Block 2
System Analysis and Control

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UNIT 5 SYSTEMS APPROACH

Structure

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5.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the concepts of system and systems analysis and design;
- describe the principles followed in the process of analysis and design; and
- identify the techniques used and the steps taken in the process.

5.1 INTRODUCTION

This Unit elucidates the concept of systems analysis and design. On studying this unit you will be able to recognise that analysis and design together are a single compound concept and that the analysis phase is the starting point for the design phase. What is determined in the first phase gets validated in the second phase. It further explains the characteristics of systems, what constitutes library as a system, how in the analysis phase the interrelationships and interdependence among the component parts are identified in the analysis phase, and how the system's total requirements are determined. Using the same data collected in the analysis phase, a new system is designed finally. The Unit also explains the process of designing a system and the principles followed and techniques used in it.

5.2 SYSTEMS

The word system can be defined in many ways. The dictionary meaning of the word 'System' is, a group of things or parts working together as a whole. A system is a set of entities or elements, which are integrated and bound by a functional relationship

to serve a purpose. They are so integrated, that a change in the functioning of one entity affects the effectiveness of others, and thereby the overall functioning of the set as a whole. Thus systems involve components or subsystems, which are placed in a defined relationship to one another. Semprevivo (1982) defines a system as "a series of interrelated elements that perform some business activity, business function, or business operation." The point that is stressed by other definitions as well is that a system involves components or subsystems, which are placed in a defined relationship to one another. A system, then, is a set of objects brought into a whole for a common purpose. They are interrelated and interdependent. Any grouping of elements in a system that includes some but not necessarily all of the elements is called a subsystem. It is important to note that any system may be a part of a larger system and may itself be composed of subsystems. In short, a system is an organisation that can be reduced to its component parts on the basis of their functions. Each functional component part is then a subsystem, which in turn can be reduced to its own component parts.

A system can be described in terms of inputs, processes, outputs and the various controls operating on it, as suggested by Brophy, 1986.

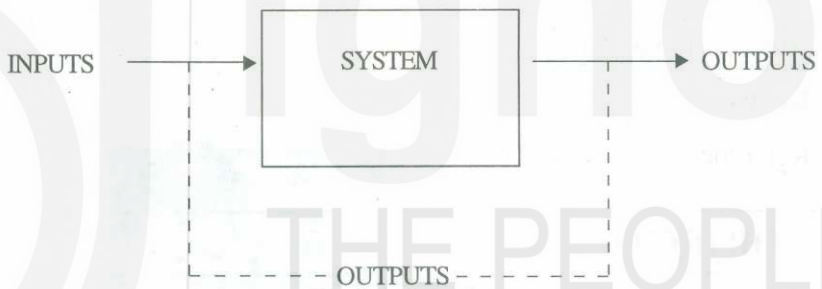


Fig. 5.1: A System

Murdick and Ross (1975) have identified different types of systems. These are:

- Conceptual Systems – These systems are basically concerned with theoretical structures as in General Theory of Relativity, Economic Theory etc.
- Empirical systems – These systems in contrast to the conceptual systems are concrete operational systems made up of people, materials, machines and other such components.
- Natural Systems – An example of such a system is an ecosystem or 'the entire ecology of life'.
- Man-made Systems – Example of such a system is the manufacturing system of a company.
- Social Systems – These systems are made up of people and comprise interpersonal and inter group relationships.
- Man-machine Systems – These systems exist in business and industry.
- Pure Machine Systems – These systems are rare. Example could be a self-sufficient system like an electrical power generating system, with self-repairing capabilities.
- Open system – This system freely interacts with its environment.
- Closed system – This system does not interact with its environment.

- Stationary systems – These are systems whose properties and operations do not vary with time. An example of such a system would be a manufacturing unit producing the similar items.
- Non-Stationary systems – These systems vary with time. An example of this system is a R&D department or any other system that keeps evolving or changing with time.
- Reactive systems – These systems interact with their environment in order to improve their functioning and thus keep evolving.
- Non-adaptive systems – These systems do not change with respect of the environmental factors.

In a typical library and information system, for example, all major activities such as acquisitions, serials control, information storage and retrieval, user services and administration and planning are a set of elements, which are interdependent because of the common purpose they intend to serve. Providing library and information service is the common purpose that binds or unites them into a set or system. All major activities of this system from acquisition to management are thus, its subsystems.

5.2.1 Library as a System

Library can infact be identified as a complex system. Seven basic subsystems that make up the library system, as identified by Hays and Becker, are acquisitions, serials control, circulation control, cataloguing, interlibrary loans, reference and administration and planning. Chapman and others list all these except inter-library loans, which understandably can form part of either circulation control or reference subsystem. These can be restated as acquisitions, serials control, information storage and retrieval, user services and administration and planning. Here, then, our library and information system has been reduced to its component parts which together serve the common purpose of providing library and information service. This common purpose binds all these component parts into an integrated whole. They are interrelated functionally and, therefore, are interdependent. For example, a change in the functioning of the acquisitions subsystem can affect the effectiveness of the user services subsystem. Similarly, a change in the functionality of information storage and retrieval subsystem can also effect the effectiveness of user services subsystem and that of the system as a whole. Thus, these subsystems are not only interrelated because of the common purpose they serve, they are also interdependent. Because of this interdependence among them, a change in any one component may affect the functioning of the whole system. The library is, thus, a system. This system can be graphically illustrated. Chapman and others have presented the model library system in the following manner:



Fig. 5.2: Graphic Presentation of a Model Library System of Chapman et. al.

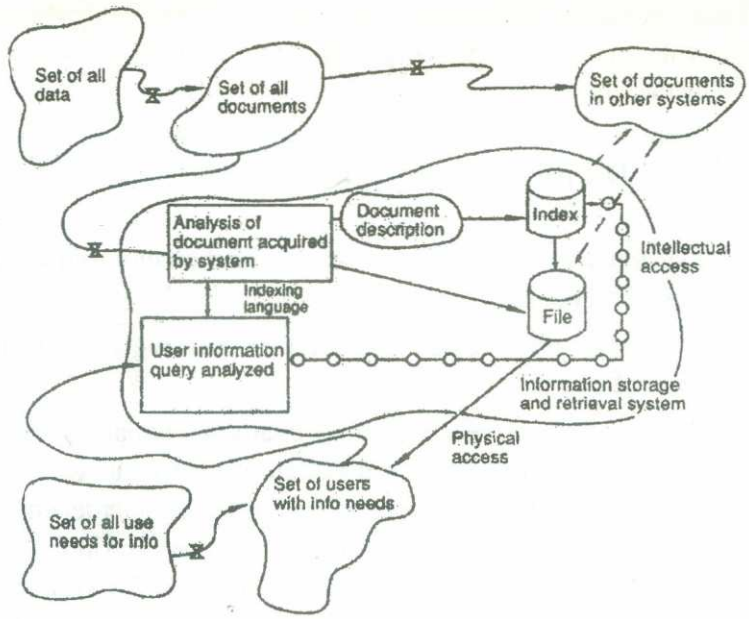


Fig. 5.3: Library as an Information Storage and Retrieval System (Source: Kraft and Boyce)

The above illustration is a presentation of well-defined functional interrelationships among the component parts of the library and information system. Because of these functional interrelationships the system is capable of achieving its objective. When a library is viewed as an integrated system the interdepartmental boundaries appear superficial and fade away.

Library is an open system that "interacts with its larger environment by drawing from that environment and exporting to that environment", (Stuert and Eastlick, 1981). It can also be seen as an information storage and retrieval system. The inputs are the documents(journal, books, reports etc.) and expressions of the needs of users seeking information. The collection in the stacks, vertical files, and catalogues, for example, is clearly storage. The processing is the analysis, representation, and organisation of requests and retrieval of appropriate information from the collection in response to these requests. The output is the dissemination of the desired information to the client. The concept of control is realised by the administration of the library (Kraft and Boyce, 1991).

Moreover, library is a dynamic organisation with all its complex interactions and discontinuities. "Changing one policy can produce anticipated changes in apparently unconnected areas of service" (Brophy, 1986).

Self Check Exercise

1) Define the term 'system' and identify the factors that shape library as a system.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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5.3 SYSTEMS ANALYSIS

Having understood the meaning of system let us now try to understand the meaning of systems analysis. Harold Borko (as quoted by Werner Kunz and others) defines the term systems analysis as 'a formal procedure for examining a complex process or organisation, reducing it to its component parts, and relating these parts to each other and to the unit as a whole in accordance with an agreed upon performance criterion' *(Methods of analysis and evaluation of information needs'.* Verlag Documentation, 1976). Following this definition, library as a system can be reduced to its component parts and these parts can be related to each other and to the system as a whole according to an agreed upon performance criterion. In the case of the library and information system, increased effectiveness can easily be such a performance criterion. Such an exercise, then, will be a library systems analysis.

These six steps are schematically represented in Figure 5.2.

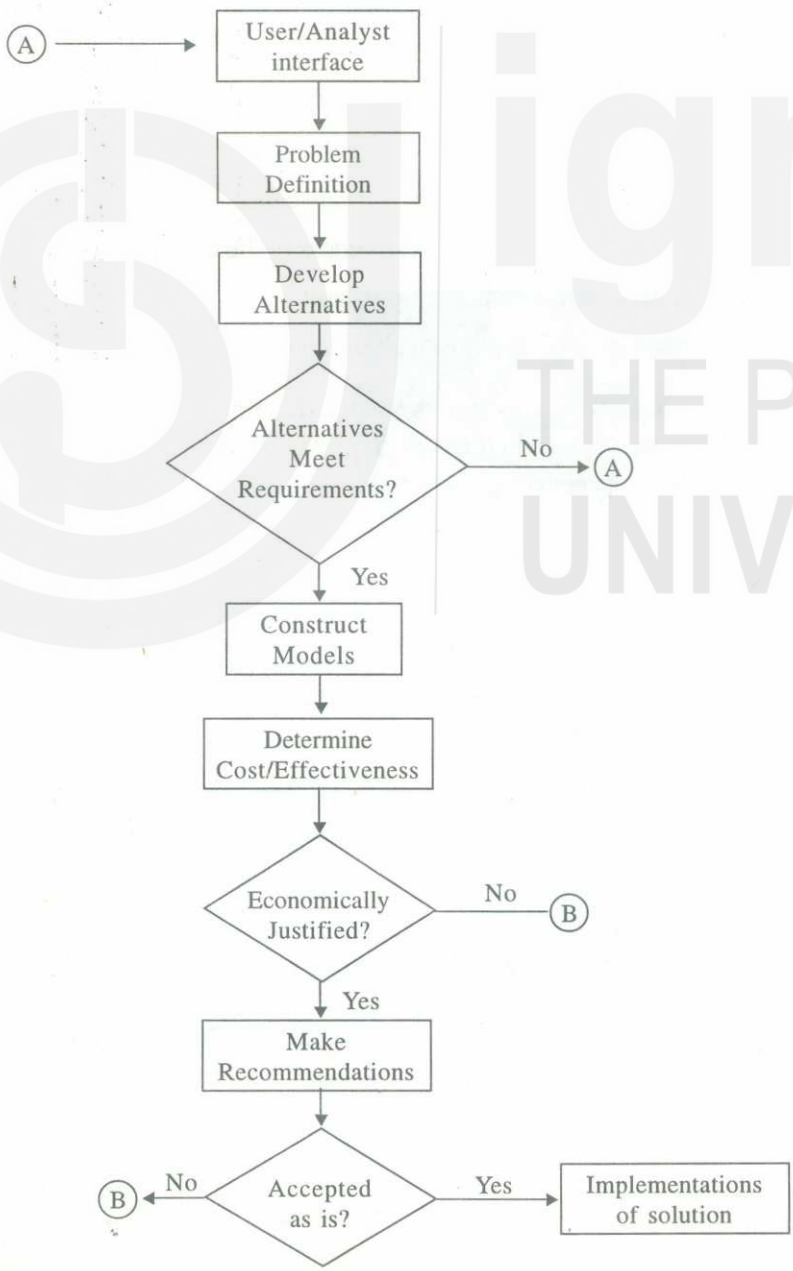


Fig. 5.4: Schematic Diagram Showing Steps and Interactive Process of Systems Analysis Used in Problem Solving (Source: Burch and Starter)

The reduction of the system to its component parts is the beginning of systems analysis. Relating these parts to each other and to the unit as a whole is the completion of the analysis. Such an analysis is undertaken while designing a new system, e.g. computerisation. Analysis is the starting point for designing a new system. Systems analysis and design together are thus a single compound concept.

At this stage it is possible to see how the process of systems analysis works. Just as a system is reduced to the subsystem comprising it, so also each subsystem is reduced to its component parts. Several interrelated operations carried in a subsystem form its component parts and each of these consists of functions, decisions and actions.

5.3.1 Steps in Systems Analysis

The process of System Analysis can be considered from two angles: one is from the point of view of problem solving and the other from the point of view of development of new systems.

From the point of view of problem solving the following six basic steps are carried out:

i) Definition and formulation of the problem;
ii) Development of alternative solutions;
iii) Construction of models which formalise the alternatives;
iv) Determination of the cost/effectiveness of the alternatives;
v) Presentation of recommendations; and
vi) Implementation of the chosen alternatives.

The application of systems analysis to the development of system generally takes greater time period than in the case of problem solving. The activities performed during the development of a system can be identified in three phases:

1) System Analysis
2) System Design
3) System Implementation.

The activities performed in these three phases are almost parallel to the six steps of problem solving as shown in Table 5.1.

Table 5.1 : Similarity of Phases of System Development to the Steps of the Problem Solving

Phases of System Development		*Steps of problem solving*		
Phase 1 : System Analysis	→	Step 1	:	Definition and formulation of the problem.
Phase 2 : System Design	→	Step 2	:	Develop alternate designs
		Step 3	:	Build models which formalise the alternative design
		Step 4	:	Determine the cost/effectiveness of the design alternatives
		Step 5	:	Make recommendations
Phase 3 : System Implementation	→	Step 6	:	Implement the chosen alternatives

A 'Systems life Cycle' depicted in Figure 5.5 indicates the three phases of an Information System Development in relation to the major activities of each phase.

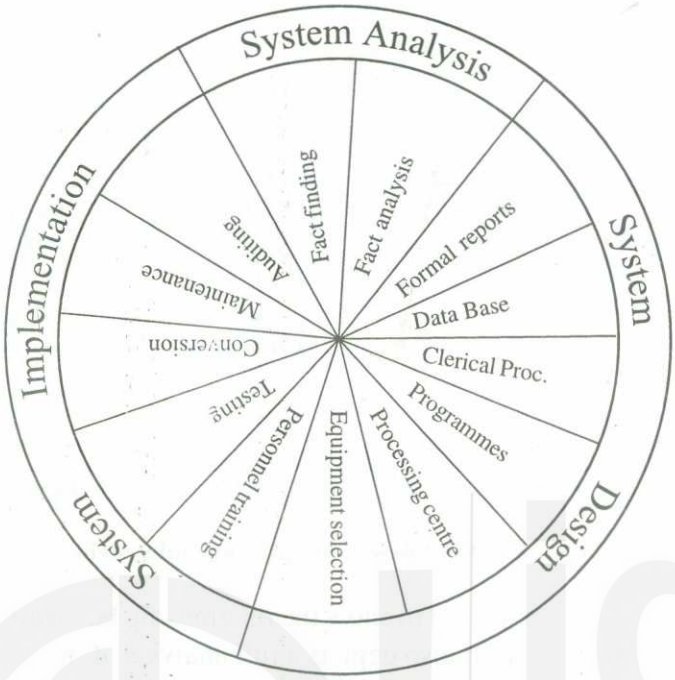


Fig. 5.5: An Illustration of the Life Cycle of an Information System and the Major Activities Associated with each Life Cycle Phase. (Source: Burch and Starter)

Generally, the application of the phases in the life cycle is a highly iterative and interactive ongoing operation, which is usually accomplished at the subsystem level and continues till the total system is modified and eventually supplemented.

The functioning of a subsystem on the other hand is a very complex process and it varies from subsystem to subsystem.

Take, for example, the acquisitions subsystem and we find that it consists of the following operations:

a)	Search	1.	In the library catalogue for availability
		2.	In the 'on order' file
		3.	If yes, report
		4.	If no, proceed
b)	Accounting:	5.	Check budget
		6.	If no, report
		7.	If yes, update expenditure account
c)	Ordering	8.	Version
d)	Receiving and Checking:	9.	Check against order
		10.	If incorrect, return
		11.	If correct, enter

Our analysis of the acquisition sub-system tells that it consists of four operations, namely (a) search, (b) accounting, (c) ordering, and (d) receiving and checking.

These four operations collectively consist of eleven elements of which 1,2,5 and 9 are functions, 8 is decision and the rest are actions. Please note that this is a simplified model; it can be more complex. For example, it is possible to insert a step between

3 and 4 where 3 will be a decision followed by the action on it. The process of system analysis is usually represented graphically as follows:

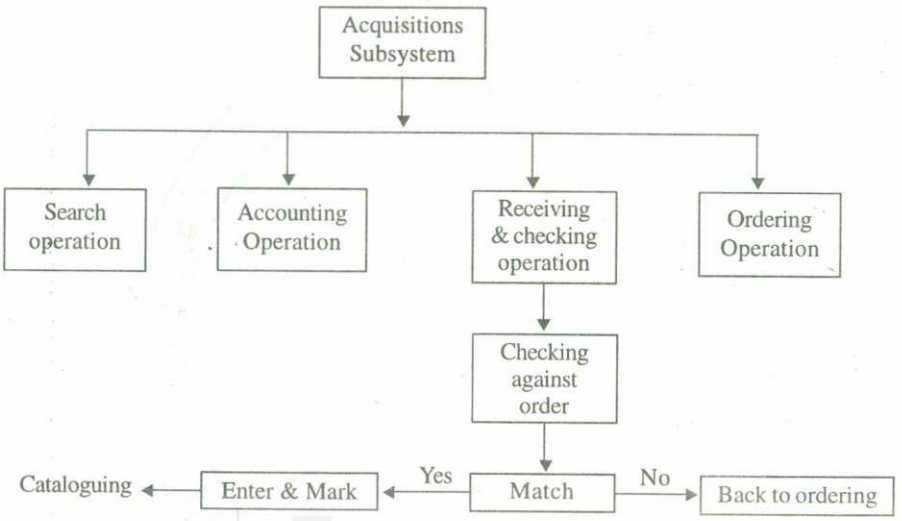


Fig. 5.6 : System Analysis of Acquisition Subsystem

The above flow chart does not fail to show the relationship between acquisition and cataloguing subsystems. It also depicts a full analysis of the receiving and checking operation. Likewise, it is possible to analyse the operations of search and accounting.

