MANAGEMENT INFORMATION SYSTEMS

BCA - 302

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Dean

Directorate of Distance Education
ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
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Preface

The Punjab Government established Punjab Technical University (PTU) in 1997 by an act of State Legislative. The University was entrusted with the responsibility of developing the new generation of technical manpower that can spearhead the industrial development of the State. Punjab Technical University has been envisaged to be the grooming ground for the future Engineers, Managers and Researchers.

As of today, PTU affiliates more than 300 Engineering, Management, Pharmacy, Hotel Management and Architecture institutions in the State that are approved by All India Council of Technical Education (AICTE).

PTU understands that restricting technical education to its campuses will not serve its objective of effective spreading of knowledge in the society. It is firmly understood that latest technical education has to be spread to the masses in every corner of the nation. This is how the Distance Education Programme (DEP) of the Punjab Technical University was conceived.

The objectives of the programme are to impart affordable, relevant, skill-based & remunerative technical education to the masses in the different corner of the country.

Today, the University has more than 2000 Learning Centres spread across the country offering quality technical education in the fields of Information Technology and Management, Paramedical Technology, Fashion Technology, Hotel Management and Tourism, Media and Mass Communication and Journalism etc.

The main purpose of this book is to impart the student an insight into the subject, explaining the complexities involved, in a simplified manner and helping them to achieve their academic goals.

For an easier navigation and understanding, this book contains the complete PTU curriculum of this subject and the topics. The various topics are dividing into Chapters, Units & Sub-Units and sufficient space is provided for students to make their brief notes.

This book encompasses a global approach for providing the simplified study material to both working as well as non-working students and is certain to get benefitted from the efforts of the authors of this book.

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"Propelling Punjab to a Prosperous Knowledge Society"

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This SIM has been prepared exclusively under the guidance of Punjab Technical University (PTU) and reviewed by experts and approved by the concerned statutory Board of Studies (BOS). It conforms to the syllabi and contents as approved by the BOS of PTU.

Reviewer

Dr. S. K. Jha	Director-Academics with Institute of Management Development & Research, New Delhi.

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CAREER OPPORTUNITIES

MIS is crucial to the progress and growth of business. It helps the management at all levels in various business processes and decisions. Students who excel in MIS will find attractive opportunities in the whole range of business enterprises, ranging from trade, manufacturing, services and consulting.

PTU DEP SYLLABI-BOOK MAPPING TABLE

BCA - 302 Management Information Systems

Syllabi	Mapping in Book
Section-I Introduction to Systems and Basic Systems Concepts, Types of Systems, The Systems Approach, Information Systems: Definition and Characteristics, Types of Information, Role of Information in Decision-Making, Sub-Systems of an Information System: EDP and MIS, Management Levels, EDP/MIS/DSS.	**Unit 1:** Information and System Concepts **(Pages 3-20)** **Unit 2:** Decision-Making and MIS **(Pages 21-34)**
Section-II ***An Overview of Management Information System:*** Definition and Characteristics, Components of MIS, Framework for Understanding MIS: Robert Anthony's Hierarchy of Management Activity, Information Requirements and Levels of Management, Simon's Model of Decision-Making, Structured vs Un-structured Decisions, Formal vs. Informal Systems.	**Unit 2:** Decision-Making and MIS **(Pages 21-34)** **Unit 3:** MIS: A Framework **(Pages 35-45)**
Section-III ***Developing Information Systems:*** Analysis and Design of Information Systems: Implementation and Evaluation, Pitfalls in MIS Development.	**Unit 4:** System Analysis **(Pages 46-56)** **Unit 5:** System Design **(Pages 57-71)** **Unit 6:** Implementation and Evaluation of MIS **(Pages 72-85)**
Functional MIS: A Study of Marketing, Personnel, Financial and Production MIS.	**Unit 7:** Application of MIS in Manufacturing Sector **(Pages 86-101)**

CONTENTS

INTRODUCTION

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The globalisation of business, competitive market and continuous innovations are the factors that forced the business world to change their strategies for managing business. Now, the need for developing and managing an information system is being felt by the business world. This is because an information system is the most important resource for the management in decision-making.

Management information system (MIS) is an information system that is used within an organisation to achieve its desired objectives. A MIS collects and processes information and then provides the information to the management of an organisation. The management of an organisation uses this processed information for decision-making, planning and controlling. An information system consists of all the resources, such as hardware, software, people and communication systems, that collect information, evaluate and disseminate it.

Objective

The objective of this book is to impart knowledge to the readers about the various aspects such as planning structure and implementation process, related to the information system. This book also discusses the functioning of the information system and how it helps an organisation to achieve the desired objective. In addition, this book also throws light on the decision-making process, which is also an important part to be considered for managing an information system.

How This Book Is Organized

This book is divided into seven units.

Unit 1

This unit describes the concept of information as a vital input for performing operations and producing desired output. This unit describes various types of information such as strategic and tactical. This unit also describes various types of systems such as abstract and physical systems, and open and closed systems.

It introduces the importance of MIS and explains MIS in details. In addition, the unit introduces various characteristics and functions of MIS. The unit also throws light on the comparison of Information Technology (IT) and MIS.

Unit 2

This unit describes the concept of decision-making and explains three different phases of decision-making process: intelligence, design and choice, respectively. It also introduces the concept of decision theory, decision analysis and decision tree. In addition, this unit also discusses the various methods for choosing the optimum alternative among the different available alternatives.

Unit 3

This unit explains the structure of MIS and various systems such as transaction processing and decision support on the basis of which MIS is classified. In addition, the unit introduces the financial information system and human resource information system that are a part of functional information system. Apart from these systems, the unit also introduces the human resource information system.

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Unit 4

This unit introduces the system analysis stage of the system development process. It also determines the various requirements for system analysis such as identification of data used and generation of information during system development. In this unit, the concept of decision table is discussed in addition to the structured analysis tools such as data flow diagram and data flow dictionary.

Unit 5

This unit introduces the objectives of system design and the design methods for designing the information system. It also introduces the conceptual design state for a system that includes various steps such as problem definition and setting system objectives. This unit also explains detailed system design that consists of a number of phases such as project planning and design documentation.

Unit 6

This unit describes the implementation process of MIS, which includes planning, acquisition of facilities and user training, etc. This unit introduces the hardware and software requirements for installing MIS. This unit also discusses evaluation of MIS that helps an organisation to know about the performance of the newly installed MIS. In addition to this, it also discusses the system maintenance and the different types of the system maintenance.

Unit 7

This unit introduces the application of the management information system. It explains the role of management in various sectors such as production, marketing, finance and personnel.

UNIT 1 INFORMATION AND SYSTEM CONCEPTS

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Structure

1.0 INTRODUCTION

Information is defined as the processed form of data that is used for decision-making. There are various types of information such as strategic and tactical. The quality of information is determined on the basis of various factors such as completeness and accuracy. A system is defined as a collection of elements integrated to achieve the organisational goals. There are various types of systems such as physical and abstract and open and closed.

1.1 UNIT OBJECTIVES

- Explaining how information helps in the decision-making and planning process
- Identifying the types of information used by the personnel at various levels of management
- Describing the various aspects of information in terms of cost, business and technical issues
- Describing the evolution of information systems in organisations
- Defining system and its various types
- Comparing a human with information processing system

1.2 INFORMATION

Information is the processed form of data that is used in the process of decision-making in an organisation. The organisation collects raw data from various sources

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and processes them to form structured data known as information. Figure 1.1 shows how processing of data generates information.

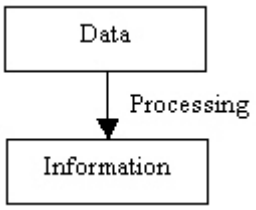

Figure 1.1: *Processing of Data*

Data is a by-product of transactions that occur during the processing of operations in an organisation. The data present in an organisation represents information in the raw form. On the other hand, information is the processed form of data that has very less uncertainty as compared to data and represents more accurate and precise information. Davis & Olson have defined information in their own terms as "data that has been processed into a form that is meaningful to the recipient and is of rail or perceived value in current or prospective actions or decisions".

1.3 TYPES OF INFORMATION

Information obtained from processing of data is vital for an organisation in terms of long term and short term planning. Based on the use and purpose of information, it is broadly categorised into three main categories as follows:

- Strategic information
- Tactical information
- Operational information

Figure 1.2 shows the various types of information.

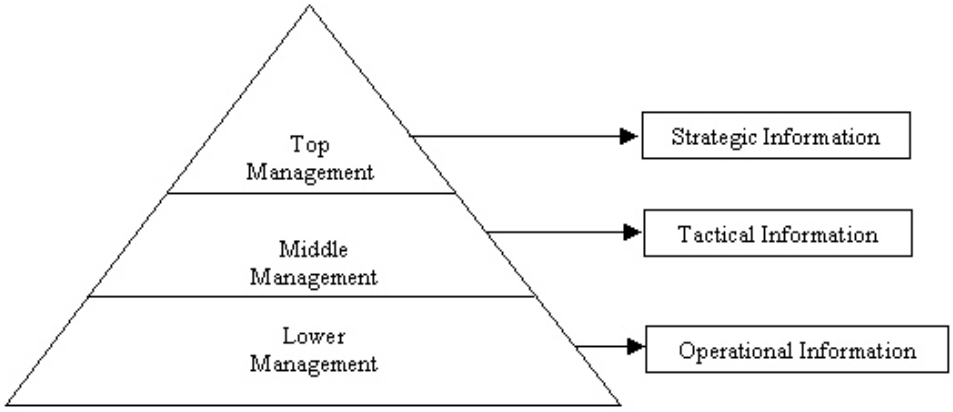

Figure 1.2: *Various Types of Information*

1.3.1 Strategic Information

Strategic information is used by higher-level management to devise strategies that need to be implemented in an organisation. The strategic information is vital for decision-making in an organisation and is generally used for long term planning.

Consider an example, where an organisation needs to plan for adopting new technologies or launching a new plant as a whole for performing the operations in an organisation. Planning for adopting new technologies involves long term planning that requires strategic information. Management takes decision based on this strategic information.

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1.3.2 Tactical Information

Tactic information is used by middle-level management to devise strategies that need to be implemented in an organisation. The tactic information is vital for making control decisions in an organisation and is used for middle term planning.

Consider an example of an enterprise, where the regional sales manager needs to forecast the sales of the products in future based on previous sales records of past three-four years. Tactical information is generally obtained from the records of the day-to-day activities in an organisation. The processing of the daily records maintained in an organisation leads to tactical information. Information obtained from external sources such as competitor records also has deep impact on the tactical information.

1.3.3 Operational Information

Operational information is used by lower-level management to devise strategies that need to be implemented in an organisation. The operation information is vital for making decisions required on day-to-day basis and is used for short term planning. This information is used at operational level to make immediate actions in daily operations.

Operational information is generally used to represent information such as work status, customer orders and stocks in hands.

1.4 QUALITY OF INFORMATION

Quality of information is measured in terms of its various attributes such as:

- Timeliness
- Accuracy
- Relevance
- Adequacy
- Completeness
- Explicitness
- Exception based

1.4.1 Timeliness

Timeliness is one of the major attributes of information. Timeliness determines that the information reaches the required recipients within the pre-specified period of time. Timeliness plays a vital role in the decision-making process of management in an organisation as well. B.K. Chatterjee gave a statement in 1974 that information delayed is information denied.

Consider an example, where the accounts officer requires financial report on 1st of every month. Any delay in the information results in delay in the decision-making process by the accounts officer. Timeliness ensures that the information intended for

a recipient should be accurate and contemporary to the most current readings and reaches the recipient on time.

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1.4.2 Accuracy

John G. Burch and Gary Grudnitski gave a statement in 1986 for accuracy. According to them, "The information that is free from mistakes and errors is clear, and accurately reflects the meaning of data on which it is based". The accurate information should be able to deliver clear picture of the information to the intended recipient be it in tabular form or graphical form. Accurate information is also free from any kind of biasing.

H.C. Advani in 1975 determined the importance of accuracy by stating that wrong information given to management would result in wrong decisions. At the same time, he advocated that accuracy should be within limits or as desired and should not be achieved by sacrificing promptitude.

Delivery of accurate information also helps the management to gain the confidence of the employees. Representation of accurate information aids the management to take right decisions on right time leading to the success of an organisation.

1.4.3 Relevance

Relevance is another key attribute of management information systems that determines the need and requirement of the information. A piece of information is said to be relevant if it is able to solve problems of what, when and why for the intended recipient.

Relevance of information depends on the intended recipient of the information. For example, the sales report information is relevant only to the sales engineer. The work status of the employees is vital to the production manager. The financial reports of the company are relevant only to the accounts officer in an organisation.

1.4.4 Adequacy

Adequacy of information is used to determine that the information presented to the Management Information System (MIS) is adequate as per the information required by an organisation. Lack of information leads to the crisis of information and overload of information create chaos in the Information System. Adequacy of information also ensures that a report generated in an organisation represents complete picture of the operational processes in execution.

1.4.5 Completeness

Completeness and accuracy go hand in hand with each other. The information that is adequate may or may not be complete in all respects. The completeness of the information ensures that the information report covers all the details required by the management of an organisation. In case, where the complete information cannot be delivered to the management, the concerned authority must be reported immediately for the lack of information.

1.4.6 Explicitness

This attribute ensures that the information presented to the management does not require further analysis of the information on the part of management. The explicit information is able to depict the meaning and purpose of the report clearly without any further scrutiny of the information.

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1.4.7 Exception-based

The most contemporary concept of representing the information is the one that is based on exception. Exception-based information ensures that only the information that is required by the management is delivered to the client. Exception-based information helps the management in saving time, cost and efforts required to evaluate the information. Whenever an exception-based report is send to the management, it directly focuses on the target piece of information.

1.5 DIMENSIONS OF INFORMATION

Information presented to the management is estimated to have its dimension in terms of cost, business and technical issues involved. Various dimensions of information systems are.

- Economic
- Business
- Technical

1.5.1 Economic Dimension

Economic dimension of information determines the cost involved in obtaining the information and the benefits that are derived from the information. Based on the cost and benefits analysis and economic dimensions are evaluated as.

1.5.1.1 Cost of information

Cost of information determines the cost involved in obtaining the information, which includes.

- Cost of acquiring the data
- Cost of maintaining the data
- Cost of generating the information
- Cost of communicating the information

The cost is estimated from the point the information is generated to the point the information is retrieved by MIS. The cost of obtaining the accurate and complete information is more as compared to the cost generally retrieved from the system.

1.5.1.2 Value of information

Value of information is determined on the basis of benefits that are derived from the information. Consider an example where two products A and B are developed. The benefits derived from product A evaluates to 20 and the benefits derived from product B evaluates to 30. The difference between the benefits of the two products is 10 units.

If you add some information, the benefits derived from product A increases by 20 points from 20 to 40. The actual value of information needs to be calculated from simple mathematics. The cost of information increases by 20 units. You need to subtract the cost involved in obtaining the information to determine the actual value of the information.

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1.5.2 Business Dimension

The business dimension of the information is used to determine the relevance of information at various levels of management. The business dimension of information at top-level management is totally different from the business dimension of information at lower level management. The difference in business dimension arises from the difference in the level and nature of work performed at various levels of management.

1.5.3 Technical Dimension

The technical dimension of information covers the technical aspects of information such as the volume of information to be stored in the database. It also undertakes the type of database that is used to store information in the database. The technical dimension covers the capacity of the database and the time required to retrieve information from the database.

1.6 SUB-SYSTEM OF INFORMATION

Information plays a vital role in the transaction processing and decision-making process of organisations. Without proper and accurate information, it is not possible to make any decision or process any transactions. Earlier information processing system used to be a very hectic task, as everything involved in information processing was a manual task. To collect a small piece of information, a lot of time was consumed and hence the work of decision-making and transaction processing used to get delayed. Following are the sub-systems of information:

Electronic data processing: In 1960s, a new system was introduced that was fast in information processing called the electronic data processing (EDP). EDP is an automated system that is used for processing data and information. The EDP systems were used for transaction processing and accounting in an organisation. Today, instead of EDP the term MIS is more commonly used for information processing system.

Decision support system: Decision support system (DSS) is evolved from MIS. MIS has not proved to be efficient in providing relevant information to the top management for making long-term decisions. DSS enhances the capabilities of MIS by providing assistance to the top management in decision-making. DSS is an ongoing evolutionary system based on operations research.

The term Decision Support System was first introduced by Gorry and Morton. The term Decision Support System is a combination of three words, which are as follows:

- Decision, which concentrates on the decision making to solve a particular problem rather than emphasising on information processing, retrieval, and reporting.
- Support, which means computer support is required for making decisions.
- System, which signifies the integrated nature of problem solving. This means that for solving a particular business problem, man, machine and decision environment are required.

Concisely, you can say that DSS is a computer-based system that helps end users to use data and models for solving unstructured problems in an organisation.

Check Your Progress

1. Match the following:

Type of information	Management
Strategic information	Middle Management
Tactical information	High level Management
Operational information	Low level Management

2. Determine whether the following statement is true or false:

   Completeness of information also determines that the information is adequate.

   A. True

   B. False

3 The economic dimension of the information system includes:

   A. Cost of acquiring the data

   B. Cost of maintaining the data

   C. Cost of generating the data

   D. All of these

Management information system: The computers have played an important role in making the management tasks faster as compared to the manual system. To perform a particular task, the managers also require relevant information. The type of information required by a manger to perform a particular task depends upon the level of the manager. The low-level managers need to perform daily routine tasks so they require detailed information about the related activity. However, a high-level manager has to obtain long-range objectives and take structured control decisions so they require summarised information from different reliable sources to take long-term decisions. In both the cases, the management requires accurate, concise, timely, and relevant information for proper functioning of the organisation. For this, the organisations use management information system (MIS).

MIS is a person-machine system, which involves highly integrated combination of information processing functions. Effective management information system is that which provides relevant information to the right person at right time. MIS also include proper file definition, maintenance and updating of information to maintain consistency in the information used by different levels of managers for taking business decisions. MIS should also ensure that information stored in the information system is not redundant. This helps in making efficient utilisation of available memory space.

1.7 SYSTEM

A system is defined as the collection of elements that are integrated to achieve the required goals. Consider an example of an organisation where various departments such as Production, Sales, Marketing and Finance are integrated to achieve the common objectives of an organisation. In general, the word system has different meanings in different situations.

1.7.1 Multiple Meaning of System

The word system implies different meaning for different people. For example, the word system in terms of sports has a different meaning from the word system in terms of organisation. The use of word system in context of computer relates to monitor, processor and printer that are integrated to perform various operations. The use of word system in MIS relates to the input, processing and output of data. Depending on the requirements, MIS may involve single or multiple processes.

1.7.1.1 Single process MIS

In a single process MIS, the system receives input from a single source, processes the input and produces an output. The output obtained during the single process MIS is sent to a single system.

Figure 1.3 shows the single process MIS.

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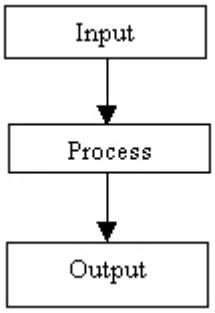

Figure 1.3: *The Single Input-Output Process*

1.7.1.2 Multiple processes MIS

In the multiple processes MIS, the system obtains input from a multiple source, processes the input and produces an output. The output obtained during multiple processes MIS is sent to multiple systems.

Figure 1.4 shows the multiple processes MIS.

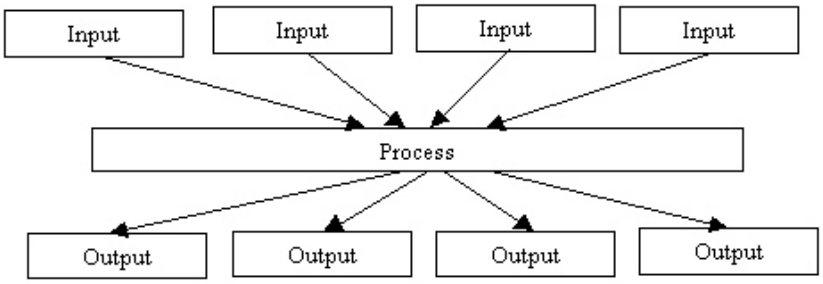

Figure 1.4: *Multiple Input-Output Processes*

1.8 TYPES OF SYSTEMS

To avoid any ambiguity of the use of the word 'system' in various circumstances, a system has been categorised into various types. Consider an example, where one person talks about system as collection of concepts and ideas. The listener perceives the system as an integrated operational unit of person, machines and equipment. The various types of systems in MIS are:

- Abstract and physical
- Deterministic and probabilistic
- Open and closed
- User machine
- Formal and informal

1.8.1 Abstract and Physical Systems

An abstract system is the collection of interdependent ideas, which may or may not be present physically in the world. Consider an example of a system, which illustrates ideas about the Indian history. This abstract system has no physical presence in the world.

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On the contrary, physical systems are defined as a collection of concrete operational systems that are physically present in the world. The concrete operational systems consist of people, materials, machines, energy and other physical things. Physical systems display some activity or behaviour in contrast to the abstract system in the world. Consider an example of the computer system that includes monitor, processor, printer and UPS. These elements constitute together to achieve the common objective.

1.8.2 Deterministic and Probabilistic Systems

A deterministic system is defined as a system in which the output of a system can be predicted with great certainty for a given set of input instructions. Consider an example of a computer program, which is defined in terms of certain machine instructions. For a particular set of input conditions and given program instructions, programmer can easily determine the output of the computer program. Any deviations from the standard output will be reported as error in MIS.

A probabilistic system is defined as a system in which the output of a system is influenced by the behaviour of the system. Under ideal conditions, the probabilistic system generates the same output as the deterministic system. The introduction of behavioural influence leads to the probability of errors in the system.

Consider an example where a job has been assigned to an employee. Under ideal conditions, the employee is expected to complete the job within 10 days. If the human factors such as behaviour and emotions are taken into due consideration, the number of days required to complete the job may be extended. Moreover, there is probability of error as well.

1.8.3 Open and Closed Systems

An open system is defined as the system that depends on its surrounding environment for inputs. The exchange of information with the surrounding environment may take place in the form of information, material or energy. Open systems are flexible in nature and tend to adopt themselves to any change in the environmental conditions. For example, humans are open systems. Human systems perform homeostasis to maintain equilibrium with the surrounding environment. Human beings also react to the change in the surrounding climatic conditions such as summer, winter or spring. Any MIS that is influenced by customer tastes and preferences is said to be an open system.

A closed system is defined as the one, which is not influenced by any change in the surrounding environment. Ideally, closed information system is rare in nature. The systems that are not ideally closed and are less influenced by the surrounding environment are called relatively closed systems. Computer programs that produce outputs as per the given set of instructions best exemplify relatively closed systems.

1.8.4 User-Machine Systems

User-machine systems are defined as the systems where people work in close proximity with machines. In the present era of advanced technology, you will hardly find any system that works without the use of machines. In these kinds of systems, both man and machines work hand in hand to achieve the common objectives of an organization. The machine systems produce deterministic results and the systems where people are involved produce probabilistic results. Computer and the operator that perform the required operations on the computers can best exemplify the User-machine system. The computer system produces the deterministic results and the

operators simply monitor the functioning of the computer systems to produce probabilistic results.

