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A BRIEF NOTE ON THE DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEMS (MIS)[1/]

(Proposed Conceptual Framework and Procedure)

presented by
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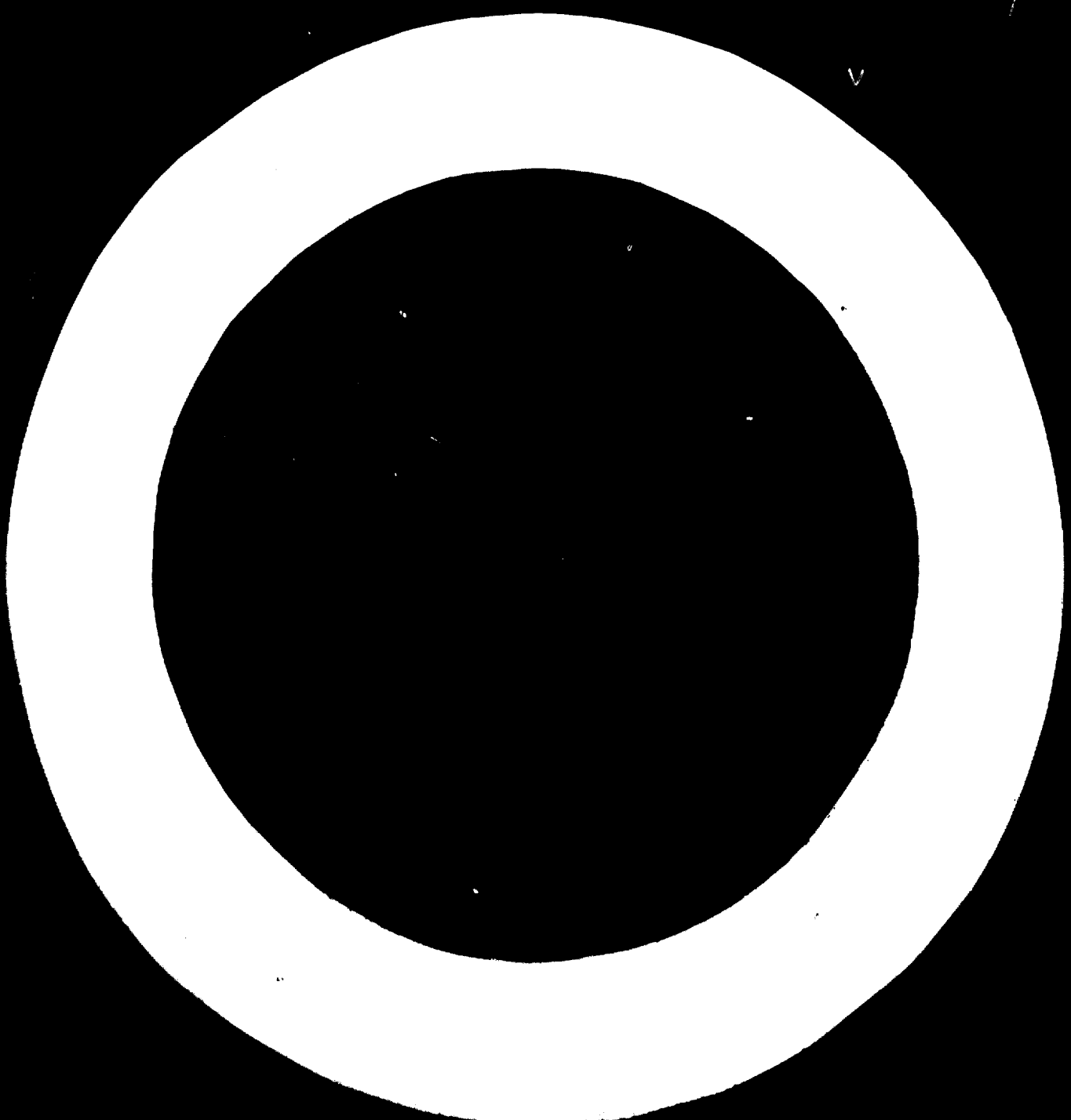

TABLE OF CONTENTS

A BRIEF NOTE ON THE DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEMS (MIS)

An MIS aims at providing information required for decision-making at the various levels of the organizational hierarchy. The term "Management" does not essentially mean industrial management, it implies the management of the activities of the organization or agency, which is intending to develop such a system, which could be a ministry of industry, an industrial development corporation, an industrial development bank, an industrial enterprise or establishment, or even a part of an establishment, ... etc.

