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A CONCEPTUAL FRAMEWORK FOR PLANNING MANAGEMENT INFORMATION SYSTEMS CURRICULUM IN DEVELOPING COUNTRIES

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A CONCEPTUAL FRAMEWORK FOR PLANNING MANAGEMENT

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APPROVED BY

DISSERTATION COMMITTEE

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CHAPTER I

THE PROBLEM

Introduction

Problems of developing countries have been given much attention and concern since the period of the late 1950s and early 1960s, when the first United Nations Decade of development program was announced. UNESCO (United Nations Education, Scientific, and Cultural Organization), UNCTAD (United Nations Conference on Trade and Development), UNCSTD (United Nations Conference on Science and Technology for Development), and academic institutions have sponsored many studies to find solutions to the problems of development. The attention was concentrated on what was called the "vicious circle." Adam Curle explains the developing countries' "vicious circle":

> Because people are ignorant they are poor; because they are poor they are sick; because they are both these things they produce very little and so they become poorer.[1]

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[1]Adam Curle, Educational Strategy for Developing Societies (London: Tavistock Publications, 1963), p. 68.

The "vicious circle" explains the conditions of poverty, inequality, and unemployment in developing countries.[1]

Development is a possible solution for the conditions of developing countries. Development is defined as growth accompanied by change.[2] Maheu indicated that change is not any change. He gave two reasons:

> The first reason is that, to be effective and lasting, . . . it [development] must grow from within. So long as it is confined to a mere transfer of foreign techniques and ideas, it remains artificial and precarious, even if the transfer results in temporary economic gains in certain respects.
>
> The second reason is that development is an attempt, often an heroic one, to improve on past achievements. It cannot be undertaken and still less succeed, unless the men who are its instruments before becoming its beneficiaries understand its goals, both of a quantitative nature (growth) and of qualitative nature (change), and believe them to be worth working for.[3]

Souza and Porter[4] noticed that research on development has neglected the diverse value systems of societies engaged in the process of development. They also noticed that development has been treated as synonymous with Western economic development. The same authors indicated that the gap

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[1] Ibid., pp. 3, 37, 90.

[2] René Maheu, UNESCO Director General, in the Foreward of: It Is Time to Begin, written by Malcolm S. Adiseshiah (Paris: UNESCO, 1972), p. 8.

[3] Ibid., p. 9.

[4] Anthony R. de Souza and Philip W. Porter, The Underdevelopment and Modernization of the Third World (Washington, D.C.: Association of American Geographers, 1974), p. 5.

between rich and poor countries, as measured by production and consumption, is widening.[1] This situation suggests the need for deeper investigations for problems of developing countries.

The need for this specific investigation stems from the developing countries' needs for advanced management, management development, and adequate information to facilitate the decision-making by management.

Lewis[2] indicated that a strong, competent, and incorrupt administration is the essential prerequisite for development planning. He goes on to say that it is precisely this which is lacking in the majority of the backward countries.

Millikan and Rostow[3] noted that one of the most serious bottlenecks inhibiting the development of absorptive capacity in the developing countries is a shortage of managerial and administrative skills.

Stefan H. Robock discussed the importance of management to the developing countries. He wrote:

> If any single factor is the key for unlocking the forces for economic growth in the underdeveloped areas of the world, the factor is management . . .
>
> Exporting capital will not, in itself, meet these countries' needs. Many of them do need capital, both public and private, on a large scale. Some

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[1]Ibid., p. 2.

[2]W. Arthur Lewis, The Principles of Economic Planning (London: Allen & Unwin, 1952), p. 122.

[3]M. F. Millikan and W. W. Rostow, A Proposal: Key to an Effective Foreign Policy (New York: Harper & Row, 1957), p. 61.

> countries, however, notably in the Middle East, do not lack capital at all. What they need most are skills and better means of employing the capital they already have.[1]

The shortage of managerial and administrative skills in developing countries is due to the lack of the use of the scientific method and the lack of opportunities for professional education for management.[2]

Hoffman[3] indicated that high-talent manpower for developing countries is needed just as urgent as capital. Unless these countries are able to develop the required strategic human resources they cannot effectively absorb capital.

Harbison and Charles[4] defined human resource development as the process of increasing the knowledge, the skills, and the capacities of all the people in a society. They indicated that formal education and systematic or informal "on the job" training are the most obvious ways of human resource development.

Properly planned educational and training programs can provide the developing countries with their needs for the high level manpower. Curle stated that "the major instrument for

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[1]Stefan H. Robock, "Management in Underdeveloping Countries," Advanced Management and Office Executive, 1 (Jan. 1962): 31.

[2]S. Benjamin Prasand, ed., Management in International Perspective (New York: Meredith Publishing Company, 1967), p. 36.

[3]Paul G. Hoffman, quoted in Frederick Harbison and Charles A. Myers, Education, Manpower, and Economic Growth - Strategies of Human Resource Development (New York: McGraw-Hill Book Company, 1964), p. 16.

[4]Ibid., p. 2.

producing the people to undertake the development of a country is the educational system."[1] He qualified this statement by adding that the wrong sorts of education, or disproportionate amounts of education, can be more wasteful of human and economic resources than too little education.[2] The educational system and employing institutions need adequate information to design and offer proper educational and training programs.

Adequate information is needed not only for the design of educational and training programs. It is needed for making decisions on the construction and authorization of all economic, social and political programs in developing countries. Murdick and Ross[3] stated that the production of information is at least as important as the production of physical commodities. The production of information is, simply, the Management Information Systems (MIS). It is a system that transforms data to information for managerial decision-making.

The foregoing discussion indicates that MIS can be implemented in developing countries through education. MIS techniques were developed and applied in developed countries. This suggested the need for a framework for planning MIS

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[1]Adam Curle, Educational Strategy for Developing Societies, p. 82.

[2]Ibid.

[3]Robert G. Murdick and Joel E. Ross, Information Systems for Modern Management (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971), p. 239.

curriculum in developing countries. Robert Anthony of Harvard stated that the "development of a framework or a conceptual scheme often has led to progress, even though the framework turns to be wrong"[1] Anthony pointed out that any practice which is developed in the Western cultural environment is not likely to be universally applicable. He said "we are mindful of the disastrous results that have sometimes occurred when an American practice was transferred without modification to some other culture."[2]

Statement of Purpose

The purpose of this study was to develop a basis for planning MIS curriculum for managers in developing countries. The basis should provide curriculum planners with the essential components for a MIS curriculum.

Statement of the Problem

The problem of this investigation was to develop a conceptual framework to enable curriculum planners in developing countries to adopt and adapt MIS conceptual factors

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[1]Robert N. Anthony, Planning and Control Systems: A Framework for Analysis (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1965), p. viii.

[2]Ibid., pp. 9-10.

to the needs of managers. More specifically, the problem involved three significant aspects.

1. Identification of conceptual factors of MIS and establishing a theory base for MIS.

2. Interpretation of the dynamic nature of curriculum planning.

3. Development of a conceptual framework for planning MIS curriculum in developing countries.

Scope and Limitations

Within a given subject area, different frameworks can be useful for different purposes. Thus, in this investigation, frameworks for systems concepts, human and organizational behavior, systems analysis, decision-making, information technology, and curriculum planning were developed. The investigation was limited to the provision of a conceptual framework for planning MIS curriculum in developing countries. The framework suggests an approach for curriculum planning—not the specific plans.

Operational Definitions

To facilitate meaningful interpretation of the content of this report, operational definitions are given to terms used frequently.

Developed Countries: advanced industrial countries which are capable of making major scientific, technological, and organizational development.

Developing Countries: countries which are literally called backward, underdeveloped, less developed, modernizing, or the Third World countries. They are completely or partially dependent on developed countries for their industrial, scientific and technological needs.

Curriculum Planning: a process of deciding on goals, scope and sequence of curriculum and courses; on changes in the curriculum.

Data: uninterpreted groups of non-random characters or signals intentionally arranged to represent certain information.

Information: processed data which are interpreted within context to convey meaning or knowledge.

Management Information Systems: the process of converting data into information that can be used by decision makers in an organization.

MIS: Management Information Systems.

Organization of the Report

The report of this investigation was divided into six chapters. The problem was presented in Chapter I.

Chapter II contains the review of the research and the literature. It includes a synthesis of materials on MIS, MIS curriculum, and MIS curriculum for developing countries.

Chapter III contains the methodology and procedures of this investigation.

Chapter IV provides a theory base for MIS. The theory was developed on five conceptual factors: systems concepts, human and organizational behavior, decision-making, systems analysis, and information technology. The five factors constitute the basic components of the MIS curriculum.

Chapter V provides explanation for the major environmental and cultural factors influencing curriculum planning in developing countries. A conceptual framework for planning MIS curriculum in developing countries was developed and presented.

Chapter VI contains the summary, findings, conclusions, and recommendations of the study.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter contains a formalized review of MIS and curriculum planning literature. The review of MIS concepts, MIS definitions and approaches provides an overview of MIS. This review resulted in the identification of basic conceptual factors of MIS. The survey of literature on MIS curriculum includes the need for MIS educational programs as well as the design of MIS graduate and undergraduate curricula.

The literature on curriculum planning was reviewed to provide a base for planning MIS curriculum in developing countries. This includes human resource development and factors influencing curriculum planning. The final section provides a summary of the chapter as well as observations about MIS literature.

MIS: An Overview

A wide body of scholarly literature on MIS has been developed. But definitions and scope of MIS were vaguely described which may cause misunderstanding. Cerveny stated that "authors who initially seemed to be in sharp disagreement are fundamentally agreed on the basic ideas. The problem occurs because they are actually discussing different things yet using the same terms."[1] For this reason, this section started with examining four closely related and operationally joined concepts: systems, data, information and management. Then, MIS definitions, MIS design approaches and MIS conceptual factors are presented.

Systems[2]

In management information systems, "systems" is the subject and other words serve only to modify that subject.[3] This justifies the consideration of "systems" first in this review of MIS concepts.

The term "system" or "systems" is widely used in many contexts to describe many things in different fields. Terms such as "communication systems," "education system," "social systems" and others are commonly used. Russell Ackoff[4]

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[1]Robert Paul Cerveny, "The Effects of Computerized Management Information System on Managerial Behavior and Attitudes: A Comparative Study of Corporate Risk Manager Subscribers and Non Subscribers" (Ph.D. dissertation, University of Texas at Austin, 1976), p. 40.

[2]The "systems" concept is presented in this section with the purpose of introducing the review of MIS literature. The concept is deeply investigated in Chapter IV.

[3]John A. Beckett, Management Dynamics: The New Synthesis (New York: McGraw-Hill Book Company, 1971), p. 13.

[4]Russell L. Ackoff, "Towards a System of Systems Concepts," Management Science, 17 (July 1971): 661-71.

observed that "system" as a concept has come to play a critical role in contemporary science. Ackoff indicated that the concept preoccupied "management scientists in particular for whom the systems approach to problems is fundamental and for whom organizations, a special type of system, are the principal subject of study."[1]

The term "system," as Hoos described it, "is a cover-all, generous in scope, loose in dimensions, and imprecise in meaning."[2] This statement suggests a need for a definition of the term at this point. "Very simply a system is a set of elements, such as people, things, and concepts, which are related to achieve a mutual goal."[3]

Data and Information

The term data is closely related and usually confused with information. Blumenthal stated that "a datum is an uninterpreted raw statement of fact," and that "information is data recorded, classified, organized, related or interpreted within context to convey meaning."[4]

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[1]Ibid., p. 161.

[2]Ida R. Hoos, "Information Systems and Public Planning," Management Science, Ser. B., 17 (June 1971): 658.

[3]Robert G. Murdick and Joel E. Ross, Information Systems for Modern Management, 2nd ed. (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975), p. 4.

[4]Sherman C. Blumenthal, Management Information Systems: A Framework for Planning and Development (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969), p. 30.

Kirkpatrick[1] distinguished between two types of information: Information which is received by a machine and that which is received by a human being (decision-maker). Kirkpatrick indicated that the engineer, who measures information in "bits," views the captured data as information because "a 'bit' of information does not change in value and can be used over and over again while retaining its original identify."[2] For Kirkpatrick, data which are transmitted to the human receiver become information only if the receiver "imparts meaning, and through logical work the data changes the decision-maker's state of knowledge."[3]

Methlie defined data and information as follows:

> Data is groups of non-random signs or symbols stored on a machine intentionally arranged to represent information about real world entities (objects, events, states or activities).
>
> Information is knowledge about real world phenomena perceived by direct observations or by semantic interpretations of messages.[4]

After this clarification of the meaning of data and information, a system for producing information can be defined

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[1]Donald Clay Kirkpatrick, "General Systems Theory as a Framework for Management Information Systems" (doctoral dissertation, University of Colorado, 1976).

[2]Ibid., p. 15.

[3]Ibid., p. 19.

[4]Leif B. Methlie, Information Systems Design: Concepts and Methods (New York: University of Columbia Press, 1978), pp. 34-35.

as "a set of elements forming a processing procedure by operating on data in a time reference to yield information."[1]

Management

Literature of management has a well developed body of knowledge about the activity of management, its functions, purpose and scope. For purposes of MIS, management consists of planning, organizing and controlling the major activities of organization and initiating action. MIS is a facilitating system for developing decisions for each of these managerial functions.[2]

For the purpose of MIS, management can be considered in terms of the following three levels:

> Top level management--concerned with long-term strategic considerations.
> Middle management--concerned with short-term planning and control.
> Operating management--concerned with day-to-day supervision of activities.[3]

Schneyman[4] illustrated the relationship of MIS and management process in Figure 1.

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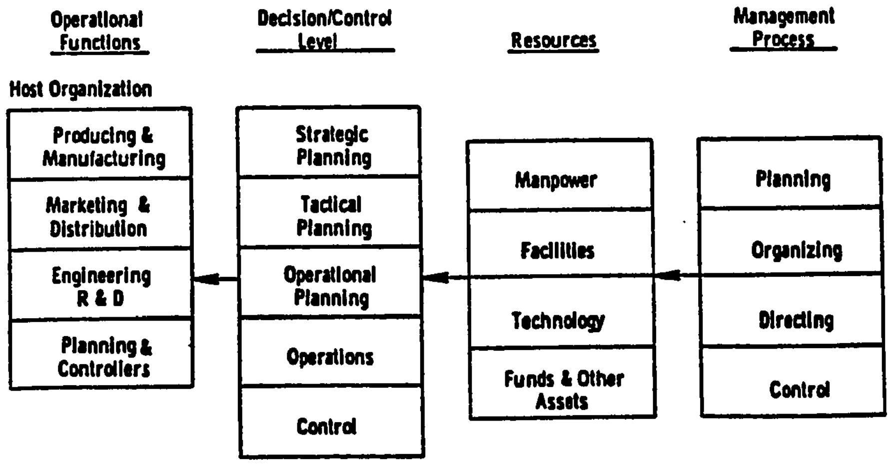
[1] The definition is adapted from Murdick and Ross, Information Systems, p. 9.

[2] Ibid., p. 5.

[3] Thomas J. Diggory, "Management Information Indigestion--A Cure?" in MIS in Action, eds., Robert G. Murdick and Jole E. Ross (New York: West Publishing Co., 1975), p. 31.

[4] Arthur H. Schneyman, "Management Information Systems for Management Sciences," Interfaces, 6 (May 1976): 52-59.

Figure 1. MIS and management process.



Source: Arthur H. Schneyman, "Management Information Systems for Management Science," Interfaces, 6 (May 1976):53.

Schneyman explained the diagram as follows:

> Moving from right to left, each element within each dimension should be thought of as applying to all elements in the neighboring or adjacent dimension. The various combinations of these elements, as illustrated, provides a checklist of data to be embodied in MIS.[1]

Murdick and Ross indicated that three changes are now occurring in progressive companies:

> 1. Management has become systems-oriented and more sophisticated in management techniques.
> 2. Information is planned for and made available to managers as needed.
> 3. A system of information ties planning and control by managers to operational systems of implementation.
>
> The combined result of these concepts is management information systems (MIS).[2]

---

[1]Ibid.

[2]Murdick and Ross, Information Systems, p. 23.

MIS Definitions

MIS literature has many different definitions of MIS. Some definitions may stress one or more of MIS characteristics, others may stress different characteristics. "Definitions, by definition, establish finite limits and boundaries, and that certainly is not what we are after in systems thinking."[1] This section presents some definitions and opinions about MIS.

In previous discussions of data and information, a definition of an information system was adapted. The definition was "a system is a set of elements forming a processing procedure by operating on data in a time reference to yield information." Such a system is not necessarily a management information system. Schwartz explained this point:

> Information processing systems become management information systems as their purpose transcends a transaction processing orientation in favor of a management decision-making orientation.[2]

MIS is not a general information system.[3] It is the information system which a manager finds useful and uses it.[4]

Ein-Dor and Segev stated that "there is very little to distinguish between MIS and information systems generally."[5]

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[1]Beckett, Management Dynamics: The New Synthesis, p. 31.

[2]M. K. Schwartz, "MIS Planning," Datamation, 16 (Sept. 1970): 28.

[3]Schneyman, "Management Information Systems," p. 52.

[4]Philip Ein-Dor and Eli Segev, Managing Management Information Systems (Lexington, Massachusetts: D.C. Heath and Company, 1978), p. 16.

[5]Ibid.

They added "the fact that this is so difficult to achieve is the reason that so many MIS fail."[1] They concluded that "there is some intrinsic difference between information systems generally and management information systems in particular."[2]

Schneyman identified the areas of MIS functions. He wrote:

> MIS is an information system for management. It therefore deals with areas of management concern: the management process, decision-making and control, and resources.[3]

Ein-Dor and Segev identified functions of MIS:

> A management information system is a system for collecting, storing, retrieving, and processing information that is used, or desired, by one or more managers in the performance of their duties.[4]

Ackoff[5] believes filtrations and condensations are the two most important functions of MIS. He indicated that the deficiency from which managers suffer is an abundance of irrelevant information and it is not the lack of relevant information.[6]

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[1]Ibid., p. 17.

[2]Ibid.

[3]Schneyman, "Management Information Systems," p. 52.

[4]Ein-Dor and Segev, Managing Management Information Systems, p. 16.

[5]Russell L. Ackoff, "Management Misinformation Systems," Management Science, Ser. B, 14 (Dec. 1967): 147-56

[6]Ibid.

Alfred Rappaport[1] does not agree with Ackoff. Rappaport raises the question of "what are the useful limits to filtration and condensation?"[2] He believes the lack of relevant information is still the critical deficiency under which most managers operate.[3]

The purpose of MIS was the main concern of Kenneran's definition.

> A management information system is an organized method of providing past, present and projection information relating to internal operations and external intelligence. It supports the planning, control and operational functions of an organization by furnishing information in the proper time frame to assist the decision-making process.[4]

Technical characteristics of MIS are usually confused with the nature of MIS. "Such characteristics do indicate the degree of sophistication and, to some extent, the potential value of an MIS."[5] Mudrick and Ross observed that many experts think erroneously that MIS is the computerization of clerical work. And others think that computer provides managers with

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[1] Alfred Rappaport, "Management Misinformation Systems--Another Perspective," in <u>Development in Management Information Systems</u>, Robert H. Trent and Thomas L. Wheeler, eds., (Encino, California: Dickenson Publishing Co., Inc., 1974), pp. 111-15.

