UNIT 2 CONCEPTUAL FOUNDATIONS OF INFORMATION SYSTEM

Objectives

After going through this unit, you should be able to :

- appreciate the significance of information systems in an organisation
- * understand the information subsystems which could be defined within a typical organisation
- differentiate between various types and levels of information systems.

Structure

- 2.1 Introduction
- 2.2 Information systems.
- 2.3 Types of Information
- 2.4 Organisation as an Information Processing unit
- 2.5 Organisational Functional Subsystems
- 2.6 Activity Subsystems
- 2.7 MIS and Data Processing
- 2.8 Operating Elements of Information System
- 2.9 MIS and Top Management
- 2.10 Structure of Information Systems
- 2.11 Types of Information systems
- 2.12 Evaluation of Management Information System
- 2.13 Summary
- 2.14 Self-assessment Exercises
- 2.15 Further Readings

2.1 INTRODUCTION

Information has been recognised has one of the crucial corporate resources which facilitates better utilisation of other important resources such as men, machines, materials, money and methods. Managers have come to realise that without proper information - at the right time and at the right place - even the other resources may not be fully utilised. And a fully informed manager is in a position to take better decisions as compared to an uniformed one.

It was way back in 1957 that the organisations in the United States passed from the industrial era to the infomation era. It was in that year that the number of employees who were primarily handling infomation surpassed the number of industrial workers; and this number of information workers kept on increasing during the 1970s also.

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To understand the use of information system, we should define the following concepts in detail. The present unit discusses various conceptual foundations related to information systems.

2.2 INFORMATION SYSTEMS

A management information system has been defined by Davis & Olson as "an integrated user-machine system designed for providing information to support operational control, management control and decision making functions in an organisaiton. The information systems make use of resources such as hardware, software, men, procedures as well as supplies." As the above given definition indicates, the information systems are meant for supplying, and not generating, the information to various managers involved in the decision making process. The imformation systems are expected to provide processed information to the decision makers at various management levels in different functional areas throughout the organisation. To understand the management information systems, it is possible to define it into three constituent components.

Management : Management has been defined as a process, a function, a profession dealing with the activity of getting the work done with and through people. The various functions of managers include directing, controlling, staffing, leading and motivating.

Information : Information could be defined as sets of facts, figures and symbols processed for the current decision making situation. The information is considered to be of significance in a particular situation.

System : A system is defined as a set of related components, activities, processes, and human beings interacting together so as to accomplish some common objective.

Putting all these three components together, it could be seen that Management Information Systems are sets of related processes, activities, individuals or entities. interacting together to provide processed data to the individual managers at various levels in different functional areas.

While defining the Management Information Systems, the following characteristics should be kept in mind:

- a) The management Information Systems are primarily meant for providing information from the data after processing them. The information systems do not generate data. The data is generated, collected, recorded, stored, processed and retrieved after it has been generated by business operations in an organisation. The information systems follow the procedures designed for processing this data which has been generated within the organisation.
- b) The information systems are designed for the job positions rather than for individuals. Regardless of who is the individual holding the job position, the information systems are designed keeping in mind the job responsibilities that the individual in supposed to perform and depends upon the information needs of the individual in the organisational hierarchy.
- c) The information systems are designed for different levels of management they are supposed to cater to the information needs of dicision makers at top, middle and junior levels of management.
- d) The information systems are designed for supplying information to managers in different functional areas. The information is supplied to managers in the areas of marketing, finance, production, personnel, materials, logistics, etc.
- e) The information systems should be integrated by way of database's. The redundancy in storage of data, processing of data and generation of reports is avoided by way of integration of information systems.

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Single point data entry and updation of master data files should be ensured to minimise chances of discrepancies in the data integrity.

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f) The information systems are facilitated with electronic equipments such as computers.

2.3 TYPES OF INFORMATION

Broadly, information can be divided into two different types - internal information and external information. Figure 2.1 shows the scope of internal and external informations in the context of business organisations.

Internal Information : The Internal Information can be defined as the information which has been generated from the operations of the organisation at various management levels in the various functional areas. The internal information gets summarised and processed as it goes from juniormost to the topmost levels of management. The internal information always pertains to the various operational units of the organisations. Examples of Internal Information would be production figures, sales figures, information on personnel, accounts, materials, etc. This type of information is usually consumed by middle and junior levels of management. However, summarised internal information is also consumed by top level of management.



Figure 2.1: Internal & External Information

External Information : The external information is usually collected from the environment of the business organisation. External information is considered to be affecting the organisational performance from outside the organisation. Information such as government policies, competition, economic status and international market is considered to be external information. The external information is usually required by the top management cadres and is helpful in shaping the long term policy plans for the organisations.