I. INTRODUCTION

Developing countries have recently recognized the importance of MIS's and the benefits that can accrue from them in the undertaking of the various activities of industrial development; planning, implementation, operation, control and post-audit. However, despite the very many talks and discussions which have taken place and the many documents written on MIS, during the last few years, it is rare for a total management information system to be established and satisfactory management information subsystems[1] have come into being in a few organizations. This can be attributed to a number of factors. Foremost may be the following:

1/ An organisation-wide or total management information system covering all information flows as well as data processing needed should be looked at as an integration or aggregation of a number of management information systems of limited scope which may be called subsystems. A management information subsystem, therefore, concerns one area of activity of the organization. For illustration, an organization may have a Project Planning and Control Information Subsystem, a Research and Development Information Subsystem, a Financial Information Subsystem, a Personnel Information Subsystem and the like. Each of these subsystems are used to plan, implement and control one particular area of activity.

1. The term MIS has been frequently used to mean different things to different people.

2. There is so far no formal procedure or methodology for establishing an MIS.

3. The fact that many organizations or bodies have a rather restriotive look at an MIS as a procedure whereby management or decision-makers can utilize advanced computer technology. This is why the term MIS has been, in some situations, geared to the application of third-generation computers and following this trend MIS would soon be related to fourth-generation computers expected to be available on the market by 1970/71.

II. OBJECTIVE OF THE NOTE

Being aware of the pressing need of developing countries for the establishment of management information systems and the importance of UNIDO's assistance in this field this note aims at outlining a workable conceptual framework and procedure for the development of management information systems in the environment of the developing countries. This has been done with the hope of enabling UNIDO to avoid most of the confusion in this respect and to reorganize and intensify its present and future work in this important area of activity. In doing so, the note discusses the major components of the MIS as well as the main steps to be considered in developing such a system. It should be noted that a more detailed paper on the subject is being prepared.

III. METHODOLOGY USED IN THIS NOTE

The methodology used in this note is known as "systems analysis". Systems analysis denotes a general approach of analysis which can be used in a variety of situations in various areas of activities at both the macro and micro levels. Systems analysis may be defined as an approach for helping the decision-maker (or an organization) in selecting a course of action. This would be done by systematically studying his goals and the different alternatives as well as their present and future consequences not only in relation to his particular domain but also with respect to the whole, where his domain is one

part of it, taking into account all factors that bear on the particular situation or problem at hand. In fact the term "systems analysis" has been used to indicate several groups of activities. A prominent group is that which is related to the analysis required for decision-making (strategic, tactical and operational) at the various organizational levels and the analysis of the information flows between these levels and the data processing facilities (systems) required.

IV. PROCEDURE FOR THE DEVELOPMENT OF AN MIS

An MIS comprises the following main components:

- Information flows (the reporting system(s))
- Data base or bank
- Data processing system

Each component will be considered as the proposed procedure for the development of the MIS.

In establishing an MIS in an organization the following steps are recommended:

1. Approval of higher executives on MIS

The higher executives in the organization should be made acquainted with the MIS. Therefore it is necessary for the system analyst(s) to explain to them the objectives of the MIS, the benefits that will accrue from it and the work and effort that is needed to develop the system. This would eventually create enquiries and some suggestions to be made by them and will then be followed by their approval on the MIS as well as the definition of its scope.