[2] Ibid., p. 111.

[3] Ibid., p. 113.

[4] Walter J. Kennenan, "MIS Universe," <u>Data Management</u>, 8 (Sept. 1970): 63.

[5] Ein-Dor and Segev, <u>Managing Management Information Systems</u>, p. 17.

answers and decisions for complex problems. The computer is a tool in MIS, not the central focus of MIS.[1]

DeCrane indicated that MIS can be implemented with a variety of hardware from pencil and paper to giant computer.[2] This viewpoint is shared by other writers, such as Dearden who calls out a MIS shortcoming when he observes that institutions of higher education, offering advanced degrees in information systems, limit their MIS material to the computerized orientation.[3]

The importance of computers in MIS was explained by Ein-Dor and Segev as follows:

> . . . given the quantity and complexity of data generated by modern enterprises, it is inconceivable that any but the smallest organization could be capable of processing that data into decision inputs within a reasonable time. Thus the extensive use of electronic computers is one of the characteristics of modern management information systems. But the presence of electronic data-processing system is by no means conclusive evidence that MIS are in operation.[4]

Gordon Davis stressed the technical characteristics of MIS in his definition. He defines MIS as

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[1]Murdick and Ross, Information Systems, pp. 5-7.

[2]David J. DeCrane, "Don't 'MIS' the Point: A Guideline for Successful Information Systems Projects," Ideas for Management, 1973 International Systems Meeting, Association for Systems Management (1973), p. 122.

[3]John Deardon, "MIS is a Mirage," Harvard Business Review, 50 (Jan.-Feb. 1972): 91.

[4]Ein-Dor and Segev, Managing Management Information Systems, p. 18.

> an integrated man/macine system. . . . The system utilizes computer hardward and software, manual procedures, management and decision models, and a data base.[1]

Davis' definition added two elements of information systems which can be used in MIS. The elements are management decision models and data base.

The interpersonal dimension of MIS was emphasized by Robert J. Fahey et al. They wrote

> The total management information systems within an organizational environment is richer and more complex than that reflected in paperwork or computer data flow. It includes a large and very important amount of interpersonal information exchange--during discussion and meetings, telephone conversation, and even golf games.[2]

This suggests that informal methods of information collection should parallel formal data procedures. As a matter of fact some type of information can be obtained through informal channels. For instance, the tone of the voice and facial expressions can be transmitted only through informal channels.[3]

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[1]Gordon B. Davis, Management Information Systems: Conceptual Foundations, Structure, and Development (St. Louis: McGraw-Hill Book Company, 1974), p. 5.

[2]Robert J. Fahey, Douglas A. Love and Paul F. Ross, Computers, Science and Management Dynamics (New York: Financial Executives Research Foundation, 1969), p. 9.

[3]Neil C. Churchill, John H. Kempster and Myron Uretsky, Computer-Based Information Systems for Management: A Survey (New York: National Association of Accounting, 1969), p. 35.

MIS Design Approaches

The literature of MIS is rich with different design approaches and different classifications of the approaches. Milano[1] classified MIS approaches into evolutionary and direct. By evolutionary approach, Milano meant that MIS evolves gradually from existing data processing systems. "Subsystems are integrated, the necessary changes are made, and, theoretically, the total system emerges."[2] In practice, systems are usually too big to allow an orderly integrated growth. Milano described the direct approach as "costlier, and requires a great deal of detailed planning, and is more time-consuming."[3]

Blumenthal[4] indicated that the different approaches tend to fall within one or another of six basic types. He also observed that the approaches are not mutually exclusive. "Most procedures that have been followed in practice are actually a combination of two or more of these types of approaches."[5]

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[1]James Vinson Milano, "Development and Implementation of a Management Information System" (doctoral dissertation, The George Washington University, 1969).

[2]Ibid., p. 24.

[3]Ibid.

[4]Blumenthal, Management Information Systems, p. 19.

[5]Ibid., p. 20.

Blumenthal's classification:

1. The organization chart approach
2. The data collection approach
3. The management survey or top down approach
4. The data bank approach
5. The integrate later approach
6. The integrate now or total system approach.[1]

The "organization chart approach" assumes that the enterprise activities and information generally follow boundaries of each functional oriented system: financial system, marketing system, etc.[2] The approach also assumes that present information systems are not sufficiently designed to serve the enterprise functions. The functions are analyzed and a MIS subsystem is developed around each function's use of information.[3]

The "data collection approach" assumes that the best time to make data classification is after the collection of all data. The first step would be extensive collection of data. Second, some classification must be made in order to make the data collection task manageable. Third, the designer must decide what is to be the smallest element of data identified as a transaction. Fourth, the designer must decide the kind of the desired data: "raw" data, processed data, or both. Fifth, he must consider the nature of data: documentary or non-documentary, internal or external, and historical or current data.[4]

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[1]Ibid. [2]Ibid.

[3]Kirkpatrick, "General Systems Theory for MIS," pp. 41-42.

[4]Blumenthal, <u>Management Information Systems</u>, pp. 20-21.

The "management survey or top down approach" aims at supporting the critical areas of decision-making in the enterprise. It assumes that the determination of the kinds of information that management needs leads to determination of the systems that supplies the information.[1] The required information is determined by the three levels of decision-making: strategic, tactical and operational. The survey of the management information needs for each level of decisions starts from the top-management (strategic level) down to the operational activities.

The "data bank approach" is based on establishing a central data base to store and retrieve the information which is used commonly by the various subsystems of an organization. Using modern information-processing techniques, all relevant information is kept in one readily and accessible file. The data bank would help avoid the maintenance of separate record files. It also tends to integrate the organizational functions.[2]

The "integrate later approach" assumes that the integration of MIS comes after establishing individual systems as needed in the organization. The approach does not recommend

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[1] Ibid., p. 22

[2] Murdick and Ross, Information Systems, pp. 182-83.

a comprehensive plan. The approach is similar to what Milano[1] has termed "evolutionary approach." Blumenthal indicated that independently developed systems do not often coalesce into larger aggregations.[2] Kirkpatrick shared the same view by stating that "if all foresight is ignored, then developed systems may be incompatible to the point that they prevent their integration at a later time."[3]

The "integrate now or total systems approach" is the opposite extreme from the "integrate later approach." The approach is closely associated with the use of computer for processing timely information for managerial decision-making.[4] The base of the approach is the interrelated nature of all processes within the organization, and between the organization and its environment. Therefore, the information networks should be interrelated by conscious design before implementation. This task would require the designer to determine all information and to know how it is interrelated through decision-making.[5]

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[1]Milano, "Development and Implementation of MIS."

[2]Blumenthal, Management Information Systems, pp. 22-23.

[3]Kirkpatrick, "General Systems Theory for MIS," P. 44.

[4]E. R. Dickey and N. L. Senensiel, "Total Systems Concept," in Development in Management Information Systems, eds., Trent and Wheelen, p. 35.

[5]Blumenthal, Management Information Systems, p. 23.

Kirkpatrick classified MIS design approaches into the following categories: (1) theoretical construction not based on business theory, (2) business theory, and (3) the evolution of EDP.[1]

Under the second category "business theory," Kirkpatrick discussed Blumenthal's six categories. He indicated that each of them is based on the theory of business and administration.[2]

The "theoretical construction" approach is "conceptual in nature and treats information and data in the context of selected theory."[3] The approach resembles the MIS to such disciplines as communication theory, information theory, probability theory, cybernatics, and control theory. Two shortcomings of the approach were mentioned. One is the disrecognition of the MIS as being a humanly unique phenomenon. Second, the average businessman cannot understand the theories.[4]

The "EDP evolution" approach is based on the evolution of EDP usage and systems analysis. EDP has served business functions such as accounting, marketing and production with operating information. Integrating these services together produces a MIS.[5] The implementation of EDP leads to great

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[1]Kirkpatrick, "General Systems Theory for MIS," pp. 38-50.

[2]Ibid., pp. 41-55.

[3]Ibid., p. 40.

[4]Ibid., p. 41.

[5]Ibid., p. 46.

improvement in the accuracy, speed, timing and forms of information. On the other hand, the approach has many shortcomings. The integration of the EDP within the work style of business enterprises creates the problem of EDP control. Should it be controlled by the accounting/finance department? Or, should it be set up as an independent activity?[1] The clearness of data communication is another EDP problem. Sparks stated that the output of EDP does present communication barriers. "It is unnecessarily gray, dull in appearance, crowded, hard to read."[2] Three more EDP problems were identified by Kirkpatrick.

1. The EDP technician usually approaches business information with his technical tools.
2. Systems analysis had only limited success in predicting human behavior because it ignores many aspects of human behavior.
3. The concentration of EDP in the historical data and the disregard of informal information do not help many levels of management.[3]

The theme of Kirkpatrick's doctoral dissertation[4] was the development of a MIS design approach. The approach is based on the general systems theory as a framework for management information system "GST/MIS." "The GST/MIS framework is composed of a MIS hierarchial expression and a

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[1]Ibid., pp. 47-48.

[2]Jack D. Sparks, quoted in Kirkpatrick, "General Systems Theory for MIS," p. 49.

[3]Kirkpatrick, "General Systems Theory for MIS," pp. 45-50.

[4]Ibid.

methodology for investigating an empirical MIS as a general system."[1] Four methodological steps provide a set of instructions for investigating a MIS. The steps are "system identification," "structural description," "behavioral expression," and "analysis extension."[2] This instruction set is applied on six selected hierarchical levels:

(1) Total enterprise
(2) Management decision behavior
(3) Production of unified knowledge
(4) Division of knowledge
(5) Data activities
(6) Data capturing[3]

> . . . the hierarchy spans that area of business enterprise from potential data sources to the use of data-producing management decisions and in turn total enterprise behavior.[4]

Basic Conceptual Factors of MIS

The review of MIS literature reveals the following conceptual factors which underlie the MIS process.

1. Systems concepts: MIS is a system which exists within an organization or it is a subsystem of the organization system. It can be said that systems concepts represent the organizational dimension of MIS. This view is supported by the Curriculum Committee on Computer Education for Management

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[1]Ibid., p. 212.

[2]Ibid., p. 188.

[3]Ibid., p. 189

[4]Ibid., p. 212.

(C^3EM) which recommended a group of courses about "analysis of organizational systems" The C^3EM stated that the purpose of the courses is to "lay the groundwork for systems approach, develop this approach for organizations and their functions, demonstrate how information systems grow and serve to support organizational management. . . ."[1]

2. Human and organizational behavior: Proper consideration of the behavior of people in the organization setting is necessary for the success of new systems. Without such consideration "the best technically designed system is likely to fail."[2] The introduction of a new MIS changes the organizational patterns and "represents a threat to individual in terms of his organizational relationships and psychological needs."[3] The newly emerging organizational patterns must be taken into account. "Resistance to the new MIS must be avoided rather than defeated by sheer power."[4]

The C^3EM recommended a course in "Human and Organizational Behavior." The purpose of the course is "to introduce

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[1]R. L. Ashenhurst, ed., "Curriculum Recommendations for Graduate Professional Programs in Information Systems," A Report of ACM Curriculum Committee on Computer Education for Management, Communication of the ACM, 15 (May 1972):374.

[2]Murdick and Ross, Information Systems, p. 95.

[3]Ibid., p. 96.

[4]Ibid.

the student to the principles governing human behavior."[1] It can be said that the human and organizational behavior represents the behavioral dimension of MIS.

3. Decision-making: The MIS literature, as it is reviewed in this chapter, reveals that decision-making is the main concern of MIS. At the same time, decision-making is a fundamental aspect of management and the most important task of managers.[2] The curriculum recommendations of the C^3EM devoted two courses for decision-making and decision models.[3] It is clear that decision-making represents the managerial dimension of MIS.

4. Systems analysis: The analytical dimension of MIS is represented by systems analysis which is essential for the design and development of MIS. Systems analysis was emphasized in the C^3EM recommendations.[4]

5. Information technology: Information technology represents the technological dimension of MIS. It is not limited to computer technology. MIS, as it was stated before,

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[1] Ashenhurst, ed., "C^3EM Recommendations for Graduate Curriculum," p. 375.

[2] Murdick and Ross, Information Systems, pp. 49-50.

[3] Ashenhurst, ed., "C^3EM Recommendations for Graduate Curriculum" p. 375.

[4] Ibid., pp. 376-77.

may utilize a variety of techniques ranging from simple manual ones to highly sophisticated electronic techniques.

The five conceptual factors presented in this section are the subject of the theory base for MIS which is developed in Chapter IV.

MIS Curriculum

The most comprehensive available documents on curriculum for MIS are reports of C^3EM which is sponsored by the Association for Computer Machinery (ACM). The C^3EM of eleven leading authorities[1] issued three reports: a "Position Paper,"[2] "Curriculum Recommendations for Graduate Professional Programs in Information Systems"[3] and "Curriculum Recommendations for

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[1]Members of C^3EM:
Daniel Teichroew, the University of Michigan
Russell M. Armstrong, Weyerhaeuser Company
Robert L. Ashenhurst, University of Chicago
Robert Benjamin, Xerox Corporation
J. Daniel Couger, University of Colorado
Gordon Davis, University of Minnesota
Martin Greenberger, Johns Hopkins University (participated in the preparation of the "position paper" only)
John F. Lubin, University of Pennsylvania
James L. McKenney, Harvard University
Frederic M. Tonger Jr., University of California, Irvine.

[2]Daniel Teichroew, ed., "Education Related to the Use of Computers in Organizations, Position Paper--ACM Curriculum Committee on Computer Education for Management," Communications of the ACM, 14 (Setp. 1971): 573-88.

[3]Ashenhurst, ed., "C^3EM Recommendations for Graduate Curriculum," pp. 364-98.

Undergraduate Programs in Information Systems."[1] The work in this section depends basically on the three reports. The section presents a review of the need for MIS educational programs, MIS graduate curriculum and MIS undergraduate curriculum.

The Need for MIS Educational Programs

The need for MIS educational programs is emphasized in the position paper of the C^3EM. The committee provided the following conclusions:

> 1. MIS is of vital importance to most organizations. There are needs for both qualitative and quantitative improvements in the educational preparation for MIS.
> 2. There is need for qualified teachers and researchers.
> 3. Management, computer science, and operations research are the appropriate fields for concentration and specialization in information processing systems.
> 4. All management educational programs should include introductory material on information systems and their organizational impact. An area of "information systems" should be parallel to production, finance, marketing, etc. in business schools.[2]

Two levels of educational preparations for MIS are mentioned in the literature. One is the education for users. "Users must be educated to adopt positive attitudes if they

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[1]J. Daniel Couger, ed., "Curriculum Recommendations for Undergraduate Programs in Information Systems," A Report of the ACM Curriculum Committee on Computer Education for Management, Communications of the ACM, 16 (Dec. 1973): 727-49.

[2]Teichroew, ed., "Position paper of C^3EM," p. 574.

are to attain maximum advantage from their use of MIS."[1] The second level is the education for designers. They should be provided with the required skills and knowledge for building MIS.[2]

MIS Graduate Curriculum

The C^3EM^3 suggested a set of thirteen courses as a basis for programs in information systems development. Figure 2 presents the courses.

The courses are grouped into four categories as follows:

> Course group A: analysis of organization systems. Four courses give background for the systems approach, develop this approach for organizations and their functions, demonstrate the importance of information systems, and provide a prospective of modern information technology.
>
> Course group B: background for systems development. Two courses provide mathematical, statistical, economic, and psychological studies as background for the remainder of the curriculum.
>
> Course group C: computer and information technology. Four courses develop aspects of information processing configurations.
>
> Course group D: development of information systems. Three courses emphasize the technical, economic, and practical aspects of the process of information systems development. The purpose of the three courses is to tie together the major objectives of the proposed curriculum.[4]

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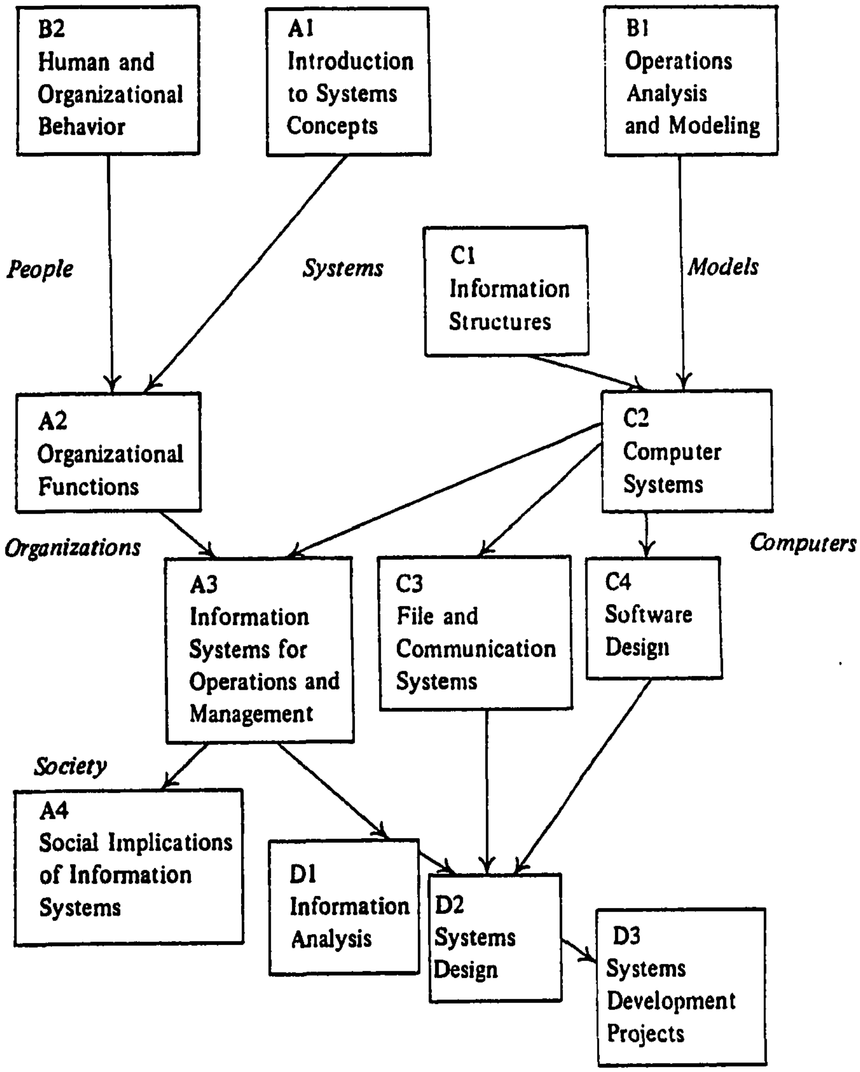
[1] Ein-Dor and Segev, Managing Management Information Systems, p. 144.

[2] Frank G. Kirk, Total System Development for Information Systems (New York: John Wiley and Sons, 1973), p. 247.

[3] Ashenhurst, ed., "C^3EM Recommendations for Graduate Curriculum."

[4] Ibid., pp. 374-77.

Figure 2. The thirteen courses recommended by C^{3}EM for information systems development.