1.8.5 Formal and Informal Systems

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A formal system is the one, which is based on the organisation represented by the organisation chart. The organisation chart represents relationships among the various levels of managements where the levels are mentioned in boxes and the relationships shown by boxes connected by straight lines. It is concerned with the pattern of authority, communication and workflow.

Informal system is an employee-based system that is designed to meet the personal and vocational needs of employees. It also helps in identifying the work related problems of employees and helping them to solve those problems.

1.9 CONCEPTS RELATED TO SYSTEMS

There are various concepts related to a system that helps perform the operations of a system at a great comfort. These concepts also help in demarcating one system from another. Various types of system concepts are:

- Boundary
- Interface
- Black box
- Decomposition
- Integration

1.9.1 Boundary

Each system whether open or closed, probabilistic or deterministic needs to be defined within the constraints of a boundary. The boundary is used to identify and isolate similar types of systems in an organisation. The boundary represents a hypothetical concept, which may or may not exist physically. The concept of boundary varies from one system to another. Consider an example of a production system where the boundary excludes raw materials and finished goods from the system. The other system in the same organisation may define its boundary that includes raw materials and finished goods in the system. The surroundings outside the boundary of a system are defined as its environment. Figure 1.5 shows the System and its boundary.

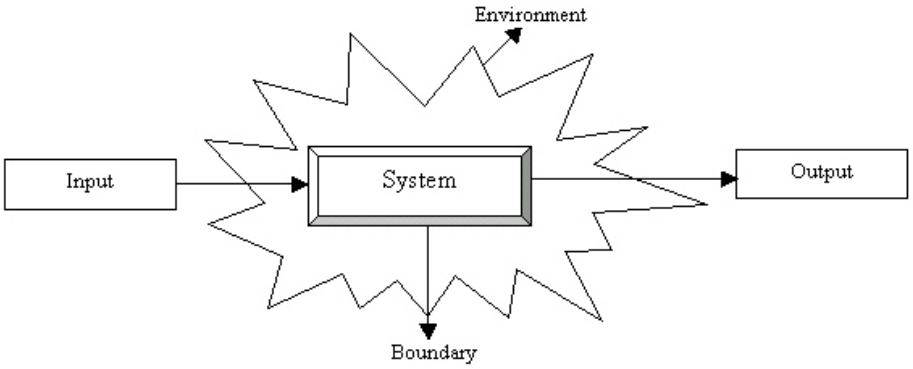

Figure 1.5: *System and Boundary*

The boundary of a system demarcates the system from its environment. The input is provided to the system from the outside environment. The system then processes the input and passes the output to the outside environment. Figure 1.5 shows the system and its environment.

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1.9.2 Interface

Interface helps the users to interact with the system. Consider an example, where multiple sub systems integrate with each other to form a perfect system. In systems where multiple systems are involved, it is essential to determine the sub system that accepts the input from the environment. At the same time, it is essential to determine the sub system that produces the output and returns it to the outside environment. Figure 1.6 shows the integration of sub systems demarcated with an interface.

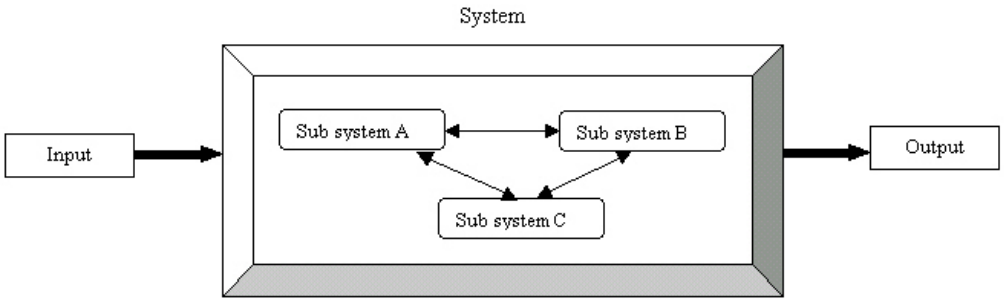

Figure 1.6: *Integration of Sub Systems*

1.9.3 Black Box

Black box is the term that is used in information systems to define the system whose transformations at the processing level are not defined by the system. In black box systems, the system is initialised with a predefined set of inputs and a certain output is determined on the basis of ideal behaviour of the system. Any transformation that takes place at the sub system level is not defined by the black box system. Figure 1.7 shows the black box system.

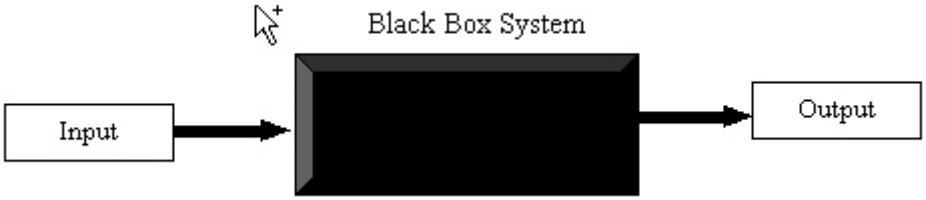

Figure 1.7: *Black Box System*

1.9.4 Decomposition

Decomposition of system defines the division of system into its various sub systems. The decomposition of system into its various sub systems allows you to perform complex tasks with greater ease. Moreover, the division of system into various sub systems lead to the hierarchical arrangement of the operation processed at the system level. A system is divided into smaller units until the smallest unit of the system becomes manageable at the system level. It is easier to construct a system from its smaller units rather than creating a complex system as a whole. Figure 1.8 shows the decomposition of a system.

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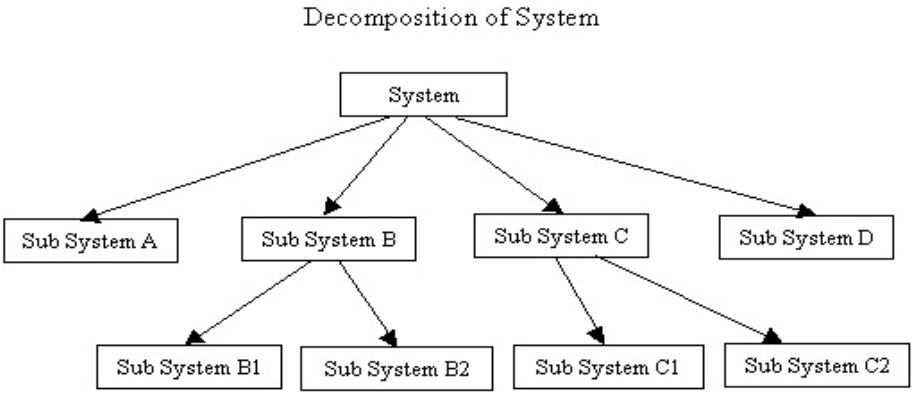

Figure 1.8: *Decomposition of a System*

The decomposition of a system can be best exemplified by hierarchical arrangement of various departments in an organisation. Consider the example of an organisation where multiple units integrate with each other to achieve a common objective. In such organisations, the system is decomposed into various departments such as Production, Sales, Marketing and Finance. The Production department is further categorised into various departments such as Production Manager, Team Leader and Workers.

1.9.5 Integration

A system is decomposed into smaller systems for better management at the operational level. However, to achieve the common objective of an organisation, there is a need to integrate all the sub systems of an organisation. The collation of output from all the sub systems to produce the desired output is called integration of sub systems. The integration of various sub systems allows you to treat the whole organisation as a single unit dedicated to perform an operation. Figure 1.9 shows the integration.

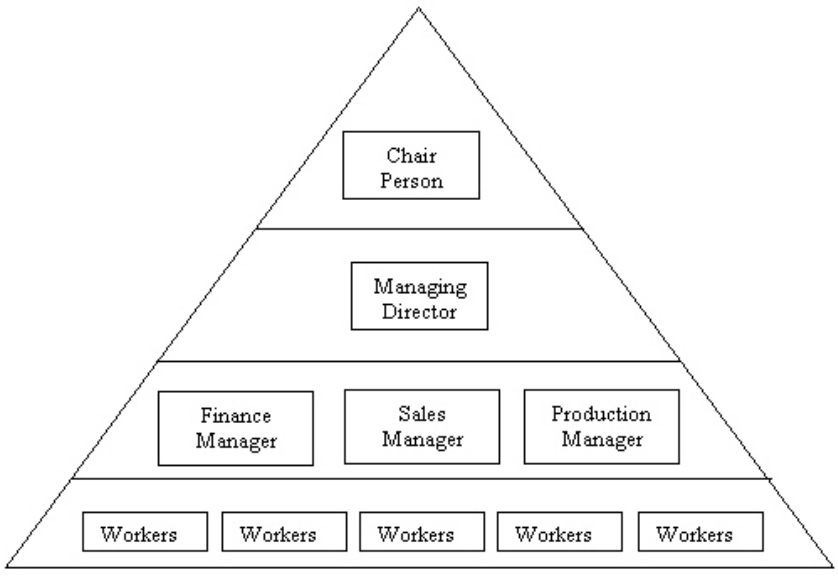

Figure 1.9: *Integration of a System*

1.10 ELEMENTS OF A SYSTEM

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Elements of a system define the components that are vital for the functioning of an information system. Various elements of a system are:

1.10.1 Input

Input is defined as the component on which the system operates to produce the desired output. The input component may be presented in the form of data, which is processed to produce the desired output. The data may be present in the form of raw facts and figures on which the system operates.

1.10.2 Process

Process is defined as the component that performs the necessary transformation on input to produce the desired output. Processing involves one or multiple activities depending on the processing requirement of the input operations. Processing of an activity may involve various machines, tools and equipments. If the transformations performed by various sub systems to process the input are not transparent to the user then the processing is called black box processing. The processing of input can be performed with ease when the system boundary and interfaces have been defined clearly. The processing of input involve various operations such as:

- Classification
- Sorting
- Calculation
- Summarising

Figure 1.10 shows the processing of input to perform operations.

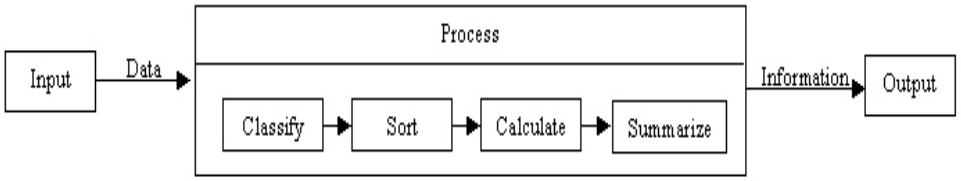

Figure 1.10: *Processing of Input*

Classification of input data allows the processor to perform complex operations easily. It helps in proper arrangement of data in the memory according to their data types.

Sorting of data allows the processor to arrange data in the order of operations to be performed on the data. It helps in faster processing of the input as per the operations required.

Calculations are performed on the data to produce the desired results. The calculations to be performed on the data may be simple or complex depending on the output requirements.

Summarising of data allows the processor to make the data available to the user. The output of the processing can either be displayed or delivered in the form of print out to the user.

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1.10.3 Output

Output is defined as a component, which is produced as a result of processing on data. Consider an example where raw data is processed to produce the information. The information obtained after processing the data is termed as output of the system. The output of a system helps in decision-making of a system.

1.10.4 Feedback

The feedback from output to input of a system ensures that the system remains in the state of equilibrium. Adequate feedback helps the user to control the system. The output generated by the system is compared with the standard output under ideal conditions. Any deviation from the standard output is sent as feedback to the input of the system. The feedback to the system initiates the control mechanism that takes appropriate actions to correct the deviations found in a system. Figure 1.11 shows the feedback and control mechanism for a system.

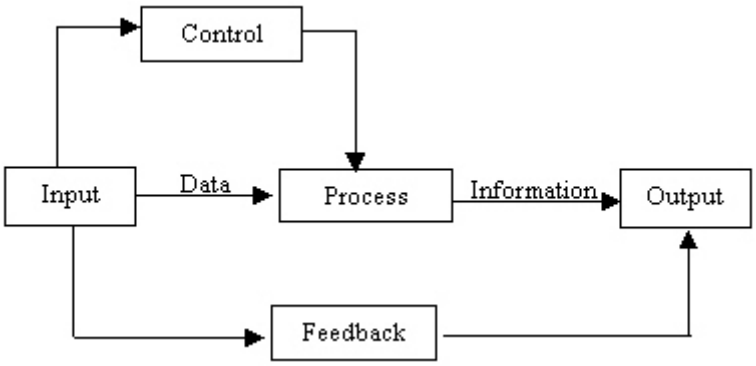

Figure 1.11: *Feedback and Control Mechanism*

1.11 HUMAN AS AN INFORMATION PROCESSING SYSTEM

Human body is also a perfect example of information processing system. Human being as information processing system consists of the following components:

- Sensory receptors
- Brain processing
- Response

Human body includes various sensory receptors such as eyes, ears and skin. These sensory receptors accept input from the surrounding environment and transmit data to the human body processor known as brain.

The brain accepts input signal from the sensors, processes them and respond to the input stimuli by performing actions or tasks. The brain processes the input based on the data provided by the input signals and the information stored in the memory. Figure 1.12 shows the brain processing inside the human body.

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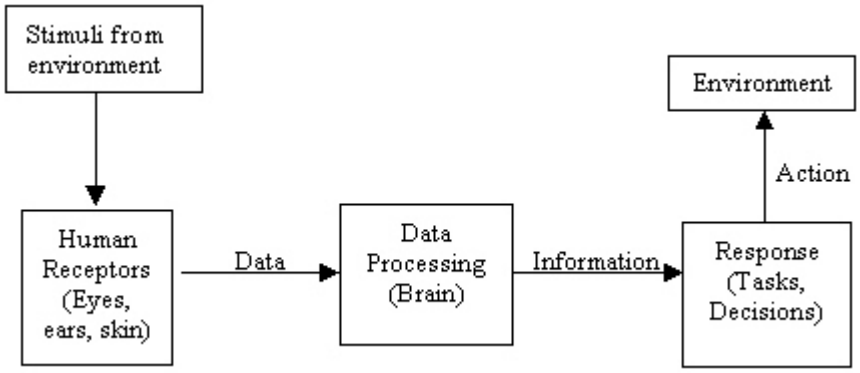

Figure 1.12: *The Human Brain as Information System*

The human brain consists of two types of memory to perform the processing of information:

- **Short-term memory (STM)**: This memory is comparatively small and stores information that needs to be retrieved in shorter span of time. It can store up to five to seven chunks of information at a time.
- **Long-term memory (LTM)**: It is very large and used to store large amount of information in the human brain. It stores information in the compressed form that can easily be retrieved from the human brain. It can store up to hundred chunks of information in the memory at a time and have unlimited storage capacity.

Note: *Chunks is the basic unit to store the information in the human brain.*

The human brain after processing the information summarises the information and produces output either in the form of action or tasks. The action generated by the human is returned as action to the environment.

1.11.1 Information filtering

Information filtering refers to the filtering of data as per the brain capacity to accept input from the environment. The sensory receptors accept input from the environment but they can only store a limited amount of information. Thus in order to store and process the relevant piece of information, the human brain performs the filtering of information. The information filtering helps human brain to neglect irrelevant piece of information. The information filtering is performed based on the number of factors that may be inherited. Figure 1.13 shows the information filtering performed prior to the processing of information.

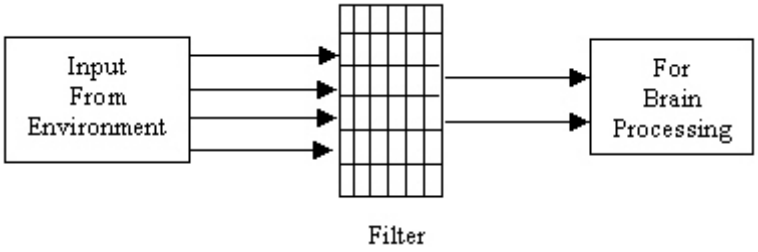

Figure 1.13: *Information Filtering*

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1.11.1.1 Selective frameworks

Human beings use selective frameworks to identify a process among various processes. To perform information filtering, humans develop frames of reference or intuitive patterns of information. Selective frameworks allow humans to store relevant piece of information by comparing it with the existing or previous information in memory. The selection of various frameworks is also influenced by decision rules.

1.11.1.2 Cognitive biases and limitations

Information filtering is also influenced by cognitive biases and limitations of humans. For example, Miller (1956) has suggested that short-term memory in humans cannot effectively process more than nine units of information (seven plus or minus two 7 ± 2). Humans tend to be more biased towards the input that likely influences their output.

1.11.2 Human Differences in Information Processing

The processing of information is also influenced by differences in human behaviour. Different people in the world may have different perception for the same matter of tasks. The differences in information processing due to differences in their attributes are referred to as cognitive style. McKenney and Keen (1974) have suggested a model of cognitive style, which categorises human styles along two continuums.

Figure 1.14 shows the cognitive style of a person.

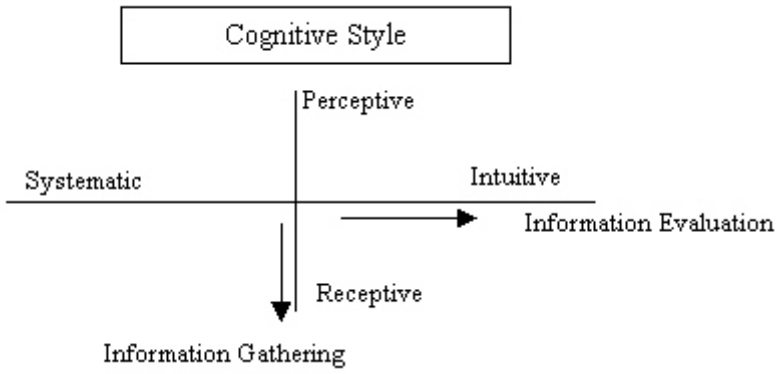

Figure 1.14: *Cognitive Style*

In the above figure, the horizontal dimension (x-axis), represents the scale how humans evaluate information. On the basis of information evaluated by people, they are categorized as:

- **Systematic humans**: They try to deal with a problem by structuring all the relevant information and facts about the problem.
- **Intuitive humans**: They try to deal with a problem by trial and error methods. They are able to solve the ill-structured problems more efficiently and act spontaneously to the problems.

The vertical dimension (y-axis) represents the scale how humans perceive a problem in different circumstances. On the basis of information gathered by people, they are categorized as:

Check Your Progress

4. List down various kind of systems.
5. The systems whose transactions are not determined at the processing level are called ……..
6. Determine the element of a system that is used to control the Information systems
   A. Input
   B. Processing
   C. Output
   D. Feedback

- **Perceptive humans**: These humans focus on relationships between various pieces of information that are gathered during the analysis of a problem.
- **Receptive humans**: These humans get deeply immersed in the problems and try to find out solutions by scrutinizing all the relevant details of the problem.

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Another explanation of human differences in information processing is due to biological processing of information. This theory explains that brain has two parts, which processes information differently. Humans that use their left part for information processing are more planned, logical, analytical and realistic in their nature. Humans that use their right part for information processing are more impulsive, insight, intuitive and imaginative in their decisions.

1.11.3 Implications for Information Systems

Better understanding of the human processing system helps designers for better designing of the information systems. Human decisions are influenced because of selective frameworks, cognitive limitations and other biases in humans. A brief description of the impact of human biases can be explained as:

1.11.3.1 Information filtering

This is one of the most significant factors that contribute to the processing of information systems. Information filtering must ensure that brain should be able to store only the relevant piece of information out of vivid types of information provided to the humans by the environment. Information system should also be able to neglect all irrelevant piece of information.

1.11.3.2 Human differences in information processing

The information system should be designed in such a manner that it helps the people in better understanding and analysis of the problem. The information system should provide the humans with the most accurate and precise amount of information. The information system should take into due consideration the nature of the humans. For example, the intuitive people require significantly less amount of information to take decisions while people that follow systematic approach to solve a problem require more information.

1.12 SUMMARY

Information and systems help management in decision-making and planning. Information can be determined in its constraints of economic dimension and business dimension. There are various kinds of systems such as deterministic and probabilistic systems and open and closed systems. Systems are defined using various concepts such as boundary and interface.

1.13 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Match the following:

Type of information	Management
Strategic information	High level Management
Tactical information	Middle Management
Operational information	Low level Management

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2. False
3. All of these
4. Various kind of systems are:
    A. Abstract and physical systems
    B. Deterministic and probabilistic systems
    C. Open and closed systems
    D. User machine systems
5. Black box
6. Feedback

1.14 EXERCISES AND QUESTIONS

Short-Answer Questions

1. Describe various factors that are used to describe the quality of information.
2. Describe single process and multiple process management information systems.
3. Explain the difference between probabilistic and deterministic systems.
4. Explain the black box system.

Long-Answer Questions

1. Explain EDP and DSS in detail.
2. Describe how humans act as an Information Processing system.
3. Explain how information plays a vital role in decision-making process.
4. Explain the role of system in MIS in detail.

1.15 FURTHER READING

Davis, Gordon B., and Margrethe H. Olson, *Management Information Systems*.

UNIT 2 DECISION-MAKING AND MIS

Structure

NOTES

2.0 INTRODUCTION

Decision-making is the process of choosing the best alternative from a given set of available alternatives. The process of decision-making is carried out by a decision-maker, who is a manager or any other official at the managerial post in an organisation. The process of decision-making involves three phases, namely intelligence, design and choice. There are various methods for choosing the optimum alternative among the different available alternatives.

2.1 UNIT OBJECTIVES

- Introducing the concept of decision-making and Simon's model of decision-making
- Describing the various types of decision for carrying out decision-making
- Explaining the concept of utility, decision tree and optimisation techniques
- Comparing decision-making and management information system (MIS)

2.2 DECISION-MAKING

Decision-making means making a choice among the given choices by a manager or a decision-maker. The decision-making process lets a manager come to a conclusion about a given situation. Therefore, decision-making may be defined as a process of selecting an optimum and best alternative from a couple of given alternatives to accomplish a particular task. Decision-making process is the core of managerial functions in MIS. It is said that the decision-making process considers two or more alternatives from which a final decision could be made. But if only one alternative is available, then no decision could be made. A decision-making process involves the entire process of establishing goals, defining activities, searching for alternatives and finally the development of plans. In addition, the decision-making process includes all the activities of problem-solving, co-ordinating, information processing and evaluating of alternatives that usually precede a decision.

A decision is an end or the final product of the decision-making process that represents a behaviour selected from a number of possible alternatives.

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2.3 SIMON'S MODEL OF DECISION-MAKING

In organisations, the decision-making process is considered as a rational process. It means the decision-making process is based on the following three phases as given by Herbert A. Simon in his model of decision-making:

1. Intelligence phase
2. Design phase
3. Choice phase

Figure 2.1 shows the decision-making process model.

