



Title: Management of agricultural research: A training manual. Module 6:
Management ...



Session 1. Management information systems

[Session guide: Management information systems](#)

[Reading note: Management information systems](#)

[References](#)

DATE

TIME

FORMAT Plenary participatory lecture

TRAINER

OBJECTIVES

At the end of this session, participants should be able to understand and appreciate:

- 1.Principles and elements of MIS
- 2.The relationship between organizational structure and MIS
- 3.Information requirements for MIS
- 4.Different types of MIS
- 5.The process of developing a MIS
- 6.Criteria for MIS
- 7.Strategies for determining MIS design

INSTRUCTIONAL MATERIALS

Exhibit 1	Management information systems
Exhibit 2	MIS elements
Exhibit 3	Steps in planning
Exhibit 4	Requirements during the planning process
Exhibit 5	Controlling
Exhibit 6	Requirements for controlling
Exhibit 7	Decision making
Exhibit 8	System
Exhibit 9	Perceiving the system
Exhibit 10	Basic parts of the organization
Exhibit 11	Why a systems approach
Exhibit 12	Information
Exhibit 13	MIS as a pyramid structure
Exhibit 14	Conceptual basis of MIS
Exhibit 15	Implications of the organizational structure for MIS
Exhibit 16	Information requirements for MIS
Exhibit 17	Strategies for determining information requirements

Exhibit 17	Strategies for determining information requirements
Exhibit 18	Strategy for determining data requirements
Exhibit 19	Types of MIS
Exhibit 20	The MIS process
Exhibit 21	MIS criteria
Exhibit 22	Strategies for determining MIS design

REQUIRED READING

Reading note: *Management information systems*

BACKGROUND READING

None.

SPECIAL EQUIPMENT AND AIDS

Overhead projector and chalkboard

Session guide: Management information systems

Show EXHIBIT 1. Define and discuss what a management information system (MIS) is, and how it helps an organization. Identify elements of MIS: management, system and information (EXHIBIT 2). Each of these should be discussed individually. Management information is an important input for efficient performance of various managerial functions at different organization levels. The information system facilitates decision making. Management functions include planning, controlling and decision making. Show EXHIBIT 3 and discuss various steps in *planning*. Using EXHIBIT 4, discuss the basic requirements for information during the planning process, and emphasize their importance. Controlling compels events to conform to plans. It includes setting performance standards, measuring performance against those standards, and correcting deviations (EXHIBIT 5). Show EXHIBIT 6 and discuss the information requirements for the controlling function. Decision making is the core of management and aims at selecting the best alternative to achieve an objective. The decisions may be strategic, tactical or technical (EXHIBIT 7). Strategic decisions are characterized by uncertainty. They are future oriented and relate directly to planning activity. Tactical decisions cover both planning and controlling. Technical decisions pertain to implementation of specific tasks through appropriate technology. The elements of decision making include the model, criteria, constraints and optimization. A model is a quantitative-*cum*-qualitative description of a problem. Criteria relate to methods for achieving goals. Constraints are the limiting factors. Once the decision problem is fully described in a model, criteria stipulated and constraints identified, the decision-maker can select the best alternative. That is optimization.

Show EXHIBIT 8. Define and discuss the concept of a system. Observe that modern management is based upon the systems approach, which views an organization as a system of mutually dependent variables and composed of a set of interrelated sub-systems. This interrelationship is a fundamental concept in the systems approach to management. Show EXHIBIT 9 and discuss how a system can be perceived. The basic elements of the organization include the individual, the formal and informal organization, patterns of behaviour, role perception, and the physical environment (EXHIBIT 10). Show EXHIBIT 11 and discuss the relevance of the systems approach in the design of an MIS. MIS aims at inter-relating, coordinating and integrating different sub-systems by providing information to facilitate and enhance the working of the sub-systems and achieve synergism.