Source: R. L. Ashenhurst, ed., "Curriculum Recommendations for Graduate Professional Programs in Information Systems," A Report of ACM Curriculum Committee on Computer Education for Management, Communication of the ACM, 15 (May 1972):373.

McFarlan and Nolan[1] of Harvard University recommended an addendum to the thirteen courses. They proposed a course on "information systems administration" for training future information systems managers.

The objectives of the thirteen courses, as proposed by C^3EM, are presented in Appendix A. The content of the fourteen courses are presented in Appendices B and C.

The courses are prepared to educate the designers of complex information systems. The C^3EM recommended five ways in which the courses and variations on them can be incorporated into graduate programs in universities:

1. A Master's degree program in information systems development to be offered as two-years program and include the thirteen courses.
2. A Master's degree program in information systems development to be offered as a one-year program if it is possible to offer the fundamental material covered in courses A1, A2, B1, B2, C1, and C2 as undergraduate courses.
3. A five or six courses concentration to be offered in existing MBA programs. The C^3EM recommended courses A3, D1, D2, and D3, and two courses covering the material from C group in condensed form.
4. Options in computer science Master's Degree.
5. Options in other graduate programs.[2]

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[1]F. Warren McFarlan and Richard L. Nolan, "Curriculum Recommendations for Graduate Professional Programs in Information Systems: Recommended Addendum on Information Systems Administration," Communications of the ACM, 16 (July 1973): 439-41.

[2]Ashenhurst, ed., "C^3EM Recommendations for Graduate Curriculum," pp. 377-79.

Vazsonyi[1] proposed the following five courses as information systems option in MBA degree programs:

1. Foundations of Systems Concepts, Computers and Information for Management.
2. Introduction to Computer Systems and Planning.
3. Information Systems, Data Base and Communication.
4. Economic, Measurement and Evaluation.
5. Management of Information Systems.[2]

Vazsonyi indicated that the first course is to introduce the student to the subject matter and to alert the student to the entire MBA program. The student would look for features applicable to information systems. The second and thrid courses correspond to the C^3EM recommendations. The fifth course corresponds to the recommendation of McFarland and Nolan of adding a fourteenth course to the C^3EM curriculum. This course needs to be supported by a course of economics, measurement and evaluation which is the fourth course.[3]

MIS Undergraduate Curriculum

The C^3EM[4] recommended two subspecialities for undergraduate concentration. The emphasis was characterized either as organization or as technological. The organizational concentration was designed to prepare a person to be an

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[1] Andrew Vazsonyi, "Information Systems in Management Science: The Information Systems Option in Master of Business Administration Degree Program," Interfaces, 4 (Aug. 1974):12-17.

[2] Ibid. [3] Ibid.

[4] Couger, ed., "C^3EM Recommendations for Undergraduate Curriculum."

effective computer user. The technological concentration was designed to prepare a person for entry-level job in an information department.[1]

Figure 3 presents the sequences of eleven courses which the C^3EM suggested for both undergraduate concentrations.

The C^3EM stated that three courses: UB1, UB2, and UA8 could be taught in schools of business. Six courses: UC1, UC2, UC3, UC4, UC8, and UC9 could be taught in the computer science department or in Engineering. The remaining two courses: UD8 and UD9 could be taught in either one.[2]

The Management Research Center, Syracuse University, sponsored a survey of business schools to determine the characteristics of MIS curriculum.[3] The researchers found that four MIS courses are typically required in undergraduate MIS programs. The courses are: Introduction into the Computer System Field; Introduction into the Information Systems Field; a Scientific Programming Course, and a course in the Systems Analysis or Systems Design Area.[4] The researchers concluded that standardization in MIS curricula at either the undergraduate or graduate degree levels seems to be little, although certain types of courses are more frequently offered.

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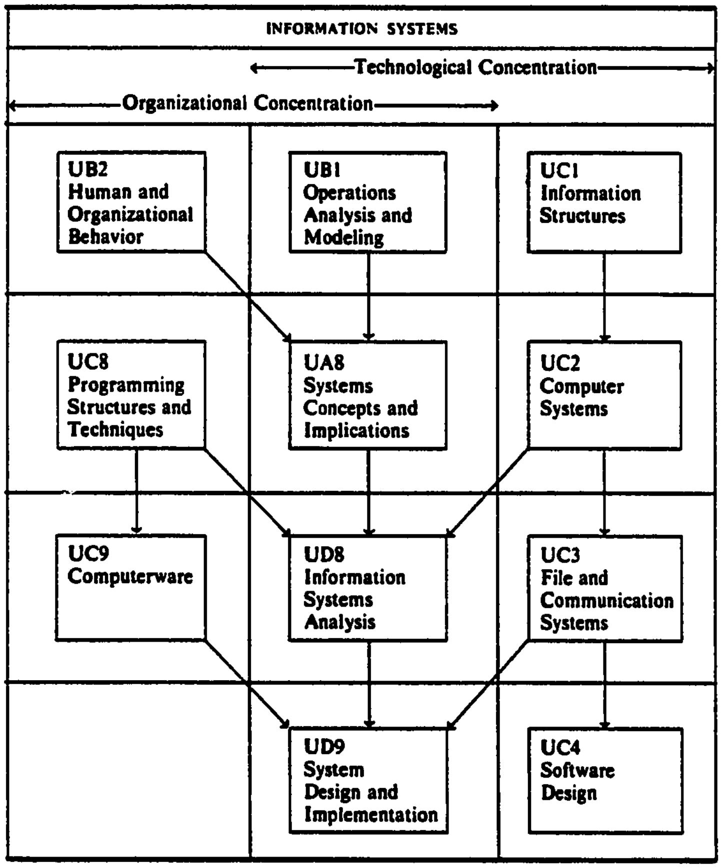
[1]Ibid., [2]Ibid., 738.

[3]Roy H. Igerhseim, and Lloyd A. Swanson, "Management Information Systems Curricula: State-of-the Art," Decision Sciences, 5 (April 1974):284-91.

[4]Ibid., 290, [5]Ibid., 291.

Figure 3. Core course sequences for information systems programs.



Source: J. Daniel Couger, ed., "Curriculum Recommendations for Undergraduate Programs in Information Systems," A Report of the ACM Curriculum Committee on Computer Education for Management, Communications of the ACM, 16 (Dec. 1973):732.

Curriculum Planning for Developing Countries

Literature of curriculum planning does not provide specific treatment for developing countries. To provide a base for planning MIS curriculum in developing countries, this section presents a review of human resource development in developing countries and factors influencing curriculum planning.

Human Resource Development

Literature of education and development, as described by Don Adams, has two characteristics. "It is largely impressionistic and worries little about using conceptual apparatus to focus analysis and even less about qualifying interpretations or recommendations."[1] Second, the literature "describes education and development in highly aggregated or abstract terms."[2] Single or composite quantitative indices were used to measure levels of national development. Such measurements consider only limited structural characteristics of the society.[3]

Harbison and Myers[4] used a composite index to distinguish among countries in terms of four levels of human

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[1] Don Adams, ed., Education in National Development (New York: David McKay Company, Inc., 1971), p. 4

[2] Ibid.

[3] Ibid.

[4] Frederick Harbison and Charles A. Myers, Education, Manpower, and Economic Growth: Strategies of Human Resource Development (New York: McGraw-Hill Book Company, 1964).

resource development. Countries were grouped according to their score on the index in which primary education is not counted at all. Secondary education scores according to the arithmetic total of enrollment as a percentage of the age group 15 to 19, adjusted for length of schooling. Higher education scores by taking the percentage and multiplying it by five.[1] The writers labeled the levels as follows: Level I, underdeveloped; Level II, partially developed; Level III, semiadvanced; and Level IV, advanced.[2]

Level I countries were described as those which are dependent upon the continued employment of foreign high-level manpower. These countries do not have sufficient qualified manpower to permit their economic and social progress to move forward on their own.[3]

Formal education in Level I countries is under-developed at every level. Quality of education is low and it reaches only a small fraction of the population. Institutions for on-the-job training are not well developed or properly utilized. Formal in-service training programs are rare.[4]

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[1]Ibid., pp. 31-32.

[2]Ibid.

[3]Ibid., p. 49.

[4]Ibid., p. 58.

Level II countries are able to produce the greater part of their own nontechnical high-level manpower. But they are still dependent upon the more advanced countries for critically needed scientific and engineering manpower.[1]

Formal education in level II countries is moving rapidly in terms of the increase of enrollments at all levels of education. But this increase has been at the expense of efficiency and quality of education.[2] There are many kinds of institutions for on-the-job training, but they are given less attention than they deserve.[3]

Level III countries have the ability of producing all needed high-level manpower and they may export some to less developed countries. There are enough scientists and engineers to import and adapt modern technology without substantial external help. The semiadvanced countries are not originators of scientific, engineering, and organizational innovations, rather they are followers of advanced countries.[4]

The level III countries have achieved great levels of progress in formal education, especially in higher education. Attention is being paid to ways of upgrading the qualifications and improving the performance of employed manpower. On-the-job training has spread more widely among employing institutions.[5]

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[1]Ibid., pp. 73-74.

[2]Ibid., pp. 77-78. [3]Ibid., p. 90.

[4]Ibid., pp. 101-102. [5]Ibid., pp. 109-23.

Each level of developing countries is faced with different problems which determine the elements and priorities of educational development for the level. Even within each level, problems vary from one country to another. But still the need for educational development is a necessity for all countries. Such a need is emphasized by Dean Rusk who wrote

> Education is not a luxury which can be afforded after development has occurred; it is an integral part, an inescapable and essential part, of the development process itself.[1]

Education alone cannot create development. It must be related to the total fabric of development. It must be so planned that it helps speed economic opportunity and returns to all groups in the society.[2] Educational planning can maximize the contribution of education to the economic and social development of society.

The hopes of all educational plans and the real growth in educational development depend on the content and the impact of what is taught, the curriculum.[3]

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[1]Dean Rusk, "The Key Role of Education," in Education and the Development of Nations, eds. John W. Hanson and Cole S. Brembeck (New York: Holt, Rinehart and Winston, Inc., 1966), p. 28.

[2]Hanson and Brembeck, eds., Education and the Development of Nations, p. 120.

[3]Ibid., p. 382.

Factors Influencing Curriculum Planning

Many forces influencing curriculum planning were discussed in the literature, such as social, economic, demographic, political, psychological, and technological forces.

King and Brownell wrote about five claims on curriculum which represent five important perspectives on man: occupational man, political man, social man, intellectual man, and religious man.[1] The claims cannot be isolated from one another because each claim is an aspect of the whole man. The claims may have priority at different periods in a person's life.[2]

Vars and Lowe,[3] after examination of research on social forces affecting curriculum decision, concluded that "what is taught, why it is taught, and how it is taught are affected by dynamic social forces. Study of these forces is a continuing responsibility of all educators."[4] They also found "numerous studies emphasize the importance of providing curricular experiences that are meaningful to the learner in terms of the cultural context in which he is living."[5]

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[1] Arthur R. King, Jr., and John A. Brownell, The Curriculum and the Disciplines of Knowledge (New York: John Wiley and Sons, Inc., 1966), pp. 1-34.

[2] Ibid.

[3] Gordon F. Vars and William T. Lowe, "Social Forces Influencing Curriculum Decisions," Review of Educational Research, 33 (June 1963): 254-67.

[4] Ibid., p. 263.

[5] Ibid.

Bowers[1] indicated that many educators believe principles of learning, characteristics of physical growth and development, and personality are the psychological forces that influence curriculum decisions. After reviewing the research in the area of psychological forces, Bowers concluded that "much of the available information did not seem to have direct usefulness and applicability in the making of curriculum decisions."[2]

Woodring[3] stated that the most recent reforms in education have been due not to new psychological discoveries but to social and political pressures.

Shaw identified the forces for curriculum innovations in the United States. He wrote

> The most important curricular innovations were introduced in response to social, economic, and intellectual problems such as the influx of minority groups into big cities, the growth of automation in industry, and the knowledge explosion. The federal government in particular, played a vigorous role in planning and supporting new curricula.[4]

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[1]Norman D. Bowers, "Psychological Forces Influencing Curriculum Decisions," Review of Education Research, 33 (June 1963): 268-77.

[2]Ibid., p. 274.

[3]Paul Woodring, "Reform Movements from the Point of View of Psychological Theory," Theories of Learning and Instruction in Sixty-Third Yearbook, National Society for the Study of Education, Pt. 1 (Chicago, University of Chicago Press, 1964), pp. 286-305.

[4]Frederick Shaw, "The Changing Curriculum" Review of Educational Research, 36 (June 1966): 350.

The literature described forces or factors that affect curriculum planning and curriculum innovations. Such forces or factors represent the environment of society and they are not the only forces that should determine curriculum decisions. Don Adams supported this view by writing

> Educational change cannot be viewed merely as a set of responses of demographic, social and economic pressures, for such pressures do not necessarily dictate particular organizational arrangements or specific educational curricula. At best such external factors offer firm output targets (e.g., number of skilled persons demanded by certain industries) and guide-lines for inputs (e.g., number of pupils to enter the first year, or grade 1); at worst they generate only statements of intent and do not offer precise data for educational planning.[1]

The force of culture has great impact on curriculum decisions. Clark, Klein and Burks explained this fact by stating that "education is a creature of the culture, and so, in the long run, it is the culture that determines what the curriculum is to be in any particular country or society."[2] The three writers indicated that the kind of educational system in society depends upon culture of the society. The curriculum reflects cultural values and the differences in curriculum from country to country is largely because of the differences of values.[3]

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[1]Don Adams, ed., Education in National Development, pp 1, 2.

[2]Leonard H. Clark, Raymond L. Klein and John B. Burks, The American Secondary School Curriculum, 2nd ed. (New York: The Macmillan Company, 1972), p. 89.

[3]Ibid., pp. 90-91.

The environmental factors and the cultural factors which determine curriculum planning in any society are not separated from each other. They are factors in a continuous dynamic process, as it is described by A. Nicholls and S. Nicholls, who wrote

> Curriculum development [planning] is a dynamic process. Its cyclical nature suggests that it is an activity which has no beginning and no end. The changing nature of society, schools and pupils supports the view of curriculum development [planning] as a never-ending activity.[1]

The dynamic process of curriculum planning, with environmental and cultural factors has not been investigated yet in terms of the interactive relationships among the different factors. This suggests the need for such an investigation which is presented in Chapter V of this dissertation.

Summary

This chapter is divided into five sections: introduction, MIS: an overview, MIS curriculum, curriculum planning for developing countries and summary. The section of the MIS overview examined MIS concepts, definitions and approaches. The analysis and discussion in that section were conducted with the intention of identifying basic conceptual factors of MIS. Five factors were identified:

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[1]Audrey Nicholls and S. Howard Nicholls, Developing a Curriculum--A Practical Guide (Boston: George Allen and Unwin, 1978), p. 104.

1. Systems concepts for MIS
2. Human and organizational behavior
3. Decision-making
4. Systems analysis
5. Information technology

The review of literature on MIS curriculum covered the need for MIS educational programs, MIS graduate curriculum and MIS undergraduate curriculum.

Human resource development in developing countries and factors influencing curriculum planning were reviewed. This review was conducted with the intention of providing a base for planning MIS curriculum in developing countries.

The literature review in this chapter reveals the following selected observations. These observations are highlighted as aids for better understanding of the purpose of this investigation.

1. The MIS literature, as reviewed in this chapter, was basically developed in the United States of America. The United States is one of the most advanced industrial countries which used the highest level of technology in the world.

2. The above mentioned observation is clearly reflected in the MIS literature. This can be explained as follows:

a. Many writers[1] indicated that MIS predates the use of computers and that MIS does not necessarily

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[1]See, for instance:
Davis, Management Information Systems; Murdick and Ross, Information Systems.

have to be computerized. The same writers devoted their work and restricted their writings to the computerized MIS.

b. Deardon observed, as it was mentioned before, that institutions of higher education which offer advanced degrees in information systems, limit their MIS material to the computerized orientation.[1]

c. The C^3EM curriculum recommendations "have served as models for much subsequent curriculum design activity."[2] The recommendations are limited to computerized MIS.

3. The state of the art of MIS in the United States is justified by needs and technological capabilities of the society. When planning MIS curriculum for developing countries, needs and technological capabilities of these countries must be considered.

4. The literature of MIS does not have any reference to developing countries.

These observations on the literature emphasized the need for developing a framework for planning MIS curriculum in developing countries. The framework is developed in chapters four and five. The methodology and procedures of developing the framework are presented in the next chapter.

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[1]Deardon, "MIS is a Mirage," p. 91.

[2]Gary R. Reeves and Robert S. Bussom, "Information Systems Curriculum" Journal of Systems Management, 30 (March 1979), p. 18.

CHAPTER III

METHODOLOGY AND PROCEDURES

Introduction

The methodology and procedures for this investigation are found in this chapter. This investigation was the kind of research "that is conducted primarily through the use of written materials most commonly located in large libraries."[1] The investigation included an exhaustive search for significant information and interpretations from library sources about the development of a conceptual framework for planning MIS curricula in developing countries.

The development of this investigation required extensive preliminary study involving: (1) preparation of a tentative bibliography of related research and professional literature, (2) collection of data, (3) analysis, classification, and synthesis of information and (4) the preparation of the final research report.

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[1] J. Francis Rummel and Wesley C. Ballaine, Research Methodology in Business (New York: Harper and Row, Publishers, 1963), p. 4.

Preparation of the Bibliography

In developing a selected bibliography, a preliminary study of the literature was made to become familiar with the nature and quantity of related research. From this review of research and professional literature, it was determined that a large number of research studies, books and articles had been completed in various areas of MIS and curriculum planning.

After the preliminary review of the literature, a selected tentative bibliography was compiled utilizing a variety of sources which included the following:

1. Dissertation Abstracts
2. Current Index to Journals in Education (CIJE)
3. Educational Resources Information Center (ERIC)
4. Business Periodicals Index
5. Business Education Index
6. Education Index.

The selection of the bibliography was based on the following criteria: (1) the recognized writings of doctoral dissertations, (2) the recognized authority of leading writers such as Daniel Teichroew, Robert L. Ashenhurst and Gordon Davis, (3) reports of such creditable professional associations as Association for Computer Machinery (CAM) and Association for Systems Management, and (4) reports in such reputable publications as Management Science and Harvard Business Review.

The tentative bibliography was revised and expanded continually as the investigation progressed. A careful check was made for additional relevant references from the bibliographies of research reports obtained and of footnotes appearing in the professional literature.

Collection of Data

An exhaustive effort was made to secure a copy of each item in the bibliography. Extensive use was made of libraries of the University of Oklahoma, Norman, and Oklahoma State University, Stillwater.

Reports were secured through interlibrary loan from colleges and universities located throughout the United States. Doctoral dissertations that were not available through this service were purchased directly from University Microfilms, Ann Arbor, Michigan.

The data for this investigation were most frequently in the general overlapping discipline areas of information systems, business administration, educational administration, library science, computer science, industrial engineering, communication, curriculum, political science, and sociology.

