all situations.

Ensuring that the data, transactions, communications or documents are genuine.

Ensuring the integrity of a transaction by validating that both parties involved are genuine, by instilling authentication features such as "digital signatures".

To ensure that once a transaction takes place, no other party can deny it, either having received a transaction, or having sent a transaction. This is called 'non-repudiation' and shared in network systems.

Information Systems and Ethics

Information systems bring about immense social changes, threatening the existing distributions of power, money, rights, and obligations. It also raises new kinds of crimes, like cyber-crimes.

Following organizations promote ethical issues:

- The Association of Information Technology Professionals (AITP)
- The Association of Computing Machinery (ACM)
- The Institute of Electrical and Electronics Engineers (IEEE)
- Computer Professionals for Social Responsibility (CPSR)
- The ACM Code of Ethics and Professional Conduct
- Strive to achieve the highest quality, effectiveness, and dignity in both the process and products of professional work.
- Acquire and maintain professional competence.
- Know and respect existing laws pertaining to professional work.
- Accept and provide appropriate professional review.
- Provide comprehensive and thorough evaluations of computer systems and their impacts, including analysis and possible risks.
- Honour contracts, agreements, and assigned responsibilities.
- Improve public understanding of computing and its consequences.
- Access computing and communication resources only when authorized to do so.
- The IEEE Code of Ethics and Professional Conduct
- IEEE code of ethics demands that every professional vouch to commit themselves to the highest ethical and professional conduct and agree:
 - To accept responsibility in making decisions that are consistent with the safety, health and welfare of the public, and also to

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disclose the factors that might endanger the public or the environment;

- To avoid real conflicts of interest whenever possible, and to disclose them to the affected parties when they do exist;

Based on available data, you need to be honest and realistic in stating claims or estimates.

Do not accept bribery in all its forms;

- To improve the understanding of technology, its appropriate application, and potential consequences;
- To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
- To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
- To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
- To avoid injuring others, their property, reputation, or employment by false or malicious action;
- To assist or help colleagues and co-workers in their professional development and to support them in following this code of ethics.

14.2 INFORMATION SYSTEM CONTROL

Information system control assures the accuracy, validity and propriety of information system activities. Control must be there to ensure proper data entry processing techniques, storage methods and information output. Accordingly management information system control is designed to see or monitor and maintain quality, security of the input process, output and storage activities of an information system.

14.2.1 Input Control

As we know whatever we give to computer the computer processes that and returns the result to us. Because of this very fact, there is a need to control the data entry process. The types of input control are:

Transaction Codes: Before any transaction can be input into the system, a specific code should be assigned to it. This aids in its authorization.

Forms: a source document or screen forms should be used to input data and such forms must adhere to certain rules.

Verification: Source document prepared by one clerk can be verified by another clerk to improve accuracy.

Control-totals: Data entry and other system activities are frequently monitored by the use of control-total. For example, record count is a

control-total that consist of counting the total number of source documents or other input records and compare them at other stage of data entry. If totals do not match, then a mistake is indicated.

- **Check digit:** These are used for checking important codes such as customer number to verify the correctness.
- **Labels:** It contains data such as file name, and date of creation so that a check can be made that correct file is used for processing.
- **Character and field checking:** Characters are checked for proper mode – numeric, alphabetic, alphanumeric fields – to see if they are filled in properly.

14.2.2 Processing Control

Input and processing data are so interrelated that we can take them as first line of defense. Once data is fed into the computer, controls are embedded in various computer programs to help, detect not only input errors but also processing errors. Processing – controls are included to check arithmetic calculations and logical operations. They are also used to ensure that data are not lost or do not go unprocessed. Processing control is further divided into hardware and software control.

14.2.3 Output Control

These are developed to ensure that processed information is correct, complete and is transmitted to authorized user in a timely manner. The output control are mostly of same kind as input control e.g. Output documents and reports are thoroughly and visually verified by computer personnel and they are properly logged and identified with rout slips

14.2.4 Storage Control

Control responsibility of files of computer programs and databases is given to librarian or database administrator. They are responsible for maintaining and controlling access to the information. The databases and files are protected from unauthorized users as accidental users. This can be achieved with the help of security monitor. The method includes assigning the account code, password and other identification codes. A list of authorized users is provided to computer system with details such as type of information they are authorized to retrieve or receive from it.