Show EXHIBIT 12. Define information in generic terms as well as in the context of different levels of decision making. Note that all data are not necessarily information. The value of management information lies in its content, form and timing of presentation. Discuss the role of the information system in linking different components of the organization through integration, communication and decision making. Integration aims at ensuring that different

sub-systems work together towards the common goal. Coordination and integration are essential controlling mechanisms to ensure smooth functioning in the organization. Communication is a basic element of organizational structure and functioning to integrate different sub-systems at different levels to achieve organizational goals. Information is generated in the organizational structure. Show EXHIBIT 13. Information requirements are different at all levels of the organization. As information flows from bottom to top, it becomes more and more focused as a result of capsulization and concretization. In contrast, information becomes increasingly diffuse as it flows from top to bottom. Since the information system is specific to an organization, organizational structure and behaviour have to be explicitly considered in designing an MIS (EXHIBIT 14). Show EXHIBIT 15 and discuss the implications of various characteristics of the organizational structure when designing an MIS. Refer to Table 1 in the Reading note in discussing these implications.

Show EXHIBIT 16 and discuss information requirements for MIS. It is important to consider carefully the information needs of the organization at different levels of the hierarchy. Strategies for determining information requirements should be discussed in the context of EXHIBIT 17. This discussion can be continued using EXHIBIT 18, in which a step-by-step strategy for determining data requirements is suggested.

An MIS can be a data bank, predictive, decision making or decision taking system. Discuss each of these in the context of EXHIBIT 19. Show EXHIBIT 20 and discuss the MIS process. As already discussed earlier, the MIS design team should first establish management information needs and clearly establish the system's design objectives. The important decision making areas should be identified, and within them the management decision areas delineated. Information needs at each of these levels have to be appreciated in the context of defined roles. A crude description of the system could then be developed and subsequently refined with more precise specifications. An MIS should be based on a few databases related to different sub-systems of the organization, for efficient management of information processing, the MIS should be tested and closely monitored to ensure that all critical data are captured.

Any MIS should be relevant to the individual decision-maker. It should provide up-to-date and accurate information to facilitate decision making. It should enable management to anticipate change. An MIS cannot be static in the face of the changing environment. As the environment changes, decision making changes and hence the information requirements change also (EXHIBIT 21).

Show EXHIBIT 22 and discuss the six strategies determining MIS design. The *organization-chart approach* is based on traditional functional areas defining current organizational boundary and structure. MIS evolves on its own in a *laissez faire* manner in the *integrate-later* approach. The *data-collection* approach involves collection and classification of all the relevant data for future use. In the *database* approach, a large pool of data is collected and stored for future use. The *top-down* approach involves defining the information needs for successive layers of management. The *total-system* approach involves collection, storage and processing of data within the total system.

EXHIBIT 1

MANAGEMENT INFORMATION SYSTEMS

Definition

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

Based on: Davis, G.B. 1985. *MIS: Conceptual Foundations. Structure and Development*. 2nd ed. New York, NY: McGraw-Hill.

MIS principal concerns

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

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

EXHIBIT 2

MIS ELEMENTS
Management functions
Planning Controlling Decision making
Information system
Management information

EXHIBIT 3

STEPS IN PLANNING
1. Selecting objectives
2. Identifying activities required to achieve the stipulated objectives
3. Describing the resources or skills, or both, necessary to perform the activities
4. Defining the duration of each activity to be undertaken
5. Determining the sequence of the activities

Source: Kumar, S. 1989. *Management Information System*. New Delhi: Ashish Publishing.

EXHIBIT 4

REQUIREMENTS DURING THE PLANNING PROCESS

1. Supplying the information needed by the planner at each step
2. Establishing procedures for procuring the information at each step (including the means to view alternatives)
3. Arranging for storage of the approved plans as information for the control process
4. Devising an efficient method for communicating the plans to other members in the organization

Source: Kumar, S. 1989. *Management Information System*. New Delhi: Ashish Publishing.

EXHIBIT 5

CONTROLLING

Controlling involves

1. Establishing standards of performance in order to reach the objective
2. Measuring actual performance against the set standards
3. Correcting deviations to ensure that actions remain on course

Source: Murdick, R.G., and Ross, J.E. 1975. *Information Systems for Modern Management*. Englewood Cliffs, NJ: Prentice-Hall.