2.4. ORGANISATION AS AN INFORMATION PROCESSING UNIT

The information gets processed within an organisation as it travels from clerical level to the top levels of management. Figure 2.2 shows how the information gets processed within an organisation. It could be seen from the figure that the data is collected from units like customers, internal operations, competition and external data on economy and market, etc. The collected data is processed so as to generate the outputs usually in the form of information reports. This output is information and leads to managerial action. The processed information is also disseminated to the members of the organisation, public at large, stockholders as well as government and

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egulatory agencies. It could also be seen from the figure that infomation is the only linking thread between the external environment and the internal members of the organisation.



Figure 2.2: Information Processing in an Organization

MIS and Organisation

The various subsystems of any information system could be better understood by looking at it from the organisation's point of view. The two approaches used to define the subsystems of an MIS are (1) Organisational functional subsystems and (2) Activity subsystems.

2.5 ORGANISATIONAL FUNCTIONAL SUBSYSTEMS

Figure 2.3 clearly shows the various functional areas which could be separated from the MIS point of view. The major subsystems and the typical reports generated within each functional area are given as under;

Functional subsystems		Some Typical Reports
Marketing		Sales Forecasting Report, Sales planning Reports, Customer and Sales Analysis Report
Production		Production planning and Machine Loading Report, Cost Analysis & Control Reports, Quality Control Report.
Materials		Goods on Order Report, Vendor Analysis Report, Inventory Control Report, Physical Inventory Report, ABC/XYZ Analysis Reports.
Personnel	- 	Personnel Information Reports, Performance Appraisal Reports, Tranining & leave Records
Finance & Accounting		General Accounting Reports, Payroll Accounting Reports, Bonus & IT Reports, Financial Analysis Reports, Cost Analysis Reports, Cash Flow Statements



Figure 2.3 : Various Subsystems of MIS

The various functional areas are integrated through the common database which is an integral part of the information system in an organisation. The processed data from marketing function is stored in the database and whenever it is required, it is fed over to the production. Figure 2.4 shows the marketing subsystem and its interaction with other subsystems through the database.



Figure 2.4: Marketing Subsystems (Information System)

The information subsystems could also be understood by looking at the subsystem from activity point of view. In each functional area, the processing activity could be done at four different levels. These levels are handled by different levels of manpower looked after by the clerical operating personnel, whereas the operational control activity is the responsibility of junior levels of management. The management control and strategic planning functions are direct responsibilities of middle and top levels of management respectively. The following table shows the typical user profile for these activity subsystems:

Activity Subsystem	Typical Users
Transaction processing	Clerical Staff
Operational control	Junior Levels Managers
Management control	Middle level Managers
Strategic planning	Top Level Managers

2.7 MIS AND DATA PROCESSING

MIS can be differentiated from data processing from the users point of view. Historically the data processing was the first subsystem to be used in business organisations. It is recently that the data processing is being treated as a lower level activity as compared to MIS. Data processing is basically aimed at processing of transactions generated from day-to-day operations within an organisation; whereas MIS aims at supplying information from the processed data to various cadres of management to support their decision making process. The use of computers for processing of data actually started with data processing; MIS has evolved only recently within the organisations. Data processing could be further divided into four different streams as given below:

a) Office Automation System (OAS)

The Office Automation Systems are those activities and processes which are undertaken on the computer to perform the office routines such as routine correspondence, scheduling, appointments, calendar functions, bulk mail, word processing, etc. However, it may be noted, that OAS does not lead to generation of data directly. These systems are designed following basic principles of Office Management.

b) Transaction Processing System (TPS)

The transactions which get generated on a day-to-day basis in an organisation are collected, stored and sed for updating master data files so as to change the current status of organisational entities within an organisation. Transaction Processing Systems are primarily aimed at updating the history files, generation of detailed t ansaction reports, and preparing summarised processed transaction data. Examples of Transaction processing Systems are sales accounting systems, financial accounting systems, personnel accounting systems, etc, All these systems are disigned following the basic priciciples of accounting.

c) Management Information Systems (MIS)

These systems are designed for providing information to the key functionaries in an organisation. These systems make use of the already processed transaction data which is outputted form TPS and generate information reports after processing data. The examples of this kind fo systems could be personnel information systems, marketing information systems, sales information systems, production and operations systems, etc. These systems are designed following the prociples of organisational theory. The major group of users for this kind of systems are the middle levels of management.

d) Decision Suport System (DSS)

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DSS are the highest order of sytems among the computer based information systems. These systems make use of the summarised organisational data as well as external data collected from the environment of the organisation. the internal data is mostly used for studying the trends where as external data is mostly used for understanding the environment. These systems also make use of analytical and planning models such as management science and operations research models. These systems are mostly used for assisting the top management in taking unstructured and semi-structured decisions having long-term impact to the organisational performance.