The sources of the data included the following:

1. Doctoral dissertations
2. Reports of professional organizations
3. Research reports in management and organization
4. Research reports in education
5. Text books of MIS
6. Articles in creditable periodicals

Analysis, Classification and Synthesis of Information

The findings in research reports were analyzed to determine the basic conceptual factors of MIS and the major factors of curriculum planning. As a result of this analysis, the conceptual factors of MIS were classified as (a) systems concepts for MIS, (b) human and organizational behavior, (c) decision-making, (d) systems analysis, and (e) information technology. The major factors influencing curriculum planning were classified as environmental or cultural.

The findings pertaining to each of the factors were then carefully studied, and a synthesis was presented of the composite findings for each factor. Pictorial frameworks were developed and presented as a part of this report.

CHAPTER IV

A THEORY BASE FOR MIS

Introduction

The major purpose of this study was to develop a basis for planning MIS curriculum for managers in developing countries. The basis provides curriculum planners with the essential components for a MIS curriculum. The basis provides a variety of MIS techniques that enable curriculum planners to plan the content of the curriculum according to the needs and technological capabilities of developing countries.

The five basic conceptual factors of MIS: systems concepts, human and organizational behavior, decision-making, systems analysis, and information technology were identified and presented in the discussion of the related literature. It was found in the literature that the five factors are essential components for providing a basis for an intellectual interpretation of the MIS process when they are interrelated and systematically connected. MIS meets the requirements of a theory according to the following definition by Kerlinger.

> A theory is a cluster of interlocking and interactive concepts systematized into an abstracted intellectual pattern capable of

> interpreting generalizable trends and interrelationships that prevail within reality.[1]

Kerlinger's definition according to Knezevich, contains three major elements of a theory:

> 1. A constellation of interlocking and interactive concepts.
> 2. Concepts subsequently systemized into a pattern.
> 3. Functional, that is, helps to explain or understand all or part of reality.[2]

This chapter develops a theory for MIS which is based on the five basic conceptual factors with the consideration of the three major elements of a theory.

Systems Concepts for MIS

MIS was described as a system which should exist within an organization. Emery stated that "the organization itself constitutes a system, and it is governed by means of a system of plans."[3] Scott[4] indicated that the only meaningful way to study an organization is to study it as a system. Buckley shared this view by defining an organization as "a cluster of components or parts sharing degrees of

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[1]F. N. Kerlinger, Foundations of Behavioral Research, (New York: Holt, Rinehart and Winston, 1964), p. 11.

[2]Stephen J. Knezevich, Administration of Public Education, 3rd edition (New York: Harper and Row, Publishers, 1975), p. 139.

[3]James C. Emery, Organizational Planning and Control Systems, Theory and Technology (Toronto: Collier-MacMillan, Ltd., 1969), p. 1.

[4]William G. Scott, "Organization Theory: An Overview and an Appraisal," Academy of Management Journal, 4 (April 1961): 15-21.

interdependence and sets of relationships which function to achieve hierarchically linked goals."[1]

The understanding and implementation of paradigm of the organization as a system requires clear definitions of systems concepts and specifications for relationships among the concepts. This section synthesizes systems concepts as they are related to organizations in general and to MIS in particular. The following topics are developed in this section: definition of a system, characteristics of systems, MIS as a system, types of systems, organizations systems, and MIS as an organization system.

Definition of a System

Murdick and Ross define a system as "a set of elements, such as people, things, and concepts, which are related to achieve a mutual goal."[2] A system was defined by Bertalanffy as "a complex of interacting elements."[3] The complexity of a system is further explained by Cleland and King as "an organized or complex whole; an assemblage or combination of things or parts forming a complex or unitary

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[1]Walter Buckley, Sociology and Modern System Theory (Englewood Cliffs, N.J.: Prentice-Hall, 1967), p. 82.

[2]Robert G. Murdick and Joel E. Ross, Information Systems for Modern Management, 2nd edition (Englewood Cliffs, New Jersey, 1975) p. 4.

[3]Ludwing von Bertalanffy, General Systems Theory (New York: George Braziller, 1968), p. 55.

whole."[1] The purposeful nature and the holism characteristic of a system are emphasized by Voich and Wren. They define a system as:

> A purposeful, organized interrelationship of components in which the performance of the whole exceeds the individual outputs of all the parts.[2]

The above definitions introduced six characteristics of systems: elements or components, complexity, interaction, purposeful, holism and the mutual goal. The six characteristics were synthesized in the following definition: a system is a set of complex interacting components forming a purposeful unitary whole in which the performance is directed to achieve a mutual goal.

Anthony made a distinction between a system and a process as: a "system facilitates a process; it is the means by which the process occurs."[3] The system refers to a structure--what it is; whereas the process refers to how it functions.[4]

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[1]David I. Cleland and William R. King, Systems Analysis and Project Management (New York: McGraw-Hill Book Company, 1968), p. 10.

[2]Dan Voich, Jr. and Daniel A. Wren, Principles of Management: Resources and Systems (New York: Ronald Press Company, 1968), p. 21.

[3]Robert N. Anthony, Planning and Control Systems, A Framework for Analysis (Boston: Graduate School of Business Administration, Harvard University, 1965), p. 5.

[4]Ibid.

Characteristics of Systems

The characteristics of systems which were included in the definition of the system, as well as other related concepts were presented to provide the reader with a common base for interpretation. The characteristics include: purpose, holism, input-processor-output format, control, boundaries, hierarchy and communication.

Purpose

It has been discussed in the literature that specified objectives or goals should be the starting point in the design of a system. All the interactive and interdependent components of a system should be assembled to work together to achieve the purposes of the system.

Holism

In the discussion of the related literature it was shown that the identifiable components of a system may be assembled in many different combinations so as to achieve a system's purposes. Such an assemblage forms a complex whole which can achieve the final objectives of the system.

Input-processor-output format

It was agreed to in the literature that components of a system take the form of input, processor and output. The system starts its operations with input components. In most cases, inputs of a system are outputs of some other system(s).

The processor transforms inputs in a way that contributes to the achievement of a designed goal or output.[1]

Any system can be described in terms of the three components. However, in the case of exceedingly complex system, a system has to be accepted as indefinable in detail.[2] Murdick and Ross emphasized the complexity of the processor. They recommended considering the processor as a "black box." It is so black as to be indescribable. The black box concept enables the analyst to handle complex systems in terms of input manipulation and output classification, not in terms of cause-and-effect analysis.[3] If a computer is the processor of a system, and the tranformation from input to output is not explained, the computer is treated as a black box.[4]

Control

The basic components of a system, input, processor and output do not provide for control to direct the system toward its goals. Davis solves this when he stated that a feedback loop is added to the components. "Control in a system essentially

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[1] Murdick and Ross, Information Systems for Modern Management, pp. 414-415.

[2] Stafford Beer, Cybernetics and Management, 2nd edition (London: The English University Press, Ltd., 1967), p. 49.

[3] Murdick and Ross, Information Systems for Modern Management, p. 415.

[4] Ibid.

means keeping the system operating within certain limits of performance."[1] Control takes place by comparing output to a predetermined standard and feeding the results back to the system. It is the function of feedback that "provides information on the deviation between output and control standard and delivers this information as input into the process from which the output was derived."[2] This process was termed negative feedback when its purpose was "to assist in maintaining the system within the critical operating range and reduce performance fluctuations."[3] Positive feedback reinforces the performance by "causing the system to repeat or amplify an adjustment or action."[4]

Boundaries

The operational definition of a system in terms of its boundary, was given by Murdick and Ross.[5]

1. List all components that are to make up the system and circumscribe them. Everything within the circumscribed space is called the system, and everything outside is called the environment.

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[1]Gordon B. Davis, Management Information Systems: Conceptual Foundations, Structure, and Development (St. Louis: McGraw-Hill Book Company, 1974), p. 96.

[2]Murdick and Ross, Information Systems for Modern Management, p. 420.

[3]Theodore C. Willoughby and James A. Senn, Business Systems (Cleveland, Ohio: Association for Systems Management, 1975), p. 7.

[4]Davis, Management Information Systems, p. 95.

[5]Murdick and Ross, Information Systems for Modern Management, pp. 408-409.

2. List all flows across the boundary. Flows from the environment into the system are inputs; flows from inside the boundary to outside are called outputs.

3. Identify all elements that contribute to the specific goals of the system and include these within the boundary if they are not already included.

Boundaries of systems should be determined by the purpose of the investigator with the consideration of the nature of systems.[1] The three main criteria for defining boundaries are spatial, functional, and analytical.[2]

A system can be defined and delineated by its boundary. A system can affect and be affected by its environment.[3]

Hierarchy

The hierarchical nature of systems was shown in the literature to be an important characteristic for interpretations and applications of systems. While each system contains subsystems the system also will be contained in a suprasystem.[4]

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[1]Alfred Kuhn, "Boundaries, Kinds of Systems, and Kinds of Interactions," in General Systems and Organization Theory, ed., Arlyn J. Melcher (Kent State University Press, 1975), p. 39.

[2]Ibid.

[3]This point is in conjunction with the concepts of closed and open systems which are presented later in this chapter. Closed systems are separated from their environments by their boundaries, while open systems are affected by their environments.

[4]James G. Miller, "Living Systems: Basic Concepts," Behavioral Science, 10 (1965): 218.

Simon indicates that a system is composed of interrelated subsystems which are hierarchic in structure including the low level elementary subsystems.[1] Davis explains interfaces within the hierarchy. He stated that "the interconnections and interactions between the subsystems are termed interfaces. Interfaces occur at the boundary and takes the form of inputs and outputs."[2] Von Bertalanffy pointed out that all property descriptors of the major system apply equally to the subsystem.[3]

All systems have a suprasystem except one. Presumably only the universe does not have a suprasystem.[4] The suprasystem should be differentiated from the environment. The immediate environment can be the suprasystem minus the system itself.[5]

Communication

It was found in the literature that communication was the "enabling process of a system."[6] The inputs, the interaction among the components, interfaces, the outputs, and feedback are linked as a system only through communication.

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[1]Herbert A. Simon, "The Architecture of Complexity," Proceedings of the American Philosophic Society (1962), pp. 467-468.

[2]Davis, Management Information Systems, p. 83.

[3]Von Bertalanffy, General Systems Theory, pp. 662-663.

[4]Miller, "Living Systems: Basic Concepts," p. 218.

[5]Ibid.

[6]Murdick and Ross, Information Systems for Modern Management, p. 438.

The four components in the communication process are the source, the message, the channel, and the receiver.[1] The communication process starts with originating the message by the source. The message is then translated (encoded) into symbols appropriate for transmission through the selected channel. The message is decoded (interpreted) by the receiver, the destination for the message.[2] Communication should be a two-way process through exchange of information. The two-way process of communication requires a feedback from the final destination to the source.[3]

MIS as a System

The design of MIS starts with the specification of its purpose. The purpose of MIS is the production of information that is useful for and used by decision-makers in the organization.

MIS starts its operations with inputs of data which come from: (1) the internal activities of the organization, (2) the external activities of the organization with others and its environment, and (3) feedback resulting from output information.[4] Then, the system processes the data according

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[1]Everett M. Rogers and Rekha Agarwala-Rogers, Communication in Organizations (New York: The Free Press, A Division of MacMillan Publishing Company, Inc., 1976), p. 10.

[2]Ibid., pp. 11-12. [3]Ibid.

[4]James B. Bower, Robert E. Schlosser and Charles T. Zaltkovich, Financial Information Systems: Theory and Practice (Boston: Allyn and Bacon, Inc., 1969), p. 14.

to specified procedures. For processing, the system may use previously stored data and it may store new data for future use.[1] The outputs resulting from processing are to be communicated to all levels of decision-makers in the organization.

The output of information is compared with standards which represent the desired information. The comparison determines the deviations and leads to control through the feedback of the results to the system.[2] Figure 4 illustrates the MIS process.

An MIS achieves its purpose as an integrated and interconnected unitary system. Such a system is sufficiently complex that it needs to be broken into a manageable hierarchy of subsystems. The black box concept is useful when subsystems, boundaries and interfaces in MIS are being defined and specified.[3]

Types of Systems

According to the literature, systems are categorized in many ways. Five categories were found to be useful for

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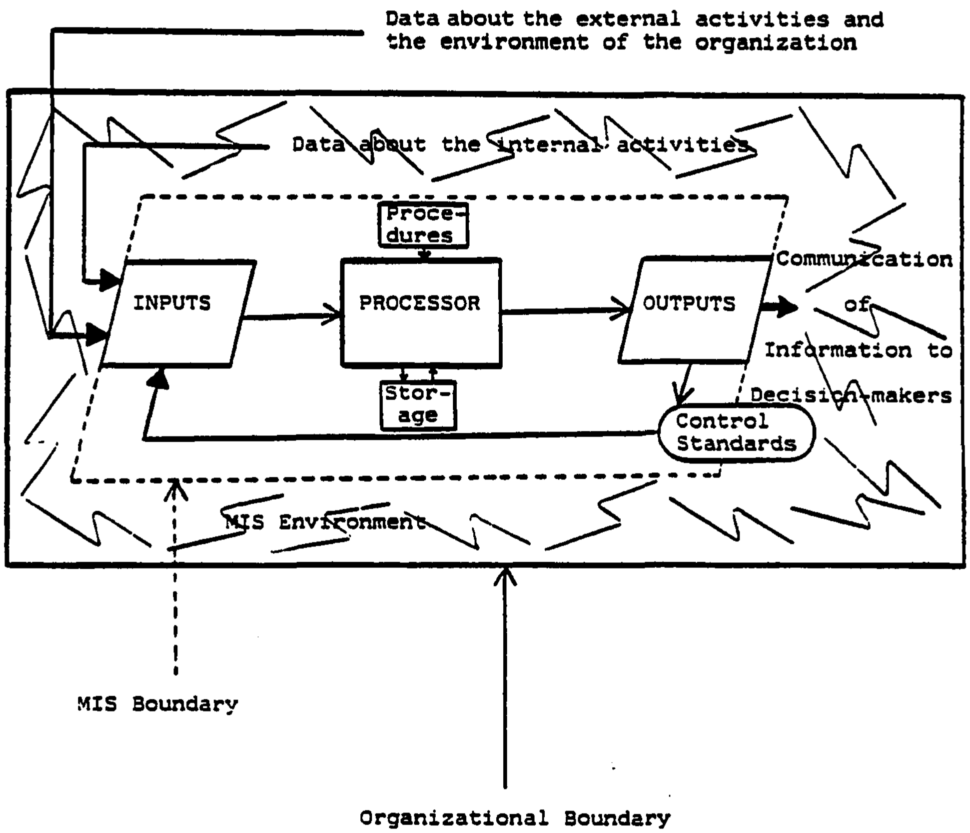
[1] Davis, Management Information Systems, p. 102.

[2] Murdick and Ross, Information Systems for Modern Management, p. 420.

[3] Ibid., pp. 415-19.

Figure 4. A basic conceptual model for MIS.



NOTE: This pictorial presentation synthesizes the concepts as they were presented in the literature. Its purpose is clarity.

understanding the nature of MIS. The five categories of systems utilized in this report are: conceptual and physical, deterministic and probabilistic, natural and man-made, social and man-machine, and closed and open systems.

Conceptual and physical systems

Conceptual or abstract systems are ones that all of whose components are concepts.[1] Such systems were "conceived with theoretical structures, which may or may not have any counterpart in the real world."[2] Examples of conceptual systems are philosophic systems, accounting system structures, and computer programs.

Physical or empirical systems were found to be: "concrete operational systems made up of people, materials, machines, energy and other physical things."[3] Systems may be: "derived from or based upon conceptual systems and thus represent the conversion of concepts into practice."[4]

Deterministic and probabilistic systems

A deterministic system according to Beer is: "one in which the parts interact in a perfectly predictable way."[5]

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[1]Russell L. Ackoff, "Towards a System of Systems Concepts," Management Science, 17 (July 1971): 662.

[2]Murdick and Ross, Information Systems for Modern Management, p. 339.

[3]Ibid.

[4]Ibid., p. 340.

[5]Beer, Cybernetics and Management, p. 14.

If the description of the state of the system at a given point of time and a description of its operation are known, it is always possible to predict, without error, its succeeding state.[1] An example of deterministic systems is a computer. It will do only what it is instructed to do.

A probabilistic system was defined by Beer as: "one about which no precisely detailed prediction can be given."[2] An example of probabilistic systems could be a statistical quality control system whereby an established degree of error is attached to the predicted results.

Natural and man-made systems:

Natural systems are those ones which are not planned and implemented by humans. Such systems maintain themselves in changing environment and adapt to changes. Natural systems are the roots for all order.[3] Examples of natural systems are the solar system and all human beings.

Man-made systems are the systems which are: "planned, designed and controlled by humans. These systems are intentional and have outcomes geared to human goals and purposes"[4]

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[1] Davis, Management Information Systems, p. 86.

[2] Beer, Cybernetics and Management, p. 12.

[3] Eugene P. Wenninger, "Entropy, Equilibrium, and Organizations: Problems of Conceptualization," in General Systems and Organization Theory, ed. Arlyn J. Melcher (Kent State University Press, 1975), p. 24.

[4] Ibid.

Examples of such systems can be governmental systems, school systems, and business systems.

Social and man-machine systems

Social systems are those which have human components. "Systems made up of people may be viewed purely as social systems, apart from other systems objectives and processes."[1] Katz and Kahn indicated that the cement of a social system is psychological and is "anchored in the attitudes, perceptions, beliefs, motivations, habits, and expectations of human beings."[2] The culture and beliefs of the members of the human social systems affect the reality of these systems. "Beliefs are changeable, so social systems are subject to pressure for change from within as well as without."[3] Examples of social systems are government agencies, political parties, and business organizations.

Man-machine systems are composed of people who utilize equipment of some kind to achieve their objectives.[4] A system

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[1]Murdick and Ross, Information Systems for Modern Management, p. 400.

[2]Daniel Katz and Robert L. Kahn, The Social Psychology of Organizations, second edition (New York: John Wiley and Sons, 1978), p. 37.

[3]Wenninger, "Entropy, Equilibrium, and Organizations," p. 25.

[4]Murdick and Ross, Information Systems for Modern Management, p. 400.

can emphasize the human so that the machine performs a supporting role, or the system may emphasize the machine and use the human as a monitor of the machine operation.[1] Information systems can be examples of man-machine systems.

Closed and open systems

A closed system is a deterministic system;[2] "it has no interaction with any element not contained within it; it is completely self-contained."[3] A traffic light is an example of a closed system.

An open system is a probabilistic system; it interacts with its environment. "All systems containing living organisms are obviously open systems because they are affected by what is sensed by the organisms."[4]

The concept of open and closed systems was explained by Kast and Rosenzweing when they wrote:

> Systems can be considered in two ways: (1) closed or (2) open. Open systems exchange information, energy, or material with their environments. The concept of open and closed systems are difficult to defend in absolute. We prefer to think of open-closed as a dimension; that is, systems are relatively open or relatively closed. The open system

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[1] Davis, Management Information Systems, p. 89

[2] Von Bertalanffy, General System Theory, p. 40.

[3] Ackoff, "Toward a System of Systems Concepts," p. 663.

[4] Murdick and Ross, Information Systems for Modern Management, p. 401.

> can be viewed as a transformation model. In a dynamic relationship with its environment, it receives various inputs, transforms these inputs in some way, and exports output.[1]

Davis defined the relatively closed system as "one that has only controlled and well-defined inputs and outputs. It is not subject to disturbances from outside the system."[2] Davis illustrated the concept of open and closed systems as it is shown in Figure 5.