2. The development of the MIS

The design and implementation of the MIS is to be carried out according to a prepared (time-phased) plan of action after the higher executives give their approval on its details: detailed definition of objectives to be met by the MIS and the activities to be undertaken for this purpose, together with their time estimates and resource requirements. This plan comprises the four following stages:

(a) Determination of Information Flows (Reporting System(s))

Determination of information flows constitutes the design of the reporting system(s) that will be used for monitoring and control. In developing countries information needs in an organization are mostly ill-defined. This stage, therefore, should constitute a great portion of the development plan of the MIS, for if information needs are not well defined and if the reporting system is not identified with the requirements of the organization, further efforts in designing and establishing the other components of the MIS will be of little benefit to the organization. This point therefore will be discussed in some depth below.

For determining the information flows, defining the information needs at the various hierarchical levels in the organization concerned, is a prerequisite. This essentially requires the study of the organizational structure (system); its different levels as well as the various components (departments, sections, ... etc.) at each level as well as the interrelationships among them and the functions of each. For this purpose a conceptual framework of the organization is to be worked out according to the strategic, tactical and operational nature of the decision-making process which corresponds to the hierarchical levels in the organisation, with the strategic level at the top and the operational level at the bottom.[1/] The idea here is to abstract the real situation and achieve an organizational breakdown into manageable organizational units which, in turn, would eventually be further subdivided into still smaller units, the size of each is practically small to contain one or a few types of information needed, known as "input", and a small number

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1/ In addition there are other bodies and agencies, other than the organisation at hand, for which the MIS is to be developed, who are interested in one or some portion of the activities of the organization or have some authority on it, and thus require certain information for their own decision-making processes. Therefore, the information requirements of such agencies should also be considered.

of well defined techniques used to work on the "input" to produce the information "output".

The decision-making process needs both information and techniques for decision-making, such as operation research techniques. Since the needs for information vary with the technique(s) applied, an important factor to be considered here is, therefore, the techniques used in decision-making at the various organization levels. An example would clarify this point.

For strategic decision-making both simulation techniques (descriptive models) as well as optimization techniques (such as investment models) are used. Information needs of the former vary from those of the latter. For tactical decision-making, as for example in programming and scheduling project implementation, both bar (or Gantt) charts as well as network analysis techniques are used. Again information needs of the former are, for a great part, different in type and degree of detail from those of the latter.

In an organization both information and decision-making techniques are part of the software available to the organisation. However, in most cases, as far as MIS is concerned, information rather than these techniques, is the one considered as a part of the MIS. The techniques belong to the fields of operations research and management science. It is, therefore, worthwhile to discuss briefly the relationship between MIS and both operations research and management science.

The Relationship between MIS and Operations Research and Management Science is characterized in the following. As previously mentioned in developing an MIS the decision-making techniques should be considered in order to determine the information flows, since information requirements vary according to the technique(s) used. All too often the processes of decision-making in developing countries are unsatisfactory. This is attributable to two main factors:

(i) The decision-making processes are unstructured and not well set up; and/or

(ii) Information needed is inadequate.

If the analysis shows that case (i) is valid, some work in Operations Research and Management Science is a prerequisite for the establishment of the MIS. This essentially attempts to:

(i) set up the decision-making processes more clearly, introduce more effective techniques and put them in a well defined form. The selected techniques and their degree of sophistication should be appropriate to the conditions prevailing in the country and the environment of the organization (lack of qualified personnel, inadequate information, ... etc.) at hand.

(ii) upgrade, through the selected techniques, the types of information used so that better application of decision-making techniques with higher degrees of sophistication can be made possible in the near future.

This will definitely assist in establishing the MIS on a more effective basis and ensuring its successful operation.