2.8 OPERATING ELEMENTS OF INFORAMTION SYSTEMS

Any information system will make use of the following physical components :

- a) Hardware : The equipment and devices for inputting, outputting, secondary storage, processing as well as communications in the system.
- b) Software : The set of programmes to facilitate processing procedures; it includes systems software, a pplications software and the model base.
- c) Data Base : The organisational data to be used by various software programmes is usually stored in the form of files and database on the physical storage media such as computer tapes, disc drives, floppy diskettes.
- d) Procedures : The operating procedures documented in the form of physical manuals constitute an important part of MIS components. These documents could be divided into three major types: Operating Manuals, User Manuals and Systems Manuals.
- e) Operating Personnel: The manpower operating these information systems include systems managers, systems analysts, data administrators, programmers, data entry and computer operators.

Processing Functions

The major processing functions in information systems include the following:

- a) Processing of business transactions : To capture, collect, record, store and process the events of business interest, so that their effect should be carried over to the organisational performance records.
- b) Updation of maste files : The effect of these transactions is carried over to the status files of the organisational performance. Master files at any given time shall reflect the status of any entity after having incorporated the impact of up-to-moment transactions.
- c) Generations of information reprots : After having processed the transactions and updation of master files, the information reports are generated so as to assist the managers in their decision making.
- d) Processing of interactive enquiries : On-line information processing systems provide the facility of responding to the business queries raised by the managers on the data files-both master as well as transaction files.
- e) Providing interactive analytical support: The key decision makers not only need to interact with the data files for extracting data, with the help of scientific and planning models, they also require on-line processing support to analyse, the impact of some possible actions. When the system is able to extract data from relevant files and address this to the models chosen by the user, this leads to a Decision Support System.

2.9 MIS AND TOP MANAGEMENT

In order to relate the information systems to the corporate strategy in an organisation, it becomes important that the top management should take keen interest in the development and implementation of information systems. More often than not it has been found that the top management does not take keen interst in the development of structured, formalized and public information systems. The key managers normally tend to depend upon their informally designed private information systems. It is necrosary that, for successful implementation of information systems in an organisation, a corporate plan should be prepared covering should include a mechanism for implementation, proposed organisational structure and changes over a period of time, applications to be computerised, issues relating to operations management, procurement of equipments and training of staff and effective control of information system function. Figure 2.5 shows the information systems strategic grid suggested by McFarlan and McKenney. This grid arrays a firm's existing applications against the applications which are currently under development.

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Figure 2.5: Information Systems Strategic Grid

It could be noted that the companies belonging to the *strategic cell* need to look after their processing activity more carefully whereas in *turnaround cell* the companies. might be able to convert their processing function as a major competitive weapon. In the factory setting, there is not much to plan, yet the existing applications should be continued. In *support cell*, processing is not at all critical to the success of the organisation. The top management involvement varies from critical in strategic cell to just negligible in support cell.

2.10 STRUCTURE OF INFORMATION SYSTEMS

The MIS structure could be discussed in terms of support for decision making, management activity and organizational functions. A conceptual framework would show the synthesis of these three approaches into an MIS structure. The structure could be understood by looking at the conceptual structure and physical structure.

The Conceptual Structure

The conceptual structure could be defined as an integrated system of functional subsystems each one of which could be divided into four different information processing components (1) transaction processing system (2) operational control information system, (3) managerial control information system and (4) strategic planning information system. Each of the functional subsystems in the organisation will have unique data files required for a particular subsystem, as well as each of the subsystems will also make use of general database files which can be accessed by more than one subsystem. The concept of database, which is common to more than one functional area is called a general database and is managed with the help of a database management system. A micro view of the MIS structure would also show the presence of the software programmes in addition to the specific programmes which are developed for each functional area : The MIS also makes use of a model base primarily meant for MIS reporting and decision support systems. The model base and common application software is common to a range of applications within and across the functional areas. Figure 2.6 shows the conceptual structure of and information system for a function. When application software for top management, middle management, junior management and clerical functions are put together, along with the common application software, it becomes a complete conceptual structure of an information system.