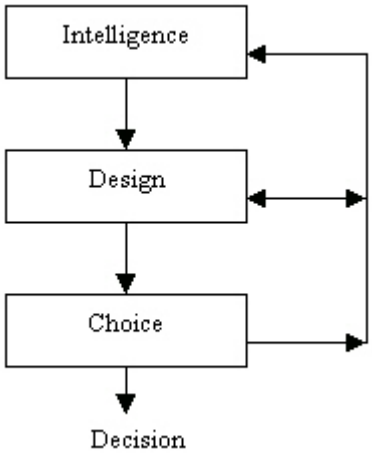

Figure 2.1: *Decision-Making Process Model*

1. **Intelligence phase:** A decision-maker studies the environment and identifies the problem or opportunity. The scanning of environment may be continuous or intermittent. For example,
   A. Reviewing of daily scrap report by a production manager to check the problems related to quality control. This is an example for continuous scanning.
   B. Periodic visiting of a sales executive to the key customers to review possible problems and to identify new customer needs. This is an example for intermittent scanning.

   The intelligence phase of the decision-making process involves:

   - **Problem searching** refers to the difference between the expected and real result obtained after making a decision, which is given by the following formula:

     ```
     (Desired/Expected) – (Actual/Reality) =
     Difference/Problem
     ```

     For example, a sales manager sets a sales target of certain amount say five lakhs in a particular month as his expected target, which is expected but he could achieve only four lakhs worth of sales for that

particular month, which is a reality. Therefore, the difference between the expected and reality value of the target, that is, one lakh is the problem. This difference worries the sales manager.

In actual practice, the reality or actual value is compared to some standard desired model. Then the differences are measured and are evaluated to determine the problem or difference. Various types of models that are used to compare reality are:

- Historical models based on estimated information
- Planning model
- Extra organisational models in which expectations are derived from customers, consultants and competition
- Models used by employees in an organisation

- **Problem formulation** refers to the proper identification of the problem to avoid the risk of solving the wrong problem. To avoid such a risk, it is very important to understand the problem well and state it clearly. Sometimes, the process of clearly defining the problem is sufficient; but in other cases, we have to simplify the problem by determining its boundaries. Boundaries are simplified by breaking the problem into smaller manageable sub-problems. In problem formulation, establishing relations with some problems that are solved earlier prove quite useful.

2. **Design phase** includes inventing or developing various alternatives in order to get the best possible alternative. Developing alternatives is a time-consuming and crucial activity, as the decision-maker has to explore all the possible alternatives. Decision-maker should not take the risk of missing any alternative since the missed-out alternative might be the best one from the given alternatives. Developing alternatives is a creative activity, which can be enhanced by various aids such as brainstorming, checklists and analogies.
3. **Choice phase** refers to the selection of an alternative developed in the design phase as the decision by the decision-maker. A decision-maker makes a detailed analysis of each and every alternative for performing this selection. After making a decision, the decision is implemented. However, at any phase, the decision-maker may return to the previous phase. For example, the decision-maker in the choice phase may reject all alternatives and return to the design phase for developing more alternatives.

2.4 DECISION TYPES

The decisions taken by an organisation are different in many ways, which ultimately affect the development of alternatives and the choice available among the alternatives. These different decisions also affect the support provided by the design of an information system for carrying out decision activities. The following bases are important to classify decisions.

2.4.1 Purpose of Decision-Making

On the basis of the purpose of the decision-making activities, the organisational decisions are divided into the following three different categories:

1. **Strategic planning** are the decisions in which a decision-maker develops objectives and allocates resources to achieve these objectives. Decisions in

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this category are of long-time period and involve a large investment and effort. Such decisions are taken by strategic planning level managers, which are the top-level of the management hierarchy in an organisation. Examples of such decisions may include introduction of a new product and acquisition of another firm.

2. **Management control** comprises the decisions taken by management control level managers, who are the middle-level of the management hierarchy in an organisation. These managers deal with the use of resources in the organisation. Analysis of variance, product mix and planning decisions fall in this category of decisions.

3. **Operational control** comprises the decisions dealing with the day-to-day problems that affect the operation of an organisation. For example, decisions such as production scheduling and inventory control fall in this category. In these decisions, the product to be produced for the day or the items and their quantities to be ordered are operational control decisions. Such types of decisions are normally taken by the operational level managers, who are at the bottom-level of the management hierarchy in an organisation.

Note: *Due to the overlapping nature of some decisions, the boundaries for classifying decisions in these categories are not very concrete and therefore, these decision types should not be taken as discrete ones.*

2.4.2 Programmability Levels of a Decision

On the basis of the levels of programmability of a decision, the decisions are of the following two types:

1. **Programmed or structured** refers to the decisions that are well defined and require application and implementation of some specified procedure or decision rule in order to reach a decision. Such decisions require little time for developing alternatives in the design phase. Programmed decisions are made by operating procedures or by using other accepted tools. More modern techniques for making such decisions involve operations research (OR), mathematical analysis, modelling and simulation.

2. **Non-programmed or unstructured** refers to the decisions, which are not well defined and have no pre-specified procedure or decision rule. These decisions may range from one-time decisions relating to a crisis to decisions relating to the recurring problems. The unstructured decisions consume sufficient time in the design phase of the decision-making process. These decisions could be solved using judgement and intuition. Modern approaches to such decisions include special data analysis on computers and heuristic techniques. Decisions of this kind are usually handled by strategic planning level managers. Because of unstructured nature, these decisions cannot be used as representatives for lower level decisions and are difficult to automate. For example, planning for R&D is unstructured decision.

3. **Semi-structured** are the decisions that are neither structured nor unstructured. These decisions are supposed to fall somewhere between the structured and unstructured decisions. For example, introduction of a new product is semi-structured decision.

Note: *There is no distinct line of difference or boundaries between the two types of decisions; rather they exhibit a continuum for the classification of decisions.*

2.4.3 Knowledge of Outcomes

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Knowledge of outcomes is another approach for classifying decisions. An outcome defines what is going to happen if the decision is taken or the course of action is taken. The knowledge of outcome plays an important role when you have more than one alternative. On the basis of the level of knowledge of outcomes, decision-making can be classified into three categories.

1. **Decision-making** under certainty takes place when the outcome of each alternative is fully known and there is only one outcome for each alternative. In such a situation, a decision-maker is required to compute the optimal alternative or outcome.
2. **Decision-making** under risk occurs when there is a possibility of multiple outcomes of each alternative, and a probability of occurrence can be attached to each outcome. Such a decision-making is also similar to decision-making under certainty where instead of optimising outcomes, the general rule is applied to optimise the expected outcome. A decision-maker is assumed to be reasonable for choosing a particular decision. For example, a decision-maker has to choose from the given two options, one offering a 2 percent probability of a profit of Rs 1,00,000 and the other an 80 percent probability of a profit of Rs 10,000. The decision-maker chooses the second alternative because it gives a higher expected value. This is explained as follows using the formula:

```
Outcome x Probability = Expected Value
1,00,000 x 0.02 = 2,000
10,000 x 0.80 = 8,000
```

3. **Decision-making under uncertainty** takes place when there are a number of outcomes for each alternative and the probabilities of occurrence of the alternatives are not known. Optimisation criteria cannot be applied for making these types of decisions because there is no knowledge of these probabilities. The decision-making under uncertainty arises when different people in an organisation take decisions by applying different decision rules. For example, some may assign equal probabilities to all the outcomes for each alternative, so as to treat the decision-making as a decision-making under risk whereas others may adopt different criteria such as maximax and maximin criteria to minimise regret.

2.5 METHODS FOR CHOOSING ALTERNATIVES

A decision-maker uses various methods for choosing the best alternative among the available alternatives. The methods that are used for choosing alternatives, generally assume that all the alternatives are known.

2.5.1 Decision Theory and Decision Analysis

The decision theory and decision analysis refers to the techniques for analysing decisions under risk and uncertainty. In the process of decision-making, a decision-maker wants to achieve his goal, purpose or objective. The decision-maker chooses one particular alternative from various alternatives, which is termed as 'Strategy' of the decision-maker. All alternatives and outcomes are assumed to be known to the decision-maker. There are certain factors termed as 'States of Nature', which affect the outcome for different strategies. The strategy or alternative along with the state of nature determines the degree to which the goal is actually achieved. This measure of

Check Your Progress

1. What do you mean by decision-making?
2. Name the three different phases involved in the Simon's model of decision-making.
3. List different categories of decisions that are used to divide the organisational decisions.

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achievement of the goal is termed as 'Pay-Off'. The pay-off matrix is used as a method of presenting data in decision-analysis. A pay-off matrix is a good representation of a decision-problem because the alternatives available to the decision-maker are represented by rows, and states of nature by columns. Each cell of the matrix, which is an intersection of a strategy and a state of nature, contains the pay-off. If the state of nature is known with certainty, then the decision-maker is required to select only the strategy that provides him the highest pay-off. Figure 2.2 shows the pay-off matrix.

Strategies	States of Nature			
	N1	N2	N3	N4
S1		a ←		→ Pay-off
S2				
S3				

Figure 2.2: *Pay-off matrix*

For example, assume that a marketing manager of a computer manufacturer chooses from the following three alternatives:

1. Launch a new PC having latest technology
2. Leave the PC as it is and do nothing
3. Modify the existing PC to improve its design and processing power

There are three states of nature that affect the pay-off from each of the alternative strategies. These states of nature are:

Conditions remain the same as they are:

- A competitor may launch a new PC with the latest technology
- The government may impose high excise duty on manufacture of PCs and reduce excise on laptops to encourage the use of laptops.

Figure 2.3 shows the various pay-offs from the combination of a strategy and a state of nature.

(Pay-off in lakh of rupees)

Strategies	States of Nature		
	Government Ban (0.20)	Same Conditions (0.40)	Competitor (0.40)
New Product (S1)	-13	10	3
Do Nothing (S2)	-2	5	1
Modify (S3)	-5	7	5

Figure 2.3: *Pay-off Matrix*

Each cell, which is an intersection of a strategy and a state of nature, contains the probabilities of occurrence of each state of nature, either based on historical data or on personal judgement of the decision-maker. It could be seen that there are three states of nature with known occurrence probabilities. This problem situation is called decision under risk. Now to make a decision under such a situation, a decision-maker should compute the expected value of each alternative. The expected value is determined by multiplying each pay-off by the probability of occurrence of the state

of nature (given in columns) and adding these values across all states of nature (across the rows). In the above example, the expected value (EV) of each strategy, S2, is:

```
EV of S3 = (-5)(0.20) + (5)(0.40) + (7)(0.40)
= -1 + 2.0+2.8 = 3.8
```

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The maximum expected value that is 3.8 lakhs is found to be of the strategy S3, which is to modify the PC. In addition, if the decision is made based on the expected value objective function, the strategy S3 will be selected.

In decision-making under risk, the decision-maker knows the probabilities of various states of nature. However, in the case of decision-making under uncertainty, the decision-maker does not know the probabilities of the various states of nature.

Figure 2.4 shows the pay-off matrix for which the decision-maker does not know have the knowledge of probability of occurrence of the states of nature.

(Pay-off in lakh of rupees)

Strategies	States of Nature		
	Government Ban (0.20)	Same Conditions (0.40)	Competitor (0.40)
New Product (S1)	-13	10	3
Do Nothing (S2)	-2	5	1
Modify (S3)	-5	7	5

Figure 2.4: *The Pay-off Matrix Where Probabilities of Nature Are Not Known*

Therefore, a decision-maker could not apply the maximisation/minimisation of expected value criteria as in the case of decision under risk. In such decision problems, the following decision rules or decision criteria may be applied:

1. **Criterion of minimise regret** refers to the selection of strategy that minimises the maximum regret for each decision taken by a decision-maker. The decision-maker might regret if he is not able to select the appropriate strategy in terms of particular states of nature. The regret of the decision-maker is the difference between the highest pay-off for a state of nature and the pay-off for the other strategies for the same state of nature regret matrix. Table 2.1 showing the regret matrix displaying minimum of maximum requests for the strategy S3, which includes modification of a PC. The regret of the decision-maker is computed by subtracting the value in each entry in the column from the highest value in the column. The decision-maker needs to select the strategy that is going to give him the minimum of such maximum regrets. Figure 2.5 shows the pay-off matrix displaying the differences between highest pay-off for a state of nature and the other pay-off for the same state of nature.

Strategies	States of Nature		
	Government Ban	Same Conditions	Competitor
New Product (S1)	-2-(-13)=11	10-10=0	5-3=2
Do Nothing (S2)	-2-(-2)=0	10-5=5	5-1=4
Modify (S3)	-2-(-5)=3	10-7=3	5-5=0

Figure 2.5: *The Pay-Off Matrix Showing the Differences between Highest Pay-Off for a State of Nature and the Other Pay-Off for the Same State of Nature.*

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Table 2.1: The Regret Matrix

Strategy	Maximum Regret
S1	11
S2	5
S3	3 ← Minimum of maximum requests

In the present case, the minimum regret is 3 lakhs. The decision-maker should select the strategy S3, which modifies the product. This is the minimum regret, if all the other strategies available to a decision-maker are taken into consideration. But at the same time, 3 lakhs is the maximum regret, which the decision-maker experiences for the strategy S3.

2. **Maximax rule or criterion of optimism** refers to the optimistic attitude of a decision-maker that enables him to select the strategy that is able to provide him the maximum pay-off under the most favourable condition. In this example, the decision-maker selects the strategy S1, which gives him a maximum pay-off of 10 lakhs for launching a new PC. Table 2.2 shows the maximum pay-off to the decision-maker by implementing the strategy S1.

Table 2.2: The Maximum Pay-off Matrix

Strategy	Maximum pay-off
S1	10 ← Maximax
S2	5
S3	7

3. **Criterion of rationality** assumes equal probabilities of various states of nature and as a result, is considered as a rational approach of decision-making. This criterion is also termed as Laplace Criterion. This criterion becomes the decision problem under risk after attaching the possibilities to the states of nature. After attaching the possibilities, the expected pay-off for each strategy is calculated and the strategy holding the highest expected pay-off is selected. In the example that we have been discussing, the expected pay-off for each strategy is given in Table 2.3. The probability of each table is assumed to be equal to 1/3 since there are three states of nature.

Table 2.3: The Expected pay-off Matrix

Strategy	Expected pay-off
S1	1/3 (10+3-13)=0
S2	1/3 (5+1-2)=1.3
S3	1/3 (7+5-5)=2.3 ← Highest EV

Therefore, as per the discussed criterion, the strategy S3 should be selected because of the highest expected pay-off.

4. **Maximum rule or criterion of pessimism** indicates that a decision-maker is of pessimistic attitude and therefore, selects the strategy, which gives him the maximum pay-off even if the worst condition occurs. Here, the decision-maker does not like to take any risk and as a result, thinks about the safest position in the worst situation. Therefore, the decision-maker selects the strategy S3, since in the worst situation, which is the case of government ban,

the decision-maker sustains the minimum loss of Rs 2 lakhs due to this decision. Table 2.4 shows the matrix for the minimum pay-off.

Table 2.4: The Minimum Pay-off Matrix

Strategy	Minimum pay-off
S1	-13
S2	-2 ← Minimum pay-off
S3	-5

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2.5.2 Utility

The utility measure is used in the organisations to cover some organisational factors such as image and goodwill of an organisation, which are qualitative in nature. The utility measure is required because these organisational factors could not be measured in terms of monetary values as compared to the pay-offs in the decision-analysis and decision-making process. The utility concept finds various applications in decision-making of an organisation as it helps a decision-maker to decide about the non-monetary factors.

2.5.3 Decision Tree

Decision tree is an important method for presenting the analysis of a project. It helps in displaying the graphical representation of a sequence of decisions and actions. The analysis of the project presented by a decision tree resembles to the branches of a tree with the root of the tree as the starting point of the decision sequence. Figure 2.6 shows the decision tree sequence.

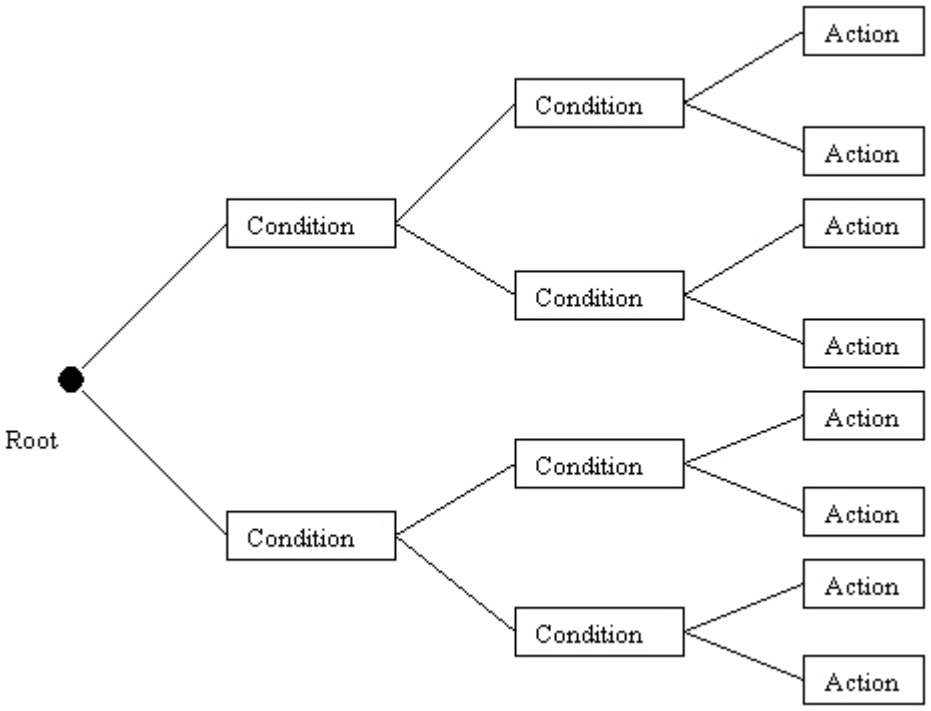

Figure 2.6: *Decision Tree Sequence*

The function of a decision tree that helps in structuring the problem is composed of the following two options:

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1. Problem structuring includes understanding the logical processing of a problem. Consider the case of a computer firm that offers the following discount policy to its customers.

   If the payment is made within a week,

   4% discount is allowed on orders above Rs 1,10,000

   3% on orders up to Rs 6,001 to Rs 1,10,000

   2% on orders up to Rs 6,000

   However, if the payment is made after a week, only 1% discount is allowed.

   The above discount policy can be presented with the help of the following decision tree as shown in figure 2.7.

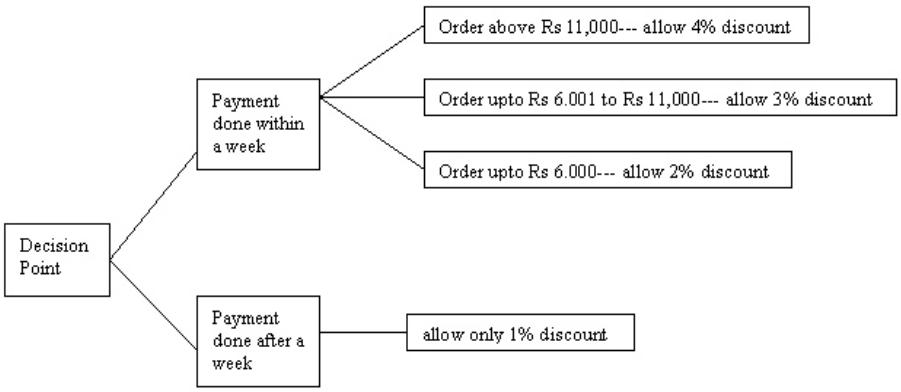

Figure 2.7: *Decision Tree for Discount Policy*

2. Problem analysis includes the analysis of a problem. Suppose a company named ABC wants to take decisions for the distribution channel for marketing of its products. The available alternatives with the company are:

   A. Selling agent

   B. Direct sales

   The company may have high or low market penetration and market share. The probabilities and net gains are as shown in figure 2.8.

Channel	Low Penetration	High Penetration
Selling Agents	0.20	0.80
Net Gains	20 lakhs	80 lakhs
Direct Sales	0.40	0.60
Net Gains	30 lakhs	40 lakhs

Figure 2.8: *The Probabilities and Net Gain Table*

Figure 2.9 shows the decision for the example as discussed above.

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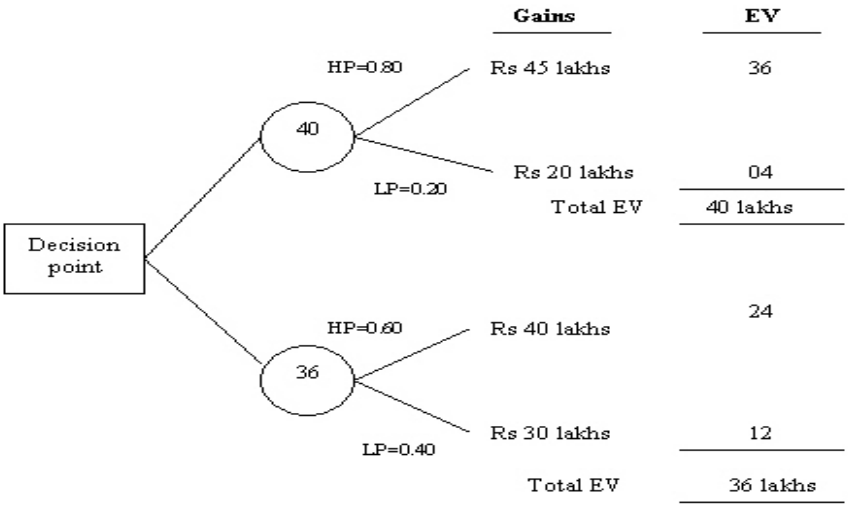

Figure 2.9: *The Decision Tree*

Here, LP means low penetration and HP means high penetration:

Expected Pay-off for Selling Agent = (0.80)(45) + (0.20)(20) = 40 lakhs

Expected Pay-off for Direct Sales= (0.60)(40) + (0.40)(30) = 36 lakhs

Therefore, the decision taken by the decision-maker is as follows:

As the channel option selling through agent would give a higher pay-off, which is equal to 40 lakhs, therefore, the company selects this channel for marketing its products. However, when large numbers of decisions need to be taken and each decision affects the subsequent decision, the rollback procedure is adopted. In this procedure, a decision-maker starts at the end of the branches and works from backward to the front till the decision point of the decision tree is reached. This is done to calculate the selected pay-off for all the branches of all the nodes of a tree. The choice of maximising the expected pay-off on the whole is found by analysing the possible outcomes at each decision point.

2.5.4 Optimisation Techniques

A number of optimisation techniques such as linear and dynamic programming are available for taking decisions during a decision-making process. Various other techniques in this category are integer programming, queuing models and inventory models. These optimisation techniques assume that the decision-maker knows all the alternatives and the outcomes of the alternatives. All these optimisation techniques are used by a decision-maker to reach an optimal decision to complete the objective of the function.