In designing the reporting system in an organisation, a balance should be drawn between cost and value of information. Value of information is related to:

(i) the necessary type(s) of information needed to make specific decisions, its coverage and level of detail,

(ii) reliability of information,

(iii) cost of accessibility to information,

(iv) the time length of the control cycle (the cycle of reporting and period revision) which comprises acquiring necessary information and transmitting it to the right person to be able to exercise a "real time", in other words, in-time control: taking corrective measures and implementing them to attain the correction needed. In the course of time, conditions change and hence deviation from a plan or programme. "Real-time"

or in-time control involves in general the detection of a deviation from the plan (for carrying out or implementing some activities), the feed-back of information, the taking of corrective measures, and the implementation of these measures in-time so that it is again possible to meet the prestated goals and objectives, i.e. to go back to the plan. This is clearly different from a case where such deviation is to be allowed to develop to the extent that no corrective measure(s) can make it possible to go back to the plan and hence modification of goals and strategies are inevitable. "Real-time" implies, therefore, that the control cycle be of an appropriate length. The time length is dependable on the organizational level concerned and the type of activity. For industry activities this could be a matter of a day, a week, a month or a three month period according to the organizational level in question, compared with other activities where the control cycle should be completed in minutes or hours.

The control cycle could be illustrated as in Figure 1. The control cycle consists of five main steps:-

1. Detection of deviation (based on appraisal of performance).
2. Feed-back of information.
3. Taking of corrective measure(s).
4. Implementation of corrective measure(s).
5. Improvement of the situation and return back to normal.

These figures suggest at least the following:

(i) With any delay in performing any of the steps mentioned above, deviation will grow beyond the limit that is taken as a standard for a given type of activity.

(ii) MIS assists in shortening the cycle by shortening each of its steps.

The aforementioned has discussed the activities to be carried out in order to determine the information flows in an organisation. It is recommended that these activities be undertaken in the context of the following practical procedure:-