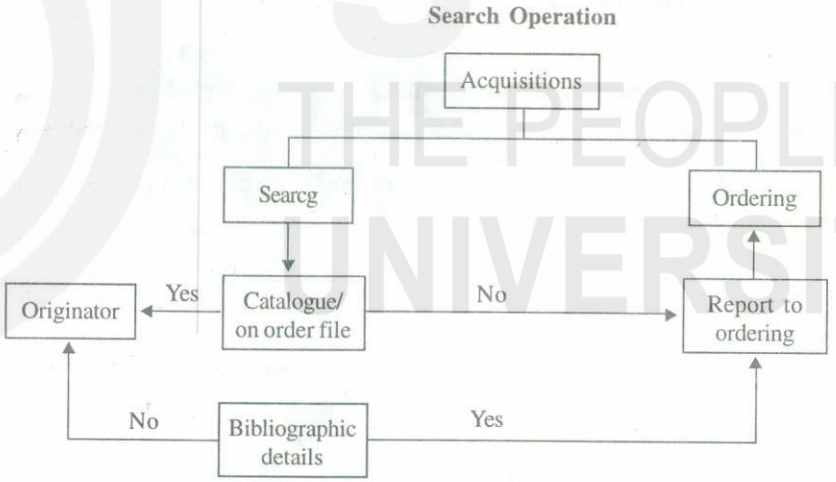


Fig. 5.7: System Analysis of Accounting Operation

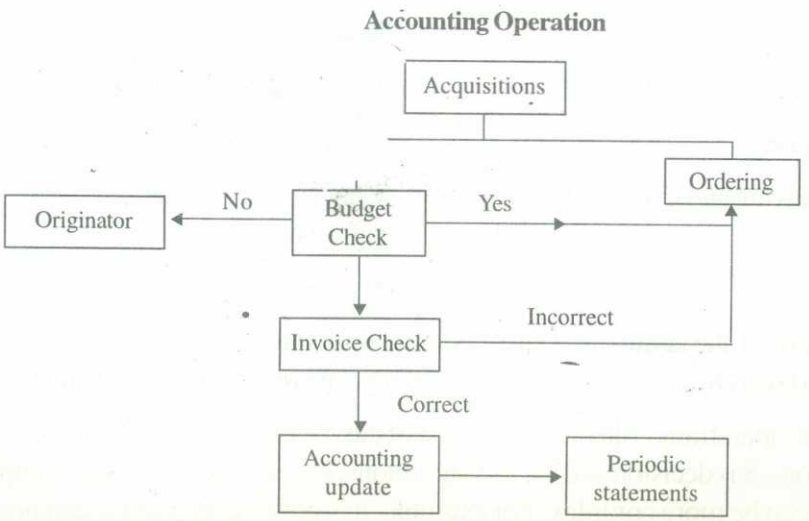


Fig. 5.7: System Analysis of Accounting Operation

Each operation in a subsystem can thus be analysed. While designing a new system the existing system is analysed into its subsystems and each subsystem into its operations, and, in turn, each operation into the functions, decisions and actions involved in it. It is only through such an analysis that it is possible to relate all operations to each other and to the respective subsystem and all subsystems to each other and to the total system. Apparently, the systems analyst prepares a series of flow charts collectively representing the complex process comprising interactions among its component parts. The systems of interactions among its component parts. The systems analyst uses the technique of flow charting to crystalise the process. It is now worthwhile to see what flow charts are and what purpose they serve.

5.3.2 Flow Charting

Flow charting is the technique of representing, in a logical progression the functions, decisions and actions involved in the operation of a system. Standardised symbols are used in drawing flow charts. A flow chart can show the sequence of steps in an operation and, therefore, as Chapman and others call it, it is the symbolism of the systems analyst.

Flow charts can symbolically represent what is otherwise very difficult to describe. Take, for example, the case of borrowing a book from the library. Both the user and the assistant at the counter do much more to complete the transaction that they can describe. With the help of a flow chart it is easy to identify the functions, decisions and actions involved in the process. Additionally, a flow chart can show where the system has developed bottlenecks and needs new procedures.

Since, the flow chart is the symbolism of the systems analyst, standardised symbols are used in preparing it in order that it may be understood universally. The following are the symbols used in flowcharting:



Fig. 5.8 : Flow Charting Symbols

A number of rules exist as guidelines for preparing flow charts. Some of the important ones are as follows:

- the above symbols form the universal language of flow charting and should be necessarily used;
- all the flow charts, irrespective of what they represent, should have terminals indicating start and halt;
- the graphic flow should be always in one direction, either top to bottom or left to right;
- all decision diamonds should have 'yes' and 'no' lines.

Using the above symbolism let us transform our earlier chart (Figure 5.6) given in sub-section 5.3.1 (Analysis). The result is as follows:

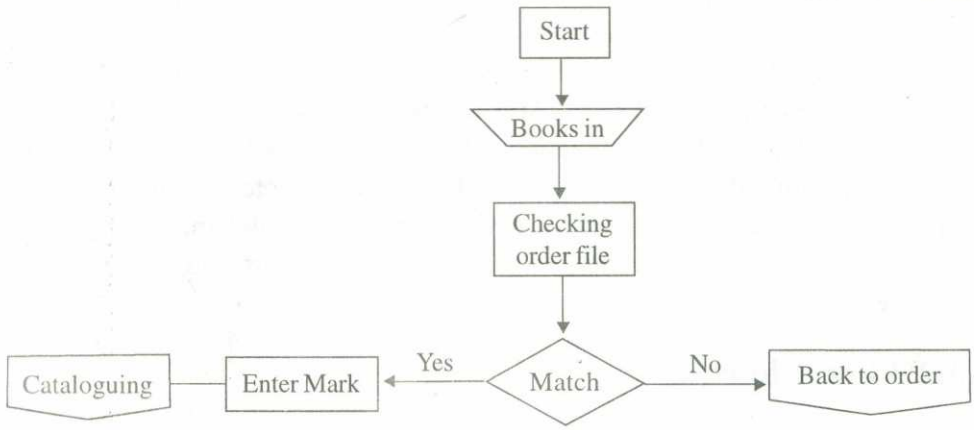


Fig. 5.9: Sample of a Flow Chart

Flow charts are thus very useful for representing in a logical progression all elements in a system, sub-system or any of its operations. Because of their symbolism they are universally understood and used. They help to identify bottlenecks in the process, thus enabling the analyst to suggest alternatives to establish a better process. As far as the librarians are concerned, flow charts enable them to identify functions, decisions and actions which they perform in the course of their work but find it difficult to describe.

Self Check Exercise

2) What is a flow chart and what purpose does it serve?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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5.3.3 Evaluation

After the completion of analysis the analysts prepares the evaluation report which helps in designing a new system. Chapman and others have given an exhaustive list of points that a report must cover. They are:

- Front matter: table of contents etc.,
- Body: introduction, problem, objectives, scope and outcome;
- Methodology: planning, personnel, equipment and procedure;
- Results: data, their interpretation and analysis;
- Conclusions, recommendations and implications;
- Back matter: appendices etc.,

Before writing the evaluation report, the analyst has to develop a complete understanding of the existing system, by becoming familiar with all its component parts and their working.

He/she undertakes a survey of demands put on the system. He/she acquaints himself/herself with the operations required in the system and their sequence, as also the functions, decisions and actions involved in them. Similarly, the analyst acquaints himself/herself with the outputs desired and inputs required. In the case of library and information system inputs are in the form of information sources and the outputs are bibliographical and document supply services. In addition to these, several management reports, e.g., the library annual report, accounts etc. also from part of outputs. The existing output formats are studied and, if necessary, modifications in them considered. For collecting data on all these the analyst usually uses worksheets which, when returned, supply him/her with information on the system and its subsystem, requirements, output for meeting these, operations involved, points where the output goes, control records and their updates.

The analyst evaluates the current procedures against the system's stated objectives. He/she examines if these procedures meet the objectives. It is in this context, that he/she assesses the information needs of the users, the strength and weakness of acquisitions, the efficiency of information storage and retrieval systems, the performance ability of the staff, the capability of the equipment in use and the financial support. This, then, forms the systems study so far as the inputs are concerned.

As for the outputs – bibliographical services, document supply and management report—their performance against the demands on them is assessed so as to determine the changes required to be effected for achieving the desired goals. The existing output formats, if necessary, are replaced by new formats. The standard formats available elsewhere and widely acceptable may be introduced.

Last, but equally important, is the task of job analysis, for the system is a set of men, machines and materials. It is always the men in the system that performs the jobs. Job analysis is necessarily done for knowing what job each member does and how, what perspective is required and how it may be developed, and what training needs exist and how they may be fulfilled.

All these factors constitute the over all assessment of the existing system. Such an assessment enables the analyst to determine the requirements of a new system. On the basis of these requirements the analyst plans and designs the alternative expected to give better results, viz. increased effectiveness.

Self Check Exercise

3) How are system's requirements determined in a systems analysis?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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5.4 SYSTEMS DESIGN

Briefly, systems design is what a systems analysis is undertaken for. The analysis phase is the starting point and the design phase is the culmination of the total exercise of systems analysis and design. The existing system is analysed in order to design an alternative which is thought to be more efficient, more productive and more rewarding. We have seen that an analysis of the existing system results in an evaluation report. The report contains data on the merits and demerits of the existing system as also suggestions on the changes that are necessary for evolving a better system. The design phase, thus, uses the data collected in the analysis phase. What is determined in the analysis phase is validated in the design phase. It is advisable to first discuss the general considerations in systems design.

5.4.1 General Considerations

The changes suggested in the evaluation report are in fact the corrective measures that ought to be adopted. These measures are adopted in the light of three considerations, namely goals, cost factor and unit cost. Let us now discuss them one by one.

Goals: The goals and objectives of the system have to be reviewed with reference to new and—augmented requirements. Appropriate modifications in either or both are made in order that, the projected system may achieve the desired goals.

Cost factor: Establishing a new system may mean a large capital outlay and increased incurring expenditure. For example, the computer and the peripherals, stationery and the personnel demand nonrecurrent as well as recurrent financial support. The cost factor is, thus, very significant. The economic feasibility of the projected system has to be studied. Such a study will enable the management to take the decision about establishing the alternative system, either as desired or as possible.

Unit cost: The estimated unit cost of each output from the projected new system is compared with the existing unit cost. If the new system can cut costs considerably, its establishment is amply justified. For example, the cost of cataloguing a book in American libraries came down to $1.5 from $15 after the establishment of OCLC network. More and more American libraries were tempted to participate in the network. This is the parameter of unit cost that is of great importance in design making.

5.4.2 Design

If the analysis phase results in the determination of requirements, the design phase is concerned with the validation of these requirements to meet the system's revised goals, with the revision of goals there is revision of outputs and consequently of inputs. Thus, the difference between the analysis and the design is of approach only. In the design phase, new procedures are worked out to meet the projected requirements. The elements of the system remain unchanged. The subsystem and the operations are these elements. Basically the design phase consists of the following four steps.

The First Step

In this, all functions are replanned so that they may be correlated. The replanning helps to eliminate duplication of records and ensure a logical sequence of all activities

to be performed. Because of the interdependence among workers the authority of the heads of subsystem is defined in order to increase the operational effectiveness of the total system. New worksheets in place of old ones are prepared. The new work sheets state – new requirements and modified outputs to meet them.

The Second Step

As the second step of designing all procedures conceived are reduced to writing. They are described in detail in a logical sequence and supported by flow charts. This is done for each operations. The description and flow charts together comprise the procedural manual. The manual covers all activities and illustrates the flow of work.

The Third Step

This step is devoted to designing appropriate manual procedures. Manual procedures exist and are indispensable even in a highly computerised library system.

Information has to be gathered and transformed as input. Even outputs have to be processed manually. Good manual procedures, when described fully, are very helpful in transforming the system from manual to automated.

At this stage it is also necessary to ensure the appropriateness of procedures. For example, they should furnish the outputs needed; have a definite purpose in the generation of outputs; justify each function; establish a smooth work flow; and prevent bottlenecks. The procedures should also ensure the full use of available equipment.

The Fourth Step

This step consists in designing the printed forms. These are used in transmitting information and storing and avoiding its repetitive transcription. The design of forms is, therefore, guided by requirements and decisions. The forms should be so designed as to allow the recording of information item by item in the logical order of elements. A single form as far as possible should serve several purposes, e.g., a book order form can be at the same time used as : (a) on-order record, (b) process slip and (c) notification to the requestor. The form should provide for checking of boxes and should keep writing to the minimum and should be of standard size to facilitate filling. Wherever economical, commercially available forms can be adopted, if they meet the data needs of the system. Lastly, the form should be redesigned if necessary.

If the forms are prepared observing the above principles, they will serve the purpose well. The most important principle here is that the same data required at various points in the system should be recorded at one time only.

A new system is thus designed on the basis of the evaluation report brought out at the end of the analysis phase. What is determined in the analysis is validated in the design.

If necessary, either the goals or functions or both are revised in the light of the objectives and requirements. Procedures are then drawn setting all operations and all steps in each operation in the logical order. The cost factor is taken into account, economic feasibility is studied and the design is completed step by step. Systems analysis and design, thus, is a two-phase exercise.

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Self Check Exercise

4) Briefly state the steps involved in designing a system.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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5.5 SUMMARY

Systems analysis consists in reducing a system to its component parts and relating them to each other and to the system. This is done with reference to an agreed upon performance criterion. It, therefore, follows that, with the recognition of the needs for improvement a system analysis becomes necessary. A system analysis, thus, starts with the objectives and goals and determines the requirements of the system, examines the functions, decisions and actions performed in it, identifies the bottlenecks and suggests alternatives that should yield better results. The analysis so completed comes out with an evaluation report.

The evaluation report contains data on the strengths and weaknesses in the existing system as also the suggestions on the possible changes that are necessary for evolving a better system. Systems analysis obviously means systems approach in evaluation. Since every operation in a system is related to, and dependent upon, other operation, no evaluation of an operation in isolation of other operations is worthwhile. Since library is a system, it is amenable to systems analysis.

If systems analysis is the starting point of systems study, systems design is the culmination of it. It gives the framework for a new system. It validates what is determined in the analysis. It uses the same data and information collected in the analysis of the system. It uses the techniques of work sheets and flow charting to build alternative procedures, prepares manuals, develops new forms, conducts an economic feasibility study, determines new department to department and worker to worker relationships and, if necessary, even restates goals. System design is, thus, the completion of systems study.

5.6 ANSWERS TO SELF CHECK EXERCISES

1) A system is a set of component parts, interrelated and interdependent functionally and bound together by a common purpose. Their interdependence is so complete that a change in the functioning of one affects the effectiveness of the functioning of the system as a whole. The factors responsible for shaping a library into a system are: (1) its component parts such as acquisitions, serials control, information storage and retrieval, user services and administration planning; (2) their interdependence to the extent that a weakness in one will in effect create weaknesses elsewhere and in the total system; and (3) the common purpose that binds these component parts together.

2) A flow chart is a graphic representation in a logical progression of the functions, decisions and actions involved in a system or subsystem. Standardised symbols are used in drawing it. It is therefore, known as the symbolism of the systems analyst.

   A flow chart can symbolically represent what is otherwise very difficult to describe. Because of the standardised symbols used in drawing a flow chart, it is universally understood. It can, and does, illustrate every step in an operation and in a logical sequence. Bottlenecks, thus, are easily identifiable. Illustrating the logic of the system and symbolising its functions, decisions and actions, a flow chart represents the system design.

3) A systems analysis is undertaken when the need for improvement is felt. Improvement then is the performance criterion according to which the analysis is undertaken. The systems analyst first reconsiders the goals of the system. Then the system's requirements are determined through a study of outputs or reports required at every point in the system. Likewise, the appropriateness of current inputs is assessed. Bottlenecks in the system hindering the logical sequence of the flow of information and material are identified. The interrelationships among departments and personnel are studied through an examination of functions, decisions and actions. The total requirements of the system are thus determined by collecting the necessary data through work sheets.

4) The system analyst designs a system step by step. The first of these consists in correlating each component part with other parts and with the system as such. He/she may replan all functions in order to eliminate duplication of actions and records and to ensure smooth flow of information. In the next step he/she reduces the procedures to writing. This is done by writing manuals and preparing flow charts on the basis of data collected as the first step. As the third step in systems design, the analyst develops manual procedures and validates the existing functions and actions by checking them against the objectives of the system. This is done in order to minimise the total effort and maximise the output. The fourth step consists in developing the necessary forms for the smooth and logical working of the system. Thus, the design of the system emerges step by step.

5.7 KEYWORDS

Bottleneck	:	Hindrance, obstruction
Decision	:	Deciding what actions are to be taken
Economic Feasibility	:	Possibility in terms of money
Function	:	Purpose, responsibility
Coal	:	Target set
Logical Progression	:	Logical sequence of things taking place
Objective	:	Basic purpose for attaining which goals are set
Performance Criterion	:	Standard for judging performance
Unit cost	:	Cost of producing one unit of a product
Update	:	Data manipulation involving adding, modifying or deleting data records to keep data up-to-date

Worksheet : Sheet with rows and columns to enter headings, numbers or data.

5.8 REFERENCES AND FURTHER READING

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UNIT 6 WORK FLOW AND ORGANISATION ROUTINE

Structure

6.0 Objectives

6.1 Introduction

6.2 Work Flow

6.3 Work Sampling

6.4 Work Simplification

6.5 Time and Motion Studies

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6.0 OBJECTIVES

The previous unit of this Block has exposed you to the importance of applying systems approach to modern management in libraries and information centres. In this unit, we introduce you to the workflow within an organisation, ways of sampling and simplifying the work, the time and motion studies, work analysis and the various techniques of work analysis in a library.

After reading this Unit, you will be able to:

- work out the importance of work flow in a library/information centre;
- explain the need of work sampling;
- describe the purpose of work simplification;
- interpret time and motion studies; and
- apply the various techniques of work analysis.

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6.1 INTRODUCTION

Library operations in recent times have been characterised by a great increase in complexity. The rapid expansion of collections, both in size and scope, the great variety of forms taken by documents that are being housed in the libraries and the growth in expectations among library users are among the factors that have contributed to this complexity.

In this setting, managerial decision-making has become an enviably difficult task. Further, the new technologies and new techniques which offer great opportunities for managers and planners make the use of traditional, intuitive approaches in day-to-day work situations even more difficult.

There is thus a need to improve the effectiveness of an organisation by studying its operations in detail and eliminating those inefficiencies that are discovered. Modern scientific management provides ways and means to carry out logical analysis of current techniques and procedures of an organisation. By studying any work situation it can be logically inquired what a particular technique/procedure intends to achieve, analysing the series of operations by which the achievement is secured and makes feasible recommendations for improvement.