14.2.5 Procedural Control

These methods provide maximum security to operation of the information system. Standard procedures are developed and maintained manually and built in software help display so that everyone knows what to do. It promotes uniformity and minimizes the chance of error and fraud. It should be kept up-to-date so that correct processing of each activity is made possible.

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14.3 FACILITY AND PROCEDURAL CONTROL

14.3.1 Physical Facility Control

Physical facility control is methods that protect physical facilities and their contents from loss and destruction. Computer centers are prone to many hazards such as accidents, thefts, fire, natural disasters, destructions etc. Therefore physical safeguards and various control procedures are required to protect the hardware, software and vital data resources of computer using organizations.

The GAL model control systems are among the most advanced known today in the field of machine and facility control.

The systems are based on several main components, which make the water treatment system fully automatic, as well as accessible and easy to handle.

- The programmed controller contains the action logic and constitutes a data processing unit, which, in a wider sense, forms the heart of the control system.
- The display unit enables an interface for the system operator for performing actions and receiving indications from the control system through local operator screens and unique computer systems.
- The end units (analyzers, transmitters) collect data and values from the process and different system components, and transfer them to the data processing unit.
- The end units are operated by the data processing unit and affect the system's performance and actions while carrying out its various activities.

An internet interface for data collection enables viewing of system data and performance, in the present and future, and contains data history and graphs. All this, from every computer, anywhere in the world and from any smartphone.

The remote control center is a unique center monitoring system actions as well as providing real-time alerts on malfunctions/ warnings.

The remote control array allows us to provide support and assistance as well as analyses events and action history, thus giving added operational value, savings and procedural stability.

The GAL Control Systems

Reliable, stable and intact systems for a long period of time.

Require minimal operator intervention.

14.3.2 Procedural control

Organizational, documental and systems controls are important to the auditor for proof of the operational checks used to defend and further

information within the processing system. Procedural controls are also important to assure management and the auditor that the real performance of the procedures within the EDP department is correctly performed.

Procedural controls are methods adopted to assure that the whole series of processing data from the time when the transactions happen to the time reports are ready for management is being ready and processed in the most accurate and well-organized manner.

Operations in the data processing department usually involved two kinds of errors, errors in processing transaction data and errors in processing permanent or semi-permanent data. Frequently, an error involving the use of transaction data will have an effect on the resultant output only once. Permanent or semi-permanent data that is to be used each time the file is processed may have deep effects on the output of data if permitted to remain not corrected for any distance of time. Thus, permanent or semi-permanent data must have more strict controls placed upon the processing of transactions and file data.

Any type of check, comparison, or confirmation used to eradicate errors, mismatched informational data, and unlawful system entry causes increases in processing time and expenses of operation. Though, to obtain the highest, most dependable quality of data, it is necessary to sustain the cost of these controls, and internal checks should be combined in the design and programming of input, output, file, and processing operations.

Controls over Input

Probably the most critical time for error detection as far as data processing is concerned, is the time at which the data is recorded. If data are not accurately recorded at the actual occurrence of the transaction, it will never become reliable, useful information.

Input controls should govern the accuracy of the data to be used as input as well as the methods used to obtain the data. Data input control involves the recognition of the transaction data to be captured, the methods to capture the data, and the accuracy with which the data is recorded.

There are a great many situations in which control can only be exercised at the input stage. It is therefore necessary that input controls be adequately maintained and designed to ensure that:

Transactions should accurately be recorded on the proper source document as soon as possible to provide the earliest accountability;

Where possible, all source and originating documents should be standardized and correctly coded;

Control totals and renumbered documents counts established in operations manuals should be in effect; and

All submissions of data are to be sent to the data processing department in accordance with prescribed routines.

Input errors may occur under several circumstances. The general reasons for input errors are improper recording of transaction data, improper

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conversion from manually readable form to machine readable form, loss through handling, and faulty processing when being read by the computer.

14.4 RISKS TO ONLINE OPERATIONS

There has been a surge in denial of service attacks hijacking of computers. To unauthorized access, data theft, and defacing of web pages massive movement of operation to the internet has attracted hackers who try to interrupt such operation daily. What is risk online operation?

Risks to application and data 1.Theft of information 2.Data alteration, data destruction, and defacement 3.Computer viruses and logic bombs 4.No malicious misshapes Risks to Information System

Risks to Information System

Hijacking

Denial of service

Defacing of Web pages

Data theft

Unauthorized access

Types of attacks include: s Many hackers try daily to interrupt online businesses

Risks to Online Operations

Deception of users to make them think they are logged on at one site while they actually are on another.