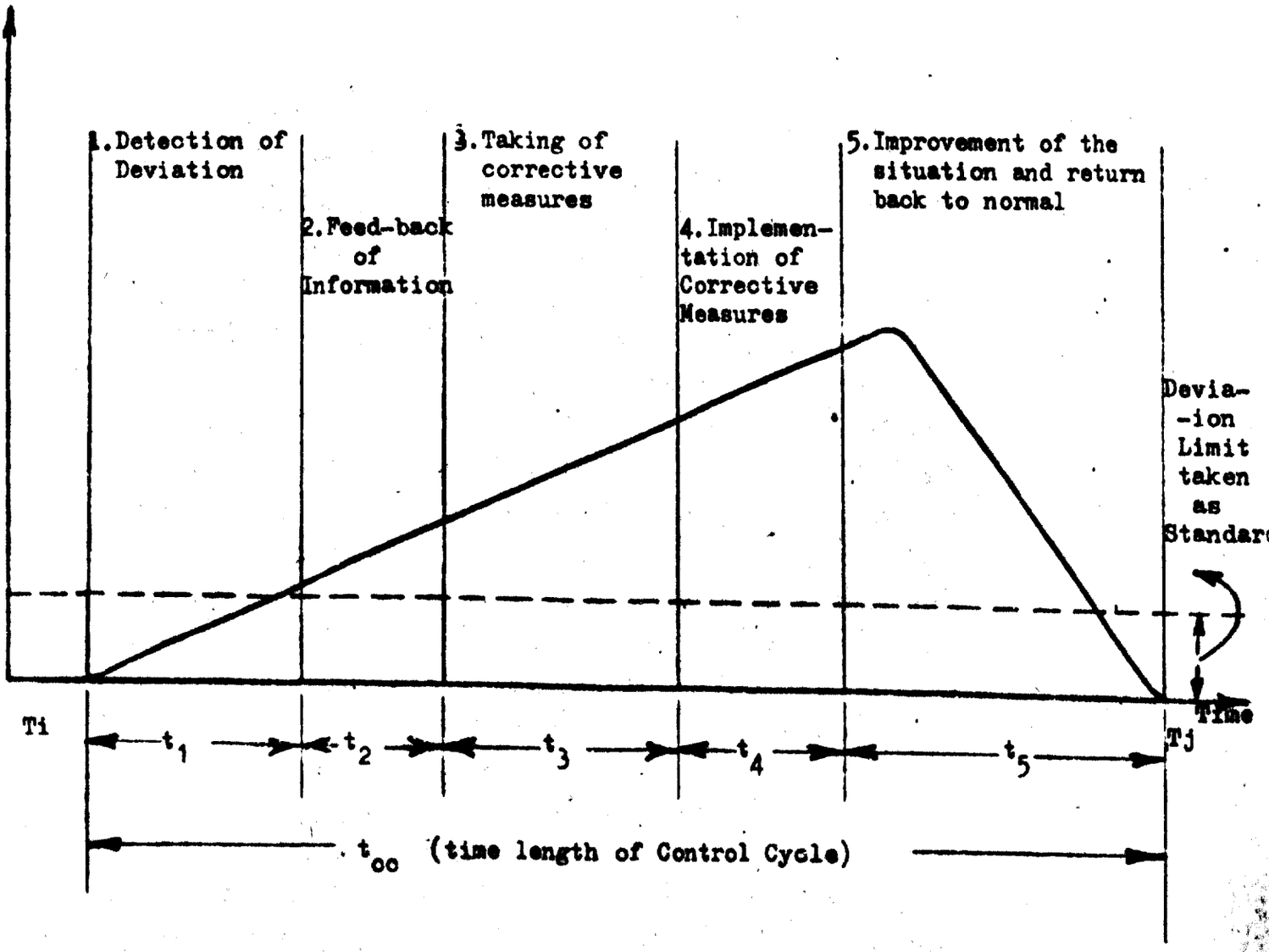


Figure 1. Presentation of the Control Cycle

(i) It should be noted that even if a total MIS could be established in an organization, due to the underlying difficulties and multitude of factors that have to be considered, it might not be feasibly established in one single operation. It is recommended, therefore, that the plan of operation for the development of the total MIS, mentioned above, phase out the development of its constituent subsystems over a reasonable period of time. This suggests that the management information subsystems required for a few specific activity(ies) corresponding to some portion of the organization structure, be selected and dealt with first. This having been accomplished, the subsystems for other activities would then follow. This will continue until all necessary subsystems are established. The question of which activity(ies) and which portion(s) of the organization structure to be dealt with first depends on the relative importance given to the various organizational areas. This in turn depends on the short as well as long term programmes of the organization or agency under study and, accordingly the short and long term needs, the priority given to the various decision-making areas and the nature of the decision-making techniques to be used now and in the future.

(ii) After defining the scope of the management information subsystems to be developed now, determination of the necessary information flows can then start. Each organisational level covered by the system is to be surveyed, analysed and then interviewed. This starts at the lower level and follows the information flows to the upper level of the organisation. In this respect the available relevant data base or banks should be considered and analysed. The point here is to know through analysis and study what information a certain unit, a supervisor or a manager at a certain organisation level, should require and to compare it with the information the manager will give as his requirements when the system

analyst interviews him. Any discrepancy here would assist in improving the organization clarity, explaining to the manager and drawing his attention to certain matters which have been so far overlooked or unsatisfactorily undertaken, promoting more effective criteria for progress and performance evaluation and eliminating redundant or unnecessary information flows.

(b) Data Base or Banks

Having determined the information flows in the organization, the establishment of data banks (data storage) is to be then started. For this purpose the following has to be considered:-

(i) The contents of the data bank(s), which imply both the types of information and its technical level, which have to be designed to serve a certain level in the organization structure to which the data bank will be assigned accordingly. For example, data banks for national planning agencies would comprise general national economy data and coefficients such as national and regional plans, production, consumption, import, export, input/output coefficients, labour productivity ... etc. On the other hand, a project management, which is responsible for the implementation of a project, needs a data bank including project implementation parameters such as time estimates, resource requirements, and cost to accomplish project components, as well as some milestones for assisting in monitoring and controlling the execution of the project.

(ii) A trade-off between the cost of access to information (including communication costs) and the cost of its storage and the appropriate degree of automation in a given situation. This is illustrated in the hypothetical diagram of Figure 2.

