CHAPTER 3

MANAGEMENT INFORMATION SYSTEM - THEORY, CONCEPT AND APPLICATIONS

3.1 INTRODUCTION

There is a growing recognition for MIS applications in service oriented organisations for improving the performance. This chapter introduces the general concepts on Management Information System and its design and development. Review of MIS applications in irrigation systems as well as in other public organisations are also dealt in this chapter.

MIS is an integrated, user-machine system for providing information to support operations, management and decision making functions in an organisation. The system utilises computer hardware and software, manual procedures, models for analysis, planning, control and decision making and a data base (PMU 1987 and Jayashankar 1991).

Timely access to good information is necessary for well-informed management decisions. MIS provides managers with timely access to information on resources, activities and outcomes for planning, directing, controlling and decision making from different parts of the organisation or system.
MIS enhances the information processing of the organisation in the following ways:

* Compact storage of data
* Swift communication
* High speed, reliable processing of raw scheme data into information
* Reduced workloads and
* High quality information support for managerial decision making

3.2 CONCEPTS IN DESIGN OF AN MIS

3.2.1 The Pyramidal Structure of an MIS

MIS has been described as a pyramidal structure representing the different levels of management in an organisation or system (Figure 3.1). In this pyramid, the bottom layer consists of information for transaction processing and status inquiries. The next higher level consists of information resources in support of day-to-day operations and control. The third level consists of information system resources to aid in tactical planning and decision making for management control. The top level consists of information resources to support strategic planning and policy making by higher level of management. Each level of information processing may make use of data provided by the lower level. Even new data can also be introduced.

3.2.2 Physical components of an MIS

The Physical components of an MIS include

* Computer hardware and software
* Model for analysis
* Rules for planning, control and decision making and
* data base
Figure 3.1 The pyramidal structure of the MIS (Head V.R. 1967)
3.2.3 **Functional Components of an MIS**

The functional components of an MIS include

* Data Input system
* Data Base Management System
* Data Analysis system and
* Feedback and Evaluation System

3.2.4 **General Information System**

Any information system model essentially consists of a data input system, processing system and an output information system.

![Figure 3.2 A simple information system](image-url)
Components of the general information system are as follows:

<table>
<thead>
<tr>
<th>Input Data</th>
<th>Processing</th>
<th>Output information</th>
</tr>
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<tbody>
<tr>
<td>Time/Frequency</td>
<td>Manual procedure</td>
<td>Time/Frequency</td>
</tr>
<tr>
<td>Source</td>
<td>Models for Analysis</td>
<td>Source</td>
</tr>
<tr>
<td>Content</td>
<td>Rules for decision</td>
<td>Content</td>
</tr>
<tr>
<td>Format</td>
<td>Computation</td>
<td>Format</td>
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<tr>
<td></td>
<td>Mode of processing</td>
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<td></td>
<td>Form of storage and retrieval</td>
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<tr>
<td></td>
<td>Procedure for analysis and</td>
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<td></td>
<td>reporting</td>
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</tbody>
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3.2.5 Basic Steps in Design of an MIS in Business Organisation

i. Identify the user requirements - Present uses and future uses
ii. Examine the requirement of the proposed system - Format of the report and volume of report
iii. Get functional specifications - What is to be built, how is it to be built and budget
iv. Detailed design and creation of necessary database
v. Implementation - Observe modifications, if any and
vi. Post implementation

There are two kinds of approaches in the design of an MIS (Davis and Olsen 1987) based on:

i. the organisational functions and
ii. the managerial activities for which MIS is used
3.2.6 Characteristics of an effective MIS

Horton et al (1993) have provided guidelines for developing and implementing MIS in an organisation. They are

i. Focus on key management and accountability needs

ii. Think of MIS as a process that integrates decision making, planning and implementation, not a series of disconnected activities

iii. Introduce MIS in a gradual fashion stating from a small and simple scale

iv. Plan an MIS system that fits the organisation's resources and needs.

v. Recognise the need for using bottom-up approach and top-down approach in the relevant context

vi. Use simple, practical methods to minimise time, cost and paper work

vii. Provide information on a timely basis for decision making

viii. Summarise the MIS results for managers and present options for action and

ix. Assign responsibilities for implementing MIS and for follow-up action

MIS is an evolving concept (Jayashankar 1991). It can make use of manual procedures or computers. The advantages of computers are used in handling the voluminous data and data processing. Lenselink and Jurriens (1993) report that the degree of acceptance of a particular software and ultimately its usefulness are conditioned by factors such as user-friendliness, flexibility, cost and availability of the tool for normal user groups.
3.3 MIS IN IRRIGATION SYSTEM MANAGEMENT

3.3.1 Need for MIS in Irrigation System Management

A considerable amount of work has been undertaken in recent years on the area of improving irrigation system performance. Improvement in performance of irrigation systems does not come easily or automatically. It requires a set of preconditions that must be in place to guarantee lasting and sustainable improvements. Among these are the identification of clear management objectives and associated operational targets, a system for monitoring actual field conditions, a procedure for processing, storing and retrieval of useful information on performance levels, and a management system that allows these performance data to be used in a program of improvement over a period of several years.

MIS is a basic tool used for monitoring of irrigation projects. MIS establishes formalised procedures to provide managers at various levels with appropriate information from all relevant sources to enable them to take timely and effective decisions for planning, controlling, directing and subsequently upgrading the operational plans (World Bank 1987).

The need for introducing MIS in day-to-day operations and management of irrigation systems has been reported by many authors (Wickham and Rao 1986; Bird 1991; Rey et al 1994 and Jain 1995). Nijman (1993) identifies and recommends MIS as one of the management conditions essential to improve the system performance based on his research study on the managerial perspective of performance of the irrigation sector.