2.5.5 Decision-Making and MIS

The role of management information system is important to understand the concept of decision-making. Decision-making concept is also used for designing an information system. The support that the management information system provides to decision-making process in various ways is discussed as follows:

- **Support for Decision-making process**: MIS plays its role in all the three stages of the decision-making process, already discussed in the earlier part of the unit. The role of MIS in the three stages of the decision-making process is discussed as follows:

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- **Intelligence stage**: Management information systems may provide information about internal as well as external environments. Internal information is generated from the functional areas but the external information is collected from various sources such as newspapers and personal contacts. Availability of a large amount of information in this stage makes it necessary to scan the data sources to get the relevant information. As a result, information system is used to scan the business environment of an organisation.

  In order to get the required information in the intelligence phase of the decision-making process, MIS must be designed so as to answer pre-specified and ad hoc queries made by a decision-maker. In other words, information system design have models such as historical planning along with a query language capability that provides decision support capability for the system.

- **Design stage**: Management information systems provide support by quantifying and automating a decision-making process during the design stage while considering structured decisions. At this stage, various alternatives are developed and evaluated. On the other hand, for semi-structured and unstructured decisions, the support of management information system provides the following abilities:
  - To reach a decision in an interactive process, which includes decision support system capability.
  - To make ad hoc queries for information in the organisational databases.

  Therefore, information systems should be designed to incorporate various models of business operations and advanced statistical and optimisation techniques. It is because these techniques can be used to manipulate information that is already collected in the intelligence stage to develop and evaluate various alternatives.

- **Choice stage**: Management information systems could provide summarised and organised information to the decision-makers at this stage of the decision-making process. It is the stage in which a course of action is selected and feedback is collected on the implemented decision. MIS also provides the feedback support to a decision-maker in case he/she wants to return to the preceding stages of the decision-making process in order to gather more information. Models such as optimisation and suggestion should be used to select the most appropriate alternative, which helps the decision-makers in selecting the best course of action.

Check Your Progress

4. Name the various criteria that are used during the process of decision-analysis.
5. Write down the functions performed by the decision tree.
6. Name a few optimisation techniques used for taking decisions during decision-making process.

2.6 SUMMARY

Decision-making is one of the main activities of an organisation. There are various decision types and methods for choosing the best alternative among the given alternatives. Simon's model of decision-making is a decision-making process that consists of three phases such as intelligence, design and choice. The organisational decisions can be divided as: Strategic planning, management control and operational control.

2.7 ANSWERS TO 'CHECK YOUR PROGRESS'

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1. Decision-making may be defined as a process of selecting an optimum and best alternative from a couple of given alternatives to accomplish a particular task.
2. Three different phases involved in the decision-making process are as follows:
    A. Intelligence phase
    B. Design phase
    C. Choice phase
3. Three different categories of decisions that divide the organisational decisions are as follows:
    A. Strategic planning
    B. Management control
    C. Operational control
4. The various criteria that are used during the process of decision-analysis are as follows:
    A. Criterion of minimise regret
    B. Maximax rule or criterion of optimism
    C. Criterion of rationality
    D. Maximin rule or criterion of pessimism
5. The function of decision tree that helps in structuring the problem is composed of the following two options:
    A. Problem structuring
    B. Problem analysis
6. Various optimisation techniques used for taking decisions during decision-making process are as follows:
    A. Linear programming
    B. Dynamic programming
    C. Integer programming
    D. Queuing models
    E. Inventory models

2.8 EXERCISES AND QUESTIONS

Short-Answer Questions

1. What do you mean by decision-making?
2. What are the stages involved in Simon's model?
3. List the various techniques of optimisation.
4. What do you mean by decision tree and decision analysis?

NOTES

Long-Answer Questions

1. Discuss in detail Simon's model of decision-making.
2. Discuss in detail the various levels of programming a decision.
3. What do you mean by utility measures and decision tree?

2.9 FURTHER READING

Davis, G.B. and M.H. Olson, *Management Information Systems*.

UNIT 3 MANAGEMENT INFORMATION SYSTEMS: A FRAMEWORK

NOTES

Structure

3.0 INTRODUCTION

Management Information System (MIS) is a combination of principles, theories and practices of management, which play an important role in business organisation in the planning and decision-making process. It provides information for the personnel at various levels of management for performing their respective jobs. The management information system can be compared with information technology (IT). IT can be considered as a sub-system of MIS.

3.1 UNIT OBJECTIVES

- Understanding Management Information Systems and their importance in an organisation
- Identifying the nature and scope of MIS in an organisation
- Comparing Information Technology (IT) and MIS

3.2 SIGNIFICANCE OF MIS

MIS is defined as the field of management where timely and reliable information plays a very important role. This information is obtained through a logical and well-structured method of collecting information and processing of the collected information, which helps the decision-makers in carrying out the decisions. MIS is very significant these days because the term information is considered equally important to the three M's related to the business industry namely money, materials, men and machines.

The significance of a planned, analysed, designed and maintained MIS is as follows:

- Helps in progress and growth of the business and management infrastructure in increasing business complexities by providing timely, useful and reliable information. This information is provided to the management for taking quick, rational and speedy decisions.

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- Helps in globalisation and liberalisation of the organisations that need to compete not only locally but globally too.

MIS assists decision-makers in organisations by providing Management Information (MI) at various stages of decision-making. Whereas MIS if in case is not maintained properly may provide inaccurate or irrelevant information that may prove costly to the organisation.

3.3 UNDERSTANDING MIS

To understand MIS in detail, you need to understand the following three words in detail:

3.3.1 Management

The term management is defined as the art of getting things done through people by dividing the people into organized groups and assigning each group a different activity. Later, the results or outcome of all the activities performed by each group are appended together to accomplish the final goal. A manager in an organisation is responsible for carrying out the functions in a systematic way. The manager plans about the project by settings goals and objectives and implement, procedures, rules, programmes, budgets, strategies and schedules to achieve the plan. The various functions performed by a manger are as follows:

- **Planning** is defined as the process of preparing for the future in advance. Planning of anything before hand helps bridge the gap between the current and the final position of the project. While planning for a project, you need to answer the following questions:
  - What to do?
  - When to do?
  - Who is to do?
  - How is it to be done?
  - Why is it to be done?
  - Where is it to be done?
- **Organising** is defined as a process of identifying the entire job that is needed to complete a particular project and then dividing the job into the following steps to carry out the job as planned:
  - Dividing the job into convenient subjects or tasks
  - Allocating subjobs to persons or groups
  - Allotting authority to each group or each person
- **Staffing** is defined as the process of assigning the right person for the right job. It means allocating a job to a person as per his/her skills or defining the requirements for the job according to the people that are appointed to accomplish the job.
- **Directing** is important to achieve the pre-determined goals and objectives. It means that people who are involved in the project need to be guided and motivated by the manager of the organisation. The directing process includes:
  - Communication
  - Motivation
  - Leadership

- **Controlling** ensures that the organisational activities are performed as planned. Controlling a process involves the following actions:
    - Setting standards for measuring work experience.
    - Measuring the actual performance of the employees.
    - Comparing the actual project with the standards and finding deviations, if any.
    - Taking corrective actions.

The work performance is controlled by the manager by setting the performance standards and avoiding deviations from the standards. The manager performs all these functions through decision-making that is a fundamental pre-requisite for each of the preceding processes.

3.3.2 Information

Information is a very valuable resource that is required by the management of an organization to run the business. Information is the processed data that is presented to the decision-makers to aid them in their project. Figure 3.1 shows the relation of data with the information.

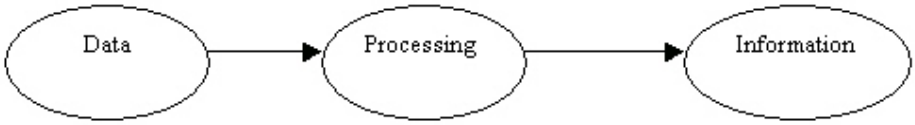

Figure 3.1: *Relation of Data with Information*

It should be noted here that the concept of data and information is a relative one. The information for one person may be data for another person and vice-versa. The type of information utilized by each level of management is according to the nature of job performed by the managers at their respective levels. The information is of four types:

- **Structured**: This information is well defined and thus the processing of the structured information is not difficult. For example, the proper monthly production schedule for a particular product.
- **Unstructured**: This information is not well defined and thus processing the information becomes difficult. For example, determining the share of the company's product into the market.
- **External**: This is the information whose source is outside the operations of the company. The top management of the organization requires the external information to carry out their future plans and policies.
- **Internal**: This is the information that is the resultant or the left over product of the normal operations of a business. The operation management of the organization required the internal information to carry out their plans.

3.3.3 System

The system in MIS is defined as a set of elements that are joined together to achieve a common objective. These elements are inter-related and interdependent. A system is made up of various sub-systems, which in turn are composed of other sub-systems. Figure 3.2 shows the various elements of a system.

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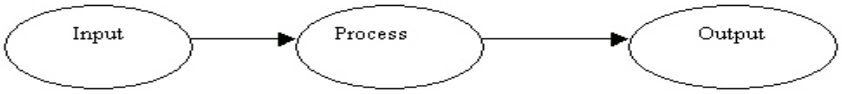

Figure 3.2: *Elements of a System*

A system may consist of multiple inputs, which are processed through a transformation process to convert these inputs into outputs.

A cybernetic system is the one in which the feedback and control elements are attached to make it self-monitoring and self-regulating. For example, a thermostat controlled heating device that automatically controls and regulates itself to maintain the desired temperature.

Various types of systems are:

- **Open system:** Interacts with its environment and exchanges input and output with the external environment.
- **Closed system:** Does not interact and exchange input and output with its environment.

3.4 DEFINITION OF MIS

After studying the concept of management, information and system in detail, now you need to define and understand the term MIS as a whole. So, MIS is defined as a system that consists of people, machines, procedures, data models and databases as the elements of the system. The system performs the following actions:

1. Gathers data from the internal and external sources of an organisation
2. Processes the data
3. Supplies the processed data or management information to the managers to assist them in the procedure of decision-making.

3.4.1 Comparing IT and MIS

IT is referred to as that part of MIS that deals with the technology aspect of MIOS. MIS is supposed to include hardware, software, networks and other devices. In other words, we can say that MIS contains IT as its sub-system. But in broad sense, the term IT can be used interchangeably with MIS taking into consideration all or many information systems, users and management of the entire organisation.

3.5 NATURE AND SCOPE OF MIS

MIS is supposed to have borrowed the management concepts from various disciplines such as accounting, computing, organizations, management and operations. Because of this interdisciplinary nature of MIS, it is considered both as an art and a science. Figure 3.3 shows the interdisciplinary nature of MIS.

Check Your Progress

1. What is the abbreviated form of MIS?
2. List various functions performed by a manager.
3. Define the term management.
4. What do you mean by information?

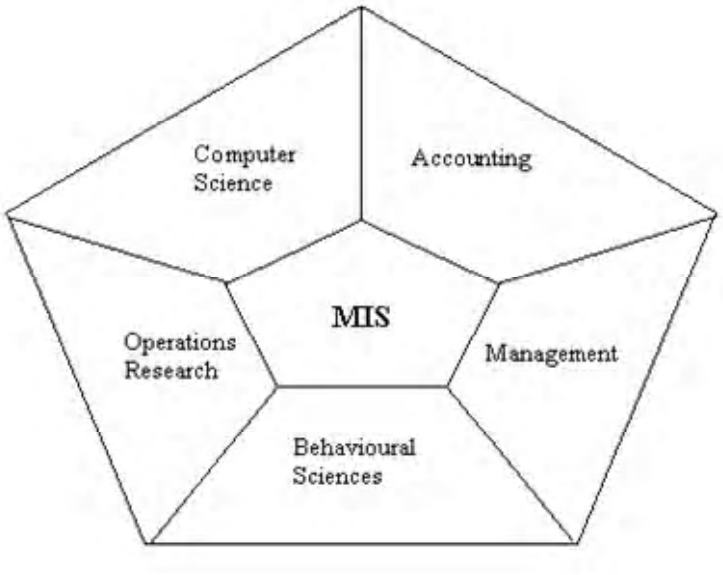

Figure 3.3: *Interdisciplinary Nature of MIS*

3.5.1 Characteristics of MIS

Following are the characteristics of MIS:

- **System approach**: MIS follows the system approach, which implies a step by step approach to the study of system and its performance in the light of the objective for which it has been constituted. It means taking a comprehensive view or a complete look at the interlocking sub-systems that operate within an organisation.
- **Management-oriented**: The management-oriented characteristic of MIS implies that top-down approach needs to be followed for designing MIS. The top-down approach suggests that the system development starts with determining management requirements and overall business objectives. In addition, the development plan of MIS should be derived from the overall business plan. This MIS characteristic also implies that the management actively directs the system development efforts towards the completion of the project.
- **Need-based**: The design and development of MIS should be as per the information required by the managers. The required design and development information is at different levels, viz., strategic planning, management control and operational control. It means MIS should cater to the specific needs of managers in the hierarchy of an organisation.
- **Exception-based**: The development of MIS needs to be on the exception-based reporting principle. This exception-based reporting principle means an abnormal situation such as the situation in which maximum, minimum or expected values vary beyond tolerance limits. In these abnormal situations, the system needs to have exception reporting to the decision-maker at the required level.
- **Future-oriented**: The design and development of MIS should also be future-oriented so that the system is not restricted to provide only the past information. It means that the system should provide such useful information on the basis of the projections based on which actions may be initiated.

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- **Integrated**: MIS has ability to produce meaningful information because of the integration concept. It means taking a comprehensive view or looking at the complete picture of the interlocking sub-systems that operate within the company. For example, to develop an effective production scheduling system, it is necessary to balance the following factors:
  A. Set-up costs
  B. Work force
  C. Overtime rates
  D. Production capacity
  E. Inventory level
  F. Capital requirements
  G. Customer services

  You can start developing an MIS by using a specific sub-system, but serious shortcomings may result unless the identity of MIS is realized and properly reflected in the total system. Thus, an integrated system, which blends information from several operational areas, is a necessary characteristic of MIS.
- **Common data flows**: Duplication and redundancy in data collection, storage and dissemination could be avoided by using the integration concept of MIS. The common data flow concept supports numerous basic views of system analysis such as avoiding duplication, combining similar functions and simplifying operations. The development of these common data flow concepts is an economically sound and logical concept.
- **Long-term planning**: MIS cannot be developed in a short interval of time because it involves heavy planning that could be done in relatively long periods. While developing MIS, the designer has the future objectives and needs of the company in mind. The designer should avoid the possibility of the system going outdated before its time.
- **Sub-system planning**: The MIS development process is quite complex and thus the system needs to be broken down into digestible sub-systems. These digestible sub-systems of a single system are more meaningful at the planning stage.
- **Central database**: A central database is the vessel that holds various different functional systems together with each system requiring access to the master file of data. This database covers information related to inventory, personnel, vendors, customers, etc. If the data stored in the database is stored efficiently and with common usage in mind, one master file can provide the data needed by any of the functional systems. It is logical to gather data once, to properly validate it and to place it on a central storage medium, which can be accessed by any other sub-system.

3.5.2 Functions of MIS

The prime objective to set up MIS in an organisation is to use the management information by its managers for decision-making. Thus, MIS needs to perform the following functions to meet its objectives:

- **Capturing data**: MIS performs usage of data whether manual or through computer terminals by using various internal and external sources of an organisation. The data related to transactions that take place in the

organisation is stored in some physical medium such as a paper form or entering it directly into a computer system by the end users.

- **Processing data**: Processing data includes converting the captured data into the required management information. To process the data, you need to perform various activities such as calculating, comparing, sorting, classifying and summarising the data. These data processing activities organise, analyse and manipulate captured data by using various statistical, mathematical, operations research and other business models.
- **Information storage**: MIS saves the less frequently used information as an organisational record and thus stores the processed or unprocessed data for future use. While performing this storage activity, data and information are reserved and organised in the form of fields, records, files and databases for future use.
- **Information retrieval**: Information retrieval includes retrieving the stored information as per the requirements of the management users. In such cases, the retrieved information is used as such or is processed again to meet the exact Management Information (MI) demands.
- **Disseminating management information**: Disseminating Management Information, which is a finished product of MIS is divided and distributed to the users in an organisation. This information could be periodic, through reports or online through computer terminals. Figure 3.4 shows various functions performed by MIS.

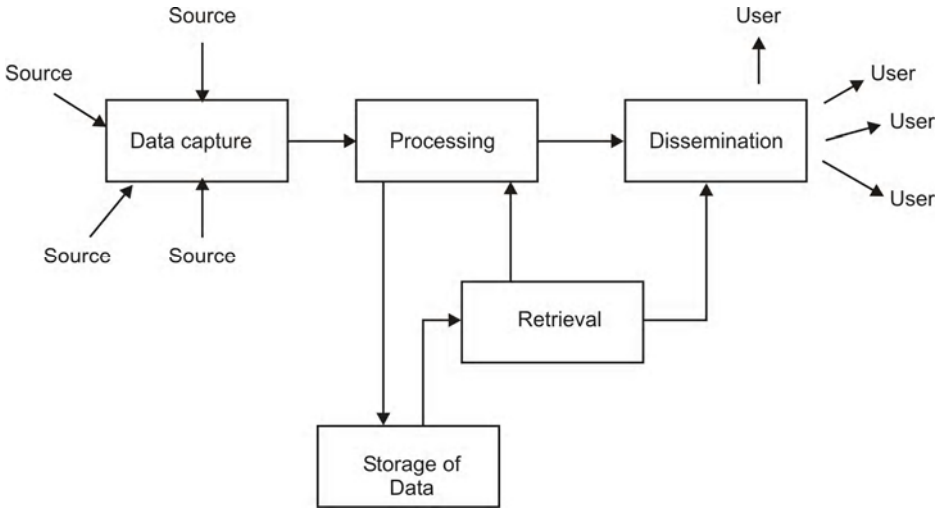

Figure 3.4: *Functions of MIS*

3.6 COMPONENTS OF MIS

MIS is a system that takes data as input, processes it to generate information that can help the management of an organisation in decision-making and strategic planning. Today, most organisations implement the MIS so as to achieve the organisational goals. The MIS has various components, which are as follows:

Hardware: The hardware components of MIS include various input and output devices that helps in feeding data as well as displaying the information when required. The input devices include the keyboard, scanners and mouse. The output devices may be the monitor, printer, network devices, and so on. The hardware

Check Your Progress

5. Describe the various actions performed by a system.
6. List various types of systems.
7. What do you mean by the cybernetic system?

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devices are the physical parts of MIS that helps in maintaining the data of an organisation.

Software: The programs and applications that convert data into machine-readable language are known as software. There are various types of software that are used for processing the information of an organisation such as ERP and CRM. ERP is software package that combines all data and processes of an organisation. It uses multiple components of computer software and hardware to achieve the integration. The main advantage of an ERP system is that it uses a single, unified database to store data for the various systems. An ERP system helps in controlling all the functions of an organisation. CRM is also a software package that includes the capabilities, methodologies and technologies in order to support an organisation in managing the customer relationships. The general purpose of CRM is to enable organisations to manage their customers through the introduction of reliable systems, processes and procedures.

Procedures: Procedures are sets of rules or guidelines that an organisation establishes for the use of a computer-based information system. The procedures may vary from one organisation to another. It may also vary from one department to another as per the requirement. For example, the working of production department is different from the working of sales department. The production department requires information regarding the raw material or quantity of goods to be produced. So, the production department sets its procedures in such a way that the MIS system helps in retrieving the information required by the department. In the similar way, the sales department requires information regarding the quantity of goods sold and the other expenses that occurred during the sales of the product. Therefore, the sales department sets the procedures in such a way that they get only that information which is required from the MIS.

Personnel: Personnel of MIS are the computer experts, managers and users who utilise the computer-based information system for achieving the organisational goals. The various personnel of the organisation use the information stored in MIS for performing different functions such as planning and decision-making.

3.7 ROBERT ANTHONY'S HIERARCHY OF MANAGEMENT ACTIVITY

Robert N. Anthony has described three levels of management activities, which are operational control, management control and strategic planning. *Operational control* is the process of ensuring that specific tasks are carried out effectively and efficiently. *Management control* is the process by which managers ensure that the resources are obtained and used effectively and efficiently in order to achieve the organisational goals. *Strategic planning* is the process of deciding the objectives of the organisation, changes required in achieving these objectives, resources used to obtain these objectives and the policies that are used in the acquisition, use and disposition of these resources. These levels of management activities are described in detail as follows.

- **Strategic Planning**: Strategy consists of making choices among alternative action programmes, commitment to specific product markets, competitive

moves and business approaches, on the part of the managers to achieve organisational goals. Strategic planning is necessary for the management at all levels from top level to the bottom level. Strategic planning facilitates smooth operational activities in the organisation. Top level needs strategic planning to define the objectives of the organisation. It helps the organisation to forsee its future in the long run and thus helps the management to take steps accordingly. It helps in policy formulation to clear the goals of organisation. Middle level management is benefited from strategic planning through smooth application of the policies formulated by the top management. It includes setting of organisational goals, designing policies and plans so that the goals set by the organisation can be easily achieved.

- **Management Control**: The management control activities are performed by the people at middle management. Management control facilitates smooth operational activities in the organisation. It is important for the management to keep a check on the operations and people involved in operations to avoid any wastage of resources and helps in utilising the resources efficiently and effectively. It includes making plans that are required to control the various activities required in the proper management of the organisation. It also includes the management of various projects that the organisation is handling.
- **Operational Control**: The operational control activities are performed by the people at the low-level management. Operational control helps in full utilisation of the resources available without any wastage. It requires proper handling of machines with reduced costs and depriciation. It also helps in managing the workers involved in operations through proper supervision and directions. It helps the organisation to produce quality products in desirable time. It includes administration of routine operations such as updating data and handling user inquiries that belongs to the operational control level. Figure 3.5 shows the hierarchy of management activities.

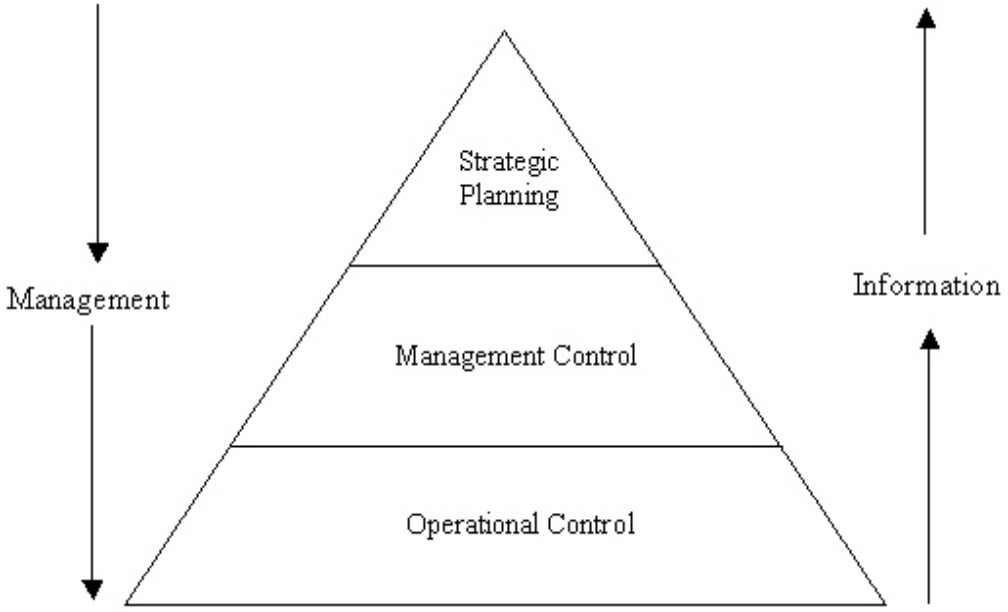

Figure 3.5: *Robert Anthony's Hierarchy of Management Activities*

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3.8 SUMMARY

MIS is an important part of an organisation as it helps in gathering information required for planning and decision-making. It also helps in performing other functions of an organisation such as staffing, directing and controlling. MIS performs various functions in an organisation such as collection and processing data for information. It also helps in storing information and retrieving it as and when required.