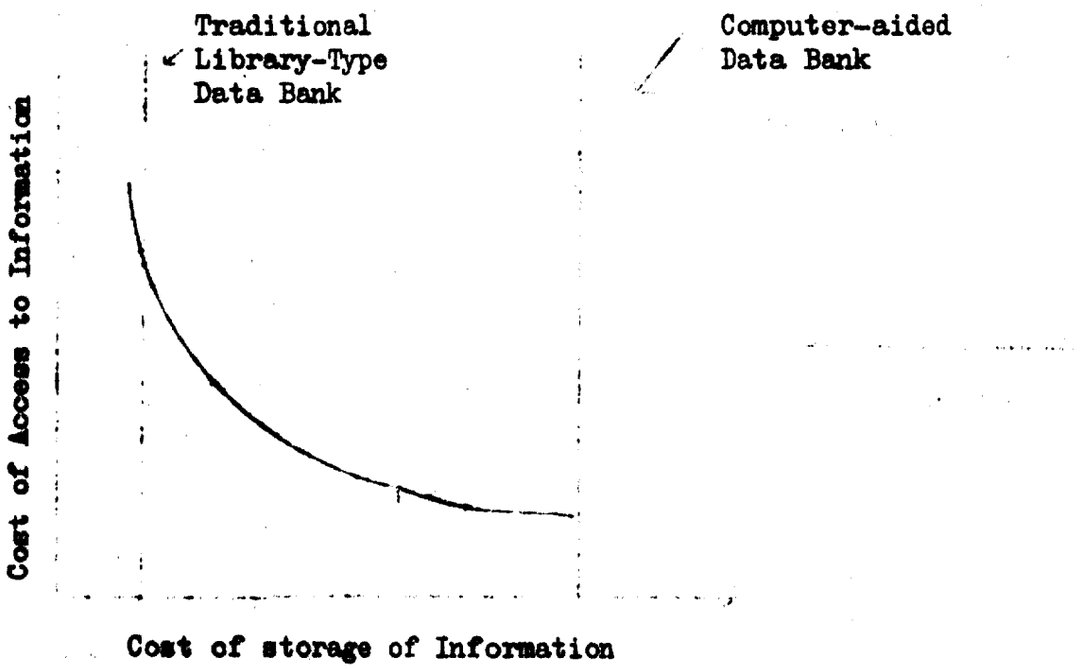


Figure 2. Hypothetical trade-off Curve between Cost of Access and Cost of Storage of Information

(iii) Centralisation versus duplication of files of information and the selection of the appropriate degree of both.

(c) Data Processing Facilities (System)

Data processing comprises the following main activities:

(i) Simple manipulation of data which converts data into information for decision-making by reorganizing, summarising ... etc. The difference here between data and information is that information is related to a specific use, in other words a specific decision-making process.

(ii) More complicated manipulation which deals with the analysis of information as when information is used with some analytical models (such as optimisation models).

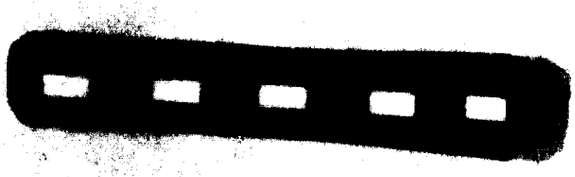
For the establishment of a data processing system a feasibility study is to be carried out to determine the most appropriate system for the