The control of a library/information centre consists of seeing that everything is being carried out in accordance with the plan which has been adopted, the orders which have been given and the principles which have been laid down. Its object is to point out mistakes in order that they may be rectified and prevented from occurring again and the work flow becomes smooth. This unit deals with all these aspects of work flow in a library or an information organisation.

6.2 WORK FLOW

In every information organisation, there is a process of organisation analysis and planning which helps to achieve the specific objectives. This is the analysis of the environment and of the human, physical and financial resources of an organisation in order to arrive at the most effective design of a system for transfer of various activities from an organisation's ultimate authority to the eventual accomplishment of its established objectives.

Work, flow is the way in which the work in an organisation is sequenced and the rate at which it progresses in each part of the organisation. This also includes studying the process used for carrying out a service or developing a process which will yield products of acceptable quality.

Work badly routed or flowed at unpredictable and uneven rates can do much to undermine conscientious human efforts.

In management work it is always necessary to analyse operations in detail step-by-step. Work flow in an information organisation or a library thus involves:

Work sampling, work simplification, work measurement or time studies, motion studies, work analysis and the techniques of work analysis.

Self Check Exercise

1) State the role of work flow in an information organisation.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.3 WORK SAMPLING

It has been found to be useful as well as reliable to observe human work activities in a non-continuous mode, most often referred to as sampling.

Work sampling is a convenient method by which the activities of individuals in an organisation can be observed readily and translated into meaningful information. It is often performed using random numbers as the basis for the time interval at which the work shall be observed.

When a problem to be studied is quite huge and impossible to be studied fully, then a small part or representative portion referred to as a sample can be selected for study. Conclusions can be based on this sample. The most popular way of choosing a sample in libraries is by random sampling, as in random sampling every member of the group has an equal chance of being selected. This selected sample then is observed or studied and the results drawn are based on this representative sample. Repeated samples from the same activity would eventually duplicate the actual pattern.

Sampling is very much necessary in work analysis as it may help to emphasise the amount of time needed for work analysis. In the survey research applied in library/ information centre operations, sampling plays a very important role.

Work sampling has three main uses in libraries:

1) Activity and delay sampling – to measure the activities and delays of staff or equipment of a library/information centre. For example, to determine the percentage of the day that a person is working and the percentage that he or she is not working.

2) Performance sampling – to measure working time and non-working time of a person on a manual task, and to establish a performance level for the person during his or her working time.

3) Work measurement – under certain circumstances, to measure a manual task, that is, to establish a time standard of an operation.

Self Check Exercise

2) What is work sampling and what are its uses in libraries?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answer given at the end of this Unit.

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6.4 WORK SIMPLIFICATION

Work simplification is a way of getting something done, step by step, by breaking a problem down into simple segments. It is an organised, commonsense attack upon the method by which work is being done in a given situation, with a view of doing it better by reviewing all the activities. By introducing and solidifying the concepts of what is useful work simplification is illustrated. It changes the habits of thinking about what must be considered waste.

Work Simplification is applied wherever work is done and is a great aid in studying work flow. The basic premise of work simplification is that once a person really sees how a job is done, asks why it is done that way, and attacks the job with the desire to improve the existing method, possibilities for improvement will inevitably occur to the person.

For effective work flow, or to channelise work in a proper sequence towards possible results, the following questions have to be asked:

1) What can be eliminated? – This could be a process, a value-adding or a non-value-adding operation, a delay, storage, idle or inspection. Elimination helps in improving a majority of work situations.

2) What can be combined? – The use of known faster devices often provides the answer. Usually by combining two operations which are cumbersome and take too long to be completed, work can be simplified. If, two operations cannot be combined, it may be possible to combine the activities of two individuals within a single operation or Combine a transportation with an operation.

3) Should the sequence be changed? – Changes in sequence may eliminate or reduce non-value-adding operations, transportation, delays, storage, and inspections. Again, the use of known faster devices helps to make this possible.

4) What can we simplify? – The time to start to think about ways to simplify is when the processes and operations have been reduced as much as possible through elimination, combination, and/or change of sequence.

Self Check Exercise

3) Give the importance of work simplification in the libraries.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.5 TIME AND MOTION STUDIES

Time Study and Motion Study became essential part of Scientific Management which came into prominence around the turn of the century. Time study, originated by Frederick W. Taylor, was mainly used for establishing time standards and piece rates. Motion study developed by Frank and Lillian Gilbreth was largely employed for the analysis and improvement of work methods. Gradually, the combined use of motion study and time study has become widespread in libraries and information centres. Motion study and time study provides a means for determining the preferred method of performing work and a means for measuring work that is, determining what constitutes a standard day's work or determining the standard time required to perform a specific task.

6.5.1 Motion Studies

Motion study, originally defined by the Gilbreths as the study of the motions, is used in the performance of an operation or an activity for the purpose of eliminating all unnecessary motions and building up a sequence of the most useful motions for maximum efficiency. Motion study not only includes the analysis of the movements used in performing work, but it also involves other considerations such as tools, equipment and materials that the worker uses, and the conditions surrounding the worker and the work place. The objective is to design the work method that will result in higher efficiency, less time and least cost with the least fatigue possible.

Before a motion study is undertaken it is desirable to make a preliminary analysis to determine the extent to which the study should be carried out, how much is likely to be saved, how long the investigation will probably take, and how much will it cost. The tools and techniques of motion study are usually divided into three categories, namely, Process Analysis; Equipment Utilisation; and Operation Analysis. These techniques will be discussed in detail under the heading "Techniques of Work Analysis" of this unit.

6.5.2 Time Studies

Time study, also referred to as Work Measurement, is a collection of techniques used to determine the time required by a qualified and well trained person working at a normal pace to do a specific job or operation. This time is called the *standard time* for the operation.

In this method, the operation to be studied is divided into small elements, each of which is timed with a stopwatch. A selected or representative time value is found for each of those elements, and the times are added together to get the total selected time for performing the operation. The speed exhibited by the operator during the time study is rated or evaluated by the time study observer, and the selected time is adjusted by this rating factor so that a qualified operator, working at a normal pace, can easily do the work in the specified time. This adjusted time is called the normal time. To this normal time are added allowances for personal time, fatigue and delay, the total being the standard time for the task.

Work measurement or time study thus is a method for estimating production times for an individual who is working under stable conditions using consistent methods. It also decides what should be measured, in what units and with what interpretation.

Self Check Exercise

4) Describe briefly the time and the motion studies.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.6 WORK ANALYSIS

The system or process of performing an activity should be thoroughly studied before investigation of a specific operation in the process. Such an over-all study will always include the analysis of each step in the process.

Work analysis can help in solving layout problems in physical space, choosing a sequence doing work and finding ways of performing tasks more efficiently. This can either save the library money or allow money to be spent on other services. Most work analysis techniques relate in one way or another to time or money.

In management work, it is always necessary to analyse operations in step-by-step detail. Several standard charting procedures have been developed to aid in the analysis.

You already know that a very substantial part of library work consists of repetitive and mechanical routines. In terms of total hours required for performance, the largest bulk of the library work consists of such routines. By analysing a process such as book ordering, acquiring, cataloguing, processing, filing, circulation, or shelving into its constituent steps, it becomes clear that, although some jobs are less clearly mechanical than others, the majority of tasks are in fact quite repetitive and measurable. Work analysis helps to improve routine efficiency and is a useful tool of not only management but of financial management of libraries and information centres too.

Work analysis is thus the key to modern job classification. Only when we have ascertained what the job consists of, and what level of productivity we may reasonably expect of the person performing it, we are able to define the sort of ability and special training necessary for its performance. It helps a library or an information centre to obtain operational efficiency and to provide a service as economically as possible, at the level of the quality required.

The remainder of this unit is devoted to explaining in a specific manner how the various tools and techniques of work analysis, long since applied to industries, can also be applied as an aid to the solution of the problems in libraries and information centres.

Self Check Exercise

5) How does the work analysis help in libraries?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.7 TECHNIQUES OF WORK ANALYSIS

You have already been told that in management work it is always necessary to analyse operations in step-by-step detail. Several standard techniques have been developed to aid this analysis. By learning and applying work analysis techniques, any librarian can make the work environment much more pleasant for everyone concerned. The result can be a more efficient process or procedure for all the personnel working in the particular unit. Each of these techniques can be applied to certain library situations and are very useful. Some of the techniques of work analysis that will be covered in this unit are:

- Block diagram
- Flow diagram
- Flow process chart
- Decision flow chart
- Operations analysis
- Form analysis, and
- Man machine charts

Let us now study each of the techniques mentioned above one-by-one.

Self Check Exercise

6) List atleast five techniques of work analysis.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.7.1 Block Diagram

A block diagram is a graphic representation of a series of operations, processes or sub processes that collectively comprise an organisation/system. It is very easy to construct a block diagram. Firstly, the whole organisation/system should be visualised in its entirety. Secondly, lay down the other processes which are influenced by or have an influence on the system to be studied. Thirdly, build up the relationships between various processes within or outside the system. And, lastly, indicate the direction of the work flow.

A block diagram is different from an organisational chart as it includes elements outside the actual organisational structure (for example, users, booksellers, publishers, etc.) whereas, an organisational chart depicts the organisational structure of an organisation by showing how the various units or departments of the organisation are tied by various lines of authority.

Figure 6.1 given below is an example of a block diagram for a circulation system in a library.

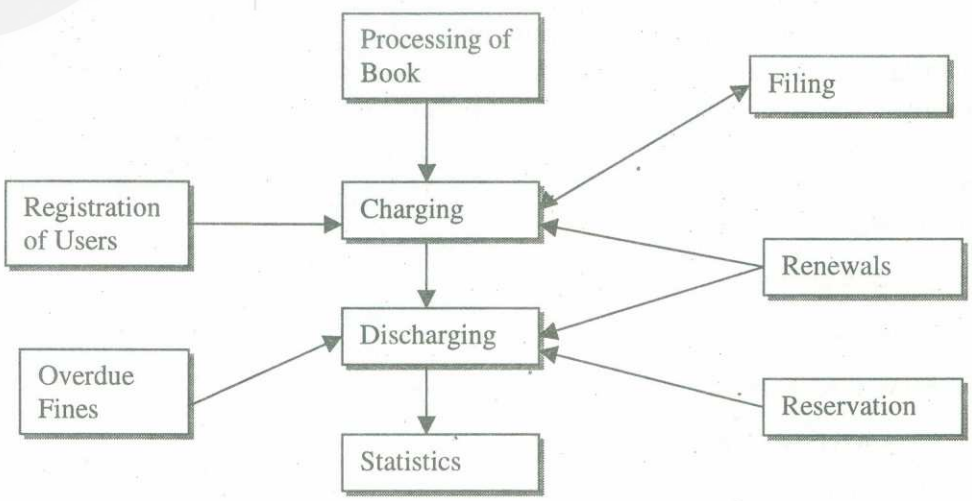


Fig. 6.1: Block Diagram

A problem which one usually confronts in preparing a block diagram is that it is not always possible to show exact relationships of directions of work flow between various processes. But as far as relevant relationships are concerned, during the initial planning stages only, the diagram serves its purpose.

6.7.2 Flow Diagram

The flow diagram gives a graphic view of a work area and the movement of personnel and materials within that area. A flow diagram is an excellent tool for jobs that require considerable movement of persons or products. Traffic flows of personnel are charted and undesirable flows can be either eliminated or minimised. The best way of representing is, a scale drawing of the unit or department or activity or a service, with all the activities identified and by drawing lines showing the movement of personnel working there each time they make a movement.

Figure 6.2 below represents a flow diagram of the reference service of a library, as it existed prior to analysis. For example, this reference service had all the reference sources located in an area which was about 15 meters from the reference desk. This had been the arrangement since the origin of the library. The library staff had to walk this distance several times during the day. After making a diagram of the area and keeping track of the number of trips to and from this collection to the reference desk during one typical day, it was found that about 20 round trips were made and the average distance travelled by the library staff was about 600 meters. Thus the person working on the reference desk had walked more than half a kilometer in a day to locate reference books.

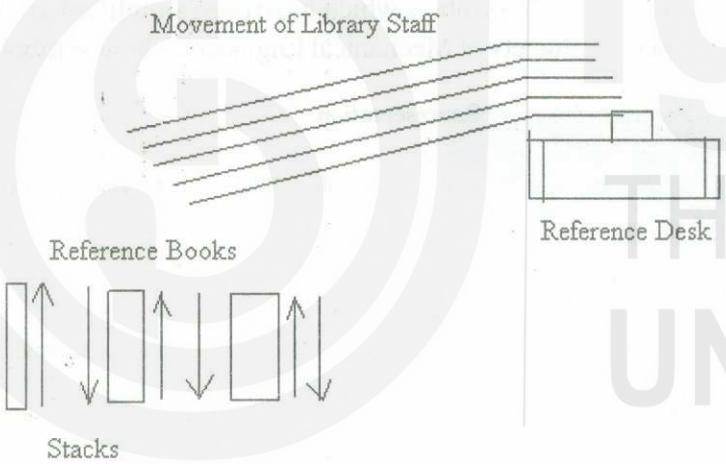


Fig. 6.2: Flow Diagram (Before analysis)

In view of the above diagram, it is being suggested that the reference sources be relocated behind the reference desk. Figure 6.3 illustrates that this change has eliminated over 90 per cent of the walking.

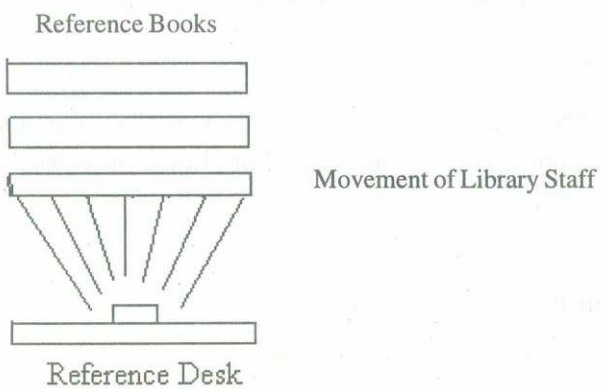


Fig.6.3: Flow Diagram (After analysis)

The flow diagrams thus are a great help to the operating staff in the decision-making process although they by themselves cannot make decisions.

6.7.3 Flow Process Chart

The flow process chart is one of the most versatile and useful tools available for analysis of library jobs. It is a graphic means of portraying the work involved in a job where the person or the product charted moves from work station to work station. The chart also includes the distance travelled and the amount of time required to perform each operation. The flow process chart can be used to record either the activities of a person or the operations performed on a product.

The beginning point in a flow process chart is to examine critically the process or problem being charted as a whole. Then the next aspects include the indication of its purpose, the functions it will carry out and finally the accomplishments. The purpose of the chart thus is to indicate whether a new service, activity, product or a process that is available is working properly or it can be made available at a lower cost with simplified procedures.

Symbols

Frank Gilbreth invented a sign language to visualise the steps on his flow process chart. Originally he devised 40 symbols which have been simplified to five basic symbols by the American Society of Mechanical Engineers. These symbols are:

Symbol	Name	Representation
	Operation	an action which indicates completion of a process
	Transportation	change in location of a person or process from one place to another
	Storage	a permanent storage usually of an indefinite duration
	Delay	something that temporarily holds up the immediate performance of the next step
	Inspection	quality or quantity inspection made against a predetermined standard
	Combined	activity performed at the same work place or at the same time as one Symbols

Fig. 6.4: Flow Process Charting Symbols

Making the Chart

A flow process chart is usually made on a form showing the time, distance, person and place for each important step. The description should be as brief as a telegram. The heading of the form should include:

- who or what is charted;
- starting and finishing point of the chart;
- the name of the person preparing the chart;
- a tabular summary block for comparing the present and proposed method; and
- date on which a process is charted.

For preparing chart, choose a definite starting and finishing point and make sure that no part of the process is left out. Each step in the process should be charted even though it might appear to be unimportant. The job should be charted as it is actually performed and not as one thinks it should be performed. Once the charting is finished, calculate the number of operations performed, the number of transportations observed, the distances travelled, the number of delays, etc. These figures are recorded in the summary block.

As an example of a flow process chart, see figure 6.5 showing the various processes involved in the discharge of a book at the circulation desk.

FLOW PROCESS CHART **SUMMARY**

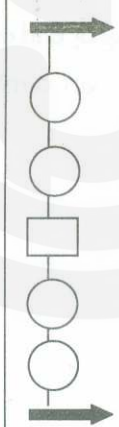
Subject Charted : Ms. Veena : Discharging of a book			*Method*	*Prop. Method*	*Diff*
Present X Proposed	Type of chart Man X Product		Operation 4		
Chart Begins : Reader walks to the circulation disk			Transportations 3		
Chart end ; Book taken to shelf			Inspections 2		
Charted be : Mr. A. Ram Date : 13.4.94			Delay		
			Distance in meters		
Distance in Meters	Time in Minutes	Symbol / Step No.	Description of Events		
		1.	Reader walks to the circulation desk and present a book.		
		2.	Accepts book from the reader.		
		3.	Open book to check/See due date, class no. and accession no.		
		4.	Inspects due date to see if book is overdue.		
		5.	Takes book card from cabinet and puts in the books.		
		6.	Places book on rack for shelving.		
		7.	Book taken away for shelving.		

Fig.6.5 : Flow Process Chart

The last aspect of a flow process chart is analysing the current method and developing the improved method. This involves questioning each step of the present method why, what, when, where, who and how. This is necessary even when the step appears to be absolutely indispensable. Eliminating steps, combining steps, rearranging sequence of steps, charting the person carrying out the job, etc.

6.7.4 Decision Flow Chart

A decision flow chart can be defined as a graphic means of representing work flows in which numerous decisions are made. When performing operations by computer, work is to be analysed element by element, or decision by decision. The decision flow charts were developed to prepare detailed instructions for use in a computer as

prior to preparing a computer programme, the flow chart is one of the preliminary steps. In computer parlance, the decision flow charts are usually referred to as flow charts.

A decision flow chart is different from a flow process chart. A flow process chart is best used for describing work when the operator simply adheres to a prescribed routine for each activity, whereas, a decision flow chart finds its greatest application in analysing complicated work flows which require numerous computer applications.

Decision Flow Chart Symbols

Flow charts are constructed from relatively few, simple symbols which indicate:

- the flow of data at various stages in the process;
- the operations to be performed the sequence of the work; and
- the equipment involved.

Some frequently used symbols of a decision flow chart are:

- rectangular boxes, which contain certain statements about the process to be performed at that step;
- diamond shaped boxes, which describe decisions resulting in a choice among alternating sequences of operation;
- lines and arrows, which describe the direction of flow from one process to another (usually from top to bottom and left to right);
- circles, called remote connectors which contain symbols tying flow from one box to another box located at a remote place, such as an another page; and
- flat ovals, which indicate terminal, that is, the beginning or end of a flow chart.