EXHIBIT 6**REQUIREMENTS FOR CONTROLLING**

1. Defining expectations in terms of information attributes
2. Developing the logic for reporting deviations to all levels of management prior to the actual occurrence of the deviation

Source: Murdick, R.G., and Ross, J.E. 1975. *Information Systems for Modern Management*. Englewood Cliffs, NJ: Prentice-Hall.

EXHIBIT 7**DECISION MAKING****Levels of decision making**

- Strategic
- Tactical
- Technical

Elements of decision making

- Model
- Constraints
- Optimization

Source: Gorry, G., and Scott Morton, M.S. 1971. A framework for management information system. *Sloan Management Review*. Fall 1971.

EXHIBIT 8**SYSTEM**

"A set of elements forming an activity or a procedure/scheme seeking a common goal or goals by operating on data and/or energy and/or matter in a time reference to yield information and/or energy and/or matter."

Source: Hopkins, R.C. *et al.* *A systematic Procedure for System Development: Systems Philosophy*. Englewood Cliffs, NJ: Prentice-Hall

EXHIBIT 9**PERCEIVING THE SYSTEM**

1. Some components, functions and processes performed by these various components
2. Relationships among the components that uniquely bind them together into a conceptual assembly which is called a system
3. An organizing principle which is an overall concept that gives it a purpose
4. The fundamental approach of the system is the interrelationship of the sub-systems of the organization

Source: Albrecht, K. 1983. New systems view of the organization. *In: Organization Development*. Englewood Cliffs, NJ: Prentice-Hall.

EXHIBIT 10

BASIC PARTS OF THE ORGANIZATION	
1.	The individual
2.	The formal and informal organization
3.	Patterns of behaviour arising out of role demands of the organization
4.	The role perception of the individual
5.	The physical environment in which individuals work

EXHIBIT 11**WHY A SYSTEMS APPROACH**

- Developing and managing operating systems (e.g., money flows, manpower systems)
- Designing an information system for decision making
- Systems approach and MIS
- MIS aims at interrelating, coordinating and integrating different sub-systems by providing information required to facilitate and enhance the working of the sub-systems and achieve synergistic effects

Source: Murdick, R.G., and Ross, J.E. 1975. *Information Systems for Modern Management*. Englewood Cliffs, NJ: Prentice-Hall.

EXHIBIT 12**INFORMATION**

'A set of classified and interpreted data used in the decision making process'

Source: Lucas, H., Jr. 1978. *Information Systems Concepts for Management*. New York, NY: McGraw-Hill.

Information has also been defined as some tangible entity which serves to reduce uncertainty about future state or events

In the context of different levels of decision making, information can be described as:

- source
- data
- inference and predictions drawn from the data
- value and choices (evaluation of inferences with regard to the objectives, and then choosing courses of action)
- action which involves a course of action

The value of management information lies in its content, form and timing of presentation

EXHIBIT 13**MIS AS A PYRAMIDAL STRUCTURE**

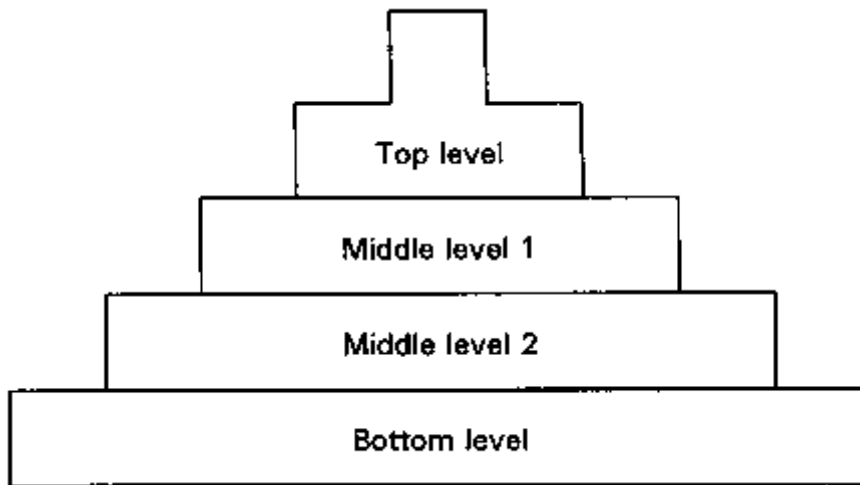


EXHIBIT 14

CONCEPTUAL BASIS OF MIS

1. Concepts of organization
2. Organizational theories, principles, structure, behaviour and processes such as communication, power and decision making
3. Motivation and leadership behaviour