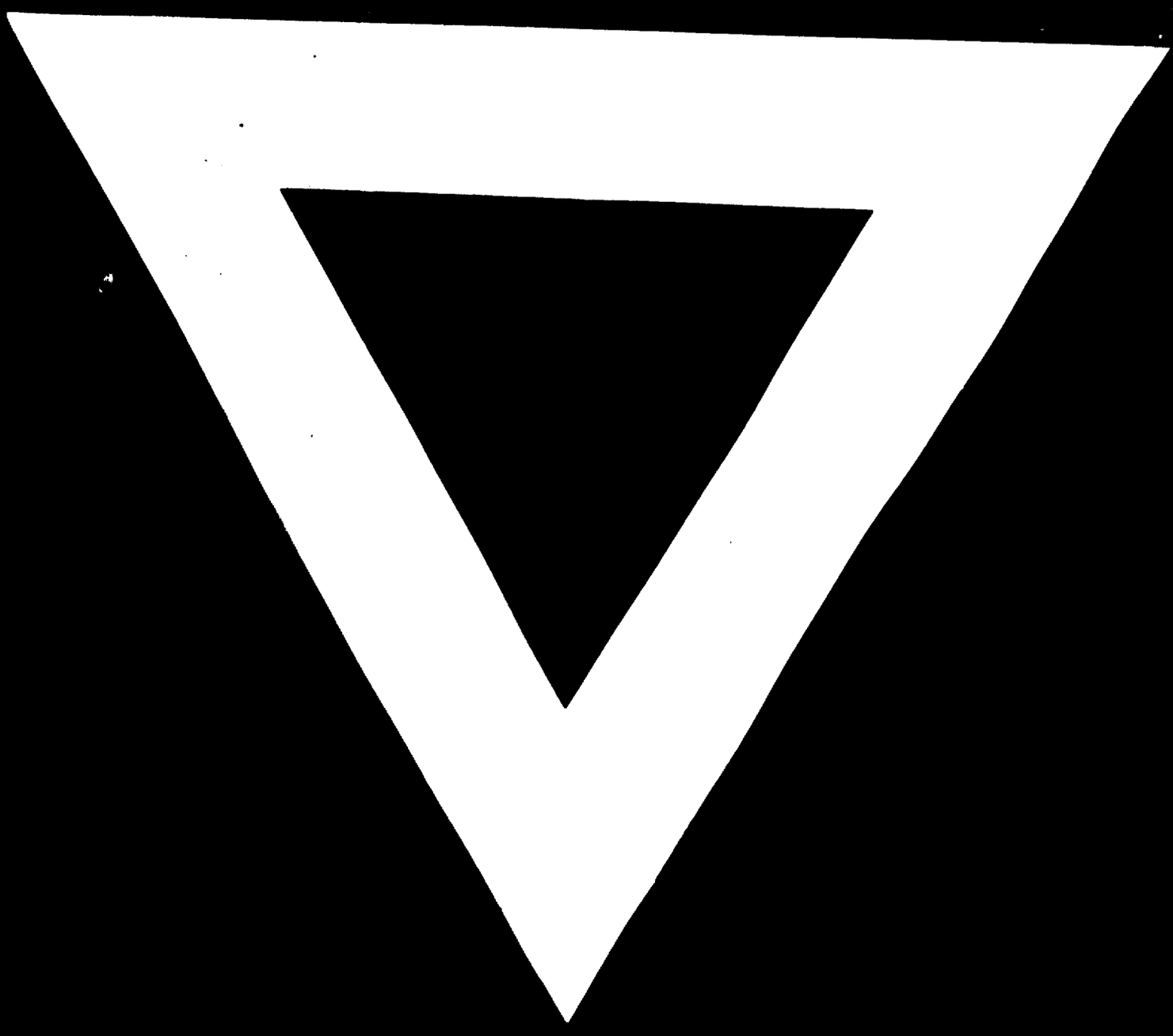
organization, which will warrant its cost and the specifications of the equipment needed. The outcome of the study might recommend: the further application of an existing manual system with some improvements, the establishment of a punched card system or an electronic computer system (which is usually called an electronic data processing system and abbreviated as EDP system).

In an organization the change towards mechanization or automation in data processing need not take a specific sequence. In other words, an organisation need not move from a manual system to punched cards system and then to electronic computer system. If the change implies a move from one data processing system to another, a "changeover" programme should be worked out in order that the new system would be implemented and would start its operation without disturbing the existing system, until the new system reaches its capacity level.

(d) Training of Personnel

The aforementioned having been accomplished, training of personnel at various levels and in various disciplines necessary for the implementation and running of the MIS, can then start.





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