Given in figure 6.6 are same frequently used decision flow chart symbols.

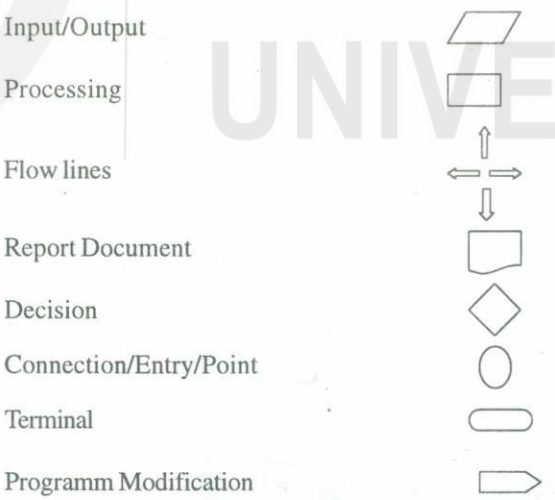


Fig. 6.6: Decision Flow Charting Symbols

Construction of a Decision Flow Chart

Each flow chart should have a logical starting or stopping point, and the person preparing it must be familiar with the work to be charted so that the job may be reduced to step-by-step instructions. The flow chart may be drawn in horizontal or vertical sequence depending upon the situation. Each piece of data should follow a single line of flow—vertical or horizontal as it progresses through the steps which affect it.

The main flow consists of the decisions and actions that occur normally in a procedure. In a typical decision flow chart, the main flow proceeds from top to bottom of each page with branch flows to the left and right. Construction of a flow chart is physically a cumbersome process and after some initial experience, some corrections and modifications only, a concise and a redrawn chart should be used.

A good way to begin with making a flow chart is to chart familiar daily routines such as shelving, ordering, filing of cards, and then move on to complicated processes.

The figure 6.7 illustrates a flow chart for a typical library operation, for example, the discharge of a library book at the circulation desk.

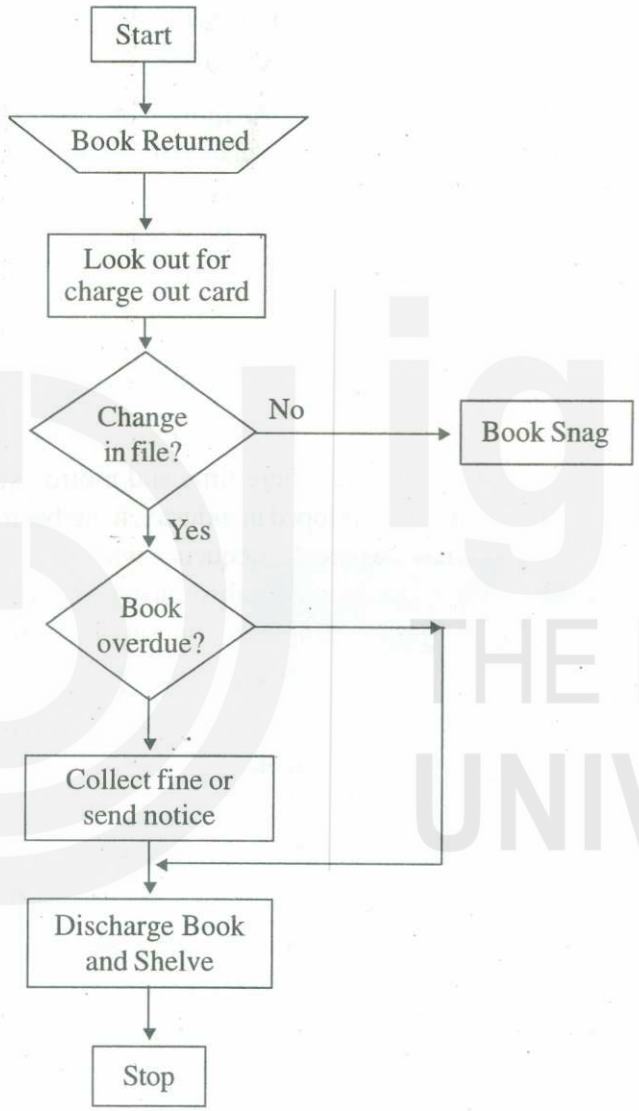


Fig. 6.7: Decision Flow Chart

Self Check Exercise

7) How is a decision flow chart different from a flow process chart?

8) Draw the frequently used symbols of a decision flow chart.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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6.7.5 Operations Analysis

The flow process and the decision flow charts are usually sufficient for most work analysis. But these are designed only to chart an individual or an activity, as it moves from one work place to another. When a library grows in size and the frequency with which routines are performed increases, these charts are not sufficient. The operations charts are then drawn to solve the problems.

Operations analysis is the study of the motion of the hands, eyes, and feet of an individual who is working on a particular activity in one location. It is most effective when used on jobs that involve a lot of repetition. This type of analysis can be performed with the aid of an operations chart – also known as a left hand-right hand chart. Operations analysis focuses attention on the most effective arrangement of the work area itself and the most effective sequence of activities within that arrangement. Library activities that lend themselves to this type of study include charging of books, discharging of books, filing, charges, alphabetisation, sorting overdue charge cards, etc.

Operations analysis is, an area where time and motion study has become very important. Although it was developed in industry, it has been successfully applied to many library oriented tasks where the frequency with which a repetitive operation is performed is very high. Operations analysis also provides an opportunity to train workers in some of the basic principles of motion economy.

Preparation of an operations chart is very similar to a flow process chart, with identical symbols. However, in operations chart the symbols apply to a body movement instead of the entire movement of an individual.

For preparing the chart, the process is first charted for one hand and then the entire process is charted for the second hand. When both hands are charted the activities performed simultaneously by both hands are lined up horizontally on the chart,

The principal advantage here is to eliminate unnecessary operations and to reduce waste motions. The operations charts also help in improving or rearranging the work place, that is, having better normal and extended work areas, placement of tools/equipment and materials conveniently and in an improved work environment.

6.7.6 Form Analysis

We all know that forms play an important role in any library working situation. Paperwork in libraries involves about 25% of all work. The variety of forms we use in libraries presently include request forms, borrower's cards, vouchers, bindery slips, date slips, overdue notices, reservation cards, etc.

In form analysis, each form should be reviewed annually to determine its functions and efficiency. This helps in reducing the number of forms employed either by elimination or by combination of one or more forms. Also, it is periodically necessary to examine contents of the forms to check that the items included are understandable or not. Preparing a checklist or a chart which includes details about all types of

forms can thus carry out form analysis. All the forms being used are then reviewed as per the check list or by preparing a chart. This brings to light the useful as well as the wasteful or no longer needed forms. Finally, only items of use can be retained and the rest can be discarded. Form analysis also helps in revision of forms.

Another problem libraries face is that of accumulating papers/forms/files. There should be a definite policy in every library to decide the period for which a form/file/paper should be retained, and after that it should be disposed off or combined with some other relevant papers.

Automation in libraries has brought about a sea change and has resulted in reduction of paperwork to a great extent. Information can now be retained on the computer disk for as long as it is required and erased after it is no longer of use. If such information may be of use in the future then it can be copied on floppy disks and stored.

6.7.7 Man-Machine Charts

These charts are designed to analyse the work relationship between people and machines. In an organisation that contains a number of equipment (computers, photo duplication, microfilming, etc.) the man-machine charts can be very valuable. If machines and personnel working in libraries/information centres are idle for long periods – it should be changed so that machines and people function effectively in order to minimise idle time. If there is too much idle time then it is better to use an outside facility which will be more inexpensive.

These charts thus help us to find out the efficient way for the use of library equipment and personnel and the very idea of buying or renting of a service (a machine or an individual).

Self Check Exercise

9) Give your understanding of operations analysis.

10) Give the importance of using man-machine charts in libraries.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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6.7.8 Other Techniques of Work Analysis

In addition to the techniques of work analysis already mentioned above, some other techniques have also been successfully applied in libraries. These are:

- Multiple activity or Gang chart
- Micromotion

Multiple Activity or Gang Chart

A multiple activity or gang chart is a type of flow process chart that has been modified to show processes involving the movement of more than one person or product. These charts can be used in special situations. For example, in stock taking, that is usually performed by teams. Another example is shifting of library books to a new building. Such jobs as mentioned in the examples requiring several people working together can be studied by a multiple activity chart.

Micromotion

The micromotion study is a technique of recording and timing an activity by means of a clock and a motion picture camera. The motions recorded on film are analysed in minute detail and improvement in work methods could be implemented. Although these studies revealed several ways to improve work methods, in library situations they were found to be uneconomical and were found not as popular as operations analysis or flow process charts.

6.8 SUMMARY

In this Unit you have studied the various aspects of analysing work in a library or an information organisation. Regulating the flow of work is very important as it helps in reduction of time, money and physical effort by the staff of the library. By exercising economy in all aspects of work situations, the library can utilise the resources in better and fruitful ways. Thus, the various techniques of time and motion studies that you have studied will help you to utilise your time for a variety of other jobs that are not just routine ones.

Further, the several techniques of work analysis, studied by you will help you to prepare charts – flow process or a decision flow chart—which will aid you in doing the work in better ways without missing any process. Besides this, the decision flow charts will be a great aid prior to writing a computer programme. Flow diagrams will be useful in arranging physical space and other similar type of jobs. Work sampling is a technique that will be useful in studying the processes or procedures where there is a huge amount of work involved or a large number of users are to be studied. It is very useful while carrying out survey research or studying current situations or problems.

This Unit, thus, helps you to learn to improve the effectiveness of a library or an information organisation by studying its operations in detail and pointing out the inefficiencies or wastage in time, work flow or movements of individuals handling the operations.

6.9 ANSWERS TO SELF CHECK EXERCISES

1) Work flow is the way in which the work in an organisation is sequenced and the rate at which it progresses in each part of the organisation.

2) Sampling applied in work analysis is known as work sampling which may help to emphasise the amount of time needed for work analysis. In survey research in library/ information centre situations, sampling plays a very important role.

   Work sampling has three main uses in libraries:

   1) Activity and delay sampling.
   2) Performance sampling
   3) Work measurement

3) Work simplification is a way of getting something done, step by step, by breaking a problem down into simple segments. It is organising the way in which work is being done in a present situation, with a view of doing it better by reviewing all the activities. Work simplification shows the librarians by introducing and solidifying the concepts of what is useful work. It changes the habits of thinking about what must be considered waste work.

4) Time study, also referred to as Work Measurement, is a collection of techniques used to determine the time required by a qualified and well trained person working at a normal pace to do a specific job or operation. This time is called the standard time for the operation. Motion study is the study of the motions used, in the performance of an operation or an activity for the purpose of eliminating all necessary motions and building up a sequence of the most useful motions for maximum efficiency.

5) Work analysis is studying the library operations in step-by-step detail. Work analysis helps to improve routine efficiency and is a useful tool of not only management but also of financial management of libraries and information centres. Work analysis is thus the key to modem job classification.

6) Five techniques of work analysis are:

- Block diagram
- Flow diagram.
- Flow process chart
- Decision flow chart
- Operations analysis

7) A decision flow chart is different from a flow process chart. A flow process chart is best used for describing work when the operator simply adheres to a prescribed routine for each activity, whereas, a decision flow chart finds its greatest application in analysing complicated work flows which require numerous computer applications.

8) The symbols of a decision flow chart are:

Input/Output

Processing

Flow lines

Report document

Decision

Connection/Entry Point

Terminal

Programme Modification

9) Operations analysis is the study of the motion of the hands, eyes, and feet of an individual who is working on a particular activity in one location. It is most effective when used on jobs that involve a lot of repetition. This type of analysis can be performed with the aid of an operations chart, also known as a left hand-right hand chart.

10) Man machine charts help in analysis of the work relationship between the machines and the library personnel. They help to find out the possibility of purchasing or hiring equipment for use in libraries.

6.10 KEYWORDS

Decision Flow Chart : It can be defined as a graphic means of representing work flows which include the yes-no decisions and actions required to perform a designated task or series of tasks.

Flow Diagram : A flow diagram is a graphic view of a work area upon which is superimposed the path or movement of workers or the flow of materials.

Flow Process Chart : It is a graphic means of potraying the work involved in a job where the person or process charted moves from place to place.

Gang Chart : A type of flow process chart that has been modified to show processes involving the movement of more than one person or product.

Man-Machine: Charts : These are designed to analyse the work relationships between a man and one or more machines.

Micromotion : It is a technique for recording and timing an activity by means of a clock and a motion picture camera.

Motion Study : It determines precisely what steps a job or an operation consists of.

Time Study : It determines the time required to perform each element in a job or an operation.

Work Analysis : It is studying the library operations in step-by-step detail.

Work Simplification : It is carrying out an activity, step-by-step by breaking it into simple segments.

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UNIT 7 MONITORING AND CONTROL TECHNIQUES

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7.0 OBJECTIVES

This Unit introduces you to the various monitoring and controlling techniques of modern scientific management.

After reading this Unit, you will be able to:

- identify different monitoring techniques;
- describe the need, purpose and role of operations research;
- get an insight into the MIS process;
- draw network charts, highlighting the inter-connections, interrelations and interdependence between all activities; and
- explain the application of various monitoring techniques in library/information centre management.

7.1 INTRODUCTION

The planning process in any information organisation becomes an empty exercise if it is not reinforced by a system of control. Control is concerned with locating operational weaknesses and taking corrective actions. It helps to know whether or not the planned activity is being effectuated and if not, to take remedial actions. Planning is, determining what should be done and, controlling or monitoring is, assuring what is done.

In every organisation, control is important but in larger organisations it is particularly important as it provides managers with facts in a comprehensive form and at the time when it is required. The controlling or monitoring processes are usually interpreted as restrictions or restraints on the system; but in the actual sense they are nothing but guides for the organisation and indicate how an organisation is progressing towards meeting its established goals.

This unit introduces you to various controlling or monitoring techniques in libraries and information centres. These techniques help managers at all levels to be aware of the various services available, how to effectively carry out the services and help to achieve predetermined goals of an information organisation.

7.2 MONITORING TECHNIQUES AND CONTROLLING

Controlling usually refers to checking, verifying, testing, regulating, exercising restrain or directing influence in order to successfully carry out a management process.

Monitoring involves looking for faults, performing of duty, giving advice and instruction and exercising caution.

7.2.1 Techniques of Monitoring and Controlling

You all know that planning and organising are necessary management functions in any information organisation but they alone do not accomplish any results. You must use the plans you developed for the organisation you established, to get something done. What makes you and your whole organisation aware of when things need to be accomplished, is a monitoring process or a monitoring technique.

A monitoring technique is a time negotiated procedure on how allocated resources will be committed to achieving objectives. It is a guideline, a tool or an aid. The best techniques are those that are not rigid as they have the provisions for adjustments as future events become known.

The various techniques that you will be studying in this

- Operations Research (OR)
- Management Information Systems (MIS)
- Management by Objectives (MBO)
- Network Analysis
- Budgeting as a Monitoring Technique
- Monitoring Team or Consultants

Self Check Exercise

1) Give your understanding of monitoring and controlling in an information organisation.

2) List any four monitoring techniques used in the management of a special library.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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7.3 OPERATIONS RESEARCH (OR)

The operations research was born during the 1939-45 war as an aid to military decision making. After the war, it was rapidly applied to industrial production and eventually spread to other spheres of management. Operations research can be described as a scientific approach to decision making that involves the operations of an organised system. As the name implies, operations research involves "research on operations". This says something about both the approach and the area of application of the field. Thus operations research is applied to problems that concern how to conduct and coordinate the operational activities within an organisation.

OR, as it is usually referred to has been very successfully applied to information fields, it is a problem-solving activity which is capable of developing new techniques as situations demand. Also it is applicable not only to the routine problems of an organisation, but also to strategic planning and to problems of design. It is thus considered to be one of the major monitoring techniques of management with a constraint, that, it can be applied to situations only where mathematical models can be prepared.

Operations research can be defined as the application of mathematical models that permit comparisons of alternative courses of action and the determination of the course that will bring maximum results.

The purpose of OR is to aid the manager in decision making and in monitoring a process or an activity. It usually uses an interdisciplinary approach.

7.3.1 Characteristics of OR

Operations research uses mathematics and mathematical models to assist management in decision-making. It is important here to remember that OR cannot substitute management, but what it can do is to present the management with alternative solutions to problems, and so allow judgment to take place on sound scientific and mathematical grounds, rather than on the basis of experience and intuition. OR is useful only where all the elements of a problem can be quantified and expressed mathematically. It has no place in problem solving involving sociological or psychological elements.

The essential characteristics of OR are as follows:

- a problem-solving activity
- uses scientific method, that is, formulation, testing and refinement of models
- uses models to estimate alternative courses of action, and then the most preferred consequence can be identified and implemented
- involves experimental manipulation of models
- uses mathematical techniques, like
  - Linear Programming
  - Probability Theory
  - Queuing Theory
  - Network Analysis

7.3.2 OR Process

You have already been told that the approach of operations research is that of the scientific method. The process, therefore, begins by carefully observing and formulating the problem and then constructing a scientific model that attempts to abstract the essence of the real problem. It is then hypothesised that this model is a sufficiently precise representation of the essential features of the situation, so that conclusions (solutions) obtained from the problem are also valid for the real problem.

The usual phases of a typical OR study are the following:

1) Formulating the problem.
2) Constructing a mathematical model to represent the system under study.
3) Deriving a solution from the model.
4) Testing the model and the solution derived from it.
5) Establishing controls over the solution.
6) Putting the solution to work, i.e., implementation.

The entire process is a cyclic one, that is, the OR team begins with an elementary formulation of the problem and the construction of as simple a model as is possible to capture the essential features. This leads to a solution system that can be used in an experimental way in the organisation to see how it affects the original problem situation. This usually leads to a much better clarification of the problem, enrichment of the model, refinement of the system and a new round of experimentation in the

organisation. The process is intended to continue in this way to evolve in to a fully satisfactory control of the operations under study, and to also lead to higher levels of management decision making. Because of the hierarchical nature of such decision making in an organisation, it is possible to begin at various problematic situations and arrive at the same level of understanding and control.