Spoofing If perpetrated from multiple computers it is called distributed denial of service (DDoS). Too many requests are received to log on to a Web site's pages.

Denial of Service (DoS) Risks to online operation.

Data alteration: sometimes hard to notice. But can be very damaging

Pharming: replacing a real website with an impostor to try to get people to enter confidential information.

Phishing: fraudulent messages (typically emails) which lure recipients into going to a fake website to try to get them to enter confidential information.

Keystroke logging: intercepts keystrokes and either stores them or sends them someplace on the Internet (very useful for stealing usernames, passwords, account information, etc.).

Social engineering: using human weaknesses to gain access to confidential information.

Theft of data: may be for identity theft, corporate espionage, etc. identity theft: using another person's credentials.

Risks to data and applications

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Honey token: a piece of data which is extremely unlikely to be accessed legitimately, but which an attacker is likely to access; it has special monitoring to immediately alert system administrators when it is accessed with information about where the access request originated

♣ Honey pot: a host on the network designed to lure attackers in so waiting monitors can attempt to track the attacker

♣ tarp it: a host on the network designed to expect attacks and respond very slowly, allowing the attacker to not get much done and spend enough time on the machine to be tracked

♣ Web defacement: basically vandalism, similar to graffiti, but can cost businesses a lot in lost revenue

♣ Data destruction: usually very noticeable, and can be alleviated somewhat by having good backup procedures in place

♣ DoS (denial of service): prevents the use of online resources; often done by flooding servers with so many requests that the servers can't handle legitimate traffic; can also be done by locking out access to a server or application

♣ Logic bomb: a program where malicious code lies dormant waiting for a specific time or set of conditions to become active and cause damage

♣ Trojan horse: a malicious program disguised as a potentially helpful or useful program; the program may even appear to be carrying out useful tasks while the malicious part of the code silently carries out its tasks or waits for the right time to spring into action; Trojans are a form of virus

♣ Worm: software that can spread itself through a network without human intervention

♣ Virus: software designed to spread from one computer to another based on something a user does, such as open a file.

Hijacking: taking control of a computer or website without the owner's consent; zombies are hijacked computers zombie: a zombie is a machine which has been attacked and has been infected with malicious software which awaits commands to carry out DDoS attacks; the user is usually unaware of the problem

♣ DDoS(distributed denial of service): a DoS attack where many computers are used to send the flood of requests; the attacking computers are usually machines which have been previously attacked and have malicious software waiting for commands from some other machine on the Internet .

14.5 DENIAL OF SERVICE

A Denial-of-Service (DoS) attack is an attack meant to shut down a machine or network, making it inaccessible to its intended users. DoS attacks accomplish this by flooding the target with traffic, or sending it

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information that triggers a crash. In both instances, the DoS attack deprives legitimate users (i.e. employees, members, or account holders) of the service or resource they expected.

Victims of DoS attacks often target web servers of high-profile organizations such as banking, commerce, and media companies, or government and trade organizations. Though DoS attacks do not typically result in the theft or loss of significant information or other assets, they can cost the victim a great deal of time and money to handle.

There are two general methods of DoS attacks: flooding services or crashing services. Flood attacks occur when the system receives too much traffic for the server to buffer, causing them to slow down and eventually stop. Popular flood attacks include:

Buffer overflow attacks – the most common DoS attack. The concept is to send more traffic to a network address than the programmers have built the system to handle. It includes the attacks listed below, in addition to others that are designed to exploit bugs specific to certain applications or networks

ICMP flood – leverages misconfigured network devices by sending spoofed packets that ping every computer on the targeted network, instead of just one specific machine. The network is then triggered to amplify the traffic. This attack is also known as the smurf attack or ping of death.

SYN flood – sends a request to connect to a server, but never completes the handshake. Continues until all open ports are saturated with requests and none are available for legitimate users to connect to.

14.6 SPOOFING

Spoofing is the act of disguising a communication from an unknown source as being from a known, trusted source. Spoofing can apply to emails, phone calls, and websites, or can be more technical, such as a computer spoofing an IP address, Address Resolution Protocol (ARP), or Domain Name System (DNS) server.

Spoofing can be used to gain access to a target's personal information, spread malware through infected links or attachments, bypass network access controls, or redistribute traffic to conduct a denial-of-service attack. Spoofing is often the way a bad actor gains access in order to execute a larger cyber-attack such as an advanced persistent threat or a man-in-the-middle attack.