The concept of open and closed systems has been associated with three other concepts: equilibrium, entropy and equifinality.

Equilibrium

Equilibrium was defined as a tendency of a system "to achieve a balance among the many forces or factors operating upon the system and within it."[3] Chin differentiated between two kinds of equilibrium as follows: "A stationary equilibrium exists when there is a fixed point or level of balance to which the system returns after a disturbance . . . A dynamic equilibrium exists when the equilibrium shifts to a new

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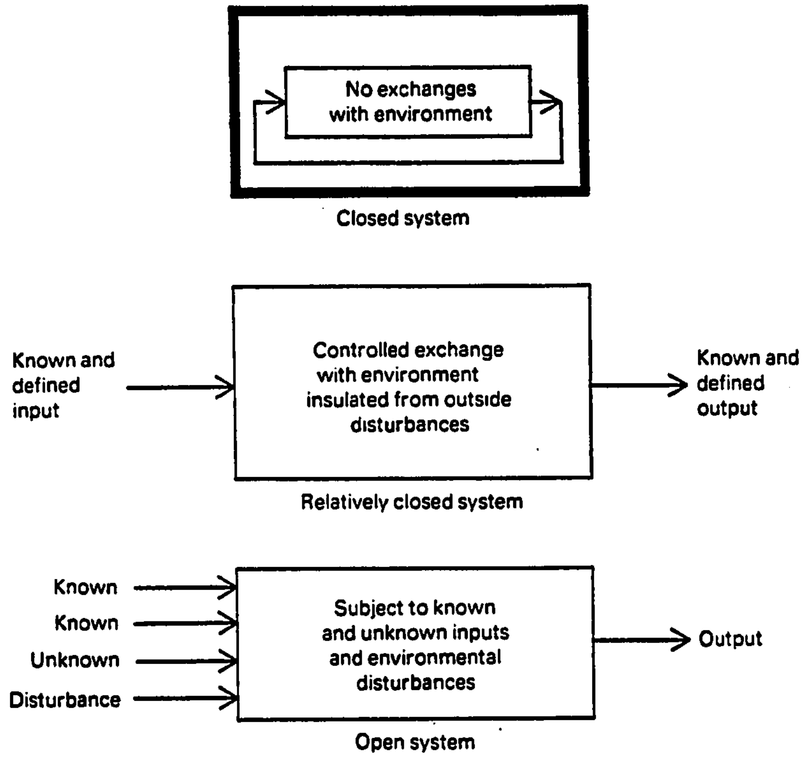
[1]Fremont E. Kast and James E. Rosenzweing, "General Systems Theory: Applications for Organizations and Management," Academy of Management Journal, 15 (December 1972): 450.

[2]Davis, Management Information Systems, pp. 86-87.

[3]Edgar L. Morphet, Roe L. Johns and Theodore L. Reller, Educational Organization and Administration, 3rd ed. (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1974), p. 61.

Figure 5. Concept of open and closed systems.



Source: Gordon B. Davis, Management Information Systems: Conceptual Foundations, Structure, and Development (St. Louis: McGraw-Hill Book Company, 1974), p. 88.

position of balance after disturbance."[1] The terms stationary equilibrium and equilibrium are used as synonymous. The terms "steady state" and "dynamic equilibrium" are used synonymously.[2]

Entropy

Kirkpatrick defined entropy as the "degree of disorganization, randomness, or deterioration of the system."[3] "Every system produces entropy, but at minimal rate when the system is in a steady state."[4] Closed systems inevitably move toward increased entropy because they are isolated from their environment.[5]

The tendency of an open system to combat entropy has been referred to as negentropy. An open system maintains a steady state (dynamic equilibrium) by receiving inputs from its environment in the form of feedback.[6]

Equifinality

Equifinality was defined by Beer as a:

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[1]Robert Chin, quoted by Morphet, Johns and Reller, Educational Organization and Administration, p. 61.

[2]Ibid., pp. 61-62.

[3]Donald Clay Kirkpatrick, "General Systems Theory as a Framework for Management Information Systems" (doctoral dissertation, University of Colorado, 1976), p. 318.

[4]Morphet, Johns and Reller, Educational Organization and Administration, p. 62.

[5]Ibid., p. 63.

[6]Ibid.

> Name given to the mechanism whereby a system has a specified goal, or final state, which it may reach in different ways from different working conditions. The goal, then, is equifinal.[1]

Beer also implied that closed systems cannot behave equifinally, therefore, equifinality is a property of open systems.[2]

Kast and Rosenzweing stressed that the flexibility of performances is permitted by equifinality when they said:

> Equifinality suggests that social organizations can accomplish their objectives with diverse inputs and with varying internal activity (conversion processes).[3]

Organizations Systems

Ackoff indicated that the type of system which management scientists are most concerned with is called "organizations." An organization cannot be a purely mechanical (deterministic) system; to be an organization a system must contain purposeful components and components that have and can exercise their own wills.[4]

Ackoff defined an organization as follows:

> An organization is a purposeful system that contains at least two purposeful elements which have a common purpose relative to which the system has a functional division of labor; its functionally distinct subsets can respond to each other's

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[1]Beer, <u>Cybernetics and Management</u>, pp. 168-169.

[2]Ibid.

[3]Kast and Rosenzweing, "General Systems Theory," p. 450.

[4]Ackoff, "Towards a System of Systems Concepts," p. 669.

> behavior through observation or communication; and at least one subset has a system-control function.[1]

Ackoff also gives the definition of a purposeful system.

> A purposeful system is one which can produce the same outcome in different ways in the same (internal or external) state and can produce different outcomes in the same and different states. Thus a purposeful system is one which can change its goals under constant conditions; it selects ends as well as means and thus displays will.[2]

The use of the term "organization" by Ackoff is similar to that of Thompson, et al.[3] The term is not used in the broad sense for any group of persons associated together, but it is limited to administered organizations. Thompson, et al. indicated that administered organizations consist of groups that have four characteristics: (1) they exhibit sustained collective action, (2) they are integral parts of a larger system, (3) they have specialized, delimited goals, and (4) they are dependent upon interchange with the larger system.[4]

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[1]Ibid., p. 670.

[2]Ibid., p. 666.

[3]James D. Thompson, et al., eds., Comparative Studies in Administration (Pittsburgh: University of Pittsburgh Press, 1959), pp. 5-6.

[4]Ibid.

In designing and studying organizations systems, it will be less confusing if the type of systems under investigation is identified and specified. An organization system, as it was defined above, can be seen as a conceptual system to refer to the theoretical structure of the organization. The implementation of the theoretical structure produces a physical organization system.[1] Such a system is an open probabilistic system because it interacts with its environment and does not have precise detailed predictions. Some of its subsystems can be closed, deterministic, or relatively closed subsystems. The roots of organizations systems are natural systems which are represented by humans.[2] Humans design and run organizations as social systems. It is difficult to find an organized group of people who do not utilize some kind of equipment to achieve their objectives. With machine component, an organization can be seen as man-machine system.

It can be said that an organization is a mix of conceptual and physical, deterministic and probabilistic, natural and man-made, social and man-machine, and closed and open systems.[3]

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[1]Murdick and Ross, Information Systems for Modern Management, pp. 399-400.

[2]Ibid.

[3]Ibid., pp. 403-404.

MIS as an Organization System

All properties of an organization system are properties of MIS. The previously cited Ackoff definition of an organization system, with its four components is applicable for MIS. That is, MIS is a purposeful system; MIS has a functional division of labor (hardware, software, data communication, etc.); the functionally distinct subsystems of MIS can respond to each other's behavior; and MIS has control function through feedback.

MIS, like any other organization system, is a mix of different types of systems. It is a conceptual system when developing models of MIS. It is a physical system when applying the models or referring to a system in action.[1] MIS is an open probabilistic system which receives inputs of data and feedback from its environment and provides outputs of information. Some of the MIS subsystems can be closed deterministic or relatively closed. MIS has components of humans which are natural systems. Humans are the makers of MIS and they form the social aspect of MIS. The MIS includes some kinds of machines and can be seen as a man-machine system. Therefore, the study of human and organizational behavior affords a solid basis for the development and implementation of MIS.

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[1] Ibid.

Human and Organizational Behavior

The human behavior in any organization can be interpreted in terms of the interactions of individuals and groups in formal and informal settings. The total behavior of humans in an organization determines the organizational behavior. In this section human behavior in organizations, and organizational behavior and MIS have been delineated.

Human Behavior in Organizations

One way of studying human behavior in organizations is to look at an organization as consisting of three interactive systems: formal organization, the individual and the social system.[1]

Formal organization

Formal organization is a system or subsystem of the organizational system. Herbert defined formal organizational system as follows:

> This system is composed of the total work that the organization is to do, the technology by which it attempts to do it, the structure of the organization itself (such as the relationship among groups of specialized jobs), and the distributing of necessary authority and responsibility throughout the organization.[2]

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[1]Theodore T. Herbert, Dimensions of Organizational Behavior (New York: MacMillan Publishing Company, Inc., 1976), pp. 44-47.

[2]Ibid., p. 45.

According to Carzo and Yanouzas, the formal organization system can be thought of as consisting of two major subsystems: technical and authority or power.

> The technical subsystem may be defined as those relations and roles in a formal organization that are prescribed for the coordination of jobs and work activity.
>
> The power subsystem may be defined as those activities or roles that involve decision and corresponding action, that is, a decision by one party and implementation of that decision by another party.[1]

Based on an illustration by Herbert, the formal organization system can be characterized in terms of the three basic components of a system as follows:

1. Input: organizational objectives.
2. Process: the specification of responsibilities and authorities of each individual in the organization. This specification helps perform the activities of men and machines in pursuit of organizational objectives.
3. Output: tendency to perform the formal requirements.[2]

<u>The individual</u>

The formal organization is dependent upon individuals whose behavior determine the organizational behavior. Such a behavior is the "product of interaction among the whole culture,

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[1]Pocco Carzo, Jr. and John W. Yanouzas, <u>Formal Organization, A System Approach</u> (Homewood, Illinois: Richard D. Irwin, Inc., and Dorsey Press, 1967), p. 254.

[2]Herbert, <u>Dimensions of Organizational Systems</u>, p. 50.

a given organization, and an individual personality which itself is the result of the genetic composition and unique experience of any given individual."[1] Each individual in the organization is likely to behave differently, even under the same conditions or in the same situations. "Exactly how each individual responds directly affects the extent to which his team or work group can achieve its goal."[2] The individual behavior in an organization requires investigation of the factors that affect the individual within the organization. This can be done by considering the individual himself as a system or a subsystem of the organization.

The individual as a system can be studied in terms of the stimulus-organism-response concept. A stimulus is "an external or internal event that brings about an alteration in . . . behavior."[3] "A response is the alternation in behavior that occurs."[4] The organism is the active processor of the stimulus that produces certain responses or behavior.

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[1] Robert Presthus, "Toward a Theory of Organizational Behavior," in Management and the Behavioral Sciences, ed., Maneck S. Wadia (Boston: Allyn and Bacon, Inc., 1968), p. 248.

[2] Herbert, Dimensions of Organizational Behavior, p. 45.

[3] G. A. Kimble, "Hillgard and Marquis' Conditioning and Learning," (N.Y.: Appleton Croft, 1961), cited in Lawrence S. Wrightsman, Social Psychology in Seventies (Monterey, California: Brooks/Cole, 1972), pp. 10-11.

[4] Herbert, Dimensions of Organizational Behavior, p. 32.

Herbert's explanation of the individual system reveals the following characteristics of that system:

1. Input: external stimulus.

2. Process: the process starts with effective communication of the external stimulus. The stimulus is to be based on the individual's needs and his personality structure in order to have motivation for obtaining certain behavior.

3. Output: tendency to behave in a cerain manner.[1]

The social system

Within the organization, it is rare to find the individual alone. Individuals "tend to band together with others who share their viewpoints or values."[2] They form a social system which tends to modify the behavior of its members. Herbert provides the following definition for the social system:

> The social system is composed of interacting components that include groups, the informal organization, status, roles, conflict, change, and leadership. They have in common the association with social interrelationships and purposes shared by individuals.[3]

According to an illustration by Herbert,[4] the social system can be explained in systems terms as follows:

1. Input: human and social requirements.

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[1]Ibid., p. 54.

[2]Ibid., p. 46.

[3]Ibid., p. 403.

[4]Ibid., p. 56.

2. Process: in response to individuals' needs for social activities, affiliation and influence, individuals establish relationships among themselves and form social groups and informal organization.

3. Output: tendency to perform human and social requirements.

Organizational Behavior and MIS

The introduction of a new MIS or the modification of an existing one is not a meaningful event unless it causes a change. Such a change has its direct impact on organizational behavior. To assure a positive result from the change, the dimensions of organizational behavior: the formal organization, the individual and the social system, must be prepared for the change.

The change in MIS starts in the formal organization. It may lead to consolidate departments, reduce the number of levels in the hierarchy, centralize the information, etc. These changes must be planned after studying its effect on the individual and the social systems.

Davis stated that "in one organization a well-defined system fails; a similar but poorly designed system in other organization succeeds. The reason can usually be traced to human factors."[1] These human factors can be studied in the light of the effect of change on the individual and the social system in an organization.

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[1]Davis, Management Information Systems, p. 425.

Change by its nature alternates the status quo; it modifies existing relationships. The planning of a successful change must consider the external stimulus of the individual system as well as the human and social requirements of the social system in an organization.

The study of human and organizational factors provides a framework for implementing the other conceptual factors of MIS. Decision-making is the first factor to be considered. If there are no decisions, information would be unnecessary. Information are only valuable when it is useful in current or prospective decisions.[1] MIS should be established for decision-making.

Decision-Making

The ultimate purpose of the MIS is to make decisions at all managerial levels. Decision-making is broadly interpreted to become almost synonymous with management. Forrester stated that "management is the process of converting information into action. The conversion process we call decision-making."[2] It is clear that the design of MIS "must begin with specifying what questions the information is to answer, and for what levels of management. Those specifications, in turn, must be derived from an understanding of

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[1]Ibid., p. 32.

[2]Jay W. Forrester, Industrial Dynamics (Cambridge: The M.I.T. Press, 1973), p. 93.

how and where decisions are made in the organization."[1]

This section explains how and where decisions are made in an organization which provides the framework for decision-making. The framework for decision-making is a necessary base for the development of MIS.

How Decisions Are Made

Simon explained three major phases of the decision process: (1) Intelligence, or the search for the problem; (2) Design, or the invention of solutions; (3) Choice, or the selection of a course of action.[2] Simon indicated that the process is a cyclic interweaving one.[3] Davis explained the porcess "as a flow from intelligence to design and then to choice, but at any phase the result may be return to a previous phase or to start over."[4] Davis illustrated the decision process as it is diagramed in Figure 6. Davis summarized the relevance of the Simon model to the design of MIS. The summary is shown in Figure 7.

Simon distinguished between two types of decisions: programmed and nonprogrammed. He stated that the two types "are not really distinct types, but a whole continuum, with

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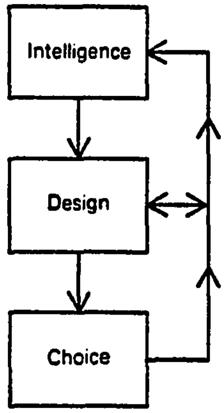
[1]Herbert A. Simon, The New Science of Management Decision (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1977), pp. 125-126.

[2]Ibid., pp. 40-41.

[3]Ibid., p. 43.

[4]Davis, Management Information Systems, p. 140.

Figure 6. Flow chart of decision process.



Source: Gordon B. Davis, Management Information Systems: Conceptual Foundations, Structure, and Development (St. Louis: McGraw-Hill Book Company, 1974), p. 319.

Figure 7. Phases of decision-making and MIS.

Phase of decision-making process	Relevance to MIS
Intelligence	The search process involves an examination of data both in predefined and in ad hoc ways. The MIS should provide both capabilities. The information system itself should scan all data and trigger a request for human examination of situations apparently calling for attention. Either the MIS or the organization should provide communication channels for perceived problems to be moved up the organization until they can be acted upon.
Design	The MIS should contain decision models to process data and generate alternate solutions. The models should assist in analyzing the alternatives.
Choice	A MIS is most effective if the results of design are presented in a decision-impelling format. When the choice is made, the role of the MIS changes to the collection of data for later feedback and assessment.

Source: Gordon B. Davis, Management Information Systems: Conceptual Foundations, Structure, and Development (St. Louis: McGraw-Hill Book Company, 1974), pp. 141-42.

highly programmed decisions at one end of that continuum and highly unprogrammed decisions at the other end."[1] Simon described the programmed decisions as "routine, repetitive decisions. Organization develops specific processes for handling them."[2]

The Simon's programmed decisions correspond to what Wilson and Alexis[3] termed "closed decision model" where minimal weight is "given to the environment of the decision maker, and the complexity of the act of choice as such."[4] In this case, the decision maker is assumed to have the following basis for the decision:

1. A known set of relevant alternative with corresponding outcomes.

2. An established rule or relation which produces an ordering of the alternative.

3. Maximizing something such as money rewards, income, physical goods, or some form of utility.[5]

Examples of closed or programmed decision-making are linear programming, inventory models and breakeven analysis.

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[1]Simon, The New Science of Management Decision, p. 48.

[2]Ibid.

[3]Charles Z. Wilson and Marcus Alexis, "Basic Frameworks for Decisions," in Decision Theory and Information Systems, ed. William T. Greenwood (Dallas: South-Western Publishing Company, 1969), pp. 63-82.

[4]Ibid., p. 66.

[5]Ibid., p. 65-66.

Simon stated that:

> Decisions are nonprogrammed to the extent that they are novel, unstructured and usually consequential. There is no cut-and-dried method for handling the problem because it hasn't arisen before, or because its precise nature and structure are elusive or complex, or because it is so important that it deserves a custom-tailored treatment.[1]

Simon's description of nonprogrammed decisions reveals that the decision processes are far more dynamic and complex than those described by the programmed or closed models. This fact has been explained by Wilson and Alexis when they described the open decision models which corresponds to the unprogrammed decisions.

> The "open" decision model parallels an "open system." Like the open system, it is continually influenced by its total environment. And, of course, it also influences the environment. Decisions shape as well as mirror environment. Contrary to main elements of "closed" decision models, it does not assume that the decision maker can recognize all goals and feasible alternatives. A more realistic view of the decision maker is emphasized. He is a complex mixture of many elements--his culture, his personality, and his aspirations.[2]

The open models or nonprogrammed decisions are based on the behavioral theory of decision-making.[3] The decision maker may use modern techniques such as heuristic problem-solving instead of the traditional techniques such as judgment, intuition and creativity for making decisions.[4]

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[1]Simon, The New Science of Management Decision, p. 46.

[2]Wilson and Alexis, "Basic Frameworks for Decisions," p. 76.

[3]Davis, Management Information Systems, p. 143.

[4]Simon, The New Science of Management, p. 48.

Where Decisions Are Made

To specify where decisions are made in an organization, activities of the organization can be classified both horizontally and vertically. Horizontally, the activities can be categorized in terms of the level of decisions involved; vertically, the activities can be classified in terms of the major functions in the organization.