EXHIBIT 15

IMPLICATIONS OF THE ORGANIZATIONAL STRUCTURE FOR MIS

Concepts:

- Hierarchy of authority
- Specialization
- Formalization
- Centralization
- Modification of the basic model
- Information model of organization
- Organizational culture
- Organizational power
- Organizational growth cycle
- Goal displacement
- Organizational learning
- Project model of organizational change
- Case for stable system
- Systems that promote organizational change
- Organizations as socio-technical systems

Source: Davis, G., and Olson, M.H. 1984. *Management Information Systems: Conceptual Foundation, Structure and Development*. New York, NY: McGraw-Hill.

EXHIBIT 16

INFORMATION REQUIREMENTS FOR MIS

1. Assessing information requirements
2. Levels of information requirements

- Organizational level
- Application level
- Technical
- Database

Source: Davis, G., and Olson, M.H. 1984. *Management Information Systems: Conceptual Foundation, Structure and Development*. New York, NY: McGraw-Hill.

EXHIBIT 17

STRATEGIES FOR DETERMINING INFORMATION REQUIREMENTS

1. Asking
2. Deriving from an existing information system
3. Synthesizing from characteristics of the utilizing system
4. Discovering from experimentation with an involving information system

Source: Davis, G.B. 1982. Strategies for information requirements determination. *IBM Systems Journal*, 21(1): 4-31.

EXHIBIT 18

STRATEGY FOR DETERMINING DATA REQUIREMENTS

1. Identify elements in the development process utilizing system:
 - Information systems or applications
 - Users
 - Analysts
2. Identify process uncertainties:
 - Existence and availability of a set of usable requirements
 - Ability of users to specify requirements
 - Ability of analysts to elicit and evaluate requirements
3. Evaluate the effects of elements in the development process over process uncertainties
4. Evaluate the combined effects of the process uncertainties on overall requirements uncertainty
5. Select a primary strategy for requirements determination based on the overall requirements uncertainty

Uncertainty level	Strategy
Low	• Asking or deriving from an existing system
	• Synthesis from characteristics of utilizing systems
High	• Discovering from experimentation

6. Select one or more from the set of methods to implement the primary strategy

Source: Davis, G.B. 1985. *Management Information Systems: Conceptual Foundation, Structure and Development*. New York, NY: McGraw-Hill.

EXHIBIT 19

TYPES OF MIS

1. Databank information system
2. Predictive information system
3. Decision making information system
4. Decision taking information system

EXHIBIT 20

THE MIS PROCESS

1. Understand the organization
2. Analyse the organization's information requirements
3. Plan overall strategy
4. Review
5. Preliminary analysis
6. Feasibility assessment
7. Detailed fact finding
8. Analysis
9. Design
10. Development
11. Cutover
12. Obtain conceptual schema
13. Recruit database administrator
14. Obtain logical schema
15. Create data dictionary
16. Obtain physical schema
17. Create database
18. Modify data dictionary
19. Develop sub-schemas
20. Modify database
21. Amend database

Source: Crowe, T., and Avison, D.E. 1982. *Management Information from Databases*. London: Macmillan.

EXHIBIT 21

MIS CRITERIA

- Relevance
- Management by exception
- Accuracy
- Adaptability

EXHIBIT 22

STRATEGIES FOR DETERMINING MIS DESIGN

- Organization-chart approach
- Integrate-later approach
- Data-collection approach
- Database approach
- Top-down approach

Source: Blumenthal, S.C. 1990. *Management Information Systems: A Framework for Planning and Control*. Englewood Cliffs, NJ: Institute of Personnel Management.