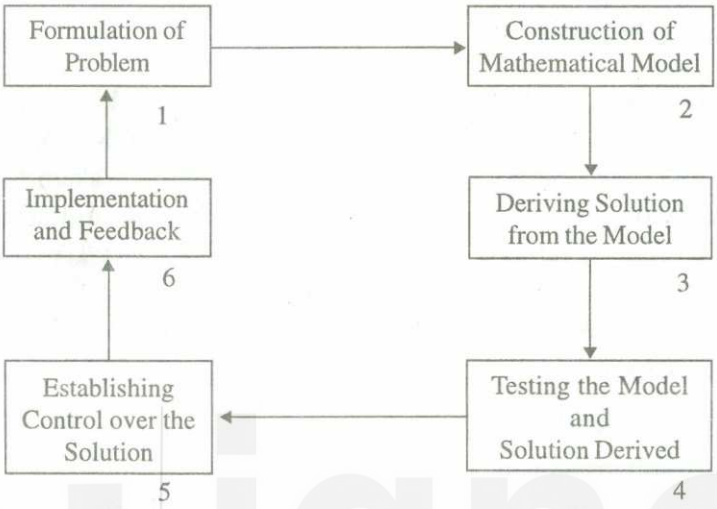


Fig. 7.1: The Operations Research Process

7.3.3 OR in Libraries

Operations research has been very successfully applied to those aspects of library/ information centre management which lend themselves to quantification. The practical motivation on the part of library managers for operations research studies is the pressure to economise and expand activities by means of computers. OR is seen as the best way to conduct exploratory studies before making costly commitments for new computerised systems. There is a need to anticipate the management problems in order to design the appropriate feedback and control devices. The initial task is to model the library as it functions in the present setup and then to experiment with new systems.

The kind of Operations Research investigations in libraries are seen to be of three types, namely, practical-problem solving, enabling research and theoretical research.

The first one here is quite readily understood, as it is the use of OR to tackle the specific problems of a particular information system, service or any other activity in any library or information centre, at any level.

The aim of enabling research is to aid practical problem solving, by removing probable stumbling blocks which would otherwise divert too much effort in solving particular problems. It is investigation that enables teams working on specific problems to overcome difficulties which otherwise remain untackled because of time and financial constraints on the practical projects. Enabling research may provide conceptual models, measurable criteria, adequate data, knowledge of user behaviour, etc. It is the kind of work that is usually referred to as background research. What has been labelled theoretical research is one possible form of enabling work. It is provision of models and solutions for a class of problems, without specific investigation of the particular systems in which they arise. Here general models may be constructed on the basis of existing theory, using parameters whose values must be measured in a particular system before the results can be applied.

Given below are some practical problems and areas of investigation in libraries and information centres where operations research may play a part.

- Resource allocation
- Long term planning
- Advertising information services
- Marketing information services
- Location of the library or the information centre
- Investment on new facilities
- Policies for acquisition of stock
- Loan policy
- Interlibrary loans
- Weeding policy
- Manpower and career planning
- Information services design
- Establishing data banks
- Developing Measures of effectiveness
- User behaviour.

Self Check Exercise

3) What is meant by the term "operations research"?
4) List the important steps of the OR process.
5) Name some areas in librarianship where the OR may play an important part.

Note: i) Write your answers in the space given below.
ii) Check your answers with the answers given at the end of this Unit.

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7.4 MANAGEMENT INFORMATION SYSTEM (MIS)

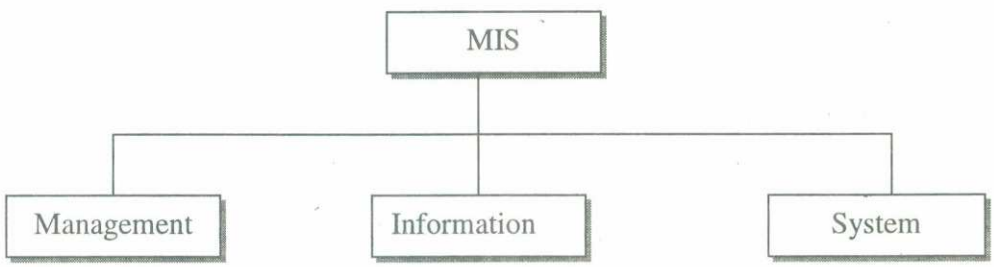
During the last couple of decades, the organisational structures of libraries and information centres have become larger and more complex. It has also become difficult to keep pace with information explosion, and tasks of libraries have become more complicated. Therefore, the library and information managers too have recognised the concept of MIS as an organisational resource which can be very effectively used as a monitoring technique in several of the managerial processes. With the help of MIS they too can have timely, accurate and up-to-date information about operational activities to fully understand and effectively manage the libraries and information centres. MIS offers the best solutions to their problems and can lead to better performance in libraries.

A Management Information System (MIS) can be defined as a normal system to provide all levels of management with all the relevant information they need with which to make appropriate decisions for the total control of an organisation. It is, therefore, one of the best monitoring techniques in the management of libraries and information centres as the key members of an organisation are provided with manual or automated data/information used in its various operations. With increasing size and complexity of present organisations many MIS reports are produced by computer. However, a computer is not a prerequisite to an MIS. The definition given above emphasises that an MIS:

- applies to all levels of management
- has and is linked to an organisational subsystem
- functions to measure performance, monitor progress, evaluate alternatives or provide knowledge for change
- is flexible both internally and externally

7.4.1 Meaning of MIS

Any Management Information System involves:



Here, **Management** makes decisions regarding planning, operating and controlling. **Information** consists of orderly data used for making decisions. **Systems** for integration of all activities of an organisation through exchange of information.

7.4.2 Need for MIS

An information system involves personnel, equipment, services, integration and objectives, and the emphasis remains on information because the manager must have information concerning each of the aspects to function. As a decision maker, the manager himself/herself is a processor of information. He/she must have the

ability to store, process, retrieve and display, whatever information is needed for decision making. To keep ahead, today's manager must keep abreast of his/her information requirements and evolve systems to deliver that information. The information needs of managers vary according to their level with management hierarchy, that is, the top, middle and lower level management.

7.4.3 Objectives of MIS

An effective management information system has the following objectives:

i) To facilitate the decision making process in an organisation by providing all levels of management with accurate, timely, and selective information, that assists the manager in determining a specific course of action.

ii) To provide for the objective performance of all relevant elements of the organisation, such as:
   - relating current operations to previously established plans
   - effectiveness of each of the major operating divisions/departments of the organisation
   - effectiveness of each functional elements
   - accomplishments and contributions of individual professionals in meeting the objectives of the organisation.

iii) To facilitate the economic and efficient production of reports representing the working of each department/division of the organisation.

iv) To provide the means for giving direction and action to the manager's formal written statement of duties and responsibilities.

v) To facilitate the processes of planning and control for all levels of management.

7.4.4 Characteristics of MIS

An effective management information system that supports the attainment of these objectives has several characteristics:

1) It is selective and relevant in nature, with emphasis on the specific problem under consideration by the decision maker.

2) It is integrated in such a manner that the functional elements or departments of an organisation and the various levels of management are considered in relation to each other, so that the impact of decisions made for one element can be measured and interpreted in terms of its effects on the organisation as a whole.

3) It represents a synthesis of the information needs of each manager, based on his/her organisational position, responsibilities and decision-making authority in the organisation.

4) It must differentiate between the kinds of information required for management planning and management control purposes in terms of time and organisation.

5) It must be responsive to changes caused by shifts in the organisational structure of the organisation.

7.4.5 Process of MIS Development

MIS process involves several steps consisting of information gathering, processing and analysis for decision-making. With the increasing size and complexity of modern

day information centres, a majority of MIS reports are being produced by computers. But it has to be remembered that a computer is not a prerequisite to MIS. The various steps in the process of MIS development are:

1) Finding out the information needs of all managers;
2) Writing down the objectives of the MIS and the anticipated benefits;
3) Preparing a plan for the design of the MIS including schedule and estimated costs;
4) Preparing a rough or gross design for the MIS, that appears to be practical and that will in all likelihood achieve the objectives established;
5) Preparing the detailed design. It requires refining and expansion of the gross design. Detailed description of management reports and a detailed description of the flow of information are required. A data bank or list of all data to be kept in files must be prepared. A procedures manual must be prepared to tell how the MIS works and what the personnel involved must do. The computer centre must also be designed and software or programmes made available;
6) Putting the new MIS into operation. Prior testing may be desirable to see that all parts work together. Imagine the problems that could arise in an organisation if the old system were abandoned and a computer programme in the new system did not work; and
7) Monitoring and maintaining the new system. That is, needed changes in procedures or the structure of the data files must be made from time to time. The MIS must also be changed to meet changing inputs and changing management needs.

7.4.6 Advantages of MIS

The MIS has several advantages for the library/information centre.

- Every bit of information required for decision making is available.
- Gaps in information get deleted, incomplete information gets completed, incorrect information gets corrected.
- Decision making becomes more accurate, less risky and rather easy.
- Two way information flow gets established, that is, manager downwards and bottom upwards.
- As updating of information is a continuous process, monitoring of every operation becomes easy, and immediate measures, corrective or otherwise, may be taken.
- Trend analysis and forecasting becomes easy and the exercise of long range planning becomes less difficult.

7.4.7 Presentation of Information

MIS presents outputs in the form of reports and documents to different management levels. Reports and documents are usually quantitative or subjective in nature, so that they can aid decision making. At times, interpretation/narration and decision are also given to aid the management to take correct decision at the appropriate time. The reports or documents are not too detailed with statements, graphs and at times with little briefing.

7.4.8 Costs of MIS

The costs of MIS are usually greater than expected as only a few of the costs are actually visible. These projected cost figures should be available at the outset of the project. The major costs associated with MIS are:

a) **Hardware**

As MIS are developed, it is found that the hardware existing with an organisation is inadequate for the task. Therefore, the computer resources, terminals, disk, and memory size etc. need to be evaluated to determine if they will serve the purpose.

b) **Software**

Each aspect of MIS will require Programming. Sufficient time is required for testing the programming phase of the MIS. This is very time consuming and thus expensive.

c) **Personnel**

The computerised MIS is a complex and sophisticated management tool. The personnel required to develop such systems have to be experienced and well versed with all aspects of the system, as MIS requires interrelating all the time. Such projects, thus involve a heavy cost with respect to personnel if new personnel are to be recruited.

d) **Maintenance**

An important aspect in development of any MIS is ongoing maintenance all the time. As up-to-date and timely information is required always, it is essential that a strong maintenance team be attached to the system. This leads to high costs.

7.4.9 Pitfalls/Constraints

The major problems found in most MIS are as follows:

i) The job is normally done by computer specialists and/or system analysts. But it requires the involvement of all engaged in management.

ii) Lack of resources

iii) Lack of trained personnel

iv) Lack of planned approach

v) Duplication of effort

vi) Time lag

vii) The volume of data at times makes it humanly impossible to be accurate and efficient.

viii) Useful and necessary data, at times, available, but often in a form or location where it is difficult to retrieve.

7.4.10 Skills of MIS Manager

As indicated previously, the output of a management information system is directed towards assisting management and operating personnel. To provide this desired output, the MIS Manager must have certain skills.

- Knowledge of the total organisation and its objectives.
- Ability to communicate effectively, orally and in writing.
- Relationship with top management.
- Relationship with subordinates.
- Knowledge of information processing and data communication techniques.
- Ability to design and judge the design of the system.

7.4.11 MIS and Libraries and Information Centres

Library/Information managers have recognised information as an important commodity and the concept of management information as an organisational resource. The difficult decisions by library managers in the present times of financial restraint, demands for new services and point to a need for better management information on which to base those decisions. This information must itself be managed and MIS offers the best solution to the problem. MIS has been found to be a valuable monitoring technique in library management. Changes in the computer technology will also indirectly enhance the MIS development in future. Some of these changes include faster processing speeds, greater disk storage capacity, multiprocessing and use of generalised software. These trends in automation forecast some of the tenets in MIS in libraries and information centres. Thus, MIS will become more widespread in future in library situations. Also, this will lead to changes in traditional report form of MIS in libraries.

Self Check Exercise

6) What do you understand by the term "Management Information System"?

7) List some skills of the MIS manager.

8) Name the various costs associated with the MIS process.

Note: i) Write your answers in the space .given below.

ii) Check your answers with the answers given at the end of this Unit.

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7.5 MANAGEMENT BY OBJECTIVES (MBO)

Management by objectives, popularly called MBO, refers to a formal procedure in which each manager pair, that is, a manager at any level and his immediate superior, periodically reach mutual agreements on specific and measurable goals or objectives, which the subordinate is expected to attain in a determined period. A written record is made of these objectives.

The MBO is thus a monitoring technique which has been effectively used to integrate individual and group goals of a library or an information centre.

MBO is basically a process whereby an information manager/librarian and his subordinates work in an information centre/library jointly:

a) identify its common goals

b) define each individual's major area of responsibility in terms of results expected of him/her, and

c) use some measures as guides for operating a unit of the library/information centre (or the whole of the library/information centre) and assessing the contribution of each of its members. These measures are:

- The goals jointly established by the manager and his/her subordinates and agreed upon in advance.
- These goals emphasise either output variables or intervening variables, or some combination of both.
- At the end of a predetermined period, the subordinate's performance is reviewed in relation to present goals. Both the superior and subordinate participate in this review/evaluation.

If after evaluation it is found that there is some discrepancy between the work planned and the work accomplished, steps are suggested to overcome the problems or to make necessary adjustments in the original plan. This sets the stage for the determination of objectives for the next time period.

MBO thus implies managing by properly identifying the objectives of an organisation.

7.5.1 Objectives of MBO

You know that objectives are intended goals which prescribe definite scope and suggest direction to efforts of an information manager. Some objectives of MBO are:

i) Management is the art of getting work done through the people and with MBO everyone in the organisation gets to know what the objectives and targets are, and accepts them as worth achieving.

ii) The organisation and the individuals work in the same direction.

iii) The objectives of the organisation are clearly defined and communicated to all.

iv) The objectives of the organisation can be reviewed periodically for adjustment if necessary.

v) Management can control information in a form and at a frequency which makes far more effective self-control and better and quicker decisions.

vi) Clarifies with each manager the key results and performance standards he/she must achieve.

vii) It helps to strengthen a manager's motivation.

7.5.2 Steps in Setting up MBO

As a top-down system MBO starts with complete commitment of the senior manager and his/her subordinates. The step by step process therefore consists of:

1) Making a complete study of the entire library/information centre and setting the common goals for the entire organisation.

2) To achieve goals of the organisation, appropriate changes in the organisation structure to be made. These changes include changes in titles, duties, relationships, authority, responsibility, span of control, and so forth.

3) The superior sets down goals for his/her subordinates, subordinates also propose goals for the jobs and select the areas in which they must be effective during the proposed period.

4) Superior and subordinates sit together, discuss the objectives and reach joint agreement on a subordinate's goals to be achieved by him/her during a stated time period. In other words, the goals are jointly established and agreed upon in advance.

5) What is to be accomplished should be compared with what is being accomplished throughout the time period. This helps in making necessary adjustments. Also unattainable and inappropriate goals can be discarded at this stage. This helps in checking wastage of resources.

6) The performance of all the subordinates is formally reviewed against their MBO plan at predetermined times during the plan.

7) Performance of the entire organisation to be reviewed with respect to the objectives initially stated. In case of discrepancies the entire process is to be repeated from the first step.

The various steps of the MBO process can be seen diagrammatically in figure 7.2.

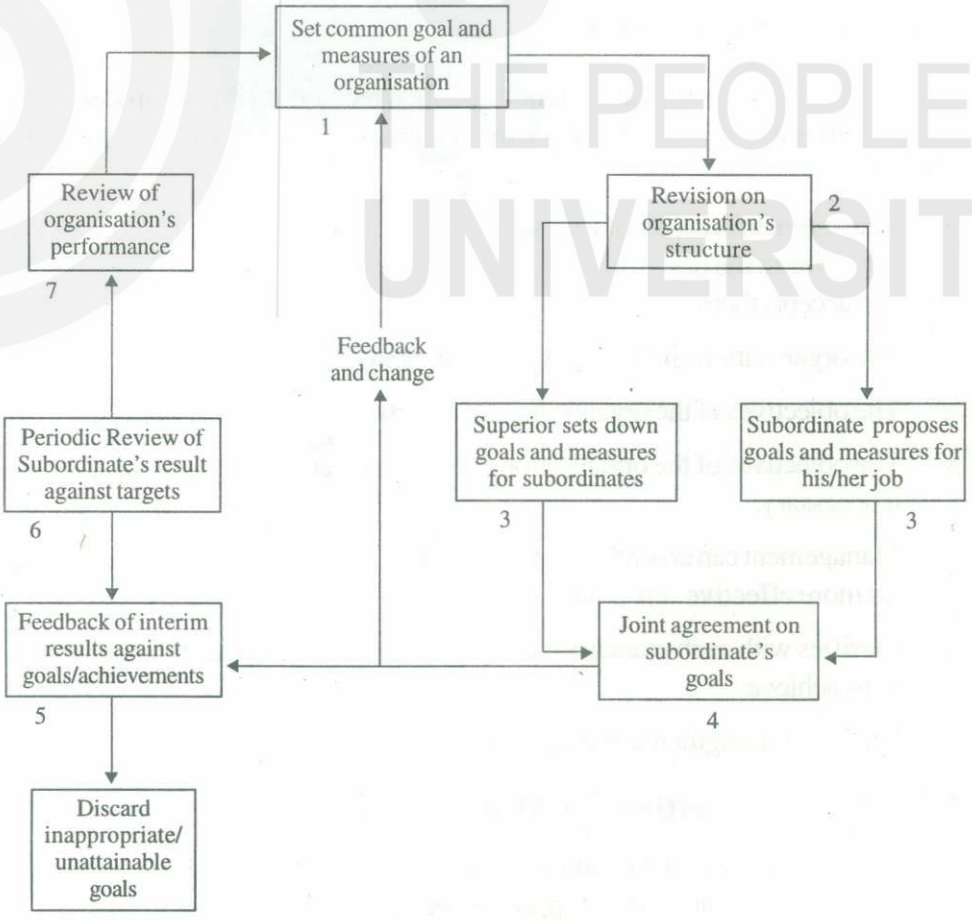


Fig. 7.2: Steps in Setting up MBO

7.5.3 Benefits of MBO

The benefits of MBO can be viewed both from the point of view of the information centre or the library and the individual manager's point of view. Let us first examine the benefits, those to the organisation:

- concentration, individually and as team, on the really important, profit oriented tasks.
- better management training to managers at a lower cost.
- improvements in management control and management performance standards.
- improvement in morale and sense of purpose in personnel due to their involvement.
- identification of personnel with potential so that reliable management plan for future be made.
- identification of problems that prevent high performance and improvement plan to solve them.
- coordinates the efforts of various departments/divisions of an organisation.
- better organisational structure with more effective delegation of responsibility and accountability.

From an individual manager's point of view, the benefits of MBO include:

- improved decision making
- less frustration
- greater opportunity to make a personal contribution and to accept more responsibility
- improved communication with other personnel
- recognition of achievement by self and superiors
- increased opportunity for personal growth
- more equitable material rewards and promotion plans.

7.5.4 Limitations of MBO

Although information organisations are benefited by MBO in many ways, there are certain drawbacks too. Management working by objectives may follow too rigid a pattern in thinking and action. There is always a need for, flexibility in management thinking and the provisions of written objectives should not be allowed to affect them adversely.