3.9 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Management information system.
2. Various functions performed by a manager are:
    A. Planning
    B. Organising
    C. Staffing
    D. Directing
    E. Controlling
3. The term management is defined as the art of getting things done through people by dividing the people into organized groups and assigning each group a different activity.
4. Information is defined as a very valuable resource that is required by the management of an organization to run the business. Information is the processed data that is presented to the decision-makers to aid them in their project.
5. The various actions performed by a system are as follows:
    A. Gathering data from the internal and external sources of an organisation
    B. Processing the gathered data
    C. Supplying the processed data or management information to the managers to assist them in the procedure of decision-making
6. Various types of systems are:
    A. **Open system**: interacts with its environment and exchanges inputs and outputs with the environment.
    B. **Closed system**: does not interact and exchange inputs and outputs with its environment.
7. A cybernetic system is defined as the system in which the feedback and control elements are attached to make it self-monitoring and self-regulating. For example, a thermostat controlled heating device that automatically controls and regulates itself to maintain the desired temperature.

3.10 EXERCISES AND QUESTIONS

Short-Answer Questions

1. Explain the significance of MIS.
2. Explain all the functions performed by a manager.
3. How can you compare information technology and MIS?

Long-Answer Questions

1. Describe the various types of information used in MIS.
2. Discuss the various characteristics of MIS in detail.
3. Discuss the various functions of MIS.

NOTES

3.11 FURTHER READING

Davis, G.B and M.H. Olson, *Management Information Systems*.

http://en.wikipedia.org/wiki/Management_information_systems

UNIT 4 SYSTEM ANALYSIS

NOTES

Structure

4.0 INTRODUCTION

System analysis is the process of identifying the system requirements in order to solve the problems of a system. The process includes collecting information so as to identify and understand the problem and improve the system accordingly. There are various tools that are used in the system analysis process such as decision tables and data flow diagrams. These tools help the person who is analysing the system requirement in collecting information required for the analysis process.

4.1 UNIT OBJECTIVES

- Explaining how system analysis helps in identifying the system requirements
- Introducing various strategies for requirement determination
- Identifying the various tools that help in the system analysis process

4.2 SYSTEM ANALYSIS: AN OVERVIEW

System analysis is a process in which data is collected and then interpreted to identify the problems within the system. Therefore, the collected information can then be used to recommend improvements in a system. In other words, system analysis includes identification, understanding and examining a system so that the objectives of the system can be achieved. The pre-determined objectives of the system analysis include:

- Knowledge of the system operation
- Identification of the user requirements in the proposed system

The system analysis stage investigates about the system operations and determines the solutions to solve the problem. Therefore, the system analysis is considered as a logical process.

System analysis is really vital in the completion of the development process of a system. It may be possible that a user is aware of the problem but may not have the solution with him. In such a scenario, a system analyst works with the user so that a logical model of the system can be developed. A system analyst of technical background may move too quickly to the program design stage to make a system more physical. This approach is not desirable and should be avoided because it can affect the ultimate success of the system. A system analyst can work with a user to obtain the complete knowledge of a system. For having the complete information about a system, a logical model of the system is developed based on the detailed study of the system. The detailed study should be done using various modern tools and techniques, which include data flow diagrams, data dictionary and rough descriptions of the relevant algorithms. A set of system requirements for a proposed information system is the final product of the system analysis stage.

NOTES

4.3 DETERMINATION OF REQUIREMENTS

It is quite essential determining the requirements of a system for system analysis process. The requirement determination is the preliminary step of the system development activity and is also known as software requirement specification (SRS). The requirement determination activity is the most difficult activity involved in the development of any system. Since there is a communication gap between a user and a developer, this activity is more prone to errors. The communication gap arises because the user usually does not understand the software of the organisation or may be the developer does not understand the user's problem and application area. To bridge the communication gap between the user and the developer, the requirement determination is introduced. This requirement determination process provides a means of translating ideas given by a user into a formal document. The benefits provided by a good SRS are as follows:

- It bridges the communication gap between a user and a developer.
- It reduces the development cost as it overcomes errors.
- It acts as a basis of reference for the system so that it can validate the final product.

The requirement determination consists of the following activities:

1. **Requirement anticipation**: This activity includes the past experience of the system analysis based on the study performed on the existing system. It also predicts the possibility of certain problems and requirements for a new system.
2. **Requirement investigation**: This activity is central to the system analysis process. In this activity, the existing system is studied and documented for further analysis. For this purpose, various methods such as fact-finding techniques are used.
3. **Requirement specification**: This activity involves the analysis of the data that was produced during the fact-finding investigation in order to determine the requirement specification.

We can conclude that the requirement determination involves the collection of information regarding:

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- The general process
- The data produced during the process
- Various constructs in terms of time and volume of work
- The performance controls applied in the system

Let us discuss all these activities one by one.

4.3.1 Understanding the Process

The basic step in the requirement determination activity is the knowledge of the process. The process can be well understood if the information collected in the process understanding step are the information regarding:

- The purpose of the business activity
- The steps involved in the activity
- The persons performing those activities
- Other information such as the frequency, time and user of the resulting information.

4.3.2 Identify the Data Used and Information Generated

After understanding the process, the system analyst should look for the data that is required to perform each activity discussed in the understanding process. For example, in an inventory system, a buyer may require data describing the quantity of an item, supplier name, item cost and demand for the item.

4.3.3 Determine Frequency, Timing and Volume

Next to identification of data, information should also be collected so that it can be easily identified that how often an activity is repeated. It also determines the number of items that can be handled in each activity. Similarly, time is also one of the constraints for evaluating certain steps in performing an activity.

4.3.4 Know the Performance Controls

The determination of performance control is important in the requirement determination activity, as it enables the system analyst to understand how the business functions can be maintained. It allows the system analyst to gather information during system investigation. The information in this phase can gathered mainly from the personnel and the written documents of the organisation. The written documents include financial reports, personnel documents and various other documents such as transaction documents and manuals.

It should be always kept in mind that the personal managerial attributes of an individual manager and an organisational environment affect the information requirements for the proposed system. The personal attributes may include the manager's knowledge of information systems, managerial style and his perception of information needs. On the other hand, the organisational environment factors may include nature of the company, level of management and structure of the organisation.

4.4 STRATEGIES FOR REQUIREMENT DETERMINATION

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There are certain strategies for the requirement determination that allows a system analyst to understand the existing system and also to determine the information requirement. Various strategies that solve the purpose are described below:

4.4.1 Interview

This strategy follows a method in which a user and a developer interact with each other to collect the required data. In this method, the developer asks questions to the user and based on the response given by the user, the developer finds some solutions. The interview can be formal or informal and the questions asked may be structured or unstructured. This method is helpful for gathering information from individuals, who do not communicate effectively in writing or who may not have the time to answer questionnaires.

This strategy is the oldest and the most often used device for gathering information about an existing system. Though, it is one of the preferred techniques, but this is not always the best source of application data. This is because the users are sometimes unable to explain the system in detail. Also, interviewing process is time-consuming and hence other methods are used to gather information.

It is important that the system analyst must be trained in interviewing the personnel. It is important because the success of an interview depends on the skills of the interviewer and on his or her preparation for the interview. Hence, it is important for system analyst to plan the interview and must know the following in advance:

- The person to be interviewed
- The time of interview
- The questions to be asked
- The venue of the interview
- The initiation point of the interview
- The termination point of the interview

4.4.2 Questionnaire

A questionnaire is a method that involves a set of questions to which an individual needs to respond. This strategy allows a system analyst to gather information regarding different aspects of a system among a large number of persons. This strategy provides more reliable data in comparison to the other fact-finding techniques. In addition, it saves time, as conducting interviews is much more time-consuming. The difference between the interview and the questionnaire strategies lies in the expressions or reactions of the respondents. In other words, you can view the reactions and expressions of the respondents while interviewing them, whereas in the questionnaire survey it cannot be done. Questionnaires must be tested and modified based on the experience of the respondents.

NOTES

4.4.3 Record Review

The record review strategy is also known as review of documentation strategy. The main purpose of this strategy is to find the quantitative information regarding constraints such as volumes, frequencies and ratios. A system analyst examines the information that has been recorded about a system and its users in various records. The records include manuals, regulations and standard operating procedures of an organisation. The records act as a guide to the managers and other employees. To study and understand the existing system, records prove to be helpful for the system analyst.

The limitation of this approach is that the records may not be completed or we can say that they may not be updated. An existing system can be viewed in two different views. One such view that favours the study of the existing system states that the shortcomings associated with an existing system can be learnt. The knowledge of shortcomings of the existing system is then further be used and therefore, the common mistakes can be avoided.

Another view argues that new ideas cannot be generated and the developer must follow the logic associated with the old system. Both the views seem valid and therefore, it is difficult to comment upon each view.

4.4.5 Observation

Observation is also one of the strategies used for gathering information. This is the process in which people, object and occurrences are recognised and noticed in order to collect information from the sources. The information collected using this strategy is useful when a system analyst needs to observe the way in which the records are handled, processes are carried out and whether the specified steps are actually followed. The drawback of this strategy is that an observer may not be able to gather all the required information. Moreover, the method used in this strategy is time-consuming and costly. Electronic observation and monitoring methods are widely used as information gathering tools because of their speed and efficiency.

A system analyst uses a combination of all the approaches to study an existing system because one approach may not be sufficient for gathering required information of the system.

4.5 STRUCTURED ANALYSIS TOOLS

The above-discussed fact-finding strategies represent only one aspect of the system analysis. The discussed strategies do not provide any mechanism that can help organising the details collected in each phase of the system analysis process. The information collected needs to be organised in some manner. Various tools that can be used for organising the collected details are known as the structured analysis tools. These tools help a system analyst to document the system specifications of a system. These tools are:

- Data Flow Diagram (DFD)
- Data Dictionary
- Structured English

Check Your Progress

1. Interview, Questionnaire, Record Review and Observations are strategies for……..
2. ……bridges the communication gap between a user and a developer.
3. What are the two pre-determined objectives of the system analysis?

- Decision Trees
- Decision Tables

We will discuss all these tools in detail one by one.

NOTES

4.5.1 Data Flow Diagram

Data flow diagram is a tool that helps in expressing the system requirements in a simple form. It provides a graphical representation of the logical flow of data. This tool is also known as bubble chart. The purpose of data flow diagram is to simplify the system requirements. DFD is responsible to decompose the requirement specification in each stage of the system analysis process. Lines that represent data flow in a system can join the information or data. The main symbols that are used in DFD are as follows:

- **Square**: This symbol is used to represent the source or destination of system data.
- **Arrow**: This symbol is used to identify the data flow. The arrow specifies a pipeline through which the data flows.
- **Circle/Bubble**: These symbols are used to represent a process that transforms incoming data flow into outgoing data flow. A process can be represented by a circle or an oval bubble.
- **Open rectangle**: This symbol is used to represent a data store.

There are certain rules that need to be followed while drawing a DFD. These rules are as follows:

1. The processes must have a name and number associated with it. The name of the process represents the process.
2. The direction in which the data flow is represented should be from top to bottom and from left to right.
3. A proper numbering of processes must be maintained. This means when a process is exploded into lower levels, the exploded processes can be easily identified. For example, process 1 is exploded to further processes, which should be numbered as 1.1, 1.2 and so on.
4. The name of the data stores, sources and destinations should be written in capital letters. The name of the process and data flow must have first letter capitalised.

It is important to note that a DFD can contain 10–12 processes. The DFD is just a graphical representation of data flow and therefore, it should have minimum content of a data store. This tool is very effective when the required design is not clear and the user and analyst require some symbolic representation for communication.

The concept of DFD can be explained with the help of an example. Consider the example of a library management system to issue books to each student of an institution. Figure 4.1 represents the data flow for the library management system.

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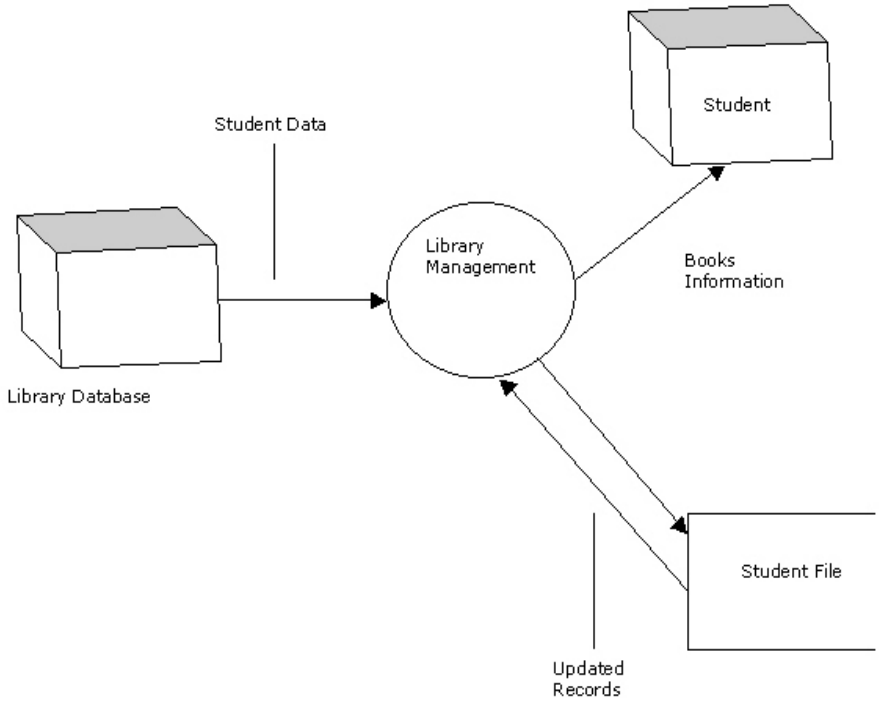

Figure 4.1: *A DFD for Library Management System.*

The student data originates from the library database and acts as a source. The data is then processed and the students receive the information regarding books. The updated data on students is stored in an intermediate file known as data store and is required for processing in the subsequent months.

The drawback of this approach is that it requires a large number of iterations to arrive at an accurate and complete solution.

4.5.2 Data Dictionary

A data dictionary is a structured repository of data that defines the basic organisation of a database. The data dictionary contains a set of precise and accurate definitions of all the DFDs, data elements and data structures.

A data dictionary makes accessing of data more simple, as it supports documentation in a better way. The data dictionary does not contain any actual data from the database. It only provides precise and consistent definitions for various data elements, terms and procedures. It also helps in improving communication between a user and a system analyst. It serves as a common database for programmers and can also be used for control purposes. The data dictionary is a desirable feature for most of the databases.

The data items present in a data dictionary include:

- **Data Element**: The smallest unit of data that cannot be further decomposed.
- **Data Structures**: A group of data elements that are handled as a single unit. It contains a number of data elements as its fields.

- **Data Flows and Data Stores**: Data flows are the data structures in motion and data stores are the data structures in rest. Data stores are the locations where the data structures are temporarily stored.

NOTES

Table 4.1 explains the different symbols used in the data dictionary.

Table 4.1: Symbols used in Data Dictionary

Symbol	Meaning
=	Is equivalent to
+	Add
[Option 1 Option 2]	Only one of the options is used at a given time
Max {Component}	Highest possible number of iterations. Component is optional
Min{Component}	Lowest possible number of iterations. Component is optional
***** Comment *	Words included within asterisks are considered as comments

You need to follow certain rules while constructing a data dictionary. The rules are:

- The terms used to describe the data structures should always be in capital letters.
- Multiple word names must be hyphenated.
- Assigned names should be straight forward and user-oriented.
- Every data flow, data store, data structure and data element must have a name associated with them.
- Consistency check should be performed.
- The processes must have their identification numbers and names that must be mentioned in the data dictionary.
- Assumed names of the processes must be discouraged.

It is important to note that the data dictionary and DFD are correlated and the data should be presented in a specification. A data dictionary does not provide functional details and therefore, is not much acceptable among the non-technical users.

4.5.3 Decision Tree and Structured English

A process can be represented using decision tree also. Similar to DFDs, a tree is formed in this graphic representation. The logic of the process that is not understood by data dictionary can be made clear using decision tree. A decision tree has as many branches as many logical alternatives are there. It is easy to construct, read and update. Figure 4.2 shows the decision tree.

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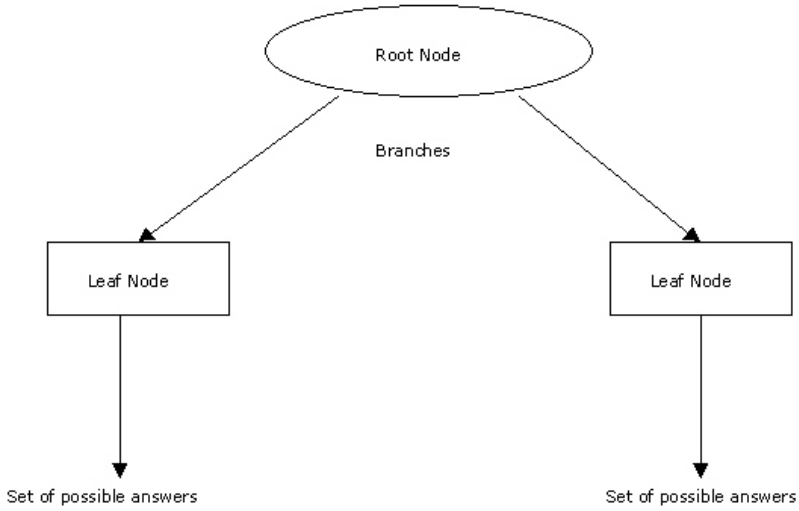

Figure 4.2: *The Decision Tree*

The logic can also be represented using structured English. The structured English uses logical construction and imperative sentences that are designed to carry out instructions for actions. In structured English, decisions are made using if-then-else statements.

Structured English consists of:

- Sequences of instructions (action statements)
- Decisions (if-else)
- Loops (repeat-until)
- Case
- Groups of instructions

Decision trees can be used to verify logic in problems that involve few complex decisions. However, its biggest limitation is the lack of information due to its structure.

4.5.4 Decision Table

Decision table is a compact way to represent complicated logic. It is a matrix that contains rows and columns representing conditions and actions. The decision tables are used in situations where complex branching routines are required.

Decision tables are divided into four quadrants. Table 4.2 lists a decision table.

Table 4.2: Decision Table

Conditions	**Condition alternatives**
Actions	**Action entries**

The table above shown describes the decision table in which the following quadrants are included:

Check Your Progress

4. What does max {Component} signifies?
5. Which symbol is used to specify the source or destination of system data?
6. Condition alternatives are used to answer the questions that were asked in the …… column of the decision table.

1. 1. **Conditions**: These are at the upper left corner in the table. Questionnaire is listed in the conditions.
2. **Condition alternatives**: This section is at upper right corner and contains answers to the questions that were asked in the conditions column.
3. **Actions**: This section is at lower left corner in the table and it outlines the action that is required to perform in order to meet each condition.
4. **Action entries**: This section is at lower right corner in the table. It indicates the appropriate action resulting from the answers to the conditions in the condition quadrant.

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There are certain rules that must be followed for constructing a decision table. These rules are:

- A name should be given to each decision that has to be written at top left of the table.
- The logic should be independent of the sequence in which the condition rules were written, but the actions take place in the order in which the events occur.
- There should be a proper usage of consistent and standardised language.
- Duplication of terms should be avoided to the maximum extent.

4.6 SUMMARY

The system analysis process helps in identifying the problem of a system and improving it. There are various types of system requirements that need to be determined while developing a system process. The person analysing the system uses several strategies in order to collect information regarding the system problem. The tools for system analysis such as data flow diagram, decision tables and trees help in the process of analysis.

4.7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Requirement Determination
2. Software Requirement Specification
3. The pre-determined objectives of the system analysis includes:
   A. Knowledge of the system operation
   B. Identification of the user requirements in a proposed system
4. 4. Highest possible number of iterations
5. Square
6. Conditions

4.8 EXERCISES AND QUESTIONS

1. What are the benefits provided by a good Software Requirement Specification?

2. Describe the data items that are required in a data dictionary.
3. List the rules that must be followed while constructing a decision table.

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4.9 FURTHER READING

Davis, W.S., *Systems Analysis and Design: A Structured Approach*.

UNIT 5 SYSTEM DESIGN

Structure

NOTES

5.0 INTRODUCTION

Software design is an important phase in the process of software development. The design phase follows the analysis phase of the software development life cycle. Design is the process of converting the software requirements of an end user mentioned in the Software Requirement Specification (SRS) document in a format that can be implemented. To develop a good design for a software product, it is important for the software designers to understand the goals and objectives of developing the software. A critical aspect of systems design is creating the user interface to enable the end users to communicate with the new software system. The input and output design focuses on the content of that interface. It focuses on the specific fields, which should be included in screens and reports that are viewed by the end users.

5.1 UNIT OBJECTIVES

- Explaining the system design process
- Describing how conceptual design helps in finding out the feasibility of management objective
- Explaining how various types of design methods help in preparing the design document

5.2 OBJECTIVES OF SYSTEM DESIGN

System design is an important step in the system development process. This phase comes into existence after the system analysis is completed. This means the output of the system analysis phase provides an input to the system design phase. In other words, the requirement specifications provided by the system analysis is used in the system design phase of the system development process. The identification of data requirements include:

- Identifying data sources
- The nature and type of available data
- Data gaps

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The design of a system must adhere to the following objectives:

- **Practicality**: This objective notifies that the design of a system should be user-oriented. This means the users of the system can easily learn and operate the system.
- **Flexibility**: The flexibility of a system design describes the dynamic nature of a system. In other words, a system must be designed in such a way that the system may respond to the changes requested by the users.
- **Efficiency**: Efficiency is highly important while designing a system. A system must perform its jobs within a specified time period. The efficiency of a system can be measured on the following features:
    - **Throughput** is the rate at which a system performs its jobs per unit time.
    - **Response time** is the time taken by a system to react to a given input.
    - **Run time** is the ability to undertake the complete job within a specified time limit.
- **Security**: The security of a system includes:
    - The hardware reliability of the system
    - Physical security of data
    - Detection and prevention of exploited data

The system design phase is carried out at two levels:

- Conceptual level or conceptual design
- Physical level or physical design

We will discuss these levels one by one in the following discussion.