MIS does not just deal with collecting information from different sources. It rather generates information and provokes thinking that will help to improve the working of irrigation systems. It involves sustained analysis of information and keeping watch on the changes that take place in the components of the system. It also helps in verifying whether
assumptions made and parameters adopted in formulation of the operational plan for the system are realised during actual operation and if any modifications are necessary to improve the system performance. The main objective is to **refine and improve** the system operation plans year after year. It ensures that the implementation of operational plan is carried out effectively and efficiently.

MIS has to be designed keeping in view the management objectives, targets and critical activities to obtain its full effectiveness and efficiency.

### 3.3.2 Purpose of MIS in System Operation and Management

* Collecting data from different observation places or points
* Communication of data to a central place for data storage
* Storage and retrieval of data in a structured manner, whenever required
* Processing of the data and providing different types of timely reports for decision making during planning, implementation and evaluation of the operational plan.

The management information which scheme managers need concern:

* Planning information to prepare operation plans for the coming season and year based on past experience and information
* Implementation and monitoring information to supervise and guide operation towards achieving the planned targets
* Review and Evaluation information to prepare O & M completion reports at the end of the season and year.
3.3.3 Review of Literature on MIS Applications in Irrigation Systems

International Irrigation Management Institute (IIMI) has done a pioneering work on MIS applications in irrigation system management. IIMI in collaboration with Irrigation Department of Sri Lanka and CEMAGREF of France has developed a software called Irrigation Management Information system (IMIS). This software essentially supports the canal operation tasks at the main canal level. This software is pilot tested at the Right Bank Main canal of the Krindi Oya Project in Sri Lanka.

IMIS consists of a canal hydraulic simulation model developed in association with CEMAGREF at France, supplemented with site specific modules, dealing with the distinct hydraulic and managerial characteristics of the system. (Baume et al 1993). Intervention of the IMIS in Krindi Oya System has provided the scope for improving the water delivery performance (Rey et al 1993). This sophisticated tool requires extensive data on canal structures, topography and frequent data on hydraulic trajectories at the structures like water levels and openings of the sluices. This requires a very good communication and other infrastructure facilities and physical system conditions, which are often a problem in many of the irrigation systems.

The same IMIS package with a fewer modifications, has been introduced at the main canal level in Fordwah Canal System (Chistian Subdivision) in Punjab, Pakistan (Riviere 1993). This study is useful to understand some of the difficulties faced by the research team during the field implementation of the tool.

IIMI in collaboration with Gujarat State Irrigation Department and Water And Land Management Institute (WALMI) at Anand in India has developed a computerised MIS named "Mahi MIS" for the Mahi Kadana
Irrigation Project in Gujarat (Murray-Rust et al 1994). This project has a command area of about 2,12,000 ha. The implementation of this MIS has been taken up in one of the subdivisions in this project and is likely to be extended to the entire system. A well designed data processing and database system facilitates the storage and retrieval of information. This MIS package uses two performance indicators, namely, area irrigated per day-cusec and number of wettings per season are not very specific to indicate the water delivery system performance and they are not helpful to make a comparison of the quality of services rendered by the staff at different parts of the command.

Irrigation Network Control and Analysis (INCA) is an irrigation management software developed by overseas Development Unit (ODU) of HR Wallingford in the United Kingdom. INCA can be used for computing water requirements, preparing cropping patterns, making irrigation schedules, setting target flows at control points and process field monitoring data with graphical display. The software requires a 486 PC with 8 Mb RAM, a 300 Mb hard disk and MS-WINDOWS 3.1 and costs approximately 3000 sterling pounds (ODU 1994). The hardware requirements and the price of the INCA place it outside the normal target group (Lenselink and Jurriens 1992).

Sagardoy (1991) and Sheng and Molden (1993) have developed computerised management information systems for irrigation. Jain (1995) has presented the possibilities for introducing computerised information system in Irrigation Departments for various activities such as construction of projects, operation and management of canals and tube wells and financial management. Only limited information are available on the MIS developed by authors other than IIMI's works.

Some of the MIS in use (Murray-Rust et al 1994 and Jain 1995) deal with computerisation of the available information and do not provide systematic analysis of the information for managerial decision making. Some of the MIS make use of sophisticated software and database dealing
with canal operation and water distribution at the main canal level (Riviere 1993 and Rey et al 1994). Hence, this study makes an attempt to develop an MIS for operation and management of the irrigation system in developing countries so that new technology coupled with better management will be available at lower costs.

3.4 MIS APPLICATIONS IN PRIVATE AND PUBLIC ORGANISATIONS

MIS is widely used in the business sector for a long time. Potential of this tool has provided its entry and use in other private and public organisations. Many of the construction companies use MIS for efficient use of the resources like material, labour and the finance in their day-to-day schedule activities. Srikanth (1995) has developed an information system for management of small and medium scale construction companies.

The public organisations are in the process of building up MIS. Indian Institute of Public Administration at New Delhi, in collaboration with urban planning agencies at New Delhi and Bombay has devised MIS for planning and management on a sample basis (Patkar 1985). MIS is used in areas such as house planning, water supply and distribution system and also in land use management (Singh 1985). Tamil Nadu Slum Clearance Board (TNSCB) has devised an MIS for planning, execution activities as well as for financial accounting. Many Government Organisations like Statistical Department and Agriculture Department are in the process of using the information system, if not in the form of MIS (TNSCB 1987). Perceptions of the end-users on MIS applications in the public organisations indicate that the speed and quality of decision making, working culture and the managerial style of the organisations have improved after the use of MIS (Singla 1992).

The above experiences show that MIS has potential and scope for improving the efficiency and the effectiveness of the organisations.