MBO has also been accused of demotivating people where it has been applied ruthlessly and of upsetting the balance of activity in an organisation, where it has been pursued too single-minded. One more problem with MBO is that librarians usually like to work in teams, whereas MBO concentrates very much on the leader of the team or the individual.

Lastly, one major limitation of MBO that overshadows all others, is that anyone introducing new planning concepts needs one or more trained advisers, and people of high potential, from middle or lower level management, can be trained and tested for some time before fully entrusting them with the job responsibilities.

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Self Check Exercise

9) Give your understanding of the concept Management by Objectives.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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7.6 NETWORK ANALYSIS

Network analysis is a system which plans large and small projects in an information centre by analysing the project activities. Presently, network analysis is considered to be one of the best techniques of monitoring, as it helps in carrying out and completing the various projects in libraries and information centres according to plan, by helping to maintain the time schedule. Projects are broken into individual tasks or activities, which are arranged in a logical sequence. It is also decided as to which tasks will be performed simultaneously and which others, sequentially. A network diagram is constructed, which presents visually the relationship between all the activities involved. Time, costs and other resources are allocated to different activities.

Network analysis helps in designing, planning, coordinating, controlling and in decision making, in order to accomplish the project economically in the minimum available time with the limited available resources.

Network techniques, developed from the Milestone chart and Bar chart, got recognition in the mid-50s when these conventional methods could not be utilized for planning large and complex projects, as details of activities could not be incorporated into them.

A number of network techniques have been developed and a few of them are listed below:

P.E.R.T. Program Evaluation Review Technique

CP.M. Critical Path Method

P.E.P. Program Evaluation Procedure

M.A.P. Manpower Allocation Resource

G.E.R.T Graphical Evaluation Review Technique

P.CS. Project Control System

The most commonly used techniques in libraries and information centres are PERT and CPM, and they are discussed below.

PERT/CPM

The PERT technique (Program Evaluation and Review Technique) is a planning device that was developed in 1958 by the U.S. Navy Special Projects Office. It focuses on the timing of each step necessary to arrive at an established goal. Du

Pont's CPM (Critical Path Method) is a related technique. Both these techniques develop a model of activities, plotted against time, that are required to achieve an objective.

In the library and information centre situations, the PERT and CPM techniques have been used jointly to plan and control the progress of highly complex, long-term projects, such as the building of a new physical facility or the planning of elaborate service projects that involve many people.

7.6.1 Developing a Network

A network is a graphic plan of all activities and events that must be completed to reach the end objective of a programme or a project, showing the planned sequence of their accomplishments, their dependencies and inter-relationships.

Every network has two basic components, namely, Event and Activity. We shall study now some terms related to network planning methods.

Event

An event is a specific instant of time which marks the start and the end of an activity. Event consumes neither time nor resources. It represents a specific accomplishment in a programme or project plan. It is represented by a circle and the event number is written within the circle.

Activity

Every project consists of a number of job operations or tasks which are called activities. An activity represents a job or project element to be completed, lying between any two events. Unlike event, it usually consumes time and resources. An activity is shown by an arrow on a network, and it begins and ends with an event. The direction of the arrow in an activity indicates the sequence in which the events are to occur. An activity is normally given a name like, A, B, C, etc., which is marked below the arrow and the estimated time to accomplish the activity, is marked above the arrow.

Activities are classified as:

i) Critical activities: These are the activities which, if they consume more than their estimated time, the project will be delayed. An activity is called critical if it's earliest start time plus the time taken by it is equal to the latest finishing time. A critical activity is usually marked by a thick arrow to distinguish it from non-critical activity.

ii) Non-critical activities: These are activities that have provision (float or slack) so that, even if they consume a specified time over and above the estimated time, the project will not be delayed.

iii) Dummy activities: When two activities start at the same instant of time, the head events are joined by a dotted arrow and this is known as a dummy activity. Dummy activities do not consume time. A dummy activity may be non-critical or critical.

Critical Path

It is that sequence of activities which decide the total project duration. Critical path is formed by critical activities. A critical path consumes maximum resources. It is the

longest path and consumes maximum time. A critical path has zero float. The expected completion dates cannot be met, if even one critical activity is delayed. A critical path reveals those activities which must be manipulated by some means or the other if the scheduled completion dates are to be met.

Duration

Duration is the estimated or actual time required to complete a task or an activity.

Total Project Time

It is the time which will be taken to complete a project and is found from the sequence of critical activities. In other words it is the duration of critical path.

Earliest Start Time (EST)

It is the earliest possible time at which an activity can start and is calculated by moving from first to last event in a network diagram.

Earliest Finish Time (EFT)

It is the earliest possible time at which an activity can finish.

EFT = EST + Duration of that activity

Latest Finish Time (LFT)

It is calculated by moving backward, that is, from last event to first event of the network diagram. It is the last event time of the head event.

Latest Start Time (LST)

It is the latest possible time by which an activity can start.

LST = LFT - Duration of that activity

The example in figure 3 explains the terms mentioned above and the method of calculating EST, EFT, LFT and LST.

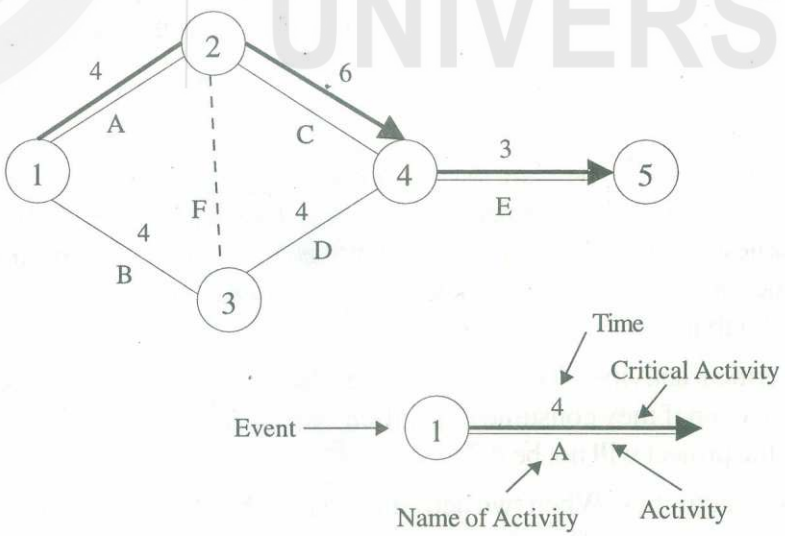


Fig. 7.3: Network Analysis

Float or Slack.

Slack is with reference to an event and float is with respect to an activity. In other words, slack is used with PERT and float with CPM, but in general practice, they may be used interchangeably. Float or slack means spare time, a margin of extra

time over and above its duration which a non-critical activity can consume without delaying the project. Float is the difference between the time available for completing an activity and the time necessary to complete the same.

Total Float

It is the additional time which a non-critical activity can consume without increasing the project duration. However, total float may affect the floats in previous and subsequent activities and it can also be negative.

Total Float = (LST - EST) or (LFT - EFT)

Free Float

If all the non-critical activities start as early as possible, the surplus time is the free float. Free float, if used, does not change the float in later activities. In other words if an activity is delayed by the free float period, the succeeding activity will not be delayed in turn. Free float = EST of tail event - EST of head event - activity duration.

Independent Float

The use of independent float of an activity does not change the float in other activities. Independent float can be used to advantage if one is interested to reduce the effort on a non-critical activity in order to apply the same on a critical activity thereby reducing the project duration. The independent float associated with an activity is not reduced by delaying previous operations whereas such a reduction can be noticed with free float.

Independent Float = EST of tail event - LFT of head event - activity duration

Independent float, if it turns out to be negative, is taken as zero.

Network or Arrow Diagram

Network diagram is the basic feature of network planning. It is a diagram (see figure 7.3) which represents all the events and activities in sequence (in which they are required to be performed to complete the project), along with their inter-relationships and interdependencies.

The network or arrow diagram is the visual presentation of the complete tasks (activities) by means of arrows. It is the most frequently used form of network diagram, where every activity is represented by an arrow and the activity sequences are indicated by the direction of arrows. For example, figure 7.3 shows that activity C and D can start only after A and B are complete. Dotted arrow (dummy activity) shows that A and B finish at the same time and C and D start at the same time. There are two paths to complete the project and they are 1-2-4-5 or 1-3-4-5.

Here the length of the arrow does not have any significance. These diagrams are very useful as they provide detailed information for making decisions in connection with large and complex projects.

Example

A library automation project consists of 6 activities namely A,B,C,D,E and F with duration of 4,6,5,4,3 and 3 days respectively. Draw the network diagram and calculate EST, LST, EFT, LFT and floats. Mark the critical path and find the total duration of completing the project.

Solution

1) EST is calculated by starting from event 1, that is, activity A and giving it a time 0 (EST).

   EST of activity B = 0 + duration of activity A = 4

   EST of activity C = EST of activity B + Duration of activity B = 4 + 6 = 10 and so on.

   EST of activity F can be found by following two paths, i.e., 1-2-3-5 and 1-2-4-5. The path 1-2-3-5 gives 15th day whereas the path 1-2-4-5 estimates 11th day as EST of activity F.

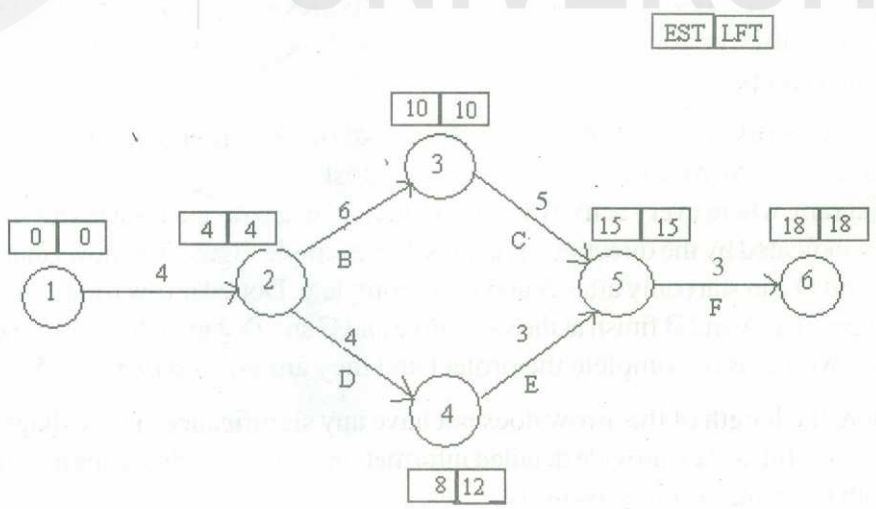
   Here the bigger value (15) is selected because until activity C is completed which ought to finish on the 15th day, activity F cannot be started.

   EST for other activities is calculated by proceeding similarly, in the forward direction from the first event to the last event.

2) LFT is calculated in a similar manner as EST but by proceeding backward from the last event to the first one. Here,

Table 7.1 : Calculation of the EST, LST, EFT, LFT and Floats

Activity	Duration (days)	EST	LST	EFT	LFT	Total Float	Free Float Float	Inde-pendent
A	4	0	0	4	4	0	0	0
B	6	4	4	10	10,	0	0	0
C	5	10	10	15	15	0	0	0
D	4	4	8	8	12	4	0	0
E	3	8	12	11	15	4	4	0
F	3	15	15	18	18	0	0	0



Critical path = 1-2-3-5-6

Project Duration = 4+6+5+3 = 18 days

Fig. 7.4: Network Diagram

LFT for activity F = 18

LFT for activity C and E = 18 - duration of activity F = 15

LFT for activity D = LFT for activity E-duration of activity E = 15 - 3 = 12 and so on.

3) LST for each activity is calculated from the relation,
LST = LFT of an activity - duration of that activity
for example, LST of activity D = 12 - 4 = 8 and so on.

4) EFT for each activity is calculated from the relation,
EFT = EST of an activity + duration of that activity
for example, EFT of activity D = 4 + 4 = 8 and so on.

5) Total float = (LST - EST) or (LFT - EFT)
for example, total float for activity D = (8 - 4) or (12 - 8) = 4

6) Free float = EST of tail event - EST of head event - activity duration.
for example, free float of activity D = 8 - 4 - 4 = 0

7) Independent float = EST of tail event - LFT of head event - activity duration.
for example, Independent float of activity
D = 8 - 4 - 4 = 0

8) Critical path is one which consumes maximum time and it is I -2-3-5-6. The total project duration, therefore, is 4 + 6 + 5 + 3 = 18 days,

Self Check Exercise

10) Examine the purpose of a network analysis chart (PERT/CPM).

11) Draw network diagram for any small project in a library and calculate EST, LST, EFT, LFT and floats. Also mark the critical path and find total project duration.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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7.7 OTHER TECHNIQUES

In addition to the techniques mentioned in the previous sections, some other monitoring techniques have also been successfully applied in libraries and information centres. Some of these techniques are discussed in the following sub sections.

7.7.1 Monitoring Team/Consultants

The problems that an information organisation encounters from day to day are usually adequately dealt with by information professionals at all the levels in the course of their duties. After all, this is why they are employed. However, there are occasions when a problem seems to be intractable, is in an area unfamiliar to the organisation, or where previously applied solutions are no longer effective. It is then that an outside expert for monitoring, guiding and controlling the activities may be engaged. These experts are usually referred to as "Consultants". Let us now study how these consultants are of use in libraries or information centres.

Most consultants specialise in a particular area, in at the most in one or two, and their special value apart from their considerable experience over many assignments lies in their detachment from the problem. As an outside party a consultant is able to look at a problem objectively and is not influenced by existing practices, prejudices or personalities. In addition, an independent consultant owes no allegiance to any particular section or group in the organisation.

A consultant must be appointed and supported throughout the assignment by the governing body and the chief executive of the information organisation. Only in this way will the consultant have the necessary authority to go anywhere in the organisation and question any member of it. However, the consultant must not identify himself/herself with the top management or any member of the management team. To do this, is to prejudice his/her opportunities to persuade management and staff to talk freely. The utmost confidence must be built up between the parties so that there is a completely free interchange of total information. It is sometimes said that consultants can speak more freely than internal managers and staff and that they suffer no inhibitions in this respect. This is certainly true, but their true value lies in their expert knowledge and experience. It is for these qualities as well as for their disinterested attitudes that they should be engaged.

Consultants are most frequently called in libraries and information centres for the following reasons:

a) To advise on ventures such as the installation of new equipment, penetrating new markets or introducing new services or products.

b) To restructure the information organisation or management pattern.

c) To raise new capital or attract funds or invite project proposals.

d) To advise on relocation.

e) To sort out difficulties being experienced in functional areas where internal solutions have not been effective.

f) To endeavour to save a totally ailing concern. This is usually an act of desperation by the management and after the call comes, it is too late for effective remedies.

Competent consultants provide a valuable service but are expensive. Their recommendations are based on very careful investigation and analysis of the problem areas and should be implemented to the full. They should report directly to the chief executive, with whose authority they speak. Finally, their activities must not be restricted in any way if they are, to be able to diagnose and recommend fully on the problems submitted to them.

Self Check Exercise

12) Give the advantages of using consultants in an information organisation.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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7.7.2 Budgeting

The budget is one of the best and most important monitoring devices as it reflects the goals and objectives of the library or the information centre. For running an information organisation funds come from various sources depending on the type of the information organisation. Budgeting helps in utilising these funds in the best possible manner for the effective running of the information organisation.

Budgetary control, therefore, is not only a financial plan but also a device for control, coordination, communication, performance evaluation and motivation. It helps in maintaining the balance in libraries as it helps in monitoring the spending of the allocated funds, justification for spending of amounts and review and approval by funding authorities.

For more details and information on budgeting, its types and budgetary control see the Units 12 and 13 of Block 4 of this course.

7.8 SUMMARY

In the subject of management, various monitoring techniques have evolved over the years to help managers better control and improve decision making. Almost all of the techniques of management have found application in libraries and information centres in various situations quite successfully.

This unit has covered almost all the monitoring techniques of management and their application in information organisations. Although some of the techniques are much more applicable than others and effectively applied if the processes and procedures in libraries are computerised, they have been found to be very useful in situations where operations are manual as well. Operations research is very useful where mathematical models can be prepared. For effective and improved decision making the MIS has been found to be of great value at all levels of management. In the case of Management by Objectives, the management pair, that is, the supervisor and the subordinate work jointly to achieve the management goals. For problems which the personnel working in the information centres fail to solve, help can be taken from management consultants or the monitoring team. Lastly, the best control device is the financial one that is the budgetary control as without finances nothing is possible in information centres.

7.9 ANSWERS TO SELF CHECK EXERCISES

1) Monitoring involves looking for faults, informing of duty, giving advice and illustration and exercising caution. Controlling usually refers to checking, verifying, testing, regulating, exercising restrain or directing influence in order to successfully carry out a management process.

2) Four monitoring Techniques are:
   - Operations Research (OR)
   - Management Information System (MIS)
   - Management by Objectives (MBO), and
   - Network Analysis

3) Operations research is the application of mathematical models that permit comparisons of alternative courses of action and the determination of the course that will bring maximum results. The purpose of OR is to aid the manager in decision making and in monitoring a process or an activity. It usually uses an interdisciplinary approach.

4) The important steps of the OR process are:
   a) Formulating the problem.
   b) Constructing a mathematical model to represent the system under study.
   c) Deriving a solution from the model.
   d) Testing the model and the solution derived from it.
   e) Establishing controls over the solution.
   f) Putting solution to work, that is, implementation.

5) Some areas in librarianship where OR may be useful are:
   - Interlibrary loans
   - establishment of databanks
   - user behaviour
   - location of library or information centre
   - weeding policy

6) A Management Information System (MIS) can be defined as a normal system to provide all levels of management with all the relevant information they need with which to make appropriate decisions for the total control of an organisation. It is, therefore, one of the best monitoring techniques in the management of libraries and information centres as the key members of an organisation are provided with manual or automated data/information used in its various operations.

7) Some of the skills of a MIS manager are:
   - Knowledge of the total organisation and its objectives.
   - Ability to communicate effectively, orally and in writing.
   - Relationship with top management.
   - Relationship with subordinates.
   - Knowledge of information processing and data communication techniques.
   - Ability to design and judge the design of the system.

8) The costs associated with MIS are:

   Hardware, Software, Personnel and Maintenance.

9) Management by objectives, popularly called MBO, refers to a formal procedure in which each manager pair, that is, a manager at any level and his/her immediate superior, periodically reach mutual agreement on specific and measurable goals or objectives, which the subordinate is expected to attain in a determined period. A written record is made of these objectives. The MBO is thus a, monitoring technique which has been effectively used to integrate individual and group goals of a library or an information centre.