Successful attacks on organizations can lead to infected computer systems and networks, data breaches, and/or loss of revenue—all liable to affect the organization's public reputation. In addition, spoofing that leads to the rerouting of internet traffic can overwhelm networks or lead customers/clients to malicious sites aimed at stealing information or distributing malware.

How Spoofing Works

Spoofing can be applied to a number of communication methods and employ various levels of technical know-how. Spoofing can be used carry out phishing attacks, which are scams to gain sensitive information from individuals or organizations.

Email Spoofing

Email spoofing occurs when an attacker uses an email message to trick a recipient into thinking it came from a known and/or trusted source. These emails may include links to malicious websites or attachments infected with malware, or they may use social engineering to convince the recipient to freely disclose sensitive information.

Sender information is easy to spoof and can be done in one of two ways:

Mimicking a trusted email address or domain by using alternate letters or numbers to appear only slightly different than the original

Disguising the 'From' field to be the exact email address of a known and/or trusted source

Caller ID Spoofing

With caller ID spoofing, attackers can make it appear as if their phone calls are coming from a specific number—either one that is known and/or trusted to the recipient, or one that indicates a specific geographic location. Attackers can then use social engineering—often posing as someone from a bank or customer support—to convince their targets to, over the phone, provide sensitive information such as passwords, account information, social security numbers, and more.

Website Spoofing

Website spoofing refers to when a website is designed to mimic an existing site known and/or trusted by the user. Attackers use these sites to gain login and other personal information from users.

IP Spoofing

Attackers may use IP (Internet Protocol) spoofing to disguise a computer IP address, thereby hiding the identity of the sender or impersonating another computer system. One purpose of IP address spoofing is to gain access to networks that authenticate users based on IP addresses.

More often, however, attackers will spoof a target's IP address in a denial-of-service attack to overwhelm the victim with traffic. The attacker will send packets to multiple network recipients, and when packet recipients transmit a response, they will be routed to the target's spoofed IP address.

ARP Spoofing

Address Resolution Protocol (ARP) is a protocol that resolves IP addresses to Media Access Control (MAC) addresses for transmitting data. ARP spoofing is used to link an attacker's MAC to a legitimate network IP address so the attacker can receive data meant for the owner associated with that IP address. ARP spoofing is commonly used to steal or modify

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data but can also be used in denial-of-service and man-in-the-middle attacks or in session hijacking.

DNS Server Spoofing

DNS (Domain Name System) servers resolve URLs and email addresses to corresponding IP addresses. DNS spoofing allows attackers to divert traffic to a different IP address, leading victims to sites that spread malware.

14.7 ETHICS FOR IS PROFESSIONALS

Ethical involves in all professions. It is included the professional that already in the profession or for those who wanted to enter to the profession. The development of information and technology environment make the professional ethics become more important and tend to become more complex and hard from a year to year. According to Abey (2011) from a website hubpages.com, 'ethics' is defined as the philosophy study of moral values and rules meanwhile, 'professional' is refer to the type of job that requires a special training that could bring a fairly high status. Professional ethics concept involves of what a professional should or should not do to any related work that they does in an occupation and how it related towards the society.

Professional ethics help the professional to make decision making when they faced with the work problem in moral issue. The action that the professional takes will be adjudged upon the individual perceptions in daily activities in work place or interrelation among the outsider. The issue that arises in professional ethics is about the code of professional ethics. There is professional that still unaware about the code of ethics and just perform their duty that focuses on services, teaching or scholarly. The professional should not only focus in their duties but they are also need to maintain the competence in their specialized fields. Besides that, the professional code of ethics will assist in decision that professional will make. This is because professional codes ethics serve as guideline to pursue knowledge and awareness.

14.8 SOCIETAL CHALLENGES OF INFORMATION TECHNOLOGY

His Blog contains information about Computer crimes: hacking, cyber theft, software piracy, Computer viruses & worms and privacy issues.

Computer Crime:

Cybercrime is becoming one of the Net's growth businesses. Today, criminals are doing everything from stealing intellectual property & committing fraud to unleashing viruses and committing acts of cyber terrorism.

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‘Criminal actions accomplish through the use of computer system, especially with intend to defraud, destroy, or make unauthorised use of computer system resources.’