Anthony developed a horizontal classification for managerial activity consisting of three categories: strategic planning, management control and operational control. The three categories are defined as follows:

> Strategic planning is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the aquisition, use, and disposition of these resources.
>
> Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.
>
> Operational control is the process of assuring that specific tasks are carried out effectively and efficiently.[1]

Anthony clarified the distinction between management control and operational control. He indicated that operational

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[1]Anthony, Planning and Control Systems, pp. 16-18.

control is concerned with tasks (such as manufacturing a specific unit) whereas management control is concerned with people (managers). In operational control area, the focus is on execution of specified tasks; in management control it is on both planning and execution of tasks.[1]

The boundaries of the three categories are not clear, and "it is easy to find situations that do not fit clearly in a single category." But "these borderline situations and exceptions are not so numerous as to upset the essential validity of the categories."[2]

Gorry and Morton[3] examined the information needs for the levels of decisions. They indicated that the information requirements of the three levels are very different from one another in terms of characteristics of information. Figure 8 summarizes observations of Gorry and Morton. The figure shows that the information requirements for operational control stand in sharp contrast to those of strategic planning, whereas the information requirements for management control fall between the two extremes.

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[1]Ibid.

[2]Ibid., p. 20.

[3]G. Anthony Gorry and Michael S. Scott Morton, "A Framework for Management Information Systems," Sloan Management Review, 13 (Fall 1971): 55-70.

Figure 8. Information requirements by decision category.

Characteristics of Information	Operational Control	Management Control	Strategic Planning
Source	Largely internal →		External
Scope	Well-defined, narrow →		Very wide
Level of Aggregation	Detailed →		Aggregate
Time Horizon	Historical →		Future
Currency	Highly current →		Quite old
Required Accuracy	High →		Low
Frequency of Use	Very frequent →		Infrequent

Source: G. Anthony Gorry and Michael S. Scott Morton, "A Framework for Management Information Systems," Sloan Management Review, 13 (Fall 1971):59.

The activities of an organization can be classified vertically according to the functional systems of the organization. Dearden[1] indicated that there are three major systems in the typical organization. He stated that:

> Each of these systems is different with respect to the type of information handled. One concerns the flow of monetary information; one concerns the flow of personal information; and one concerns the flow of physical goods.

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[1] John Dearden, "How to Organize Information Systems," Harvard Business Review, 43 (March-April 1965): 65-73.

> Although these three systems have interfaces, they can be treated separately for organization purposes. . . .
>
> There are, however, many other minor information systems. Many of these systems use little or none of the information developed by the three major systems.[1]

Dearden defined a major system as "one that affects the entire structure of an organization;" and a minor system as "one that is confined to limited part of the organization."[2] The major functional system in a typical organization are financial, personnel and logistics systems. The minor systems are numerous, but they are not standard in all organizations. Examples of minor systems are marketing, manufacturing, and research and development.

A Framework for Decision-Making Process

The development of a framework for decision-making process has been the purpose of this section. After presenting the explanation of how and where decisions are made, a synthesis of the material has been arranged in a "framework" to assist the reader in summarizing the content. This framework should be considered as a combination of the works and analysis of Anthony, Simon, Dearden, Wilson, Alexis, Davis, Gorry and others that were presented in this section.

The framework for decision-making in an organization, as it is presented in Figure 9, consists of the following five main parts:

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[1]Ibid., p. 67.

[2]Ibid., p. 69.

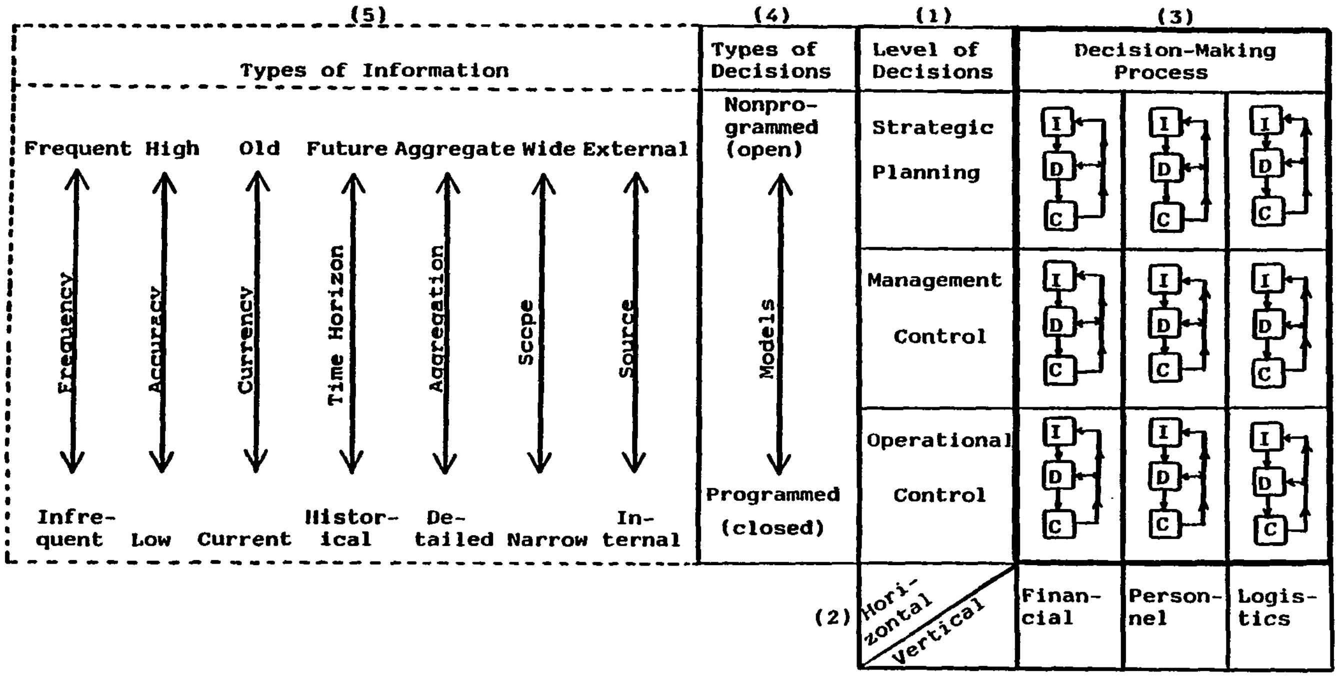

Figure 9. A framework for decision-making in an organization.

1. The three major levels of decision-making which are strategic planning, management control and operational control. These three levels represent the horizontal classification of the managerial activities in a typical organization.

2. The three major functional systems in a typical organization which are financial, personnel and logistics systems. These three systems represent the vertical classification of activities in an organization. Minor functional systems have been ignored in this framework, not because they are not important, but only for the purpose of simplicity. Any organization can simply add as many functional systems as it has to the framework.

3. Part three represents the process of decision-making. Each one of the 9 cells requires a specific type of decision which in turn requires a specific type of information. This point will be explained further in parts four and five. The three letters, I,D,C stand for Intelligence, Design and Choice which constitute the general model of decision-making. The process of decision-making in all of the 9 cells is the same one, but the horizontal and vertical levels, or the managerial and functional activities are completely different.

4. Part four presents the types of decision or the decision models: nonprogrammed (open) and programmed (closed) decision models. The two types represent a whole continuum where highly unprogrammed (open) decisions at one end of the continuum are associated with strategic planning, and highly programmed (closed) decisions at the other end are associated with oeprational control.

5. Part five presents types of information which are required for each level of decisions. The information has been classified according to seven characteristics: source, scope, aggregation, time horizon, currency, accuracy and frequency. The figure shows the required information for the highest programmed decisions and operational control, on one side, stand in sharp contrast to those of unprogrammed decisions and strategic planning on

> the other side. The information requirements represent continuum levels between the types and levels of decisions.

A framework of decision-making is essential for the analysis and design of MIS.

Systems Analysis

Systems analysis is the most important conceptual factor for MIS. The development and the operation of MIS are built on systems analysis. Therefore, information systems and systems analysis are used interchangeably.[1] This section contains the theories from the related literature on systems analysis and the development of MIS, approaches for MIS development, MIS development cycle, and systems analysis techniques.

Systems Analysis and the Development of MIS

Systems analysis is described as "nothing more than quantified or enlightened common sense."[2] What does systems analysis mean in organizational context? How can systems analysis be applied in the development of MIS?

What is systems analysis?

Semprevivo defined systems analysis as "the process of studying the network of interaction within an organization and

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[1] James Vinson Milano, "Development and Implementation of an MIS" (doctoral dissertation, The George Washington University, 1969), p. 44.

[2] Alain C. Enthoven, quoted by Richard L. Shell and David F. Stelzer, "Systems Analysis: Aid to Decision-Making," Business Horizons, 14 (December 1971): 67.

assisting in the development of new and improved methods for performing necessary work."[1] Black stated that systems analysis is "undertaking with a view to supporting decisions as to design, selection, or operation of a new system."[2] For the purpose of MIS, systems analysis can be seen as involving two basic functions, one being information analysis and the other the design of the system which handles the required information.[3] The information analysis function produces the logical design for the MIS; the system design function produces the physical design of MIS.[4] These two functions of systems analysis are the base for the "MIS development cycle." In each phase of the MIS development cycle, the iterative cycle of systems analysis is required.

The iterative cycle of systems analysis

Shell and Stelzer[5] developed the iterative cycle of systems analysis (Figure 10). It is composed of ten basic

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[1]Philip C. Semprevivo, Systems Analysis: Definition, Process, and Design (Chicago: Science Research Associates, Inc., 1976), p. 7.

[2]Guy Black, The Application of Systems Analysis to Government Operation (Washington, D.C.: National Institute of Public Affairs, 1966), p. 3.

[3]Daniel Teichroew, ed., "Education Related to the Use of Computers in Organization," Communications of the ACM, 14 (September 1971): 576-578.

[4]J. Daniel Couger and Robert W. Knapp, eds., Systems Analysis Techniques (New York: John Wiley and Sons, 1974), p. vii.

[5]Richard L. Shell and David F. Stelzer, "Systems Analysis: Aid to Decision-Making," Business Horizons, 14 (December 1971): 67-72.

steps for any systems analysis. The following is a brief description of the ten steps.

1. An accurate description of the problem is the first step in the cycle. It is the most important step because "the most perfect solution to the wrong problem does nothing to the real problem."[1]

2. Defining the objectives to establish guidelines for the remaining steps.

3. Defining the competing alternatives which are possible for achieving the objectives.

4. Defining the assumptions and constraints that affect the problem situation or the alternatives. The constraints include money and the management's philosophy towards scientific management. Other constraints are "psychological, sociological, technical, traditional, administrative, political (both office and national) and, of course, physical (men and equipment)."[2]

5. Defining criteria which are the rules or standards for ranking the alternatives.

6. Collecting data that relate to each alternative.

7. For complex problems, it is desirable to build a model.

8. The assumptions can be tested as preparation for the evaluation step.

9. The alternatives can be evaluated by using some tools such as cost-benefit analysis and cost-effectiveness analysis.

10. If an alternative is considered acceptable, it can be implemented. If no alternative is acceptable, an iterative process begins with reexamining the problem and the other steps.[3]

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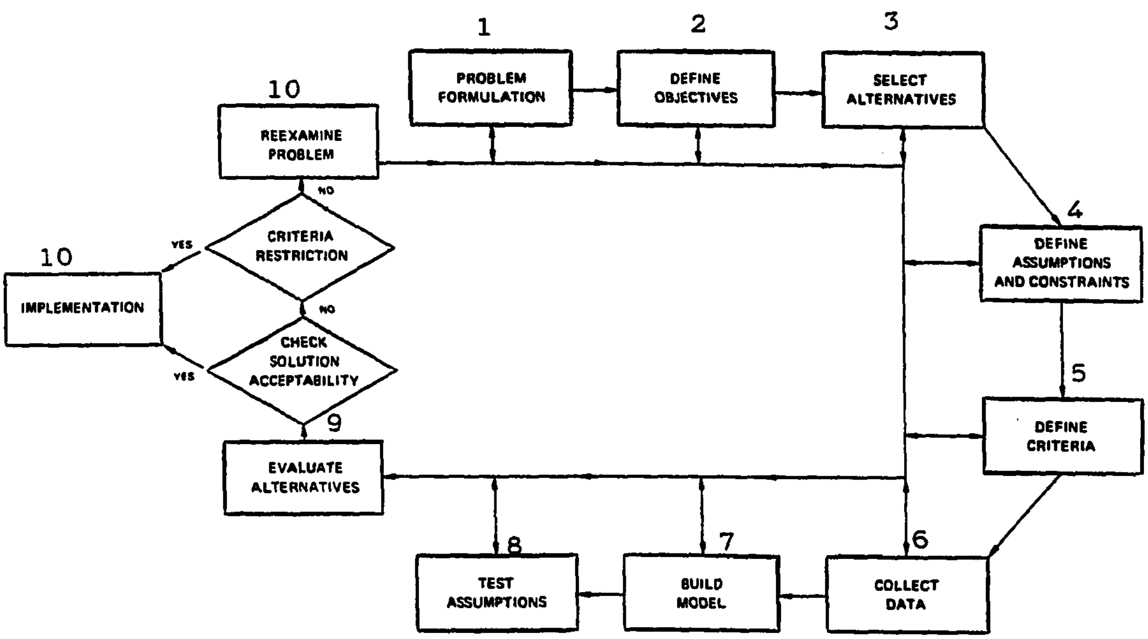
[1] Ibid., p. 68.

[2] Ibid.

[3] Ibid., p. 69

Figure 10. The iterative cycle of systems analysis.



Source: Richard L. Shell and Davis F. Stelzer, "Systems Analysis: Aid to Decision-Making," Business Horizons, 14 (December 1971):71.

These steps, according to the literature, are to be used in each phase of the MIS developing cycle. In addition to these steps, an approach for MIS development must be determined before the development process begins.

Approaches for MIS Development

There are many different approaches for MIS development; but the two most frequently found in the literature were included in this review. The approaches are the bottom-up and the top-down.

The bottom-up approach

Historically the bottom-up approach was the first to be recognized in the MIS field.[1] Under this approach, the analysis and implementation of MIS begin from the bottom level of an organization with gradual development of subsystems or modules. The modules are to be combined and integrated to serve the different managerial levels of the organization. This means that the process begins with developing "operations modules for processing transactions and updating fields and then to add planning, control, decision, and other modules as demand develops."[2] This approach assumes that the growth of MIS comes in response to needs of management.

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[1] William M. Zani, "Blueprint for MIS," in MIS: Management Dimensions, eds., Raymond J. Coleman and M. J. Riley (San Francisco: Holden-Day, Inc., 1973), p. 400.

[2] Davis, Management Information Systems, p. 405.

The approach has the advantage of the gradual development of MIS which leads to avoiding the risk of developing a large-scale system. Also, the cost of any addition to the system can be justified. On the other hand, the approach may not lead to accomplish the desired integration which, in turn, may require the redesign of the system.

The top-down approach

The top-down approach focuses on the use of information rather than on the information itself.[1] The analysis starts with objectives, environment and constraints of an organization. The activities or functions are identified along with the necessary decisions. Then, the required information for decisions are inferred from the required decisions.[2] The approach stresses the necessity for careful planning and integration of the system.

A disadvantage of the approach is that "it is difficult to make such large-scale plans by factoring from the objectives and activities of an organization down to the information processing development modules."[3]

The two approaches have been presented as distinct and contrasting alternatives. But it is possible to employ

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[1]Jaime Ivon Rodriguez, "The Design and Evaluation of a Strategic Issue Competitive Information Systems" (Ph.D. dissertation, University of Pittsburgh, 1977), p. 16.

[2]Davis, Management Information Systems, p. 408.

[3]Ibid., p. 409.

a combination of the two.[1] The IBM Corporation suggested top-down analysis and bottom-up implementation of MIS.[2]

Gehrman, in his dissertation, gave the following conclusions:

> The organization whose external environment includes significant customer responsiveness requirements should design its associated MISs from the top-down.
>
> The degree of independence for participants in the information system that is a part of bottom-up designs was found to be desirable when the organization's external environment included rapidly changing technology.[3]

It can be said that the best approach for MIS development should be determined on the light of internal and external environment of the organization. The approach can be one of the two approaches which are discussed in this section. It can be a combination of the two approaches, or it can be a combination of one or the two approaches with some of the approaches that were included in Chapter II. The best approach for MIS development is contingent on the organization's environment (a contingency approach).

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[1]Ibid.

[2]IBM Corporation, Business Systems Planning, Information Systems Planning Guide (White Plains: Technical Publications/Industry, 1975), p. 7.

[3]Raul R. Gehrman, "A Study to Identify Contingent Functional Relationships Between an Organization's External Environment and Its Design of Effective Management Information Systems" (Ph.D. dissertation, Universtiy of Nebraska, Lincoln, 1976), pp. 138-139.

The MIS Development Cycle

There was little agreement between writers as to the number or composition of phases of the MIS development cycle. Rosove explained the use of phases in this context as follows:

> The use of the term "phase" in the context of system development should be qualified. Only at a high level of abstraction can we assert that there are five [or six] distinguishable phases of development and that they represent a logical and temporal sequence. In some cases, the primary process within a phase which gives that phase its name, such as requirements or design, is also an activity or function which is performed in other phases as well.[1]

The division of the MIS development cycle into phases was not to determine where one phase ends and the other begins; it was to make the discussion manageable. As in most such division of phases, the sequencing of the phases was in terms of the initiation rather than in terms of the execution of each. Thus, phase one may begin before phase two, but because of the implicit feedback loops and interdependencies in the process, phase one may not end prior to the end of phase two.[2]

The number of phases that have been suggested in the literature, range from four to seventeen. A synthesis of

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[1]Perry E. Rosove, Developing Computer Based Information Systems (New York: John Wiley and Sons, Inc., 1967), p. 18.

[2]William R. King and David I. Cleland, "The Design of Management Information Systems: An Information Analysis Approach," Management Science, 22 (November 1975): 228.

the phases was organized into the following six phases.

Phase one: Feasibility study

Many recognized writers in the MIS field have proposed various definitions for the term "feasibility study." A comprehensive definition of the term is given by Li:

> A feasibility study can be described as a logical, systematic, and well-documented approach to solving a problem or analyzing a proposal. More aptly, it may be defined as a critical investigation conducted to establish the practical or economic justification, or both, of an idea, standard, technique, software, or hardware. The concept is not new, it has been applied to different problems in varying degrees for many years. Properly executed it becomes a critical examination for determining an organization's needs, and the cost-benefit relationships of existing and proposed approach.[1]

Glaser indicated that the feasibility study should give management the answers to three questions:

1. Can the job be done?--a technical question.
2. Should the job be done?--an economic question.
3. Will the system work?--an operational question.[2]

Glaser's three types of the feasibility study (technical, economical and operational) should be the basis for organizing and planning the MIS project.

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[1]David H. Li, quoted by Helen H. Ligon, Successful Management Information Systems, Research Press, 1978 (Research for Business Decisions, no. 9), p. 29.

[2]R. George Glaser, "Are You Working on the Right Problem?," Datamation, 13 (June 1967): 22.