10) Network analysis helps in designing, planning, coordinating, controlling and in decision making in order to accomplish the project economically in the minimum available time with the limited available resources.

11) The example in Section 7.6.1 can be used as a model network chart.

12) Most consultants specialise in a particular area, or in at most one or two, and their special value apart from their considerable experience over many assignments lies in their detachment from the problem. As an outside party a consultant is able to look at a problem objectively and is not influenced by existing practices, prejudices or personalities. In addition, an independent consultant owes no allegiance to any particular section or group in the organisation.

7.10 KEYWORDS

Controlling : It is checking, verifying, testing, regulation and exercising restrain in order to successfully carry out a management process.

CPM : Critical Path Method – a network analysis technique.

Management by Objectives : It is the formal procedure where a management pair periodically reach mutual agreements to achieve specific goal or objectives of an organisation

Management Information System : It is a system that provides all levels of management with all the relevant information they need with which to make appropriate decisions for the total control of an organisation.

Monitoring Team : It refers to experts from outside the organisation specially selected for guiding, monitoring and controlling certain activities or processes.

Network Analysis : It helps in designing, planning, coordinating, controlling and in decision making in order to accomplish a project economically in the minimum available time with the limited available resources.

Operations Research : It is the application of mathematical models that permit comparisons of alternative courses of action and the determination of the course that will bring maximum results.

PERT : Program Evaluation and Review Technique – a network analysis technique.

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UNIT 8 PERFORMANCE MEASUREMENT AND EVALUATION TECHNIQUES

Structure

5.0 Objectives

8.1 Introduction

8.2 Performance Measurement

- 8.2.1 Performance Measures

8.3 Evaluation

- 8.3.1 Methods of Evaluation

8.4 Evaluation Techniques

- 8.4.1 Performance Measurement
- 8.4.2 Performance Evaluation
- 8.4.3 Marketing Research
- 8.4.4 Cost Effectiveness Analysis
- 8.4.5 Bibliometrics
- 8.4.6 Delphi Technique

8.5 Evaluation of Information Systems

- 8.5.1 Collection Evaluation
- 8.5.2 Evaluation of Retrieval Systems
- 8.5.3 Document Delivery Systems Evaluation

8.6 Evaluation of Information Services

- 8.6.1 Evaluating the Personnel
- 8.6.2 Macro-Level Evaluation of Information Services
- 8.6.3 User Studies
- 8.6.4 Direct Assessment
- 8.6.5 Evaluation of Current Awareness Services

8.7 Summary

8.8 Answers to Self Check Exercises

8.9 Keywords

8.10 References and Further Reading

8.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the relevance of performance measurement in libraries and information centres;
- explain the need and purpose of evaluation;
- identify the methods of evaluation;
- attain a good insight into the major evaluation techniques; and
- apply these techniques to:

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- evaluate collection
- evaluate information systems
- evaluate information services.

8.1 INTRODUCTION

Performance measurement and evaluation are important aspects in any management process. Performance Measurement refers to monitoring and reviewing of programme accomplishments and progress towards pre-established goals. On the other hand, evaluation involves comparisons of performance with the objectives of the information organisation, in order to determine the change in performance over a given period, or to see whether the change is in right direction or not and if so then to what extent. For performance measurement and evaluation purposes we must have two things — specific and clear objectives of the organisation, and the measurement tools which are easy to apply.

Any evaluation process should reveal the inadequacies of objectives. Therefore, the evaluation process needs objectives as its criteria. The evaluation process should have measures of performance which are easy to apply, relevant and reliable, there are a number of ways to evaluate and improve a library or an information centre. The techniques used to evaluate various aspects of an information organisation are many and the same techniques are not applied in all the situations.

This unit introduces you to the concept of performance measurement and the process of evaluation, the methods of evaluation, the various techniques available for evaluation and lastly the kind of techniques to be applied in evaluating a particular aspect of the library or information centre.

8.2 PERFORMANCE MEASUREMENT

Measuring performance and providing feedback is an important factor in the controlling process and helps in checking whether activities conform to predetermined direction. The control, as suggested by Reeves and Woodward (1970), "is limited to monitoring the outcome of activities, reviewing feedback information about this outcome, and if necessary taking corrective action." The technique also involves measurement of performance in relation to standards. These standards are decided, and then some sort of analysis is performed to measure the activity against the standards.

Performance measurement is the monitoring and reviewing of programme accomplishments and progress towards pre-established goals. Performance measurement helps us to decide how well the information system, service or resource is operating, compared with some theoretical maximum. It helps in assessing how a resource or service is performing and, also acts as an accountability factor to the stakeholders. It is thus an important technique for establishing the "value" of information services to the intended customers or funding authorities. Performance measurement is a part of the strategic planning process and is used as an essential feedback mechanism to support decision making in libraries and information centers. Performance measurement is a continuous and continuing process.

8.2.1 Performance Measures

Performance measures provide quantitative information about products, services, and the processes that produce them. These measures serve as tools to understand, manage, and improve the effectiveness of an organisation. They may address the type or level of programme activities conducted (process), the direct products and services delivered by a programme (outputs), and the outcomes of the products and services. Three characteristics of the measures have been identified by Lawler and Rhode (1976):

- how complete or inclusive they are
- how objective or impersonal they are
- how much they can be controlled or influenced by the members of an organisation.

Performance measures are always set in context of a goal or an objective. They should be expressed in units of measure that are most meaningful to these who must use or make decisions based on those measures. Some of the performance measures, used to measure the performance, in library and information centres are cost benefit analysis measures, decision analysis, and the survey methods (which include observation, interview, questionnaires and case study method).

Various performance measures used can be categorised as follows:

Effectiveness: This indicates the degree to which a process output i.e., a service or product conforms to the set requirements.

Efficiency: This indicates the degree to which the required service or product is produced the required service or product is produced at minimum resource cost.

Quality: This measures the degree to which a service or product meets the requirements and expectations of the user.

Timeliness: This measures if the product or service was provided on time. The criteria for evaluation of timeliness are based on customer requirements.

Productivity: This is calculated by dividing the value added by the product or service by the value of labour and capital cost.

As suggested by, Stueart (2002), measures can be conducted on aspects of extensiveness (i.e., amount of service provided), effectiveness, efficiency, costing (i.e., cost-benefit or cost effectiveness), service quality, satisfaction or any number of other factors.

Outputs are the most common means of measuring a library or information centre's performance. Attempts have been made to measure outcomes or the library and information centre's impact on its target markets and environment. It is measured in terms of the user's ability to utilise the library and information centre's services to create further output. In order to evaluate the performance of a system it is essential to measure the system both in terms of its inputs and outputs and then to analyse the resulting data (Brophy, 1986).

"Researchers and practitioners have not yet adequately developed a set of representative outcome measures that convey customer expectations from which libraries can choose which ones to use (or modify) for local benchmarking nor have they produced meaningful frameworks for interpreting qualitative outcomes of service quality"(Hernon, 1997).

Various pieces of information used for evaluating or measuring the performance of library and information centre are called performance indicators. They provide the formula for measuring the progress of a programme towards achieving the organisation's goals and objectives. Performance indicators must combine the elements of inputs, outputs and outcomes, as suggested by Bryson (1996).

A research report developed by International Organisation for Standardisation (ISO) specifies a set of twenty-nine indicators grouped in three areas:

i) user satisfaction

ii) public services, which include general indicators as well as specific indicators on providing documents, retrieving documents, lending documents, document delivery from external sources, inquiry and reference services, information searching, and facilities; and

iii) technical services, including indicators in the area of acquiring processing and cataloguing documents.

There is a need for proper infrastructure to collect, filter, analyse, and disseminate performance measures data within and outside the organisation. Quantitative and descriptive statistics are important and easier to develop and measure than the qualitative ones.

Proper Documentation i.e., keeping accurate records of whatever is done is important in all performance measurement activities. It helps in continuous monitoring of the process. In absence of proper records it becomes difficult to measure the outputs objectively. This in turn makes it difficult to assess how much actual performance deviate from the planned performance and also to determine a measure of progress.

The effectiveness of the objectives, and the policies and the practices followed to accomplish those objectives, availability of resources, allocated budget and funds, the competence of the staff, and the leadership skills of the staff are various factors affecting the performance of a library and information centre.

Performance measurement in library and information centres helps in:

- Setting goals and standards in keeping with the broad organisational objectives.
- Detecting and correcting problems that arise in achieving those goals and objectives.
- Managing, describing and improving various processes in the organisation.
- Documenting the accomplishments and achievements.
- Analysing and making decisions about the effectiveness and efficiency of various programs, products and services being offered to the user and the employees.
- Assessing whether the library and information centre is fulfilling its mission and meeting the user-oriented objectives.
- Measuring the progress made towards achievement of organisational goals and objectives.

The aspects of performance being measured should reveal whether objectives are being met or not. The various performance measures used should be as complete, objective and responsive as possible. As stated by Hampton et. al. (1986) " complete measures help people concentrate on all aspects of job instead of neglecting unmeasured tasks in favour of measured tasks. Objective measures avoid the risk of bias and resentment inherent in personal and subjective assessments of performance".

Objective established for the organisation, the department, and the individuals involved help in determining "what to measure".

Performance management helps a library and information centre to improve its effectiveness. Various issues involved in designing of performance measurement system are: determining what to measure, developing effective performance measures, considering costs and difficulties associated with alternative measurement, analysing the effects of feedback and deciding to whom it should be directed, and identification of various undesirable motivational and behavioural consequences associated with the performance measurement and feedback.

A simple methodology to measure the accuracy of the shelving operation is suggested by Kendrick (1991), in his article, "Performance measures of shelving accuracy". This method was used at Melville Library at SUNY, Stony Brook. The Melville Library houses about one million volumes and stack management was done by two full-time clerical supervisors with the support of student assistants. Shelving done by students was checked by the stacks supervisors. Under the new method, a form was developed and used to record library of congress call numbers for five books on every truck that is shelved. After shelving by the student each of the five books is searched in the stack by the stacks supervisor who records whether the books are shelved correctly and puts his/her comments in the form. Every couple of weeks all the slips are tallied and each shelver's accuracy is achieving and average shelving accuracy of 91 per cent. This performance measurement programme for shelving accuracy provides a measure of shelving accuracy, and the data gathered by the programme helps to assess the overall access of the reshelving process and to evaluate the work of individuals.

In a library and information centre "services need to be analysed on the basis of both their cost and the effectiveness". Cost Effectiveness analysis can be based on the following questions as suggested by Mason (1980):

i) How would the alternative information service be provided?

ii) Who would provide?

iii) Would it match the effectiveness of the existing service?

iv) What would be its total cost?

Evans et. al. (1972) categorised the measures of library effectiveness as accessibility of materials, cost, user satisfaction, response time, cost/benefit ratio, and use. He has stressed the development of precise operational procedures for:

a) defining the variables involved in the measurement of each criterion concept;

b) specifying the statistical data and formulae needed to calculate the criterion measures;

c) suggesting a procedure that will enable one to combine these individual criterion measures so as to evaluate total library performance;

d) developing a procedure to weigh the individual criterion measures in accordance with each library's estimation of the importance of services being provided; and

e) eventually arriving at a procedure whereby meaningful comparisons can be made of libraries.

Feedback is an integral part of the performance measurement system. Feedback of performance measurement makes it possible to compare actual with intended results. It also enables to make adjustments wherever required. Feedback could be external,

coming from a supervisor, staff specialist, or user. It could also be self-generated, arising from observable results of activities or work equipment that records results.

Performance measurement also influences the behaviour of the people being measured. Measurement of subordinate's performance by superiors triggers a chain of perceptual, cognitive, and motivational processes.

While choosing appropriate performance measures, alternative methods to monitor performance relative to a set objective must also be considered. The difference in cost of this alternative measure and the different behavioural responses it might produce in the people being measured are other factors to be taken into consideration.

Special libraries and information centres cater to the information needs of the parent organisation; therefore, their measures of performance are somehow linked to the objectives of the parent organisation. These libraries add value to the quality of knowledge within the organisation by acquiring, analysing and providing accurate and timely information. The performance measures are thus set in accordance with their functioning. Whereas public libraries serve the information needs of the general public. Their measures of performance are decided according to the information needs of the society they serve, keeping in view the various financial and economic constraints. In modern times of budgetary constraints, it is quality and not quantity that distinguishes a library and information service. The knowledge and resourcefulness of the employees in the library and information centre has a significant impact on the quality of service provided. While reviewing programmes and their performance, the various marketing strategies adopted, and the adequacy of the technical and material resources is measured. Then the competence, skill, knowledge, experience and productivity level of the staff should be assessed. Finally, the leadership skills of the management should be evaluated.

8.3 EVALUATION

Evaluation of any service, process or activity in management usually refers to "determining its worth" or "assessment valuation, appraisal, criticism, review, calculation, measurement" or need to know closely the utility. Evaluation thus is a matter of comparison of actual results, not only with anticipated results, but also with external standards, in the light of existing institutional realities which may be relevant to evaluating the future trajectory of the program or service and provide an objective basis for decision-making.

Any process of evaluation has several purposes:

- assess a set of programme objectives, a programme plan or a programme design prior to implementation;
- determine how well objectives or performance expectations are being fulfilled;
- determine the reasons for successes and failures;
- discover principles underlying the success of a programme;
- explore alternatives and techniques for increasing programme effectiveness;
- establish a foundation for further research on the reasons for the relative success of alternative techniques;
- reassess programme objectives and programme design after implementation.

Some of the objectives of evaluation are:

a) It helps to determine how well performance expectations are being realised.

b) It determines a set of objectives prior to implementation.

c) It assesses the reasons for specific successes and failures.

d) It helps to uncover principles underlying success.

e) If explores techniques for improving effectiveness.

f) It establishes a foundation for further research.

g) It redefines system objectives.

Evaluation of any library/information centre is of two types namely macro evaluation and micro evaluation.

"Macro evaluation simply aims to state how well a system is performing. Here only the way of working of a system or its failings are taken into consideration and not the details of its components. The result after evaluation is just a statement about the performance.

Micro evaluation, on the other hand is diagnostic, examining in detail a system's performance, and especially its failures. Here, the system must therefore be thought of as a series of interacting components, each to be considered separately. Micro evaluation can enable recommendations to be made for improvements to a system, whereas macro evaluation cannot do more than indicate that improvements that are required by indicating an overall poor performance.

8.3.1 Methods of Evaluation

The process of evaluation is highly complex and aims to aid the decision makers to improve the situation under investigation. There are several methods of evaluation that can be applied in the library/information context. Some of these are:

1) Experimental Evaluation

The approach here is that certain aspects of a problem under investigation can be studied in isolation. The emphasis is on control of all variables that is everything which could influence the results, with most variables being kept constant or eliminated and a few being varied under the control of the environments.

Experimental studies of information systems have been carried out to prove theories of information retrieval, or many times to test hypothesis about performance of information retrieval systems. In computer-based information systems, these types of experimental evaluations are possible to be carried out.

2) Qualitative Evaluation

Qualitative evaluation covers a variety of techniques in which a common aspect is the study of behaviour, that is, the information seeking and handling behaviour in real situations. In qualitative method, the major benefit is that the viewpoint of the user emerges, which becomes a real factor in evaluation. Also qualitative data provides depth and detail of understanding, particularly from direct quotation and careful description. A variety of methods come within the qualitative method of evaluation. Given below are some techniques of evaluation:

Interviews are regarded as the best of the qualitative evaluation, since a verbal discussion is the best way of getting an indepth understanding of a situation, from the

viewpoint of a user of an information system. The format of interview can vary, from being formal, closed or structured to free, unstructured or informal.

Observation is a valuable supplement to interviewing, on the basis that what people do is likely to be more revealing than what they say. Observations too, may be entirely unstructured or structured depending upon the situation. Very often, observation has been found to be very valuable for evaluating real life situations or getting first hand information.

Questionnaires are usually considered to be most authoritative, highly structured evaluation techniques, if a quality element is introduced into all questions in the questionnaires. Here open-ended questions should be avoided as they might lead to difficulties in the analysis of data.

Examination of Records and Documents can be another useful form of qualitative evaluation. Here, records, letters, memoranda, forms etc. are examined with the aim of identifying important issues, and problems for evaluation.

You will be studying more details on the qualitative methods of evaluation in the course on Research Methodology.

3) Decision Analysis

In the context of evaluation, decision analysis aims at providing an objective procedure for reaching and justifying a decision, which itself is a choice of alternatives. The procedures for this require the user to specify all the considerations which come into the making of the decision, to give each of these alternatives a value as to how well they meet the requirements posed by each consideration, and to calculate an overall value for each alternative. The highest value naturally wins.

This method allows for a great deal of subjective judgment in the choice of considerations, in the weights given to them and in the values for the alternatives.

Quantitative decision analysis is also possible and many times helps to take decision between two alternatives. Another form of decision analysis is the checklist which can be used for the choice of all manner of things and services related to library information work.

4) User Studies

In any information system or service, studying the user characteristics and behaviour is very essential. Satisfaction of user needs is the ultimate, and only, justification for the existence of any information service, for obtaining information as to the way in which it is used, and the degree of success achieved by its users is a fundamental part of its evaluation,

5) Cost-Benefit Analysis

The performance of any information system or service without a consideration of resources is pointless. These resources are always assessed in financial terms, which come under the heading of costs. To know details of this aspect, a six-level categorisation of cost-related evaluations can be carried out. These six aspects are: cost, effectiveness, benefit, cost-effectiveness, cost-benefit and cost-performance benefit.

Self Check Exercises

1) Give the meaning of the term "Evaluation".

2) List the various methods of evaluation.

Note: i) Write your answers in the space given below:

ii) Check your answers with the answers given at the end of this unit.

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8.4 EVALUATION TECHNIQUES

You have already been told that evaluation is carried out for ensuring a reliable and in-depth knowledge of what an information system or information service in a library or information centre actually does and how it is best used. In order to carry out evaluation process several techniques are available. The application of these techniques varies from situation to situation depending upon the type, category and kind of information organisation or users, that are involved. Many of these techniques are borrowed from the scientific management. You have already been acquainted with some of these techniques in the previous units. Given below are some basic techniques which are applicable for evaluation processes.

8.4.1 Performance Measurement

Performance measurement helps us to decide how well the information system, service or resource is operating, compared with some theoretical maximum. The evaluation of information services and systems involves measures which are little or no different from those used in the evaluation of other aspects of life using the same methodologies. Some of the performance measures are cost benefit analysis measures, decision analysis, the survey methods (which include observation, interview, questionnaires and case study method).

Besides these, the individual libraries/information centres may develop their own set of evaluation techniques which can be used for their performance measurement. Performance measurement has been discussed in detail in section 8.2.