Reading note: Management information systems

[Information and the MIS concept](#)
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[Systems approach](#)
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Information and the MIS concept

Information is a set of classified and interpreted data used in decision making. It has also been defined as 'some tangible or intangible entity which serves to reduce uncertainty about future state or events' (Lucas, 1978). A management information system (MIS) is 'an integrated user-machine system for providing information to support operations, management and decision making functions in an organization. The system utilizes computers, manual procedures, models for analysis, planning, control and decision making, and a database' (Davis and Olson, 1984). MIS facilitates managerial functioning. Management information is an important input at every level in the organization for decision making, planning, organizing, implementing, and monitoring and controlling. MIS is valuable because of its content, form and timing of presentation. In the context of different levels of decision making, information can be described as:

- source,
- data,
- inferences and predictions drawn from data,
- value and choices (evaluation of inferences with regard to the objectives and then choosing a course of action), and
- action which involves course of action.

The MIS concept comprises three interrelated and interdependent key elements: management, system and information (Murdick and Ross, 1975).

Management and the MIS process

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

Planning

Planning consists of five sequential and interactive steps (Kumar, 1989). These are:

- selecting objectives;
- identification of the activities which are required to achieve the stipulated objectives;
- detailing the resources - including the various skills - required to undertake the activities;
- determining the duration of each activity to be performed; and
- defining the sequence of the activities.

The basic requirements during the planning process of most importance in designing and implementing an MIS for an organization are (Kumar, 1989):

- providing the information required by the planner at each step of planning;
- establishing procedures for obtaining the information;
- arranging for storage of the approved plans, as these will provide the information requisite to monitoring and controlling; and
- evolving methods for communicating the plans to employees in the organization.

Monitoring and controlling

Controlling 'compels events to conform to plans' (Murdick and Ross, 1975). It involves:

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

The requirements for successful development of a control system are:

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

Decision making

Decision making is the process of selecting the most desirable or optimum alternative to solve a problem or achieve an objective. The quality and soundness of managerial decisions is largely contingent upon the information available to the decision-maker. Gorry and Scott Morton (1971) classified decision making on three levels of a continuum:

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

Elements of decision making

The four components of the decision making process are (Burch and Strater, 1974):

- *Model* A model is an abstract description of the decision problem. The model may be quantitative or qualitative.
- *Criteria* The criteria must state how goals or objectives of the decision problem can be achieved. When there is a conflict between different criteria, a choice has to be made through compromise.
- *Constraints*. Constraints are limiting factors which define outer limits and have to be respected while making a decision. For example, limited availability of funds is a constraint with which most decision makers have to live.

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

Systems approach

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

- some components, functions and the processes performed by these various components;
- relationships among the components that uniquely bind them together into a conceptual assembly which is called a system; and
- an organizing principle that gives it a purpose (Albrecht, 1983).

The organizing system has five basic parts, which are interdependent (Murdick and Ross, 1975). They are:

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

The interrelationship of the sub-systems within an organization is fundamental to the systems approach. The different components of the organization have to operate in a coordinated manner to attain common organizational goals. This results in synergic effects. The term *synergy* means that when different sub-systems work together they tend to be more efficient than if they work in isolation (Murdick and Ross, 1975). Thus, the output of a system with well integrated sub-systems would be much more than the sum of the outputs of the independent sub-systems working in isolation.

The systems approach provides a total view of the organization. It enables analysis of an organization in a scientific manner, so that operating management systems can be developed and an appropriate MIS designed (Murdick and Ross, 1975).

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

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

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

Organizational structure and MIS

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

Thus, MIS as a support system draws upon:

- concepts of organization;
- organizational theories, principles, structure, behaviour and processes such as communication, power and decision making; and
- motivation and leadership behaviour.

Davis and Olson (1984) analysed the implications of different characteristics of the organizational structure on the design of information systems (Table 1).

Information requirements for MIS

Assessing information needs

A first step in designing and developing an MIS is to assess the information needs for decision making of management at different hierarchical levels, so that the requisite information can be made available in both timely and usable form to the people who need it. Such assessment of information needs is usually based on personality, positions, levels and functions of management. These determine the various levels of information requirements.