5.3 CONCEPTUAL DESIGN

The conceptual design stage allows a system analyst to choose an effective information system among different management information system designs. This design stage determines the feasibility of the management objectives that are accomplished. The conceptual design is also known as external design or high-level design. This high-level design becomes a basis for the detailed design of the information system. In other words, we can say that a conceptual design is a prerequisite for the detailed design. The steps involved in the conceptual design are:

1. 1. Problem definition
2. Set system objectives
3. Constraints identification
4. Determination of information requirements
5. Determination of information sources
6. Development of various designs

7. Conceptual design documentation
8. Preparation of report

A brief discussion of these steps will make the concept clear.

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5.3.1 Problem Definition

The first step in the conceptual design of an information system involves the problem definition. It is important to understand the definition of the problem prior implementing the information system. The function of information system is supposed to solve the problems related to information requirements for the organisation. This is important to note that in the problem definition step, not only the current problems are considered, it also deals with the long-range planning for an organisation so that future problems also get resolved. The problems resolved in this stage can include problems related to information requirements for a business organisation. The information requirements of an organisation are identified and then determined by understanding the objectives and strategic plans of the organisation.

5.3.2 Set System Objectives

After the problem definition step, a system analyst must set the system objectives. The system objectives are always set with the help of the users. This is because the value of an information system lies in the benefits of the users. The stage of setting the system objectives is not straightforward and hence, a system analyst needs to consider the specific objectives. Once the specific objectives are set, they help an organisation in improving the efficiency of the information system. However, it is quite difficult to set the real objectives of an information system. The circumstances should be avoided in which the objectives of an information system are set in vague terms. In other words, the objectives such as keeping accurate records, maximum efficiency, reduced costs and quality information should not be considered as the specific objectives.

It is also important that the system objectives must be defined in such a way that they can be easily achieved by the system. In addition, the system provides a measure of performance. In other words, the system objectives should be stated, as far as possible, in quantitative rather than qualitative terms.

5.3.3 Constraint Identification

System constraints, also known as problem boundaries, are essential for the conceptual design of a system because the identification of constraints helps the system designer in considering the limitations that restrict the design of the system. These constraints help in designing the system that meets the specified objectives. In addition, the constant review of the objectives is necessary. System constraints can be classified as:

- **External constraints**: These constraints are external to an organisation. This category includes constraints posed by the customers, government and suppliers.
- **Internal constraints**: The constraints that are internal to an organisation are known as the internal constraints. The constraints within the organisation include:

- Non-cooperation and lack of support from top management
- Organisational policy
- Resource constraints such as manpower, time, money, etc.

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5.3.4 Determination of Information Requirements

For an effective design of an information system, it is important to understand the information requirements of the users. This step focuses on the identification of the information requirement that helps the management of an organisation in performing their functions. A user must specify the following requirements:

- What are the expectations of the user from an information system?
- The information required in achieving the pre-determined objectives.

It is the responsibility of the system analyst to adopt an approach that can help in achieving the information requirements of the system. There are two approaches for extracting information requirements: direct and indirect.

The direct approach allows a system analyst to ask various responsibilities of the users. This is followed by certain information that is required to carry out each of the specified responsibility. On the other hand, the indirect approach avoids the direct questions. A system analyst in the indirect approach asks a user to describe the decision-making process that helps in the system development process. An indirect approach is considered to be simpler, as the user is familiar with his/her job and can easily describe the decision-making process.

Similar to the system analysis process, several approaches to system design also include interviewing the users, using questionnaire, record review and observations. Also, it is required for the system analyst to take a thoughtful decision for adopting the best approach.

5.3.5 Determination of Information Sources

As the determination of information requirement is essential, in the same way the determination of information source is also important. The determination of information source identifies the input data along with the information such as timing and format of the information source. The main information required by most of the information systems can be managed within the organisation. The information that can be managed within the organisation includes internal records, books, statistical and accounting documents. The study of existing system is quite helpful in determining the information source. The classification of information sources of a system includes:

- **Internal and External Records**: Internal records can be in written form such as files, inputs and outputs, reports and documentation. On the other hand, external resource may include trade publication and government statistics.
- **Managers and Operating Personnel**: This classification is an important source for understanding input, output and data processing requirements of an information requirement. The information in this classification can be gathered by conducting interviews of the managers and the operating personnel.

After the information sources and information requirements are determined, the next step is to match the information requirements and sources. This can be done using a matrix diagram, which is considered as a valuable means for integration of sub-systems and for the remaining system design process. Figure 5.1 shows the information requirements and information sources matrix.

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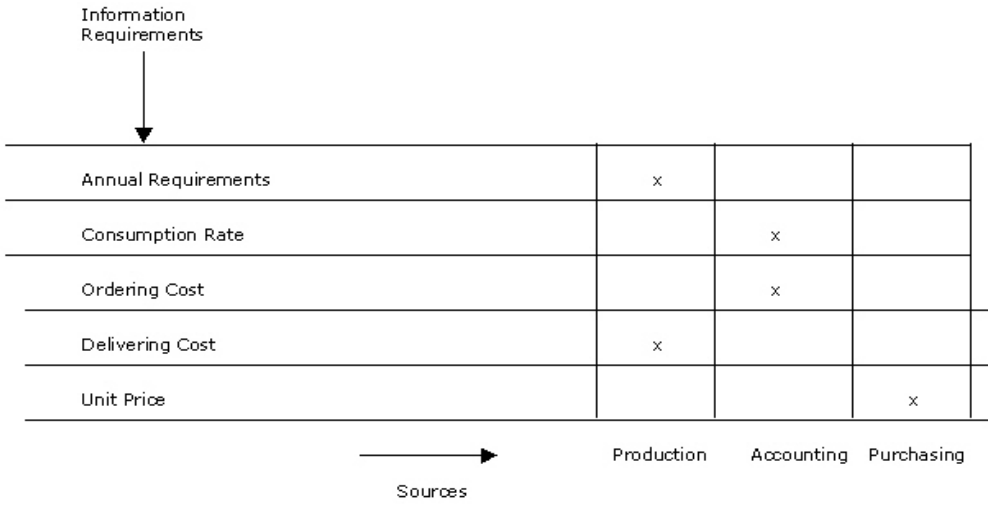

Figure 5.1: *Information Requirements and Information Sources Matrix*

5.3.6 Development of Various Designs

The next activity includes the development of various designs in the conceptual design process. In this activity, a system analyst must know the overall structure of the information system that has to be designed. This is important to note that a conceptual design provides an overview or a sketch of the structure of an information system. The conceptual design further guides and restricts the detailed design of an information system. The development stage of the conceptual design process defines the following areas:

- The decision points
- The flow of information
- The channels of information
- The roles of users

Based on these areas, the system analyst works on the combinations of input, storage, processing and communication, and generates the output in terms of various conceptual system designs. Different conceptual designs are developed and then compared in order to select the optimum design. The selected design should be the one that meets the requirements of the users and organisation and must be cost-effective.

The development of various conceptual designs can be evaluated on the basis of the following criteria:

- **Economic Basis**: Each alternative based on this criterion provides the benefits in terms of cost analysis.

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- **Performance Basis**: Each alternative must be evaluated for the anticipated performance in accordance to the system objectives.
- **Operational Basis**: Each alternative must determine the strong and weak points in terms of quality of the databases, information and potential breakdown points.

5.3.7 Conceptual Design Documentation

After the selection of the final conceptual design, this design is documented in specific terms. The documentation of the conceptual design involves:

1. Overall system flow
2. System inputs
3. System outputs
4. Other documentations such as activity sheet and system description.

5.3.8 Preparation of Report

The next step to the documentation of the conceptual design is to get an approval from the management of an organisation. Once the approval is being given to the prepared document, the detailed design activity can be introduced. We can say that a proposal, which involves the cost incurred and probable organisational changes, is prepared in this stage. The report prepared in this stage should contain the following specifications:

1. A brief statement of the problem
2. A brief statement of the objectives
3. An overall view of the system
4. A simple justification for selecting a particular design among different designs
5. Other resources such as time required for developing and implementing the system

The top management of the organisation then reviews the submitted report. If the submitted report is approved, the detailed system design activity can be undertaken.

5.4 DESIGN METHODS

Various methods are used for designing the information systems. Following are the methods involved in designing of an information system:

- Problem Partitioning
- Structured Design
- Top-Down Design

A brief description of various design methods is discussed in the following section.

5.4.1 Problem Partitioning

In this method, a problem is partitioned into different modules. This method follows the 'divide and conquer' strategy. A problem is divided into small manageable modules that can be solved separately. As the problem is separately resolved, therefore, it reduces complexity.

This is because each module can be developed, a code can be added to it and tested relatively independent of the others. In addition to complexity, maintenance can also be minimised if each module can be modified separately.

5.4.2 Structured Design

In the structured design method, a structured chart is created. The implementation of a system can be performed with the help of structured chart, as each module in the chart depicts a specific function. The purpose of the structure design method is to prepare a structure in which the different modules have minimum dependence on each other. The process in which the modules can perform their function well with a minimum interdependency is known as decoupling. This method also has a high level of cohesion, which means that all the statements within a module are functionally related to each other. The tools that can be used in structured design include flowcharts, data flow diagrams, structured charts and structured English.

5.4.3 Top-Down Design

In the top-down design method, a system is considered to have further sub-systems, which can have their own sub-systems. This means there is a hierarchy of sub-systems. This method involves identification of the main components of the system. This strategy is iterated and followed until the desired level of detail is achieved.

In this method, adequate attention is given at each stage. The top-down approach allows the subsequent interfacing so that the system is easily expanded. Therefore, more modules can be inserted in this design method. The top-down method smoothens the path of system design by starting at the top and designing the broad modules first.

5.5 DETAILED DESIGN OF A SYSTEM

The system design process is not considered complete, once the conceptual design process is terminated. The next step in the system design process involves the detailed design of a system. Conceptual design serves as a basis for the detailed design of an information system. The performance requirement specified in the conceptual design phase acts as an input to the detailed design phase. The performance requirements are further refined, detailed and finalised in the detailed design of the system and are known as the system specifications. Following are the phases involved in the detailed system design:

1. Project planning and control
2. Involvement of the user
3. Definition of detailed sub-system
4. Output/Input design

NOTES

Check Your Progress

1. ……is the rate at which a system performs its jobs per unit time.
2. Response time is the ability to undertake the complete job within a specified time limit.
   A. True
   B. False
3. Files, inputs and outputs, reports and documentation are the forms of……..

NOTES

5. Feedback from the user
6. Design of the database
7. Design of the procedure
8. Design documentation

We will discuss each phase involved in the detailed system design one by one.

5.5.1 Project Planning and Control

An effective and efficient design of an information system can only be ensured when the detailed design process is considered as a complete project. The introductory step in the detailed design process includes planning and controlling of the project. The various important stages in planning and controlling of a detailed design process are:

- Project Planning

  The project planning stage of a detailed design involves the following activities:
  - Formulation of the project objectives
  - Definition of the project tasks
  - Creation of a network diagram of all events and activities in order to specify sequential and parallel events
  - Scheduling the job as per the requirements of a user
  - Preparation of a budget for the project
- Project Control

  The project control stage of a detailed design involves:
  - A feedback of the actual performance is generated for the project in terms of time, cost and work of the project. It is then followed by comparisons with the schedules, budgets and technical plans.
  - A proper action is to be performed, if required, in order to maintain the proper functioning of the project control.

5.5.2 Involvement of the User

In the detailed design of a system, involvement of a user is also required because it is important to obtain information from the user regarding the design of the system. System designers must inform the users of an organisation about the new information system that is being developed. The users are assured that the changes in the existing system will always benefit them. Also, in case the new systems are developed, the users still get benefit out of it. The involvement of the user ensures successful implementation of the information system.

5.5.3 Definition of Detailed Sub-system

Every system in the detailed system design needs to be decomposed in order to establish the required activities and their respective inputs and outputs. Generally, the sub-systems are defined in the conceptual design phase but the sub-systems are specifically defined at this stage so that every detail of the sub-systems can be implemented. The decomposition of the systems to the operational activities,

performed at this stage, can be carried out one by one. Figure 5.2 shows the decomposition of an information system into certain operational activities.

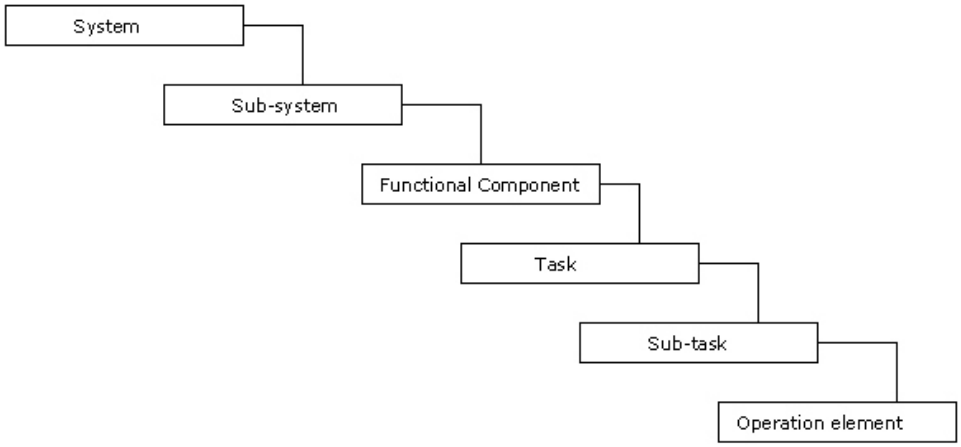

Figure 5.2: *Decomposition of the Information System*

The integration of activities into a sub-system can also be performed. When the integration of activities is required, it can be performed based on the following features:

- Common functions
- Common techniques or procedures
- Logical flow relationship
- Common outputs or inputs

5.5.4 Output/Input Design

The output/input design is one of the most important characteristics of an information system because it solves the major purpose of the information system of providing support to a user for the decision-making process. After the sub-systems are also identified, the system designers define the specifications of outputs and inputs for each sub-system. The programmers then use these specifications to develop programs so that the output/input design can be produced. The important key points that need to be considered while preparing output and input design are:

- Output design
- Input design

5.5.4.1 Output Design

The term output necessarily implies to information printed or displayed by an information system. Following are the activities that are carried out in the output design stage:

- Identification of the specific outputs required to meet the information requirements.
- Selection of methods required for presenting information.
- Designing of reports, formats or other documents that acts as carrier of information.

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Output Design Objectives

The output design of an information system must meet the following objectives:

1. The output design should provide information about the past, present or future events. The operational control level outputs provide information of the past and present events. On the other hand, outputs required at the strategic planning level provide information of the future events.
2. The output design should indicate the important events, opportunities and problems.
3. The output design should be designed keeping in mind that an action must be triggered in response to some event. A set of rules is pre-defined for such trigger.
4. The output design should produce some action to the transaction. For example, when the telephone bill is received, a receipt is printed.

Presentation of Output

The next consideration in the output design is the presentation involved with an information system. The presentation of an output is regarded as an important feature of output design. The presentation of an output can be represented either in tabular or graphical form or in both forms. A tabular format is preferred in the following conditions:

- When the details dominate the content of the output.
- When the contents of the output are classified in groups.
- When the output designs are to be compared.

A tabular format is also preferred for the detailed reports. Table 5.1 shows the tabular format of output.

Table 5.1: Tabular Format of Output

Serial Number	Item Code	Quantity Ordered

Graphical representations are used to improve the effectiveness of the output because some users prefer to view information in graphic form rather than in rows and columns of the tables. Figures 5.3 and 5.4 show the two different graphical formats of output.

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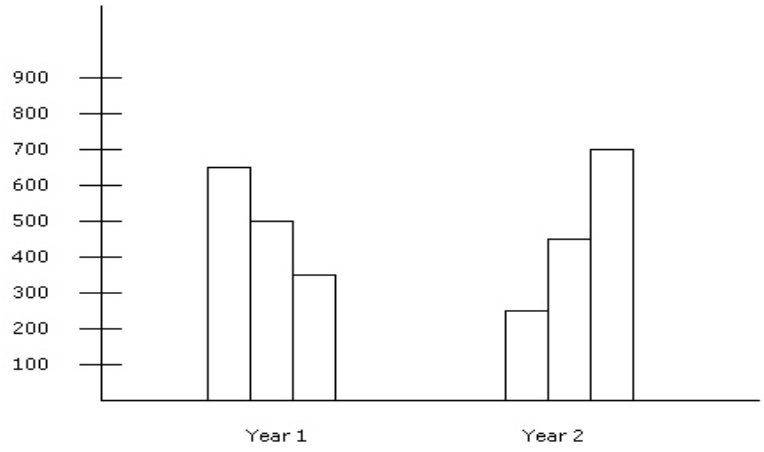

Figure 5.3: *Graphical Format of Output*

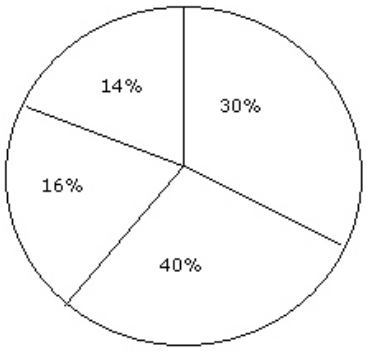

Figure 5.4: *Graphical Format of Output*

The tabular and graphical formats may be combined together to enhance the presentation of the output.

Output Design Specifications

The specifications for the output design should be considered first while designing any output. The main points in the output design specifications are:

- **Paper size**: It is important for a system designer to specify the size of the paper to be used for the output. The size of the paper can be A4 or A3 size. It can also be 9.5 × 11 or 11 × 14.7/8 inches.
- **Special forms**: Outputs can be designed on the pre-printed form. The pre-printed form requires the standard print headings or titles for the output design. Let us say, an organisation wants to display the name and logo of an organisation at the top of the output document produced by the information system. Other organisations may require the address of an organisation should also be displayed along with the name and logo of the organisation. The output display depends on the choice of organisation and it varies in different organisation. The different ideas can be helpful in enhancing the presentation skills of the output document of that organisation.
- **Multiple copies of output**: At times, more than one copy of an output is required and in such cases, multipart forms can be used to produce multiple

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copies of the output. Multiple papers are available in carbon and carbonless forms.

- **Turnaround documents**: The output can be produced as a turnaround document. In this specification, the output can be used as an input document also. The turnaround documents can be used in the organisations where the optical scanners are used for reading data from the forms.
- **Output layout**: The output layout may be defined as the arrangement of items on the output medium. The layout design guides a programmer in the development of codes. The output layout should contain the following items:
    - Headings and date
    - Data and details
    - Summaries and totals
    - Page title, number and date
    - Notes and comments
    - Column headings and data type.

The designers usually use N [*n*] for numeric data type and X [*n*] for alpha data type, where *n* specifies the width of the column.

A system designer may design multiple screens or special windowing capabilities such as pop-up windows for designing screens. Such designs will enhance readability for the visual displays.

5.5.4.2 Input Design

Similar to the output design, input design is equally important for a system designer. This is because output from a system is regarded as the foremost determinant for defining the performance of a system. The output of the system greatly affects the input design of the system.

Input Design Objectives

The input design of an information system must meet the following objectives:

- The input design of the system must attempt and try reducing the data requirements. It should also avoid capturing unnecessary data such as constant and system-computable data.
- The input design must avoid processing delays during data entry. Capturing automatic data can reduce this kind of delay.
- The input design must avoid data entry errors. This can be achieved by checking the errors in data entry program. This technique of checking data entry programs for errors is known as input validation technique.
- The input design must keep the process simple and easy to use.

Input Layout

The layout of the input design must contain the following items.

- Headings and date of data entry
- Data heading and value
- Data type and width of the column
- Initials of data entry operator

5.5.5 Feedback from the User

All the sub-systems, outputs and inputs have been specified till now. The system designer once again requires the involvement of a user in the detailed design of the system. This time the involvement of the user is for providing feedback. The feedback of the user on the system design will increase the acceptance of the information system being designed.

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The system analyst should demonstrate the proposed information system to the users of the system. This step also assures that the detailed design project is progressing according to the specifications being made.

5.5.6 Design of the Database

A database is an arrangement of all the records that are inter-related. The database design serves as a data resource for the information system of an organisation. This phase is considered as an important phase in order to achieve an optimum performance and also for storage and fast retrieval of data.

A system designer must keep the following points in mind while designing a database:

- All the data tables and record types are identified.
- The fields, the key fields for each table and relations between various tables are identified.
- The data type and width of each field of the tables are determined.
- The data tables are normalised.
- Data dictionary is properly documented.

5.5.7 Design of the Procedure

Procedures are the rules, standards or methods designed to increase the effectiveness of an information system. The procedures specify the tasks require for implementing the information system. The procedures help the designers as well as the users in designing procedures. The procedures can be classified as follows:

- **Data Entry Procedures**: These procedures are designed for data entry such as data entry sequence.
- **Run-time Procedures**: In this procedure, an action is to be performed by the users to achieve the intended results. For example, a procedure may instruct a user to load printer with a specific size of paper.
- **Error-handling Procedures**: These procedures help the users in detecting and rectifying errors.
- **Security and Backup Procedures**: These procedures provide information regarding actions performed in order to protect a system against any damage.
- **Software Documenting Procedures**: The programmers get instructions on how to document the programs.

A system designer should keep the following points in mind while designing the documents.

- He must understand the purpose and quality standard of each procedure.
- He must develop a step-by-step direction for each procedure.
- He must document all the procedures.

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5.5.8 Design Documentation

Detailed design starts with the performance specifications provided by the conceptual design and ends with a set of design specifications for the construction of an information system. A system analyst should document the detailed design very carefully. The design documents should consist of comprehensive details of all the design phases. The design documentation stage of the detailed design report consists of:

1. System objectives
2. Design constraints
3. Inputs/outputs
4. Data files
5. Procedures or manuals
6. Proposed system, which contains summary and detailed flow charts
7. Input/output specifications
8. Program specifications
9. Database specifications
10. Cost of installation and implementation
11. System test conditions

System documentation of a system should also include a user-manual and operator-manual. A user-manual prepares the users and makes them understand the implementation of the system. Therefore, the system documentation should be simple and easy to understand. On the other hand, an operator-manual is written for the computer operators. The operator-manual should include an operator's view of the system, specifying start, stop and restart sequences. It should also contain various procedures that guide the operators regarding security, privacy and integrity of data.

5.6 SUMMARY

Since specific organisational environments and general technologies change over time, organisations need new systems or major revisions to existing systems, to continue to meet their objectives. Therefore, system development is an ongoing process in all organisations that use it. The logical models form the basis for physical system design. Various design methodologies are available that the system analyst can use to develop the design of a software system, but the most difficult task in system design is to select the most appropriate tools and techniques from various available techniques for developing an application.