Phase two: Project management

The development of MIS includes a large number of interrelated activities which need to be organized as a project. The project activities "must be planned, scheduled, and controlled if it is to be completed within the desired time and within the resources allocated for the project."[1]

The output of the project management phase should be the following:

> -Definitions of project activities and required results.
> -Estimates of work content of project activities, . . .
> -Activity schedules, with milestone and checkpoints for progress reviews.
> -Specific assignments for personnel and other resources.
> -Resource "loading" estimates (use of resources by time period) or budgets, for personnel, equipment, and other resources.[2]

The project plan should be subject to the approval of the user organization executive. Then, the plan becomes a base for the remaining phases of the development cycle.

Phase three: Analysis of information requirements

Analysis of information requirements focuses on the information needs and data flow in an organization. This phase requires a thorough knowledge of the organization. Krauss stated that:

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[1]K. M. Hussain, ed., Management Information Systems for Higher Education (Paris: OECD, 1977), p. 34.

[2]William B. Miller, "Fundamentals of Project Management," Journal of Systems Management, 29 (November 1978): 22.

> Requirements analysis begins with gaining a thorough knowledge of the business functions that are of concern. Included will be an understanding of management's objectives, underlying philosophy, attitude toward innovation and change, responsibilities, and plans for the future.[1]

The output of this phase should be the logical design of the MIS, a base for the next phase.

Phase four: Systems design

Systems design is the "most creative phase"[2] of the MIS development cycle. It can be defined as "the drawing, planning, sketching, or arranging of many separate elements into a viable, unified whole."[3] The design should break the system into manageable subsystems.[4]

"In most cases there will be no sharp demarcation between the completion of the analysis phase and the beginning of the design phase."[5] While the identification of the flow of data and the information requirements is the purpose of the

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[1] Leonard I. Krauss, Computer Based Management Information Systems (Chicago: American Management Association, Inc., 1970), p. 70.

[2] Robert J. Thierauf, Systems Analysis and Design of Real Time Management Information Systems (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1975), p. 521.

[3] John G. Burch and Felix R. Stanter, Information Systems: Theory and Practice (Santa Barbara, California: Hamilton Publishing Company, 1974), p. 257.

[4] Ibid.

[5] M. J. Alexander, Information Systems Analysis: Theory and Applications (Chicago: Science Research Associates, Inc., 1974), p. 127.

analysis phase; the purpose of the design phase is to specify how the system can be developed to meet these requirements. The analysis phase produces the logical design for the MIS; the design phase produces the physical design.

Phase five: Development and testing

The development activities are of especial importance for computerized MIS. Programming constitutes the principle activity of this phase. Programming was defined by Shaw and Atkins as:

> The skill of expressing generalized system requirements and logical functions in specific machine-compatible terms. This is done through the rendering of generalized objectives into specific instructions, or coding, which control computer performance.[1]

The purpose of the development activities is "to produce sets of programs by the designers."[2] The development of the programs completes the design process. "The design can be tested to see whether it yields the appropriate output to meet the previously defined objectives and information needs."[3] While systems testing is a part of all systems

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[1]John C. Shaw and William Atkins, Managing Computer System Projects (New York: McGraw-Hill Book Company, 1970), p. 201.

[2]Willoughby and Senn, Business Systems, p. 86.

[3]Joel E. Ross, Modern Management Information Systems (Reston, Virginia: Reston Publishing Company, Inc., 1976), p. 256.

(computerized and non-computerized), programming is only applicable to computerized systems.[1]

Phase six: Implementation

The implementation phase begins when a new system starts, replacing the old one. "It ends when the old system is completely discontinued, with its people reassigned and the equipment either reassigned, modified, or discarded."[2] If a new system is completely new to the organization, the implementation process is usually known as "installation."[3]

Implementation is the final phase of the MIS project. After the implementation, the system begins its normal operation which continues until the system is modified or replaced. A continuing care is needed during the operational life of the system. The need for this care "stems from the dynamic nature of both systems and their environments."[4]

Figure 11 shows the sequence of the MIS development phases. The arrows between the phases indicate that knowledge acquired and decisions made in later phases are fed back to earlier phases. The feedback loops reflect the iterative cycle of systems analysis for the whole development process.

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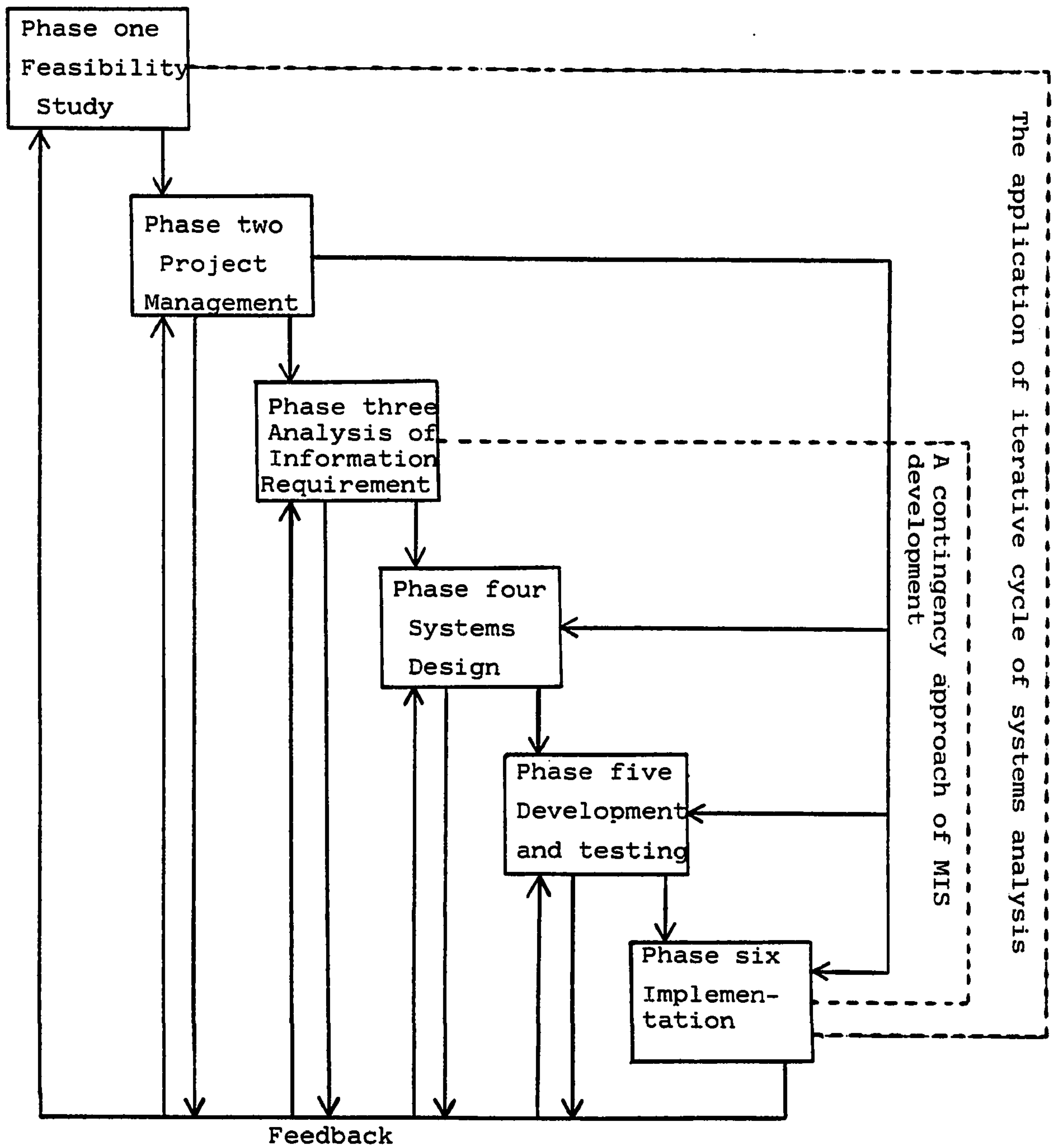
[1] Willoughby and Senn, Business Systems, p. 86.

[2] Frank G. Kirk, Total System Development for Information Systems (New York: John Wiley and Sons, 1973), p. 37.

[3] Ibid.

[4] Ibid.

Figure 11. MIS development cycle.



The overlapping of the phases in the figure illustrates concurrent development activities. The outer dotted line refers to the application of the iterative cycle of systems analysis in each of the six phases. The inner dotted line refers to the need for determining a contingency approach for MIS development in the last four phases.

Systems Analysis Techniques

There are many techniques available for the systems analyst. Table 1 shows where some of the techniques can be used in the various phases of the MIS development cycle.

The simplicity or complexity of systems analysis in the MIS development and operation is a function of the information technology used in the MIS.

Information Technology

Information technology, in this paper, means manual, semi-automated, and computer technology that can be used for processing data and producing information in an organization. This section includes MIS functions and information technology, manual technology, semi-automated technology and computer technology.

MIS Functions and Information Technology

The application of any kind of technology does not change the basic functions of MIS.[1] These functions, as

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[1] To prove this point see: Murdick and Ross, Information Systems for Modern Management, pp. 146-160; Morton F. Meltzer, The Information Imperative (American Management Association, 1971), pp. 12-17.

TABLE 1

SYSTEMS ANALYSIS TECHNIQUES USED IN EACH PHASE

MIS Development Phases / Systems Analysis Techniques	Feasibility Study	Project Management	Analysis of Information Require-ments	Systems Design	Development and Testing	Implemen-tation
Flowchart	2	-	1	1	1	2
Decision Table	-	-	3	1	1	2
Interview	1	1	1	-	-	2
PERT	4	1	3	3	2	-
Cost-Benefit Analysis	1	-	-	1	-	-
Cost-Effectiveness Analysis	2	-	-	3	-	-
Work Measurement	-	-	2	2	-	4
Documentation	2	2	2	1	1	1
Records Management	-	-	-	3	-	1

1 = most used   2 = frequently used   3 = occasionally used   4 = infrequently used

Source: Adapted from Theodore C. Willoughly and James A. Senn, Business Systems (Cleveland, Ohio: Association for Systems Management, 1975), p. 78.

illustrated in Figure 4 (p. 63), are as follows:

1. The acquisition of data (the input component).

2. The arithmetic and logical analysis and synthesis of data (the processor component).

3. The instructions for data processing (the procedures component).

4. The classification and arrangement of data in files for easy access and retrieval (the storage component).

5. The retrieval and dissemination of information to the users (the output component).

6. The users understanding of information and their feedback to the system (the communication component).

The six functions or components are essential for MIS under any kind of information technology. The change results from technology when the processing of data is performed by humans when using manual technology. The humans are aided by machines when using semi-automated technology. When using computer technology, the computer is the processor of data.

Manual Technology

"Despite the fantastic growth of computer applications, manual information systems still outnumber them in quantity of systems and information handled."[1] For these manual systems, indexing and manual card systems are important.

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[1] Murdick and Ross, Management Information Systems for Modern Management, p. 149.

Indexing

Indexing consists of "methods of recognizing, selecting, identifying and arranging information to facilitate organized storage and searching."[1] Indexing is usually considered an intellectual process. This process requires the ability of humans to read documents and analyze them from the viewpoint of how others would ask for the information in the documents.[2]

Manual card systems

Manual card systems such as 3-by-5-inch card files have proven to be a flexible means for recording, sorting, rearranging and updating data.[3] In such systems, each card contains a relatively small amount of information and can be handled, as a file item, independently of the other file items.[4] The manual care systems may use some mechanical aids to assist in the manipulation of cards, but all the major operations are performed manually. Examples of these systems are the Edge-notched cards and the Interior-notched cards.

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[1]William F. Williams, Principles of Automated Information Retrieval (Elmhurst, Illinois: The Business Press, 1968), p. 20.

[2]Ibid., p. 74.

[3]Charles P. Bourne, Methods of Information Handling (New York: John Wiley and Sons, Inc., 1965), p. 80.

[4]Ibid.

Semi-Automated Technology

Today computers are popular in the field of MIS. However there are other semi-automated hardware for indexing, storing and the retrieval of information. Such hardware can be used for establishing effective MIS especially in small organizations and in countries where computer technology is not available. Punched cards and microforms are useful kinds of semi-automated technology.

Punched cards

Punched cards make it possible for an MIS to be mechanized so that data could be transformed into information more rapidly and more effectively than by manual means. The philosophy of the punched cards was explained by Bower.

> Punched card systems are centered around the fact that every transaction can be broken down into data units of the least common denominator, and these can then be processed by machine. The punched card is the unit record into which data units of the least common denominator are entered. It is possible to represent data on a card of uniform size by means of holes arranged in a definite pattern.[1]

Equipment can be used to punch data into cards, verify, sort, collate, and select. However, humans must handle cards and supervise first-hand manipulation of the cards.

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[1]Bower, Schlosser, and Zlatlkovich, Financial Information Systems, Theory and Practice, p. 389.

Microforms

The National Microfilm Association defined microform as "a generic term for any form, either film or paper, which contains microimages."[1] The technology of microforms "can compress data in a ratio of 99 to 1 compared with original bulk--while retaining the vital capability of returning the original in the form of a true paper replica."[2]

Kish and Morris summarized the benefits of microforms as follows:

1. Conservation of space and equipment.
2. Vital records protection.
3. An information storage and retrieval tool.
4. As part of an active business procedure or system.
5. To facilitate reproduction or transmittal of records.[3]

Business applications of microforms were limited to storage and saving space. Today, the technological improvement of microforms involved the use of data processing equipment in conjunction with microforms. There are several systems which marry the microforms to the computer.[4]

Computer Technology

The computer is the most powerful management tool that has ever been devised. It has revolutionary rather evolutionary

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[1]Joseph L. Kish, Jr. and James Morris, Microfilm in Business (New York: The Ronald Press Company, 1966), p. 12.

[2]Ibid., p. iii. [3]Ibid., p. 3.

[4]Meltzer, The Information Imperative, p. 67.

impact on management decision-making. Ferranti[1] explains the reasons for this impact.

1. The computer capability of storing data which is large enough and correct enough to give a valid supply of information for the decision-makers.

2. The computer capability of performing logical analysis with great speed and accuracy has altered the time basis of decision-making.

3. The computer capability of modeling and simulation enables the decision-makers to investigate and evaluate a wide variety of alternatives before making decisions.

4. These great capabilities of the computer provides decision-makers with the ability of planning and control the most vital aspects of their organization.

5. The production of different sizes of computers, micro, mini, and large-scale, gives different sizes of organizations the opportunity for economic utilization of the computer.

When the use of the computer is economically, technically and operationally feasible, it will be the ideal devise for MIS in an organization.

The comparison of manual and semi-automated information technology with the computer shows the powerful capabilities of the computer. The manual technology is limited by the ability of humans for processing data. Miller described the human capability for data processing by indicating that the number of symbols humans can hold in short-term memory and process effectively is from five to nine but with a common

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[1] Basil Z. de Ferranti, "Forward," in Computer Applications in Management, eds., John Birkle and Ronald Yearsley (New York: Brandon/Systems Press, 1970), p. 7.

limit of seven.[1] When using semiautomated technology, humans employ some equipment which increases the processing capabilities. Computer capabilities are measured by a microsecond (one thousandth of a millisecond or one millionth of a second). Birkle cites the following example.

> To add together two 5-digit numbers would take an average commercial computer about 10 microseconds.
>
> A printer printing at 1,000 lines per minute takes 60 milliseconds to complete the printing of each line.[2]

Summary

This chapter presented a constellation of the interlocking and interactive concepts of MIS. These concepts were presented as the basis for understanding the MIS process which comprise the basic components of MIS curriculum. The content of the chapter was organized and presented in five sections. The five sections and a brief summary are:

1. Systems concepts for MIS. The section provides the essential systems concepts which can be used in the analysis, design and organization of MIS.

2. Human and organizational behavior. Three dimensions of organizational behavior have been presented for successful implementation of a new MIS or modification of an existing one. The three dimensions are the formal organization system, the individual system and the social system.

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[1] George A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capability for Processing Information," The Psychological Review, 63 (March 1956): 81-97.

[2] J. R. Birkle, "The Impact of Commerce on Computers," in Computer Applications in Management, eds., Birkle and Yearsley, p. 35.

3. Decision-making. A framework of how and where decisions are made in an organization has been presented. The framework services as a base for the analysis and design of MIS.

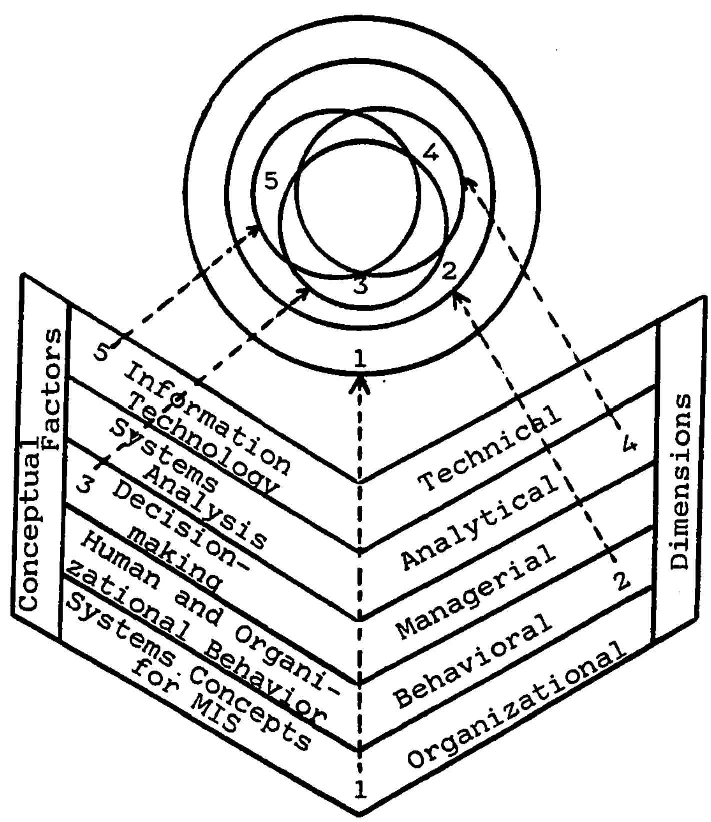
4. Systems analysis. It has been treated in the broadest meaning to include information analysis and systems design. The steps and techniques of systems analysis have been related to each phase in the MIS development cycle.

5. Information technology. Technology does not change MIS functions. It affects the efficiency of MIS in terms of speed, accuracy and quantity of available information.

Figure 12 illustrates the relationships among the five conceptual factors of MIS. The systems concepts for MIS provide the essential systems concepts for all other factors. The human and organizational behavior constitutes the behavioral framework for implementing the three remaining factors. Decision-making, systems analysis and information technology overlap in implementation. The five factors represent five complementary dimensions of a theory base for MIS. The dimensions are organizational, behavioral, managerial, analytical and technical.

This chapter provided a theory base for MIS which can be used as a guide for planning MIS curriculum. But the purpose of this dissertation is to develop a framework for planning MIS curriculum in developing countries. The achievement of this purpose requires investigation of factors that influence curriculum planning in developing countries. Then, the framework can be developed. This task is the subject of Chapter V.