Table 1 Organizational structural implications for information systems

Concept	Implications for Information Systems
Hierarchy of authority	A tall hierarchy with narrow span of control requires more formal control information at upper levels than a flat hierarchy with wide span of control.
Specialization	Information system applications have to fit the specialization of the organization.
Formalization	Information systems are a major method for increasing formalization.
Centralization	Information systems can be designed to suit any level of centralization.
Modification of basic model	Information systems can be designed to support product or service organizations, project organizations, lateral relations and matrix organizations.
Information model of organization	Organizational mechanisms reduce the need for information processing and communication. Vertical information systems are an alternative to lateral relations. Information systems are used to coordinate lateral activities.
Organizational culture	Organizational culture affects information requirements and system acceptance.
Organizational power	Organizational power affects organizational behaviour during information system planning, resource allocation and implementation. Computer systems can be an instrument of organizational power through access to information.
Organizational growth	The information system may need to change at different stages of growth.
Goal displacement	When identifying goals during requirements determination, care should be taken to avoid displaced goals.
Organizational learning	Suggests need for information system design for efficiency measures to promote single loop learning and effectiveness measures for double loop learning.
Project model of	Describes general concepts for managing change with information system projects.

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

Source: Taken from Gordon and Olson, 1984: 358-359.

Levels of information requirements

There are three levels of information requirements for designing an MIS (Davis and Olson 1984). They are:

- At the *organizational level*, information requirements define an overall structure for the information system and specific applications and database.
- *Application level* requirements include social or behavioural - covering work organization objectives, individual roles and responsibility assumptions, and organizational policies - and technical, which are based on the information needed for the job to be performed. A significant part of the technical requirement is related to outputs, inputs, stored data, structure and format of data and information processes.
- At the *user level*, database requirements can be classified as perceived by the user or as required for physical design of the database.

Strategies for determining information requirements

Gordon and Olson (1984) suggested six steps in selecting a strategy and method for determining information requirements (Table 2).

Table 2 Strategies for determining information requirements

1. Identify elements in the development process <ul style="list-style-type: none"> • Utilizing systems • Information system or application • Users • Analysis
2. Identify characteristics of the four elements (in 1, above) in the development process which could affect uncertainty in the information requirements.
3. Identify the process uncertainties <ul style="list-style-type: none"> • Existence and availability of a set of usable requirements. • Ability of users to specify requirements. • Ability of the analyst to elicit and evaluate information requirements. <p>Assess how the characteristics of the four elements in the development process (listed under 1, above) will affect the these process uncertainties.</p>
4. Determine how the overall requirements uncertainties would be affected by the combined effects of the process uncertainties.
5. Considering the overall requirements uncertainty, choose a primary strategy for information requirements. <p>If uncertainty is low, then the strategy should be to:</p> <ul style="list-style-type: none"> • Ask the users what their requirements are. This presupposes that the users are able to structure

their requirements and express them objectively. Asking can be done through

- questions, which may be closed or open,
 - brainstorming sessions, totally open or guided, and
 - group consensus as aimed at in Delphi methods and group norming.
 - Wherever there are close similarities in the organization and easy replication is possible, information requirements can be derived from the existing system.
 - Characteristics of the utilizing system should be analysed and synthesized. This is particularly useful if the utilizing system is undergoing change.
- If uncertainty is high, discover from experimentation by instituting an information system and learning through that the additional information requirements. This is 'prototyping' or 'heuristic development' of an information system.

6. Select an appropriate method.

Source: Davis and Olson, 1984: 488-493.

Types of MIS

MIS can be categorized (Mason, 1981) as follows:

- *Databank information systems* refer to creation of a database by classifying and storing data which might be potentially useful to the decision-maker. The information provided by the databank is merely suggestive. The decision-maker has to determine contextually the cause and effect relationships. MIS designs based on the databank information system are better suited for unstructured decisions.
- *Predictive information systems* provide source and data along with predictions and inferences. The decision-maker can also enquire as to 'what if a certain action is taken?' and whether the underlying assumptions are true. This type of MIS is useful for semi-structured decisions.
- *Decision-making information systems* provide expert advice to the decision-maker either in the form of a single recommended course of action or as criteria for choice, given the value system prevailing in the organization. The decision-maker has just to approve, disapprove or modify the recommendation. Decision-making information systems are suitable for structured decisions. Operations research and cost-effectiveness studies are examples of decision-making information systems.
- *Decision-taking information systems* integrate predictive information and decision-making systems.