Check Your Progress

4. ……., …….. and ……. are the popular methods for designing an information system.
5. The presentation of an output can be represented either in …….or ……form.
6. The input design must avoid data entry errors.
   A. True
   B. False

5.7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Throughput
2. False
3. Internal records
4. Problem partitioning, Structured design and Top-Down design
5. Tabular or graphical form
6. True

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5.8 EXERCISES AND QUESTIONS

Short-Answer Questions

1. Discuss the different objectives of the system design process.
2. Write a short note on determination of information sources in the conceptual design process.

Long-Answer Questions

1. List various design methods of system design.
2. Explain the detailed design phase of an information system.

5.9 FURTHER READING

Lucas, Henry, Jr., *The Analysis, Design and Implementation of Information System*.

UNIT 6 IMPLEMENTATION AND EVALUATION OF MIS

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Structure

6.0 INTRODUCTION

Implementation is the process of ensuring that the information system is operational and allowing users to take over its operation for use and evaluation. This involves training the users to handle the system. The analyst needs to plan for a smooth conversion from the old system to the new one. Once the information system has been developed and acceptance testing is completed, the implementation process starts. Users must be trained on the use of the new system, focusing on its requirements and its capabilities. Many organisations combine testing and training in the same stage. This works well because users can become familiar with the new information system as well as ensure that it can handle errors at the same time. Training, like testing and documentation, is ultimately a management responsibility.

6.1 UNIT OBJECTIVES

- Describing the implementation process that helps in establishing a proper MIS system in an organisation
- Explaining the ways for selecting proper hardware and software for an organisation
- Evaluating the MIS process
- Introducing the system maintenance process

6.2 THE IMPLEMENTATION PROCESS

Implementation is a process of placing a newly developed MIS into operation or functioning at the user's workstation. Steps to implement MIS are:

- Planning for implementation
- Acquisition of facilities and space planning

- Developing MIS organisation and procedure
- User training
- Acquisition of hardware and software
- Creating forms and database
- Testing
- Change over

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6.2.1 Planning for Implementation

Planning involves identifying various activities such as deciding the sequence for the activities and estimating the time needed for each activity that is required to implement MIS. All these activities vary according to the design specification of MIS, such as input, output, equipments and processing. To specify and describe the planning, various tools can be used such as Gantt Charts and Network Diagrams. Figure 6.1 shows a Gantt Chart.

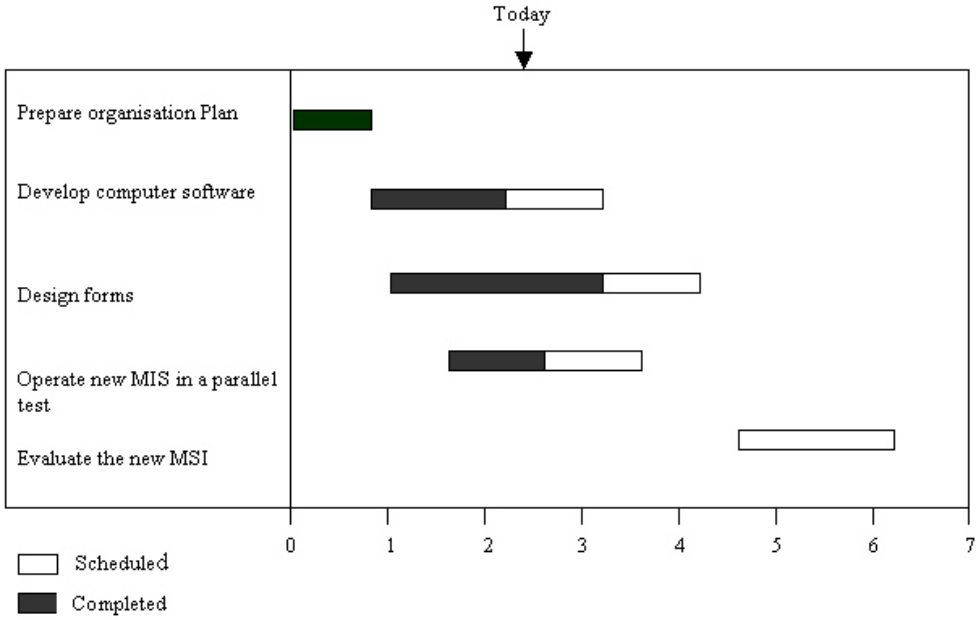

Figure 6.1: *A Gantt Chart*

6.2.2 Acquisition of Facilities and Space Planning

To implement MIS at the user's workstation, various facilities such as office, computer room and computer library are required. Therefore, the MIS manager also needs to do space planning. The space planning is an activity that includes estimating the space occupied by computers and its various peripherals such as terminals, printers, workers, etc. The MIS manager also needs to decide the location of the computer room and its safety and security factors.

6.2.3 MIS Organisation and Procedure Development

Now, the MIS manager starts recruiting other required human resources for the MIS. The MIS manager also starts developing procedures for various other activities such as evaluating and selecting hardware and buying or developing required software.

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6.2.4 User Training

For successfully implementing MIS, the MIS manager must arrange trainings for the users according to the user's requirement. For example, the training for the clerical users must be about the processing and functioning of MIS and a manager must be informed about how to make on-line inquiries.

6.2.5 Acquisition of Hardware and Software

Immediately after deciding the MIS design specifications, the process of purchasing or developing the required hardware and software starts. Selecting hardware and software is discussed later in this unit.

The MIS manager should ensure that the prerequisite such as computer room, electric connections and communication lines, required to install the hardware are fulfilled. The MIS manager should also ensure that other consumables such as papers and floppies are available as required.

6.2.6 Creation of Forms and Database

Database is used to store data, and forms are used for transmitting data. Forms are used to input data to MIS and receive the output data from the MIS. Therefore, the implementation of MIS also requires forms and databases. Therefore, database and forms must be generated for the MIS and these database and forms are generated in context of the entire MIS.

6.2.7 Testing

Testing is a process that is performed to find out whether or not each and every element of MIS such as equipments, programs and forms, are working according to their design specifications. The testing also calculates accuracy, range of inputs, frequency of inputs, operating conditions and reliability factors of the MIS.

Nowadays, the Computer Aided Software Engineering (CASE) tool is used to perform testing of MIS.

6.2.8 Change Over

After performing the testing, the last step is to put the MIS at the user's workstation. The process of placing the newly developed MIS at the workstation differs depending on the following two situations:

- Placing only the new MIS system
- Replacing an existing MIS system by the new one

If an MIS system is not available at the user's workstation, then you can directly install MIS.

However, if an MIS system is available at the user's workstation, then there are following four policies to replace the existing MIS system with the new one:

- **Direct** uninstall or remove the existing MIS and install the newly developed MIS in place of the old one. This policy is used when the existing MIS is absolutely worthless.
- **Parallel** installs the newly developed MIS in parallel with the existing MIS until the new MIS is not tested properly. In this policy, the output from both the existing and the new MIS are compared and tested. If the new MIS is giving the desired output then the previously installed MIS can be removed.

- **Modular** installs the new MIS at the user's workstation on a module basis. In this policy, the user's workstation is divided into groups and the new MIS is installed for each group.
- **Phase-in** is similar to the modular policy. However, in this policy the new MIS is segmented instead of the user's workstation. In this policy, each MIS segment in installed at the users workstation and performs a specific function.

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6.3 SELECTION OF HARDWARE AND SOFTWARE

You need to select hardware and software products for installing an MIS. For selecting the hardware and software products, following steps are taken into consideration:

1. Requirement analysis
2. Preparing tender specifications
3. Inviting tenders
4. Technical scrutiny and short-listing
5. Detailed evaluation of short-listed vendors
6. Negotiations and procurement decision
7. Delivery and installation
8. Post-installation review

6.3.1 Requirement Analysis

In this step, the MIS configuration specifications are identified and on the basis of these specifications, hardware and software requirements are identified.

6.3.2 Preparation of Tender Specifications

After identifying the specifications, tender documents are designed for vendors. The tender document is a document that contains various information and specifications, which are:

Purchasing Schedule

The purchasing schedule contains the following information:

Date of tender submission

- Evaluation criteria
- Scope for negotiations, if any

Hardware and Software Specification

It contains all the technical specifications of each hardware and software product. For example, the UNIX operating system and 32-bit CPU with in-built processor.

Quotation Format

Quotation format specifies different formats for

- Technical details for each product

Check Your Progress

1. Define the Implementation process.
2. Write all the steps that are taken into consideration for implementation of an MIS.
3. To analyse and describe the planning, various tools can be used, such as Gantt Charts and Network Diagrams. (True\False)
4. Immediately after deciding the …….. the process of purchasing or developing the required hardware and software starts.

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- Prices and levies such as duties and taxes
- Required validity of the quotation
- Earnest money deposit required, if any

Terms of Contract

It contains the following terms and conditions for a specific hardware or software product:

- Expected delivery date
- Warranties
- Penalty, if any
- Mode of payment terms
- Arbitration
- Training needs

6.3.3 Inviting Tenders

After specifying the tender specifications, tenders are invited. Depending on the quantity of purchase, tenders can be invited through one of the following procedures:

- *Open tender* is invited through an advertisement in newspaper.
- *Limited tender* is invited by simply sending queries to a few selected vendors.

Different organisations follow different procedures for inviting tenders.

6.3.4 Technical Scrutiny and Short-listing

In this step, the technical specifications of the tendered bids are evaluated and all tendered bids are compared. Depending on the compared results, the tendered bids are short-listed. The technical scrutiny and short-listing involves:

- Opening all tendered bids on a specific date and time
- Specifying or marking deviations from the specified product specifications in each bid
- Preparing a comparison list and short-listing the vendors according to the comparison list.

6.3.5 Detailed Evaluation

Detailed evolution involves the following tasks:

- In-depth examining of the technical specifications of the vendor's products
- Visiting the vender's workplace for inspections
- Examining a specific product, if any specific performance of the product is predetermined, through suitable benchmarks test

6.3.6 Negotiations and Procurement Decisions

Nowadays, there is extensive competition in the market. Therefore, the vendors may offer considerable concessions on the products and also price negotiations are

held to maximise these concessions. For the price negotiations, committee members must have good price knowledge of the each product.

However, some vendors do not allow any negotiations. For the vendors that do not allow negotiations, following steps can be taken into consideration for the procurement decision:

1. Short-list vendors according to the comparison list.
2. Arrange a meeting with the short-listed vendors.
3. Explain the final products configuration (including optional items, such as RAM and additional disk).
4. Allow each vendor to offer his final price for the selected product configuration.
5. Compare the entire final price list and select the lowest bid.

6.3.7 Delivery and Installation

In this step, the selected vendor delivers the hardware and software products to the buyer's organisation. Now, the buyer organisation compares the delivered product's configurations with the specifications mentioned in the tender. If the entire configuration matches, then MIS is installed in the buyer's organisation.

6.3.8 Post-installation Review

After installing MIS, an evaluation is made to determine how closely the new system confirms to the planning. For this, a post-installation review is made in which system specifications and user requirements are examined.

6.4 EVALUATION OF MIS

Evaluation of MIS is a process in which the performance of an organisational MIS is determined. According to the performance results, the organisation evaluates and implements the necessary modifications in MIS. Various terms related to the evaluation of MIS are:

- Evaluation approaches
- Evaluation classes
- Product-based MIS evaluation
- Cost/benefit-based evaluation

6.4.1 Evaluation Approaches

Various approaches are used to evaluate the organisational MIS performance. The most common approaches are:

Quality Assurance Review

The quality assurance review is also known as technical review. It determines the technical quality performance of MIS. The quality assurance review determines the data transmission rate, main or secondary storage and CPU capacity. The MIS development personnel or a quality assurance group performs the quality assurance review.

Compliance Audits

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Check Your Progress

5. Write the information that a purchasing schedule contains.
6. Hardware and software specifications contain all the ……. of each hardware and software product.
7. Detailed evolution involves in-depth examining of technical specifications of a product. (True\False)

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The compliance audit is also known as application control review. It determines the adequacy and completeness of MIS controls for the system inputs, outputs and security, etc. A specific internal audit function is used to perform the compliance audit.

MIS Personnel Productivity Measurement

The MIS personnel productivity measurement determines the capacity of MIS personnel. The capacity of the MIS personnel is evaluated in terms of productivity. For example, lines of code per unit time determine the capacity of the programming personnel.

Computer Performance Evaluation

The computer performance evaluation determines the production capacity of computer hardware. The production capacity is calculated in terms of performance efficiencies and bottlenecks such as actual throughput and I/O channel utilisation, which limits the production.

User Attitude Survey

The user attitude survey determines the operational consideration evaluation. The operational considerations refer whether or not the input data is adequately provided to MIS and the output is usable.

Cost/Benefit Analysis

The cost/benefit analysis is also known as economic evaluation. It determines the MIS effect on the organisational performance in terms of money. The cost/benefit analysis is commonly used in capital budgeting to estimate the return on an investment.

6.4.2 Evaluation Classes

To evaluate the performance of MIS, the following two classes are used:

- Effectiveness
- Efficiency

Effectiveness

The effectiveness class determines the quality of the MIS output. MIS is effective, if the quality of its output is good and the process of producing output is right.

Efficiency

The efficiency class specifies the total amount of resources required by MIS to obtain the output.

The relationship between effectiveness and efficiency can be defined as effectiveness is a measure of quality of an MIS output, while efficiency is a measure of the resources required to achieve the output.

6.4.3 Product-based MIS evaluation

The product-based MIS evaluation is also known as effectiveness evaluation. It determines the effectiveness of an MIS output. For assessing the effectiveness of an MIS output, a model structure may be used.

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Model Structure

A model structure is a structure that contains various information attributes such as timeliness and relevance. To determine the MIS effectiveness in an organisation, you need to determine the information attributes for the MIS output. The information attributes are already discussed in detail in Unit 4 of this book. Some of the commonly used attributes are:

- Timeliness
- Relevance
- Accuracy
- Completeness
- Adequacy
- Explicitness
- Exception-based

Model Implementation

The organisational MIS output can be evaluated for their effectiveness in terms of information attributes. The information attributes are listed in the structure of the model, as mentioned above. To implement this model, MIS users in an organisation are asked to give response for every information attribute in terms of rating.

For example, to collect the response from the users, a five-point scale can be used. MIS users rate on the scale for the effectiveness of the MIS in terms of the information attributes. A numeric value 0 is assigned on the scale for the least rating, 1 is assigned for the next rating and so on. Now, the following formula can be used to evaluate effectiveness for each information attribute:

$$ES_k = \sum sf/N$$

where

ES_k = effectiveness score for an attribute

s= score assigned to the response

f= frequency of the score

N= number of respondents (users of MIS)

The following formula can be used to evaluate the effectiveness score for n information attributes of MIS:

$$ESmis = \sum_{k=1}^{k=10} ES_k / n$$

Effectiveness Norm

Ideally, the value of ESmis should be 4. However, because of uncertain environment conditions, this value is not possible. Therefore, a tolerance limit is specifies, which is known as effective norm. Now, against this effective norm an organisation

compares the effectiveness of the MIS output to determine deviation. The tolerance limit is specified by the organisations concerned and it may vary from 5 to 20%.

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6.4.4 Cost/benefit-based Evaluation

The cost/benefit-based evaluation determines the cost effectiveness of MIS. The cost/benefit-based evaluation involves a study of various expected costs, expected benefits and savings from the MIS.

Various types of costs such as initial development cost and capital cost, and various benefits such as efficiency and reduced costs, are measured and included in the cost/benefit analysis. All these costs and benefits are briefly introduced below.

Initial Development Cost

The initial development cost is the cost that is incurred to develop MIS. The initial development cost includes, planning cost, design cost and implementation cost.

Capital Cost

The capital cost is the cost that is incurred in various facilities such as wiring and flooring and in purchasing various equipments, such as computers and peripherals, while implementing MIS.

Annual Operating Cost

The annual operating cost is the cost that is incurred in operating MIS. The annual operating cost involves computers and equipments maintenance cost, personnel cost, overheads cost and supplies cost.

Improving Performance

Improving performance is a benefit that includes improvement in accuracy, timeless, non-duplication, usefulness and adequacy.

Minimising Cost

Minimising cost is a benefit that is measured in terms of the error controls, reduced labour and reduced inventory cost because of the newly installed MIS.

Classification of Costs and Benefits

The costs are classified into various categories to make the cost/benefit analysis easy. These categories are:

- **Tangible cost** is the cost that incurred on a specific product or activity and whose monetary value can be measured. For example, computer cost and employee salary are tangible costs.
- **Intangible cost** is the cost whose monetary value cannot be determined. For example, lowered employee morale because of the new MIS is intangible cost.
- **Direct cost** is the cost that directly associate to any of the product or activity. For example, the purchase of a computer floppy for Rs. 20 is an example of direct cost.

- **Indirect cost** is the cost that is not directly associated to any of the product or activity. For example, expenditure on safety or security of computer room is an indirect cost.
- **Fixed cost** is the cost that does not change and remains fix. For example, development cost and capital cost.
- **Variable cost** is the cost that always keeps on varying on regular basis. For example, cost of supplies that depends on volume of reports or processing.

The benefits are also classified into various categories to make the cost/benefit analysis easy. These categories are:

- **Tangible benefit** is the benefit that is incurred on a specific product or activity and whose monetary value can be measured. For example, reduced employee salaries and producing reports with no errors are tangible benefits.
- **Intangible benefit** is the benefit whose monetary value cannot be determined. For example, improved organisation image and increased employee morale are intangible benefits.
- **Direct benefit** is the benefit that directly associate to any of the product or activity. For example, 5% reduction in the employee salary is an example of direct benefit.
- **Indirect benefit** is the benefit that is not directly associated to any of the product or activity. For example, a computerised salary system gives detail of total amount required for payment and total deductions because of insurance, provident fund and recovery from loan advances etc. In this example, information about the amount recovered from loan advances is an indirect benefit of the salary system.
- **Fixed benefit** is the benefit that does not change and remains fix. The 10% reduction in the staff salary is an example of fixed benefit.
- **Variable benefit** is the benefit that always keeps on varying on regular basis. The amount of daily time saved by a manager is an example of variable benefit.

After identifying various costs and benefits, you need to create a table that contains all the expected benefits, the expected costs and the expected savings from MIS.

Table 6.1 shows costs, benefits and savings form for MIS.

Table 6.1: MIS Evaluation

Name of the organisation _____ Date _____ Address _____ Ref. No._____	
(A) Estimated Initial Development Cost	Rs
1. Project Planning	___
2. Feasibility Study	___
3. Design	___
4. Conversion	___
5. Implementation	___

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6. Miscellaneous	___
Total (A)	_____
(B) Estimated Capital Cost	Rs
1. Computer Room Equipment and H/W	___
2. Facilities	___
Total (B)	_____
(C) Estimated Operating Cost	Rs
1. Personnel	___
2. Computer/Equipment Rent	___
3. Overhead and Supplies	___
Total (C)	_____
(D) Estimated Benefits	Rs
1. Reduced Salary and Labour Cost	___
2. Reduced Inventory Cost	___
3. Better Decisions	___
4. Any Other Intangible Benefit	___
Total (D)	_____
(E) Annual savings (D – C)	Rs
(F) Rate of Return (rate at which present value of savings equals present value of one-time costs) (Pv of E=Pv of A + B)	%

6.5 SYSTEM MAINTENANCE

The evaluation process helps an organisation to analyse whether or not MIS is effective and efficient. On the basis of the evaluation results, an organisation performs system maintenance. System maintenance is a process of monitoring, analysing and modifying the existing MIS to make some desired or specific improvements. The system maintenance includes removing errors, which may be due to environment change, organisation change or system design. In the system maintenance process, various tasks are performed that are categorised into the following categories:

- Corrective maintenance
- Adaptive maintenance
- Perfective maintenance

Check Your Progress

8. Write the various terms related to the evaluation of MIS.
9. MIS personnel productivity measurement determines the capacity of ……...
10. Write the classes that are used to evaluate performance of an installed MIS in an organisation.
11. The evaluation process helps an organisation to analyse whether or not the MIS is effective and efficient. (True/False)

NOTES

6.5.1 Corrective Maintenance

In the corrective maintenance, the processing or performance failures are repaired. These failures are due to faulty design or wrong assumptions during the MIS design and implementation process.

6.5.2 Adaptive Maintenance

In the adaptive maintenance, MIS is repaired according to some organisational changes. The organisational changes include:

- Change in the organisational procedures
- Change in organisational objectives, goals and policies
- Change in forms
- Change in system controls and security needs

6.5.3 Perfective Maintenance

In the perfective maintenance, MIS is repaired to enhance its performance. The perfective maintenance includes adding new program and modifying the existing programs in an MIS system.

6.6 PITFALLS IN MIS DEVELOPMENT

There are fundamental weaknesses in any organisation, such as improper management and unclear organisational functions. When the organisation decides an MIS, these problems directly affect and limit an MIS. Various limitations of an MIS are:

- Organisational Framework: Some managers think that they can solve company's shortcomings using MIS. An MIS does not help to achieve this goal without a good planning and control within the framework of an organizational structure. 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.
- Generation of Information: The lack of managerial and operational applications to the MIS makes a great impact because it implies that the process of management is not being performed well to generate the information. The information is the raw material of decision-making for MIS, and if information is not being generated, disseminated, and used for management, then no system-manual or computer is going to solve organisational problems.
- Managerial Participation: The most striking characteristic of a successful company is that the MIS development has been viewed as a responsibility of management. Their success is attributed directly to the fact that managers are required to become involved in the design of their own systems. This includes both top management and operating line management. Moreover, the presidents need to take personal interest and participate directly in defining what work the computer should do for the company.

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- Communication Gap: In MIS, user cannot adequately express information needs and the designer designs the flow chart and graphs according to the user requirements. After designing, the programmer incorporates his own ideas and interpretations, for developing the system. In these development stages, one undefined requirement can develop an incorrect information system.
- Bias in Information: The presentation of information may generate a bias and may influence the user such as, if the information is presented in an alphabetic order and if it lengthy, the first few information entries will get more attention.
- Delayed Delivery of Information: It reduces the immediate action or decision. Thus, delayed information will only have knowledge value.
- Suppresion and Filtering of Information: This is done with the confidential and sensitive data to achieve unrealistic goals.

6.7 SUMMARY

Maintenance is the term applied to those activities, which correct flaws or errors in both systems design and implementation with respect to system requirements and system specifications. System enhancement falls between system maintenance and system development in that it also corrects flaws in requirements and specifications. System enhancement adds to system capability by incorporating new or augmented requirements.

6.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Implementation is a process of putting a newly developed MIS into operation or functioning at the user's workstation.
2. For the implementation of an MIS, following steps are taken into consideration:
    A. Planning and implementation
    B. Acquisition of facilities and space planning
    C. MIS organisation and procedure development
    D. User training
    E. Acquisition of hardware and software
    F. Creation of forms and database
    G. Testing
    H. Change over
3. True
4. MIS design specification
5. A purchasing schedule contains the following information:
    A. Date of tender submission
    B. Evaluation criteria
    C. Scope for negotiations, if any
6. Technical specifications

7. True
8. The various terms related to the evaluation of MIS are:
   A. Evaluation approaches
   B. Evaluation classes
   C. Product-based MIS evaluation
   D. Cost/benefit-based evaluation
9. MIS personnel
10. To evaluate performance of MIS, the following two classes are used:
    A. Effectiveness
    B. Efficiency
11. True

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6.9 EXERCISES AND QUESTIONS

Short-Answer Questions

1. Explain the MIS implementation process? Also discuss various steps to implement a newly developed MIS in an organisation.
2. Why do organisations need system maintenance? Explain the different types of system maintenance.