AITP define Computer crime as:-

The unauthorised use, access, modification & destruction of hardware, software, data or network resources.

The unauthorised release of information.

The unauthorised copying of software.

Denying an end user access to his/ her hardware, software, data or network resources.

Using or conspiring to use computer or network resources to illegally obtain information or tangible property.

Hacking:

Hacking is the obsessive use of computers, or the unauthorised access or use of networked computer system.

Cyber thieves have at their fingertips a dozen dangerous tools, from “scans” that ferret out weakness in website software programs to “sniffers” that snatch passwords.

Common Hacking Tactics		
<p>Trojan Horse: A program that unknown to the user, contains instruction that exploit a known vulnerability in some software.</p>	<p>Sniffers: program that covertly search individual packets of data as they pass through internet, capturing passwords or the entire content.</p>	<p>Malicious Applets: tiny programs, sometimes written in popular java computer language, that misuse your computer’s resources.</p>
<p>Scan: widespread problem of internet to determine types of computers, services and connections.</p>	<p>Password Crackers: software that can guess password.</p>	<p>War Dialling: programs that automatically dial thousands of telephone numbers in search of a way in through a modem connection.</p>

Check your Progress:

1. What is Security of an information System?
2. What is Information System Control?
3. What is Physical Facility Control?
4. What is A DOS?
5. What is Spoofing?

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14.9 ANSWERS TO CHECK YOUR PROGRESS:

1. Information system security relates to the way the system is protected against unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction
2. Information system control assures the accuracy, validity and propriety of information system activities. Control must be there to ensure proper data entry processing techniques, storage methods and information output. Accordingly, management information system control is designed to see or monitor and maintain quality, security of the input process, output and storage activities of an information system.
3. Physical facility control is methods that protect physical facilities and their contents from loss and destruction. Computer centres are prone to many hazards such as accidents, thefts, fire, natural disasters, destructions etc. Therefore, physical safeguards and various control procedures are required to protect the hardware, software and vital data resources of computer using organizations.
4. A Denial-of-Service (DoS) attack is an attack meant to shut down a machine or network, making it inaccessible to its intended users. DoS attacks accomplish this by flooding the target with traffic, or sending it information that triggers a crash. In both instances, the DoS attack deprives legitimate users (i.e. employees, members, or account holders) of the service or resource they expected.
5. Spoofing is the act of disguising a communication from an unknown source as being from a known, trusted source. Spoofing can apply to emails, phone calls, and websites, or can be more technical, such as a computer spoofing an IP address, Address Resolution Protocol (ARP), or Domain Name System (DNS) server.

14.10 SUMMARY

- Spamming is the discriminate sending of unsolicited e-mail message (spam) to many internet users. It is the favourite tactic of the mass mailers of unsolicited advertisements, or *junk e-mails*. Spamming has also been used by cyber criminals to spread computer viruses or infiltrate many computer systems.
- Many Countries strictly regulate the collection & use of personal data business corporations & government agencies. Many government privacy laws attempted to enforce the privacy of computer-based files & communications.
- Cybercrime is becoming one of the Net's growth businesses. Today, criminals are doing everything from stealing intellectual property & committing fraud to unleashing viruses and committing acts of cyber terrorism.
- Email spoofing occurs when an attacker uses an email message to trick a recipient into thinking it came from a known and/or trusted source. These emails may include links to malicious websites or

attachments infected with malware, or they may use social engineering to convince the recipient to freely disclose sensitive information.

14.11 KEYWORDS

- **Hacking:** Hacking is the obsessive use of computers, or the unauthorized access or use of networked computer system.
- **Software Piracy:** Computer programs are valuable property & thus are subject to theft from computer system. However, unauthorized copying of software or Software Piracy, is also a major form of software theft.
- **Virus:** Virus is the more popular term but technically virus is the program code that cannot work without being inserted into another program.
- **Data destruction:** usually very noticeable, and can be alleviated somewhat by having good backup procedures in place.

14.12 SELF ASSESSMENT QUESTIONS AND

EXERCISES:

Short Answer questions:

1. What is Email Spoofing?
2. What is ARP Spoofing?
3. What is Trojan Horse?
4. What is Cyber Theft?
5. What is Spamming?

Long Answer questions:

1. Explain about Societal challenges of Information Technology?
2. Explain about Denial of Service and Spoofing?
3. Explain about Risks to data and applications?
4. Explain about Information System Control?

14.13 FURTHER READINGS

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