Process of MIS

The MIS implementation process (Table 3) involves a number of sequential steps (Murdick and Ross, 1975):

1. First establish management information needs and formulate broad systems objectives so as to delineate important decision areas (e.g., general management, financial management or human resources management). Within these decision areas there will be factors relevant to the management decision areas, e.g., general management will be concerned about its relationship with the managing board, institute-client relationships and information to be provided to the staff. This will then lead the design team to ask what information units will be needed to monitor the identified factors of concern. Positions or managers needing information for decision making will be identified.
2. Develop a general description of a possible MIS as a coarse design. This design will have to be further refined by more precise specifications. For efficient

management of information processing, the MIS should be based on a few databases related to different sub-systems of the organization.

3. Once the information units needed have been determined and a systems design developed, decide how information will be collected. Positions will be allocated responsibility for generating and packaging the information.

4. Develop a network showing information flows.

5. Test the system until it meets the operational requirements, considering the specifications stipulated for performance and the specified organizational constraints.

6. Re-check that all the critical data pertaining to various sub-systems and for the organization as a whole are fully captured. Ensure that information is generated in a timely manner.

7. Monitor actual implementation of the MIS and its functioning from time to time.

Table 3 Methodology for implementing MIS

1. Understand the organization
2. Analyse the information requirements of the organization
3. Plan overall strategy
4. Review
5. Preliminary analysis
6. Feasibility assessment
7. Detailed fact finding
8. Analysis
9. Design
10. Development
11. Cutover
12. Obtain conceptual schema
13. Recruit database administrator
14. Obtain logical schema
15. Create data dictionary
16. Obtain physical schema
17. Create database
18. Modify data dictionary
19. Develop sub-schemas
20. Modify database
21. Amend database

Adapted from Crowe and Avison, 1982.

Criteria for MIS

Crowe and Avison (1982) suggested five criteria for an MIS:

- *Relevance* Information should be relevant to the individual decision-makers at their level of management.
- *Management by exception* Managers should get precise information pertaining to factors critical to their decision making.

- *Accuracy* The database from which information is extracted should be up-to-date, contextually relevant and validated.
- *Timeliness* The information should be provided at the time required.
- *Adaptability* The information system should have an in-built capability for re-design so that it can suitably adapt to environmental changes and changing information requirements.

Strategies for determining MIS design

MIS design should be specific to an organization, respecting its age, structure, and operations.

Six strategies for determining MIS design have been suggested by Blumenthal (1969):

- *Organization-chart approach* Using this approach, the MIS is designed based on the traditional functional areas, such as finance, administration, production, R&D and extension. These functional areas define current organizational boundaries and structure.
- *Integrate-later approach* Largely a *laissez faire* approach, it does not conform to any specified formats as part of an overall design. There is no notion of how the MIS will evolve in the organization. Such an MIS becomes difficult to integrate. In today's environment - where managers demand quick and repeated access to information from across sub-systems - the integrate-later approach is becoming less and less popular.
- *Data-collection approach* This approach involves collection of all data which might be relevant to MIS design. The collected data are then classified. This classification influences the way the data can be exploited usefully at a later stage. The classification therefore needs to be done extremely carefully.
- *Database approach* A large and detailed database is amassed, stored and maintained. The database approach is more and more accepted for two main reasons: first, because of data independence it allows for easier system development, even without attempting a complete MIS; and, second, it provides management with immediate access to information required.
- *Top-down approach* The top-down approach involves defining the information needs for successive layers of management. If information required at the top remains relatively stable in terms of level of detail, content and frequency, the system could fulfil MIS requirements (Zani, 1970). The usefulness of this approach depends on the nature of the organization. It can be suitable for those organizations where there is a difference in the type of information required at the various levels.
- *Total-system approach* In this approach the interrelationships of the basic information are defined prior to implementation. Data collection, storage and processing are designed and done within the framework of the total system. This approach can be successfully implemented in organizations which are developing.

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