Retrieval Measures

Two measures of great importance to ascertain the effectiveness of information retrieval are: Recall and Precision. **Recall** is essentially a measure of how well the system performs at yielding up all the relevant items within it, and the extent to which relevant items are retrieved is referred to as the **recall ratio.**

Whereas, **Precision** describes how efficiently the system provides only the relevant items. The user will judge the results of the search by their relevance to his/her requirement and also by the time taken to get the results. Here it is customary and meaningful to express the relevance of results in terms of the proportion of items

retrieved and delivered which the requester judges relevant This proportion is usually referred to as the **precision ratio.**

The precision ratio is frequently used in conjunction with the recall ratio to give an indication of how efficient or discriminating a search has been. Thus, the precision ratio actually is an indirect measure of users' time and effort, that is, the higher the precision ratio, the less effort the user will need to expend in separating relevant items from those that are not relevant

Quality of Information

When dealing with real life situations, it is possible to set up criteria by which quality may be judged. These sorts of criteria are subjective and dependent on the particular need. They can be applied consistently. For example, quality may be judged by the type of document (e.g., prefer journal article to newspaper clipping or conference paper), by date (e.g., work published in the last five years), by place (e.g., papers from USA or UK preferable to African countries), by language (e.g., papers in English language).

Failure Analysis

Failure analysis helps to find out why things work as they do, and how matters may be improved. It helps in carrying out a broader study of retrieval systems and is of particular importance in collaborative evaluation. It helps to overcome problems in situations where improvements are required. It is useful to construct new search strategies in the retrieval system and is also useful for back searching.

8.4.2 Performance Evaluation

Performance evaluation is an assessment of how well a system or service is working, according to some previously decided measure. It is defined as the process of systematically assessing effectiveness against a predetermined norm, standard, or expressed goal.

Besides meeting the needs of the organisation, performance evaluation also helps individuals to know how they are performing. Performance evaluation when carried out correctly, meets several important needs. In performance evaluation, the totality of an information service should be examined in order to get a feel of the overall performance, and an idea of how the various components interact. The components of the system or service are examined in isolation.

Two types of measures can be used for performance evaluation:

Input measures investigate the system from the viewpoint of its operators and look at the resources invested, and how they are deployed – money spent, in total and in detail; number of staff, in total and in particular functions; number of purchases, enquiries, loans, etc.

Output measures, try to look at user satisfaction, and the extent to which the service is succeeding in its objectives.

These measures approximate to effectiveness or to some degree benefits. Cost is another aspect that is important in performance evaluations.

Performance evaluation has been applied to components of systems and services in libraries and information centres. Other areas which are subjects of such investigations are reference services, library collections, document delivery, current awareness, etc. These specific topics will be discussed in more detail later in this unit.

The last aspect in any library and information centre which is of utmost importance is the staff, and the degree of success with which they operate their information organisations for the benefit of the users will be the ultimate determinant of the value of any service. The evaluation of staff performance is an important topic which is being discussed in detail in the Block 3 of this course.

8.4.3 Marketing Research

Marketing research aims at testing, identifying and measuring the markets. It includes market research, looks at market mix, pricing research, the effectiveness of advertising and the whole of the marketing community.

Marketing research is essential as an evaluation technique as it helps in planning and implementation and needs to be an almost continuous process for most libraries and information centres in the present times. The information gathered must be put to effective use in forecasting, planning, instructing and illuminating the whole management decision making process.

Market research helps in investigation of current users as well as potential users and markets, plus the evaluation of current service and products, which are essential to the changing well-being of the library and information service. It helps to identify unsatisfied enquiries, monitor use of services, tell the way services are used and levels of satisfaction of these services. All these lead to steps which can remedy many situations. The technique of marketing research has evolved from surveys, based on observation.

Researching a market can take a number of forms – experimentation, observation and surveys.

The traditional scientific method of experimentation involves investing matched groups —one controlled group and other subject to variables – which can then be measured to evaluate whether effects of the variables can be said to be significantly different. This method can be used where a library wants to reorganize circulation, shelving and seating areas in new arrangements, and test user's reactions before proceeding further. Observations, measure overt behaviour only. Users can be observed physically from various angles.

Surveys, widely used in most research situations, have an important role to play in marketing research too. They should be used to find out user's knowledge, beliefs, behaviours, preferences or satisfaction rate. Personnel interview, mail, telephone or questionnaires can be used for carrying out the surveys.

Marketing research seeks to measure markets and explore the motivations and the behaviour of the user. Marketing research is active, draws statistics, is aim-oriented and is" an evaluation technique that informs libraries and information centres about collection, users and dissemination of information in the information world.

8.4.4 Cost Effectiveness Analysis

Cost-effectiveness is the relationship between the level of performance (effectiveness) and the costs involved in achieving this level. Several methods may be used to obtain a particular performance level. The least expensive alternative is the most cost-effective. Cost-benefits refer to the relationship between the benefits of a particular product or service and the cost of providing it. Generally, it is most difficult to measure benefits than performance (effectiveness). The expression

"cost-performance-benefits" relates to the entire spectrum of costs, performance (level of effectiveness) and benefits.

The cost of library service is measured in terms of input of resources. Under costs, both the costs that are relatively fixed and that are relatively variable need to be considered. A cost-effectiveness analysis seeks to increase the value received (effectiveness) for the resources expended (cost). The cost-effectiveness of a library operation can be improved in one or two ways:

1) Maintaining the present performance level while reducing the costs of operating the system.

2) Holding operating costs constant while raising the average performance level.

The six aspects which may be evaluated are:

a) Cost : It is simply a measure, expressed in financial terms, of the resources expended on a service

b) Effectiveness : This is a measure of the extent to which the needs of the users are satisfied, or stated differently, of the extent to which the overall objectives of the system or service are attained. Since these are difficult to assess, effectiveness is usually taken as a measure of a system's ability to meet certain stipulated performance levels which will generally be stated objectively and quantitatively.

c) Benefit : This measures the true worth of information services to their users, and is difficult to quantify. One major problem here is that to get a true measure of benefit, one would have to identify and compare a control group, deprived of all the benefits of an information service, impossibility in most circumstances.

d) Cost-effectiveness : This approach relates the cost of a system or service to some level of effectiveness. This implies that improvement may be sought on either side of the equation or on both, that is, by improving performance while containing or reducing costs. Because of the difficulties in defining cost and effectiveness for a total system, these techniques are generally used on isolated components, typically in choosing between alternative procedures.

e) Cost-benefit : This attempts to relate costs to overall benefits, but because of defining benefit, this approach is slightly difficult to follow.

f) Cost-performance-benefit : This aims at the investigation of the entire set of interrelationships between system cost, performance, and benefits, and is the best method of cost-related evaluation.

Library managers have a general agreement that cost-related measures of performance and benefit are an important part of library/information management.

8.4.5 Bibliometrics

Bibliometrics is the application of various statistical analyses to study patterns of authorship, publication and literature use. A number of distinct techniques in bibliometrics have been identified that have a practical application in libraries. The techniques of bibliometrics often used in libraries are:

1) The use of citation analysis to determine the scatter of papers by a journal and by the author.

2) The use of citation analysis to identify the research fronts of a particular field. Most cited papers in a field representing the research front are identified, and an analysis can be made of how these papers couple bibliographically.

3) It is also possible to identify whether a field is growing or declining and in particular to determine when it reaches the peak in terms of the amount of literature being published.

Bibliometric techniques have been applied successfully to evaluate the journal collection of any library especially when decision regarding continuation of subscription of journals is to be made.

8.4.6 Delphi Technique

Delphi technique helps managers and decision makers to make better forecasts and advice. This method recognises human judgments as legitimate and makes useful inputs in generating forecasts and also that the judgment of a number of informed people is likely to be better than the judgment of a single individual who may be misinformed or highly biased. Thus, the Delphi technique is a way of allowing only those interactions to occur that are likely to improve the quality of a forecast or decision.

The Delphi Technique has been widely used to generate forecasts in technology, education and other fields. It may also be possible to apply this technique as an evaluation technique in case a situation demands.

Self Check Exercises

3) List some evaluation techniques applicable in libraries.

4) How does marketing research help in the evaluation of libraries/information centres?

5) Give your understanding of cost-effectiveness.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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8.5 EVALUATION OF INFORMATION SYSTEMS

In the previous section you studied the various evaluation techniques. Let us now study how these techniques are actually applicable in evaluating the various aspects of the information systems or the library.

8.5.1 Collection Evaluation

Collection is the most important aspect of any library or information centre, as the whole work of an information organisation revolves around the collection. The various techniques used for collection evaluation also include counting of materials and are quantitative in terms of its value to the users of the information organisation. Based

on the various methods for evaluating the collection, we can classify the major approaches to collection evaluation as:

1) **Quantitative**

- By size of the collection
- By size of the collection by various methods of categorisation
- By current growth rate
- Size in relation to other variables (includes number of volumes per capita and number of volumes per item circulated)
- Expenditure on collection (includes per capita expenditure and expenditure on collection in relation to total budget).

2) **Qualitative**

Subjective evaluation (Expert judgment)

List checking method (evaluation against standard lists by analysis of use or holdings of other institutions)

- analysis of collection use
- circulation statistics
- in-library use

8.5.2 Evaluation of Retrieval Systems

The retrieval system includes any method of getting access to the information contained within any kind of information source – printed index, online searching systems, library catalogues, etc. The techniques usually used in evaluating the retrieval systems include the case study and qualitative evaluation techniques, mostly the failure analysis.

a) Evaluation of bibliographic search systems

As the bibliographic search systems are the operational aspect of the information system, the, techniques used to evaluate them include the case study method, questionnaires and failure analysis. Here the evaluators determine the relevance and adequacy of the service to the system and check the results in terms of recall and precision.

b) Evaluation of printed indexes

The printed indexes have been very popular with the users and their performance or value is usually judged from the user's point of view. If a user is able to retrieve whatever he/she requires, then it is considered to be a valuable service otherwise, not. Therefore, the technique that is being used here is recall and precision as the time spent on searching the index is the most important factor here.

c) Evaluation of databanks

It is possible to evaluate both type of databanks – that is the numerical as well as factual, and the criteria for evaluating them is usually different from those for the databases. The criteria for evaluating the databanks are – coverage, comprehensiveness quality, accuracy, reliability and ease of access. The question of quality is also important here. The techniques used include recall and precision besides individual case study approach.

d) Evaluation of catalogues and in-house databases

The evaluation of in-house operational databases, of which the most popular one is the library catalogue, has much in common with the evaluation of retrieval systems. The approaches used here are quantitative performance assessment and user studies. But the evaluators in this case will be persons with a great deal of knowledge and control over this sort of function. Another technique that can be used is evaluating the quality of the catalogue by means of a quantitative comparison of each cataloguer's work and also assessing the users reactions in a large scale.

e) Evaluation of SDI system

The SDI systems simply provide searches, limited to recent material at frequent intervals and as you very well know they are a part of the current awareness services. In this case, the evaluator is concerned with relevance/pertinence of the material produced, with the performance expressed by recall, precision, with the ease of use of the system with cost-effectiveness. Timeliness is an obvious concern, as is uniqueness that is the extent to which the system delivers material. Quality is also of considerable importance as users prefer to have small amounts of high quality: highly relevant material, rather than a large amount of dubious quality material.

8.5.3 Document Delivery Systems Evaluation

The document delivery systems refer to any of the means by which documents—books, journal articles, etc. are brought to the user, who may have been made aware of their existence by retrieval systems. For evaluation purposes, the document delivery aspect has to be viewed from two angles, firstly, the document availability, that is, what can be found in the user's local library or information centre, and secondly, the true document delivery, that is delivering the actual document. The techniques to be used in this case are failure analysis, availability study, questionnaire, interview, observation and quantitative analysis. The quantified measurement of waiting time, costs, amount of availability can be carried out. In this case user frustration is another parameter to carry out the evaluation of the service.

Self Check Exercises

6) Enumerate the ways by which the collection of a library can be evaluated.

7) Which techniques would you use to evaluate

   i) printed indexes

   ii) document delivery systems

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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8.6 EVALUATION OF INFORMATION SERVICES

An important goal to pursue library/information service evaluation is multiplicity of testing and of measurement. Evaluators should study as many of a library's services and as many areas of its stock, from as many angles as possible. The more areas of a library one sets out to evaluate, the better and more reliable that evaluation will be.

The basic approach in evaluation of information services is to examine and test the service in as many ways as feasible, attempting to relate the measures used to the needs of the users. In information services evaluation, the user thus is of utmost importance and the effect of each service on users has to be measured or evaluated. Let us now study the various ways in which the information services can be evaluated.

8.6.1 Evaluating the Personnel

The starting point of carrying out evaluation in any information centre is the staff as a subject for evaluation in their own right. The performance of the individuals is assessed in relation to specific operations in each library or information service. In any evaluation process, the evaluation of staff performance is automatically done while the evaluation of a service is being carried out. The various aspects of staff evaluation are covered in this course in Block 3.

8.6.2 Macro-Level Evaluation of Information Services

In the majority of information centres/libraries, each service is not evaluated or assessed individually. An overall performance evaluation for the whole organisation is carried out which is referred to as macro evaluation. It is usually in the form of "library statistics", "library surveys" or at times "performance indicators".

An important concept in the macro-level evaluation of services is that, attempts to assess, by any techniques can be made to know the extent to which information services are actually used by various segments of the user community. Also comparisons of services, proper utilisation or under utilisation of services, and the very worth of a service can be measured.

The techniques of this type of evaluation are many and varied. The kind of technique to be applied is according to the nature of the service being evaluated.

8.6.3 User Studies

User studies are important part of any information service and play an important role in the evaluation of the services as the users using a particular service are the best persons to asses – the value of a service.

There are several techniques for carrying out user studies – for example surveys (these include observation, interview, questionnaires, case studies, etc.), qualitative, illustrative, descriptive accounts of a service by users. Behaviours of real users in real situations also valuable ways of carrying out user studies.

8.6.4 Direct Assessment

A good way of knowing the success or failure of a service is its direct assessment while dealing with particular users. This is very helpful in knowing the adequacy of a reference service. This has the advantage i.e., if a user wants to know something, he/she comes to the library, and either gets a correct and useful answer or does not.

The success or failure is determined by a variety of factors – the scope of the library resources, the quality of the resources, the skill of the staff in knowing the user's needs and in searching, etc. It is therefore, a genuine test of the totality of the service.

The techniques of evaluation used in this approach are – asking the user, asking the librarian and observation. Here help from the questionnaire approach or diary keeping can also be taken.

8.6.5 Evaluation of Current Awareness Services

The current awareness services need a special treatment while carrying out the evaluation process as they play a central role in the total operation of an information service. Also, the current awareness activities are highly personalised and individual aspect of each user's information-seeking behaviour is represented here.

The evaluation of current awareness services is carried out by the techniques of cost effectiveness and analysis of the procedures and systems.

Self Check Exercises

8) How can the evaluation of an organisation at macro-level be carried out?

9) Why are user studies important in the evaluation process?

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

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8.7 SUMMARY

In this unit you have been introduced to the concept of performance measurement and evaluation techniques in a library or an information centre. Evaluating the library performance has many variations. Libraries perform multiple services and, therefore, it seems unlikely that any single criteria can be considered as the sole valid measure of a library performance. When it is possible to apply several different criteria, the question of weighing one becomes critical. It is essential to know the relative importance of each element in achieving a specific library function.

Therefore, the best approach would be the development of a technique for evaluating that will aid in establishing for each individual library a list of its services, ascribing to each service its relative importance to the total library programme.

From an overall point of view, the best course would be to develop modification of existing measures of evaluation and precise operational, procedures for:

- defining the variables involved in the measurement of each criterion concept;
- specifying the statistical data and formulae needed to calculate the criteria measures;

- suggesting a procedure that will enable one to combine these individual criteria measures so as to evaluate total library operations;
- developing a procedure to weigh the individual criteria measures in accordance with each library's estimation of the importance of services being provided; and
- eventually arriving at a procedure whereby meaningful comparisons can be made of libraries.

You have thus studied that evaluation of a library/information centre helps the library managers in achieving the long term objectives of the information organisation. It also helps in providing effective utility services to users and satisfies the users needs.

8.8 ANSWERS TO SELF CHECK EXERCISES

1) Evaluation of any service, process or activity in management usually refers to "determining' its worth" or "assessment, valuation, appraisal, criticism, review, calculation, measurement" or need to know closely the utility.

2) Some methods of evaluation are: experimental method, quantitative method, decision analysis, user studies and cost-benefit analysis.

3) Some evaluation techniques applicable in libraries are:
   - Performance evaluation
   - Performance measurement
   - Marketing research
   - Cost effectiveness analysis

4) The market research helps in investigation of current users as well as potential users and markets, plus the evaluation of current service and products, which are essential to the changing well-being of the library and information service:

5) Cost-effectiveness is the relationship between level of performance (effectiveness) and the costs involved in achieving this level. Several methods may be used to obtain a particular performance level. The least expensive alternative is the most cost-effective.

6) The ways by which a library collection can be evaluated are:

   a) Quantitative
      - By size of the collection
      - By size of the collection by various methods of categorisation
      - By current growth rate.
      - Size in relation to other variables (includes number of volumes per capita and number of volumes per item circulated).
      - Expenditure on collection (includes per capita expenditure and expenditure on collection in relation to total budget).

   b) Qualitative

      Subjective evaluation (Expert judgment)

      List checking method (evaluation against standard lists or holdings of other institutions)

      By analysis of use
      - analysis of collection use
      - circulation statistics
      - in-library use.

7) The printed indexes can be evaluated by the technique of recall and precision. The document delivery systems can be evaluated by the following techniques – The techniques in this case are failure analysis, availability study, questionnaire interview, observation and quantitative analysis. The quantified measurement of waiting time, costs, amount of availability can be carried out.

8) The macro-level evaluation can be carried out by library statistics, library surveys and performance indicators.

9) User studies are an important part of any information service and play an important role in the evaluation of the services. as the users using a particular service are the best persons to assess the value of a service.

8.9 KEYWORDS

Bibliometrics : It is the application of various statistical analysis -to study patterns of authorship, publication and literature use.

Cost Benefit Analysis : It is relating the cost of providing a particular service to the benefits produced by this service.

Cost Effectiveness : It relates to measures of cost to measures of effectiveness.

Evaluation : It is the comparison of actual results, with anticipated results on the basis of objectives of an information organisation.

Marketing Research : It aims at testing, identifying and measuring the market in order to provide better and improved services.

Performance Evaluation : It helps to assess how. well a system or service is working with respect to some predefined measures.

Performance Measurement : It means investigating and measuring how well an operational system meet the needs of its users.

Precision : Tells how efficiently the system provides only relevant items.

Recall : A measure to check how well a system performs at yielding up all relevant items within it.

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