Figure 2.6: Conceptual Structure for a Functional Subsystem

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The Physical Structure

It is quiet similar to the conceptual structure except that there is lot of integrated processing and it makes use of common modular software. The integration of information systems takes place through database which is normally a common database. The various subsystems and different functions interact with each other through the database. The outputs of one subsystem are stored in the common database which are subsequently used by the next subsystem as inputs. This is how the integration of information processing activity takes place across the various subsystems. To reduce duplication of efforts for development and maintenance of software as the common modules of application software are also used across the various functional areas. These modules cross the functional boundaries and are useful in more than one functions. These modules are either inserted into the system or called in by the system.

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2.11 TYPES OF INFORMATION SYSTEMS

The information systems usually belong two different types i.e. structured and unstructured information systems. Formalization and publicisation of information leads to structuredness in information processing activity; whereas absence of these two leads to unstructuredness of information systems. Figure 2.7 shows the various information system components in an organisation. It could be seen from the figure that public information systems are designed to provide the organisational information to the authorized persons in the organisation. Private systems, on the contrary, are designed to limit the availability of the information to the select individuals. Normally, the private information systems are meant for supplementing or duplicating the efforts of public information systems. The public information systems are characterised by the presence or formal documents and records whereas the information systems may or may not have any recording or predesigned process of retrieval.





The information systems could also be characterised as formal and informal. Formal information systems are those which follow the hierarchical structure of the organisation. The information system where all those who are using information are authorized to use it and are also responsible for dissemination of specific information is called formal information system. Whereas information systems where unauthorized people pass on the public or private information from one level to another level are called informal systems. In informal systems, the user as well as sender may or may not be authorized users. It could be seen that when the information systems are formalized and they are developed for handling of public information, they become more and more structured with predefined frequency, content, source and objective; whereas absence of predefined frequency, content, source as well as justification leads to unstructured information systems. With computerisation of information systems, more and more structuredness is achieved and the information system components are affected as shown in Figure 2.8



Figure 2.8: Impact of Computerization on MIS Components

2.12 EVALUATION OF MANAGEMENT INFORMATION SYSTEM

Introduction

Computerised Information systems are developed and utilized by two categories of organisations: (a) firms which have the in -house capability and (b) service-bureaus which develop them for use by the outside clients. In both cases, the basic investments are of a high order in terms of not merely the computer system, but also site preparation involving air-conditioning, civil and electrical works followed by recruitment of manpower (computer-center manager, system analysts, programmers and operators, besides input/output, quality control, data preparations and other support staff) and their training. There can be only one objective behind making such sizeable investments and that is to provide satisfaction to the end-user, in-house or outside.

System Cost

Design, development and implementation of computerised information systems are done deeping the above aim in view. In most cost-conscious organizations, an initial estimate is prepared for the one-time cost of developing the system. and the recurring costs of running the system. The cost estimation has to cover such details as: routine manpower(systems, programming operations and, for service-bureau, marketing staff); manual manpower (specially employed to handle production, quality control, correction of checklists etc); data preparation (direct entry or punch entry or punch-card kind, whether done in-house or by outside agencies), consumable stores (stationery, cards or floppy disc, carbon, ribbons, etc.); computer time (actual usage hours, often logged by the computer itself); administrative expenses; logistic expenses (for conveyance of manpower, transportation of documents or output reports, etc); and miscellaneous expenses (overtime, etc.).

For a service bureau a fair basis to know if the computer is paying for itself in terms of the cost-estimate for usage per hour can be the cost of a computerised system is chargeable to the outside client and the latter's acceptance of the billed money (without asking for cancellation of billed computer time, etc.) can be a good yardstick to know if the client has turned out to be satisfied or not.

Need for Evaluation.

Whether or not service-bureaus face their irate customers, or user-organisations meet their dissatisfied departmental heads, a sound principle to run computerised information , systems is to introduce, side by side, a reliable procedure for management of hardware, software and data preparation. Such practices as regular and time-bound spares and components do help hardware management. Attention to programming capability, scientific design and development of systems and a high-quality support for system software is invaluable for software management. Data preparation is a weak link in most organisations and quality control of entered data is a must, among other factors.

An actual evaluation plan has to begin from the stage when one knows what has been spent on a computerised information system (through first estimation and later assessing the actual cost on a monthly basis as outlined above), and then proceed to find out if there has been value for money spent. Such as evaluation is certainly not easy and can be approached in a two-fold manner: from the process side of system evaluation and from the product side of output reports.