Long-Answer Questions

1. Discuss various costs and benefits considered during the MIS evaluation process.
2. What are the criteria for selection of hardware and software in MIS?

6.10 FURTHER READING

Davis, B. and M.H. Olson, *Management Information Systems*.

UNIT 7 APPLICATION OF MIS IN MANUFACTURING SECTOR

NOTES

Structure

7.0 INTRODUCTION

An information system is an organised collection, storage and presentation system of data and other knowledge for decision-making, progress reporting and planning and evaluation of programmes. The various applications of the information system include accounting, query analysis, decision-making and report generation. A typical information system provides these applications at various function levels, such as personnel management, financial management, production management and marketing management. For example, in personnel management, the accounting application primarily focuses on attendance, manpower, salary, skill, etc., whereas in financial management, the accounting system accounts for all direct and indirect money transaction in the organisation.

The query system also varies in the different function levels. The production management queries include production programmes, job schedules, status of availability of materials, status of the job, etc. However, the marketing management queries revolve around price, supplier and stocks. There are also various reports generated in an information system that help take various decisions at different function levels.

7.1 UNIT OBJECTIVES

- Describing objectives behind applications of information system
- Understanding the applications of MIS at different function levels
- Explaining the reports generated in an MIS at different function levels
- Discussing how various reports help take decisions at various function levels

7.2 INFORMATION PROCESSING SYSTEM

NOTES

An information processing system is the system that takes information in one form and transforms that information into another form. Information system and MIS are similar to each other, as the main aim of both the systems is to provide information for the proper functioning of the organisational activities.

It is not necessary that every organisation follow the same system of information processing or MIS. The application of MIS in organisations may vary depending on the requirement and the flow of information. Generally, information is stored in databases maintained in the organisation, the data for which is collected from the online transaction processing (OLTP) system. A typical information processing system is shown in the figure 7.1, which helps view various application of the information system:

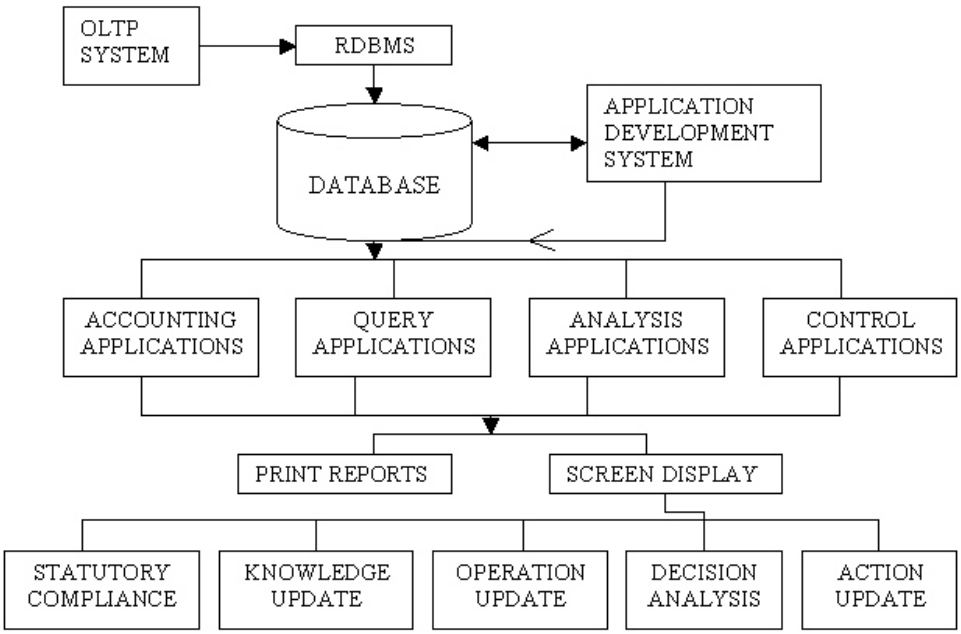

Figure 7.1: *A Model of Information Processing System*

For each application of an information processing system, OLTP provides the input data. The objectives behind developing the different applications in an information processing system are:

- To keep an account of the transaction results in the information system and providing reports on them
- To provide a query system to assess the status of the system
- To provide a system of analysis of data that gives specific business trends or results
- To provide control information that helps run the business as per the plan and focus on progresses in a set direction to achieve business goals.

7.3 PERSONNEL MANAGEMENT

The main task of personnel management is to provide required and suitable human resources that possess specific skills, knowledge and capability. It has to cater to the

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demand of an organisation from time to time and its goal is to control personnel cost through continuous increase in manpower productivity by adopting the following techniques:

- Human Resource Development by means of training and upgrading of skills and knowledge
- Motivation through leadership and job enrichment
- Promotion and rewards through performance appraisals
- Grievance handling
- Structuring the organisation

7.3.1 Input

The application of MIS for personnel department consists of several forms or documents, which serve as inputs. These can be enlisted as follows:

- Personnel application form
- Appointment letter
- Attendance and leave record
- Biodata or CV
- Appraisal form
- Production/Productivity data on the jobs
- Wage/Salary agreement
- Record of complaints, grievances, accidents
- Industry data on wage/salary structure
- Industry data on manpower, skills, qualifications
- Record of sources of manpower—University, Institutions, Recruitment agencies
- Record on manpower application trend in view of mechanisation, automation, and computerisation.

7.3.2 Application

These documents form a database, which are then observed and used by personnel managers, head of human resource development department and top management.

Accounting

Following entities are accounted for in the personnel management system

- Attendance
- Manpower
- Leave
- Salary/Wages, statutory deductions
- Loans and deductions
- Accidents
- Production data
- Skills
- Bio data
- Family data

Query

Personnel management has queries regarding the following topics

- Identification of each employee
- Strength of a section, department, division
- Number of persons with a particular skill
- Attendance, leave, and absenteeism record of all the employees
- Salary/Wages of employees
- Designation and number of persons holding these designations
- Personal records of the employees

The queries are processed with employee number, skill code, and department/division code as keys.

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Analysis

In view of personnel management, data analysis takes into consideration the following factors:

- Analysis of attendance by a class of employees
- Leave analysis by a group of employees
- Trend in the leave record
- Analysis of accidents and types thereof
- Analysis of salary/wages structure
- Analysis of overtime

Control

In the view of personal management, control consigns the working criteria of a person and the industry norms. Some of the considerations taken into control are:

- Probable absence versus workload
- Personal cost against manpower increase
- Assessment of accident records against safety measures taken
- Personnel cost versus industry cost and its projection
- Projection on manpower needs, evolving recruitment and training programmes

7.3.3 Reports

The personal department and the top-level management use reports to analyse the information of the industry. Following are the major categories of the reports.

Statutory reports

The personal department of the organization generally prepares statutory reports. A statutory report consists of:

- Attendance record
- Category of employees—permanent, trainee and apprentices
- Information about funds, ESI Reports, Ledgers and Returns
- Accident Reports

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- Income Tax Form 16, 24A
- Strength of employees to Director general of Technical Development (DGTD)

Statutory reports are submitted to the Provident Fund Authorities, ESI Authorities, Income Tax Department, Directorate of Industrial Safety and Health, and Labour Department.

Knowledge Update Reports

These reports help to keep the data up to date and consist following information:

- Daily attendance report
- Employee strength
- New joining and leaving and transfer of the employees
- Personnel cost by department, job and product
- Evaluation of personnel cost by salary/wages and overtimes

Operational update reports

Operational reports determine and plan the following aspects for futures activities:

- Daily attendance to plan the workload
- Overtime versus work completed
- Projected absenteeism and distribution of workload
- Cost of personnel by jobs or work completed

Decision analysis reports

These reports analyse the data and help to decide the plans.

- Analysis of attendance for season, festival, and predetermined schedule
- Overtime analysis
- Analysis of accidents and deciding on safety measures and retraining
- Cost versus work analysis
- Job versus recruitment analysis

Action Reports

These reports are taken into consideration for some actions based on the analysis of the reports. These reports include following actions:

- Recruitment and additional manpower or subcontracting of jobs
- Acceptance of orders on the basis of workload
- Reduce cost by reorganising or transferring workers
- Prepare training and development programmes according to the need

7.4 FINANCIAL MANAGEMENT

The function of the financial management is to meet the financial needs of an organisation. It also helps in meeting the statutory compliance by way of declaring the audited financial results, submit all reports and return to the Government and Tax

Authorities. There are various tools that help the financial management in meeting the required organisational goals. These tools are as follows:

- Break Even Analysis
- Cost Analysis
- Cash Flow Projections
- Ratio Analysis Capital Budgeting
- Management Accounting
- Financial Modelling, and so on.

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7.4.1 Input

There are several documents and forms, which serve as inputs for financial management. These documents and forms are prepared in specific formats according to the need of different organisations. The various forms of inputs available in financial management are:

- Payments
- Receipts
- Data from Stock Exchange

7.4.2 Applications

The financial accounting system is the primary application in financial management. The financial accounting system is responsible for handling the financial transactions and producing financial results for a company.

Accounting

In financial management, the financial accounting management system controls all the applications related to accounting. This system handles all direct and indirect financial transactions, which can affect various financial aspects of a company. Some of these aspects are:

- Sales
- Purchase
- Capital purchase
- Inventory
- Fixed deposits
- Shareholder's funds
- Income tax
- Salary/wages
- Budgets
- Fixed assets

Query

The query system in financial management provides the debit or credit balance of an account that shows the transactions involved in producing the balance. The query system involves the following queries:

- Main account
- Subsidiary account

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- Location of Factory, Branch, etc.
- Documents, such as bills, credit notes, reciept, etc.

Decision Analysis

Based on the analysis of the financial status of a company, financial management has to take several decisions. These decisions include borrowing short-term working capital, analysing debtors and creditors, capital budgeting, selection of investment alternatives, etc. The following applications support these decisions of the financial management:

- Cash flow analysis
- Debtors analysis and aging
- Creditors analysis and aging
- Sources and uses of funds
- Budget analysis
- Capital budgeting and ranking of investment alternatives

Control

When a business does not progress as per planning, the cost to run the business increases. In such situations, the control applications need to focus on the exceptions that arise in the business operations. Some of these exceptions are:

- Accounts receivable, outstanding beyond the acceptable norms
- Advances to creditors and non-realisation of obligations
- Analysis of non-moving accounts and legal actions
- Shortage of funds in excess of planned and rescheduling of activities and priorities
- Cost over-runs beyond the norm and action on alternatives

Based on these exceptions, the control applications take several decisions and bring out revised business terms, which include:

- Choosing alternative source of financing
- Revising specific activities to cut down the expenses
- Relocating resources
- Revising schedules, plans and priorities

7.4.3 Reports

The information received from the financial management plays a pivotal role for information management of a company. Because the information is received as basic data and can be reliable as it is thoroughly checked, audited and validated using a computer system. The top management primarily relies on the statutory compliance and operations update from the financial management.

Statutory Compliance

- Tax returns
- Sales tax registers
- Excise registers

- Periodical public declaration of financial results
- Declaration of annual results to the board, share holders and public

Knowledge Updates

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- Monthly trial balance, balance sheet and profit and loss account
- Stock valuation
- Receivable accounts and aging
- Payable accounts and aging
- Expenses on major accounts
- Position of cash
- Overall business achievement in major business areas

Operations Update

- Filling of statutory retuns and reports
- Statutroy payments that include advance tax, sales tax, excise duty, etc.
- Reports on finished goods and dispatches
- Report on payment to the supliers
- Report on material receipts

Decision Analysis

- Break even analysis for cost and price decision
- Return on investment analysis to choose investment
- Trend analysis on price of selected comodities
- Analysis of current and fixed assets
- Analysis of current liabilities
- Analysis of overdue receivables

Action Update

The decision analysis specifies the areas where decision is to be made and actions to be taken. However, actions are taken in exceptional cases. The reports of the actions implemented and their impacts on the business include:

- Overdue receivables that can result in legal action and termination of business association
- Non supply of goods and services after payment that can lead to legal action, revision of terms and termination of business association
- Payments to creditors including penalties
- Poor usage of fixed assets

7.5 PRODUCTION MANAGEMENT

The function of production management is to provide manufacturing services, which involve manufacturing products with specific quality, cost and time to fulfil the customer needs. The function of production management is supported by the following systems:

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- Production planning and control
- Industrial engineering
- Maintenance and quality control
- Materials management

The organisation of the production management of a company varies due to the type of production and its production policies. The production policies can differ with whether the production is made on customer order or for stock. It also depends on the manufacturing technology adopted by the company.

There are several functional goals of the production management to provide the manufacturing services. These include:

- Fuller utilisation of manufacturing capacity
- Minimal rejections
- Maximum uptime of plant and equipment
- Fulfiling the delivery promises

7.5.1 Input

The production management involves several transactions that are related to plan, issue and control the various tasks during product manufacturing. The details of these transactions are listed in the following documents:

- Production programme
- Production schedule
- Process planning sheet
- Job card
- Quality assurance rating form
- Material requirement
- Breakdown advice
- Material requisition
- Customer order

7.5.2 Applications

Production management involves various support systems, such as:

- Production planning and control
- Bill of material processing
- Drawings and process planning
- Scheduling and monitoring systems

Accounting

Production management requires several entities to perform the tasks and activities involved in manufacturing process. These entities are:

- Quantity of production in a specific time-period
- Material requirement and usage
- Rejection of quantity at the intermediate stages and at the final stage
- Use of power and fuel

- Utilisation of machine and facilities
- Labour hours

Query

NOTES

The queries in production management involve seeking job status or information on fixed entities, such as machine or worker. These queries include:

- Job status or order in terms of stage and level of completion
- Job schedules and production programme
- Status of material availability
- Status of loads on machines
- Standard information on worker skills and their capacities
- Standard information on products and processes

Decision Analysis

Production management needs to make a number of decisions, both short-term and long-term, to fulfil its objectives. These decisions are:

- Make or buy
- Make or subcontract
- Using alternative material
- Using alternative process
- Job planning and scheduling
- Job rescheduling and loading
- Selecting production facilites
- Selecting alternative maintenance policies

These decisions implies on:

- Cost
- Productivity
- Efficiency
- Utilisation of the manufacturing facility
- Utilisation of material and physical resources

Control

In production management, control applications help control production programme, production capacity and quality of production. The control applications also need to focus on utilisation of the production capacity and labour force. In production management, the following exceptions need to be highlighted to perform the control applications:

- Excessive product rejection due to material or process
- Hold up key job beyond a specific limit
- Continuous breakdown manufacturing facility beyond a specific period
- Continuous deviation from the norms and standards of production rate
- Below limit utilisation of key facilities
- Backlog of orders due to failure of delivery dates

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7.5.3 Reports

Statutory Compliance

In production management, information on statutory compliance is not of much significance. Only a few companies need to submit the report on raw material and finished good to the Government. Some companies classified under Director General of Technical Development (DGTD) also need to provide information on production and production hours to DGTD.

Knowledge Update

- Down-time of production facilites
- Output of various jobs versus machines
- Job completion time
- Breakdowns and causes of breakdowns

Operations Update

- Production per day
- Rejections by process or job
- Machine breakdowns
- Jobs completed and handed over for inspections

These reports can help take various decisions, such as:

- Extending production hours
- Going on second shift
- Job rescheduling
- Change of tools or process

Decision Analysis

The Decision Support System (DSS) helps the management take decisions, which are supported by:

- Programming models
- Simulation techniques
- Material requirement planning systems
- Artifical interlligence and knowledge-based systems
- Planning and scheduling systems

The analysis of DSS also helps make the following decisions:

- Optimum product mix
- Alternative loading pattern
- Alternative assignment of jobs and machines
- Alternative material, tools and process

Action Update

The action update reports help find out the post-implementation scenario of the decisions taken by DSS. These reports inform whether the decisions result in expected performance or not.

They also provide an early opportunity to the management to correct decisions that are not proper in action. Such reports, which help correct a decision, are called exception reports.

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7.6 MARKETING MANAGEMENT

The prime objective of the marketing management is to satisfy the customer. This involves:

- Identifying the need of the customer
- Developing product concept
- Designing the product
- Positioning the product in the market
- Pricing the product appropriately to sell in the market

The function of marketing management has strong relation with the financial and production management. This is because marketing management needs to depend on uninterrupted supply of goods, appropriate stock and inventory at different locations. Marketing management controls the sales from the point of view of sales income. It also has different responsibilities, which help in various tasks, such as retaining market share, penetrating into new market and assessing consumer responses to a new market. Some of the key responsibilities of marketing management are:

- Forecasting sales
- Evolving marketing strategies
- Pricng
- Designing products
- Launching products

7.6.1 Input

In marketing management, the following documents are used for input transactions:

- Customer order
- Order acceptance
- Delivery note
- Invoice
- Credit and debit note

7.6.2 Applications

Accounts

In marketing management, the following entities are involved in accounting application:

- Product sale
- Product family

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- Sales value
- Sales tax
- Dealer
- Customer
- Excise duty
- Area
- Inventory
- Market segment
- Exports market
- Complaints

Query

The queries involved in marketing management are:

- Product specifications
- Price and discounts
- Product quality
- Customer names and addresses
- Dealers
- Distributors
- Sales
- Stock

Decision Analysis

Marketing management needs to take decisions on the following:

- Price increase or decrease
- Allocation of stock
- Acceptance of order
- Discounts and commision
- Deciding sales terms
- Deciding new products
- Packaging
- Distribution channels
- Product positioning

The applications that support these decisions are:

- Break even model
- Risk analysis model
- Distribution model
- Network model
- Product launch model

Control

In marketing management, following factors need to be controlled in order to achieve business goals:

- Sales versus budget
- Marketing cost versus budgeted cost
- Product sale verus target fixed for market segments
- Planned sales programme versus actual sales and sales of competitors

NOTES

7.6.3 Reports

Statutory Compliance

In marketing management, statutory compliance involves taxes and duties and filing the returns to the appropriate authorities of the government. The main statutory compliance reports are sales tax register and returns and excise duty returns.

Knowledge Update

In marketing management, the knowledge update reports are based on various entities, such as orders, value, sales, stocks and budgets. The various knowledge update reports are:

- Product sales ledger
- Sales summaries
- Accounts receivables
- Received and accepted orders
- Sales analysis
- Market analysis
- Competition analysis

The knowledge update reports are presented in a summarised fashion with fixed format to comply with the structure of the companies. The factors that help summarise these reports are:

- Customer
- Class of customer
- Market segment
- Product
- Product family
- Sales representative
- Dealer
- Distributor

Operations Update

The operations update reports in marketing management provide the various marketing operations, which involve:

- Orders receive
- Orders processed
- Orders accepted

Check Your Progress

1. What do you mean by information system?
2. What is the role of personnel management?
3. What is the main objective of finance department?
4. What are the responsibilities of marketing management?

- Orders despatched
- Orders billed
- Money recovered

NOTES

The operations update reports provide facts on day-to-day operations, which help prepare statistical summaries for quick update. Some of the operations update reports are:

- Order book
- Despatch report
- Inventory
- Invoice
- Customer complaints

Decision Analysis

Decision analysis reports help provide information on whether the expected results are realised or not in marketing management. Among the decision analysis reports, market research analysis reports help in sales analysis with reference to price, choice of market, design, packaging, etc. These reports also allow marketing management to take correct decisions with the help of the following decision analysis models:

- Break even analysis
- Product market mix
- Marketing expense and market mix

Action Update

The action update reports help marketing management take decisions, such as price reduction, withdrawal of product from the market, changing product position and allocating more budgets. The various action update reports are:

- Sale versus budget
- Sales growth versus sales objective
- Stocks versus budgeted stock levels
- Number of complaints recieved versus number of complaints serviced

7.7 SUMMARY

Information system is the process of collecting data and information and storing the collection so as to retrieve it when necessary. The information system is useful in various areas of an organisation such as personnel, production, marketing and finance. For example, in personnel management, the accounting application primarily focuses on attendance, manpower, salary, skill, etc., whereas in financial management, the accounting system accounts for all direct and indirect money transaction in the organisation.

7.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. An information processing system is the system that takes information in one form and transforms that information into another form. Information system

and MIS are similar to each other, as the main aim of both the systems is to provide information for the proper functioning of the organisational activities.

2. The main task of personnel management is to provide required and suitable human resources that possess specific skills, knowledge and capability. It has to cater to the demand of an organisation from time to time and its goal is to control personnel cost through continuous increase in manpower productivity.
3. The main objective of finance department is to meet the financial needs of an organisation by applying various tools such as break even analysis, cost analysis and cash flow projections.
4. The responsibilities of marketing management are as follows:
    A. Forecasting sales
    B. Evolving marketing strategies
    C. Pricing
    D. Designing products
    E. Launching products

7.9 EXERCISES AND QUESTIONS

Short-Answer Questions

1. What is an information processing system? Explain briefly the model of an information processing system.
2. What are the objectives of the applications of an information system?
3. What are the various function levels of an information system? Mention the types of inputs at the various function levels.

Long-Answer Questions

1. Explain the significance of a financial accounting system in financial management.
2. Explain briefly the primary objective of marketing management.
3. What does production management emphasise most on?

7.10 FURTHER READING

Jawadekar, W.S., *Management Information Systems*, Second Edition.

PUNJAB TECHNICAL UNIVERSITY

LADOWALI ROAD, JALANDHAR

ASSIGNMENT SHEET

(To be attached with each Assignment)

Full Name of Student:_____

(First Name) (Last Name)

Registration Number:

Course:_____ Sem.:_____ Subject of Assignment:_____

Date of Submission of Assignment:

(Question Response Record-To be completed by student)

S.No.	Question Number Responded	Pages ____ - ____ of Assignment	Marks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Total Marks:_____/25

Remarks by Evaluator:_____

_____

Note: Please ensure that your Correct Registration Number is mentioned on the Assignment Sheet.

Name of the Evaluator

Signature of the Student

Signature of the Evaluator

Date:_____

Date:_____

PUNJAB TECHNICAL UNIVERSITY

LADOWALI ROAD, JALANDHAR

INTERNAL ASSIGNMENT

TOTAL MARKS: 25

NOTE: Attempt any 5 questions
All questions carry 5 Marks.

Q. 1. Explain the role of MIS in the decision-making process.
Q. 2. Discuss the various components of MIS.
Q. 3. Explain Robert Anthony's Hierarchy of Management Activity.
Q. 4. Write a short note on Data Flow Diagram.
Q. 5. What are the tools that help financial management attaining the organisational goals?
Q. 6. Explain the significance of MIS in the manufacturing sector.
Q. 7. Explain the MIS implementation process.
Q. 8. Describe the various stages involved in Simon's model.
Q. 9. Differentiate between single process and multiple process MIS.
Q.10. What are the different objectives of system design process?