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Process Evaluation

A process evaluation is carried out from the computer professional's point of view. Design the system and the quality of programming have to stand the rigours of careful assessment. Quite often the system design is presented by the project leader to the entire application software group and gains from their friendly criticism. Programming standards are today quite high and a modular approach is far preferable to single integrated programmes. Internal or external training in efficient program-writing techniques can achieve surprisingly good results.

Another aspect of process evaluation is the utilisation of hardware resources. In all computers capable of running multiple programs, there should be adequate prior consideration to arrive at different memory partitions and to allocate input-output devices in a judicious way to each partition. The allocation of certain tapes or discs to production or development jobs often helps in obtaining an efficient and steady mix of jobs. The test for evaluation is to ensure optimal system utilisation, with the least possible idleness of any single device.

The third aspect of process evaluation is to check whether there is mininum wastage of computer-time. It may happen that well-designed systems with good quality programs are running with an apparently maximum use of hardware resources, and still they may hide many wasteful runs. This arises due to two reasons associated with development and production stages of the information system. At the development stage, lack of rigorous quality control may allow many avoidable runs of the programs. At the production stage, lack of full-scale debugging may make some programs prone to repeated runs. In fact, the best relevant check is to lay down permissible number of developmental runs and ensure fitness of the programs for release for production runs without wasting system resources.

Product Evaluation

The product evaluation is concerned with the end-user and has to ensure that the output reports (which were developed to generate the information system in the first place) are of acceptable quality and continue to be of use. Instances are not rare that computer outputs, which have long fallen out of use, are not pointed out as such by user-managers out of deference to the higher-level policy of computerisation, while the managers continue to use their little pocket –books containing relevant data. To avoid such a possibility, organisations having a fairly long tradition of computer-based information systems should, once in a while, take stock of the existing mechanisation.

One way this was done at Tata Steel sometime back was to devise a questionnaire for each userdepartment, outlining the group of computer applications for them. General questions related to the usefulness, quality level and achievement of promised improvement, and responses were sought on a three-tier basis. Specific questions were also framed regarding the reported items of information, frequency of reports, nature of formats and reporting levels. The purpose of the questionnaire was to elicit frank response from the user-managers on the utility of the prevailing computerised information systems.

The replies received were then tabulated and put up to the higher management for evaluation of each computerised system from three angles: should the system be continued as such? Or, should the system be curtailed or even replaced altogether by other more useful system? Or, should the system be modified to cover more ground so that its utility is enhanced?

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The results of such an introspection are not always as per expectations, as managers do not feel comfortable to answer such questions, or, the questions themselves are not formulated clearly or followed up persuasively. These considerations, however, do not belittle their usefulness. In another forum provided by the public sector enterprise Hindustan Zinc, the general feeling was that a three-year interval from the time of introducing large-scale computer-based information systems could be about right to raise such searching questions and to seek answers about the utility of the computerised systems.

Conclusion

In any scheme of evaluation, pertinent attention needs to be paid to data integrity. It should be kept in mind that capture of data from input documents and the transition through more than one medium (say, cards and tapes) are error – prone. How good an information system is, quite often depends on how "clean" the data is. Computer-based validation techniques for accuracy, completeness, consistency, logical balance and homogeneity of data are well-proven and are an essential step to negate a garbage-in, garbage-out situation. The number of errors brought out in the checklist during the editing stage of data (i.e., prior to running the main processing job) is quite often a measure of the dependability of the basic data. Process evaluation and product evaluation have both to follow considerations of data integrity for any information system.

2.13 SUMMARY

The unit defines the information system as an organisational system designed for the purpose of providing information to various managers in different functional areas so as to assist them in decision making. The internal information, which is mainly generated from the operations of the organisation, is consumed by lower level managers. Summarised internal and environmental information is used by the senior managers for long-term perspective planning. The organisational information systems could be studied by looking at these from the functional view point as well as from the managerial activity level. The top management interest for positioning of information processing activity has been considered important for proper use of the information resources. The information systems in an organisation vary from totally structured to totally unstructured systems. However, they necessarily consist of physical components such as hardware, software, manuals and men.

2.14 SELF-ASSESSMENT EXERCISES

- 1) What is the role played by business information in an organisation?
- 2) Define Management Information System and discuss various characteristics expected of a good MIS.
- 3) "Internal information is used for day-to-day decision making whereas external information is crucial for long-term planning." Comment.
- "The way organisations cannot exist without MIS, even information does not exist without organisation." Discuss.
- 5) What are the typical functional information subsystems in an organisation?
- 6) Differentiate between physical structure and the conceptual structure of information systems.
- 7) What is the impact of computerisation of the structuredness of MIS?

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2.15 FURTHER READINGS

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