Figure 12. MIS conceptual factors: dimensions of a theory base for MIS.



CHAPTER V

PLANNING MIS CURRICULUM IN DEVELOPING COUNTRIES

Introduction

The purpose of this chapter was to complete a conceptual framework for planning MIS curriculum in developing countries. A part of the framework was developed in the previous chapter; the remaining part is developed in this chapter.

Chapter IV provided the basic components of MIS curriculum involving the five factors for the theory base of MIS. This chapter presents curriculum planning in developing countries. The concentration is on major environmental and cultural factors which constitute a framework for curriculum planning. The chapter concludes with the conceptual framework for planning MIS curriculum in developing countries.

Curriculum Planning in Developing Countries

The major factors which influence curriculum planning in developing countries were included in this chapter. The factors were classified as environmental and cultural. The classification was made to facilitate the understanding of the complex interrelationships among the factors. The following subheadings were utilized to assist the reader in organizing the topic: the process of curriculum planning, major environmental factors influencing curriculum planning, major cultural factors influencing curriculum planning, and a framework for curriculum planning in developing countries.

The Process of Curriculum Planning

Curriculum planning was defined in Chapter I as "a process of deciding on goals, scope and sequence of curriculum and courses; on changes in the curriculum." As a process, curriculum planning is a dynamic and never ending process.[1]

Curriculum planning was found to be a decision-making process. As such, it has the three phases of decision-making.[2] It involves: (1) the search for problems of society; (2) the investigation of educational solutions; (3) the selection of a solution and translating it into educational goals. Educational goals should be used as criteria for determining the scope and sequence of curriculum and courses.

The curriculum planning process includes the determination of the structure and sequence of each course, analysis of the course objectives, specification of content, methods and performance objectives of each course.[3] The

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[1]See the description of curriculum planning, p. 45.

[2]See the section of "How Decisions are Made," pp. 81-85.

[3]Robert M. Gagné and Leslie J. Briggs, Principles of Instructional Design, 2nd edition (New York: Holt, Rinehart and Winston, 1979), pp. 23-39.

activities referred to by Gagné for curriculum planning show a sequence to be followed when planning a curriculum. However, there should be a constant moving backwards and forwards during the process. Nicholls illustrates the back and forth referencing as follows: "in considering content, there is constant reference back to objectives and forwards to methods."[1]

Miel indicated that curriculum reflects the environmental and cultural factors of society at a given time. The changing nature of these factors requires decisions for changing the curriculum from time to time. Miel described curriculum change as being:

> . . . something much more subtle than revising statements written down on paper. To change the curriculum of the school is to change the factors interacting to shape the curriculum. In each instance this means bringing about changes in people--in their desires, beliefs, and attitudes, in their knowledge and skill. Even changes in the physical environment, to the extent that they can be made at all, are dependent upon changes in the persons who have some control over the environment. In short, the nature of curriculum change should be seen for what it really is--a type of social change, change in people, not mere change on paper.[2]

Major Environmental Factors Influencing Curriculum Planning

Many environmental factors influence curriculum planning in any society. The selection of major influencing

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[1]Audrey Nicholls and S. Howard Nicholls, Developing a Curriculum: A Practical Guide (Boston: George Allen and Unwin, 1978), p. 96.

[2]Alice Miel, Changing the Curriculum (New York: Appleton-Century-Crofts, Inc., 1946), p. 10.

factors in developing countries can be determined by characteristics which distinguish these countries in the world. Three major characteristics were found for developing countries: (1) the backwardness in technology and science; (2) the high level of unemployment; (3) the high rate of population growth. The three characteristics indicate the major factors that can affect and be affected by curriculum planning in developing countries.

Technology and science

Technology can be defined as "knowledge of how to do something."[1] The efforts of man to discover technology goes back to his very beginnings when he began to use weapons and tools.[2] It has been a major force for shaping or changing social life. Litterer explained the effect of technology on the social and economic life:

> First, technology is the major source for productivity increases. Changes in the motivation of individuals by superiors have an effect, but it is small compared to the changes in productivity when machines are substituted for human effort.
>
> Second, the jobs people do are largely determined by the technology used.
>
> Third, the immediate social situation is dramatically influenced by technology. Who should be in groups, the size of groups, patterns of interpersonal interaction, opportunity to control

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[1]Joseph A. Litterer, The Analysis of Organizations, 2nd edition (New York: John Wiley and Sons, Inc., 1973), p. 27.

[2]Charles Susskind, Understanding Technology (Baltimore: The John Hopkins University Press, 1973), p. 1.

> one's activities, and many other things are influenced in a variety of ways by technology.[1]

Litterer specified what technology and science are. He explained them as follows:

> First, technology and science are often lumped together as if they were essentially the same thing. One definition of science is a body of knowledge. Technology is a body of knowledge, but a particular type of knowledge. Furthermore, although it frequently is, it need not be knowledge developed through the scientific method.
>
> Second, at the most basic level, technology is not only knowledge the way the term is typically used . . . but it also includes things: tools, machines, devices, and gadgets.
>
> Third, technology is related to solving problems and producing desired outcomes, goods, or services through activities performed by men or machines or a combination of both.
>
> Fourth, more is needed than to have activities performed, they must be performed in a specific order or pattern. To do this there must often be some layout of machines and men who will perform the activities.[2]

A wide and deep technological gap exists between developed and developing countries. Murphy explained this gap:

> The technological processes of the developed countries, and the factor supplies and the operational processes of the developing countries have moved in opposite directions over the last century and a half. These movements have more than offset the increased ease of acquiring knowledge with the result that the transfer of technology from the leaders to the followers may now be more difficult.[3]

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[1] Litterer, The Analysis of Organizations, p. 280.

[2] Ibid., p. 283.

[3] John Joseph Murphy, "Retrospect and Prospect," in The Transfer of Technology to Developing Countries, eds, Daniel L. Spencer and Alexander Woroniak (New York: Frederick A. Praeger, Publishers, 1967), p. 23.

One of the obstacles of transferring technology to developing countries is the difference between the capital-labor price rations in the developed and developing countries. Rosenblatt stated that "capital is relatively more expensive in developing countries than in the industrial countries, and labor is relatively cheapter."[1] This obstacle created the problem of what is the appropriate technology for developing countries? So much has been written in recent years about "labor intensive," or "traditional" technolgoy as opposed to "capital intensive," or modern technology.[2] Rosenblatt stated that "the simultaneous presence of both of these technologies in developing countries is at once a cause and effect of the unbalanced nature of their economies and the problems associated with these imbalances."[3] These problems and imbalances result from the inability of the developing countries to absorb the advanced technology. The mere transfer of foreign techniques and ideas is not sufficient. It must be accompanied with a diffusion process. The diffusion of

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[1]Samuel M. Rosenblatt, "Introduction and Overview," in Technology and Economic Development: A Realistic Perspective, ed., Samuel M. Rosenblatt with a Forward by Harlan Cleveland (Boulder, Colorado: Western Press, 1979), p. 12.

[2]Gustav Ranis, "Appropriate Technology: Obstacles and Opportunities," in The Technology and Economic Development, ed., Rosenblatt, p. 23.

[3]Rosenblatt, ed., The Technology and Economic Development, p. 8.

technology refers to the natural flow of technology from one cultural environment to another.[1]

The diffusion of technology does not mean that developing countries cannot use modern technology. Ranis stated that "there is even less validity to the presumption that technologies appropriate to developing countries must be somehow 'traditional' . . ."[2] He indicated that the choice of technology should be appropriate "to the maximization of social objectives given the society's capabilities."[3] Modern technologies are not necessarily equated with the latest technology of advanced countries. "They can be modern and labor-intensive, or modern and capital-intensive, . . .; it depends on the place, the resources, the preferences, and the time."[4]

The transfer of technology from developed to developing countries should be based on: (1) the choice of the appropriate technology, and (2) the diffusion of technology. One way of transferring technology to developing countries is professional education.[5]

Employment

A successful transfer of technology through education

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[1]Spencer and Worniak, eds., The Transfer of Technology to Developing Countries, p. 185.

[2]Ranis, "Appropriate Technology: Obstacles and Opportunities," p. 24.

[3]Ibid., p. 23. [4]Ibid., pp. 24-25.

[5]Nathaniel Leff, "International Transfer of Technology to Developing Countries," in Technology and Economic Development, ed., Rosenblatt, p. 88.

should help solve one of the major problems of developing countries which is the employment. During the 1970s, attention was focused on widespread and growing unemployment in developing countries.[1] Blaug stated that "in all developing countries, it appears to be true that unemployment is higher among educated groups than among illiterates and higher at the middle levels of the educational system than at the lower or upper ends."[2] Blaug gave some examples from developing countries. He stated that "streets of Calcutta, Karachi, Cairo, Accra, Bogota and Buenos Aires are filled with unemployed university graduates, even as the civil services in these countries are overstocked with graduates."[3]

The problem of educated unemployment reflects poor educational planning in developing countries. The rapid extension of formal education has not provided appropriate skills for promoting the development process. According to Callaway education has been: "a significant factor in the growth of youth unemployment."[4]

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[1]Archibald Callaway, Educational Planning and Unemployed Youth (Paris: UNESCO, International Institute of Educational Planning, 1971), p. 11.

[2]Mark Blaug, "The Quality of Population in Developing Countries, With Particular Reference to Education and Training," in World Population and Development: Challenges and Prospects, ed., Philip M. Hauser (Syracuse: Syracuse University Press, 1979), p. 368.

[3]Ibid., p. 362.

[4]Callaway, Educational Planning and Unemployed Youth, p. 12.

The provision of education not based on the needs of the people in developing countries is a serious problem. Callaway gave some reasons for considering this problem as critical and important:

1. The numbers of educated young people without jobs are already considerable and are continuing to grow. The condition is not correcting itself, and, in fact, in the immediate future is likely to grow worse.

2. Such unemployment has a high social and economic cost. Those not working reduce the standard of living and the potential savings of family members who are. And for the nation, heavy expenditures of scarce public resources (as well as private funds) have been devoted to the education of these young people. When development is urgently being sought, unemployment means a tragic waste of human resources.

3. Given that distribution of income and property is unequal in most developing nations, unemployment of this magnitude accentuates these inequalities by pressing down the wages and earnings of the self-employed. The situation within countries thus tends to polarize: 'The rich get richer, while the poor get poorer.'[1]

Population

The problem of unemployment in developing countries has been compounded by the dramatic acceleration in population growth. As Hauser indicated, there have been many problems associated with population that have been brought to the attention of humankind since the end of World War II. Among these problems are manpower, employment, and unemployment.[2]

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[1]Ibid., pp. 17-18.

[2]Philip M. Hauser, ed., World Population and Development, p. 1.

The population problems are a result of the great acceleration in the rate of population growth. This rate is created by the excess of births over deaths. The highest rate of population growth is in developing countries. Hauser stated that:

> The more developed countries (MDCs) have achieved relatively low growth rates; some are already at, or below, a zero growth level; and others will reach zero growth in the not too distant future. By contrast, the economically less developed countries (LDCs) as a whole are still experiencing rapid growth; and although evidence of declines in birth rates in some LDCs is accumulating, the LCDs as a whole will experience substantial population increases, at least until the end of this century.[1]

Projected populations of the MDCs and the LDCs until the year 2000 are shown in Table 2. Table 2 shows that a major portion of the projected growth will occur in the LDCs.

This change in population should have an effect on the demand for education. Girand states emphatically that population has "repercussions on the aims and content of education."[2]

Both population and education can be seen as processes which maintain a society. As Muhsam stated "the theory of population is concerned with the process by which a society maintains, increases or decreases, as the case may be, its number from generation to generation."[3] Muhsam defined education as

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[1]Ibid., p. 5.

[2]Alain Girard, "The Effect of Demographic Variables on Education," in Education and Population: Mutual Impacts, ed., Helmut V. Muhsam (Belgium: International Union for the Scientific Study of Population, 1975), p. 25.

[3]Muhsam, ed., Education and Population, p. 1.

TABLE 2

ESTIMATES OF PAST, PRESENT, AND FUTURE WORLD POPULATION, 1750-2000[1]

Year	World	Population (in millions) MDCs	LDCs	Percent of Population MDCs	LDCs
1750	791	201	590	25.4	74.6
1800	978	248	730	25.4	74.6
1850	1,262	347	915	27.5	72.5
1900	1,650	573	1,077	34.7	65.3
1950	2,486	858	1,628	34.5	65.5
1970	3,632	1,090	2,542	24.9	75.1
2000					
High variant	6,530	1,402	5,128	21.5	78.5
Medium variant	6,211	1,345	4,866	21.7	78.3
Low variant	5,859	1,295	4,564	22.1	77.9

Source: Philip M. Hauser, ed., World Population and Development: Challenges and Prospects (Syracuse: Syracuse University Press, 1979), p. 13.

> the process by which a society transmits its culture from generation to generation. . . . Indeed, the survival of a society depends on its capacity to evolve processes of both these types--education and demographic--which comply with certain minimum conditions.[1]

Major Cultural Factors Influencing Curriculum Planning

The major cultural factors which influence curriculum planning were found to be included under two categories: values (the roots of culture); ideology (the framework for interpreting values). To add clarity to the discussion, the writer included a brief section on the meanings of culture.

The meanings of culture

The term "culture" has a long history. Edward B. Tylor, in 1871, defined culture as follows:

> Culture or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society.[2]

The definition has two main aspects. First a culture or civilization refers to any way of life whether it is simple or technologically elaborate. Second, culturally standardized behavior is transmitted socially rather than biologically.

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[1] Ibid.

[2] Edward B. Tylor, quoted in Morris E. Opler, "Values and Education in Cultural Perspective," in Values in American Education, eds., Theodore Brameld and Stanley Elam (Bloomington, Indiana: Phi Delta Kappa, Incorporated, 1964), p. 115.

Merton[1] distinguished civilization from culture. He defined civilization as "a body of practical and intellectual knowledge and a collection of technical means for controlling nature." Merton added, "culture comprises configurations of values, of normative principles and ideals, which are historically unique." Merton justified this distinction by stating that "the civilizational aspects tend to be more accumulative, more readily diffused, more susceptible of agreement in evaluation and more continuous in development than the cultural aspect."[2] This distinction is useful for explaining the material and ideological aspects of culture as a whole, however, the two aspects are not separable.

A single culture can be found only in a very primitive society. Taba said that in complex societies "there can be no single allcompassing culture pattern. There are many sub-cultures--regional, religious, class, ethnic, rural, urban." [3]

Taba emphasized that "scientific understanding of culture . . . should be part of the professional equipment of all those who deal with curriculum development."[4]

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[1]Robert K. Merton, "Civilization and Culture," Sociology and Social Research, 21 (1936): 103-113.

[2]Ibid.

[3]Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace and World, Inc., 1962), p. 49.

[4]Ibid., p. 47.

Values

Each culture has values which "are reflected in all its aspects, and each detail can be seen in its relationship to the larger whole."[1] Understanding the cultural values is important for curriculum planners. Values are the rules by which people shape their behavior.[2] Inlow described values as "the most vital aspect of the structural stability of any society . . . These values evolve slowly, change slowly, and constitute, at any given time, a bedrock foundation for an education program."[3] According to Inlow "values of any culture automatically frame the values of the educational system that exists to serve the culture."[4]

The importance of considering values in curriculum planning was emphasized by Smith, Stanley and Shores.

> The heart of a culture is its universals. The heart of the universlas is the values or, in other words, the rules by which people order their social existence. These rules, when built into the personalities of the individuals comprising the society, create the personality type peculiar to the culture. Hence, the heart of any satisfactory educational program consists of those basic values that give

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[1]George D. Spindler, Education and Culture--Anthropological Approaches (New York: Holt, Rinehart and Winston, 1963), p. 121.

[2]George A. Beauchamp, Curriculum Theory, 2nd edition (Wilmette, Illinois: The Kagg Press, 1968), p. 156.

[3]Gail M. Inlow, The Emergent in Curriculum (New York: John Wiley and Sons, Inc., 1966), p. 4.

[4]Ibid., pp. 6-7.

> meaning to the purposes, plans, and activities of the individual.[1]

Beauchamp indicated that "the first task for curriculum planners with respect to values is to identify and state those expressed as attitudes, beliefs, ideals or concepts that the school should bring to the attention of the pupils."[2] O'Connor suggested that these should consists of "a set of values or ideals embodied and expressed in the purposes for which knowledge, skills and attitudes are imparted . . ."[3]

Ideology

Lodge defined ideology as:

> . . . a collection of ideas that makes explicit the nature of the good community. It is the framework by which a community defines and applies values, such as survival, justice, self-respect, fulfillment, and economy (the efficient use of resources).[4]

The meaning of values at different points in time and space is a function of the ideology of society. For example, "justice" is a social, economic and political value. It is as old as the history of mankind, however; its meaning follows the ideology of society. As Lodge pointed out "in ancient Egypt, justice

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[1] B. Othanel Smith, William O. Stanley, and J. Harlan Shores, Fundamentals of Curriculum Development, revised edition (Yonkers-on-Hudson: World Book Company, 1957), p. 85.

[2] Beauchamp, Curriculum Theory, p. 162.

[3] D. J. O'Connor, An Introduction to the Philosophy of Education (London: Routledge and Kegan Paul, 1957), p. 5.

[4] George C. Lodge, The New American Ideology (New York: Alfred A. Knopf, Inc., 1975), p. 7.

and self-respect involved lugging stones to glorify the god-king. For a time the Pharaonic ideology provided an acceptable consensus, . . .; then it eroded and collapsed."[1] In socialist and communist societies, justice involves the nationalization of all economic resources, an approach which is injustice in capitalist societies. This example illustrates how a value has remained a constant through the history of man; but its interpretation and application changed from time to time and from society to society.

Lodge also explains that the ideology of the society should provide social, political and economic definitions for values at any one time.[2] According to Taylor and Richards, it is the duty of curriculum planners to consider ideology as a framework which gives "meaning to the complex and diverse practical enterprise of teaching and provides general guidelines towards which this enterprise can be directed."[3]

A Framework for Curriculum Planning in Developing Countries

The analyses reported in this chapter have been presented for the purpose of developing a framework for curriculum planning. The three elements of the framework for curriculum planning were: the process of curriculum

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[1] Ibid., pp. 7-8.

[2] Ibid., p. 21.

[3] Philip H. Taylor and Colin M. Richards, An Introduction to Curriculum Studies (Atlantic Highlands, New Jersey: Humanities Press, Inc., 1979), p. 40.

planning, major environmental factors and major cultural factors influencing curriculum planning in developing countries. A fourth element of curriculum planning, the educational system, was presented in this section to complete the theoretical bases.

Curriculum planning was explained by Beauchamp as being a part of the total operations of the education system (schooling system).[1] An educational system in society can be described in terms of input-processor-output format of a system. Correa gave some examples of inputs of the system such as "teachers, building, financial resources, . . . the school-age population."[2] Correa indicated that the process of education was the combination of the inputs "that produces educated people as its output."[3]

Figure 13 contains a framework for curriculum planning. The following explanation of the framework was based on the synthesis of findings which have been presented. The explanation utilizes small letters in circles to crossreference with those in Figure 13.

a At a particular time, an educational system (schooling system) provides certain curriculum which reflects the environmental and cultural factors of society. The educational system

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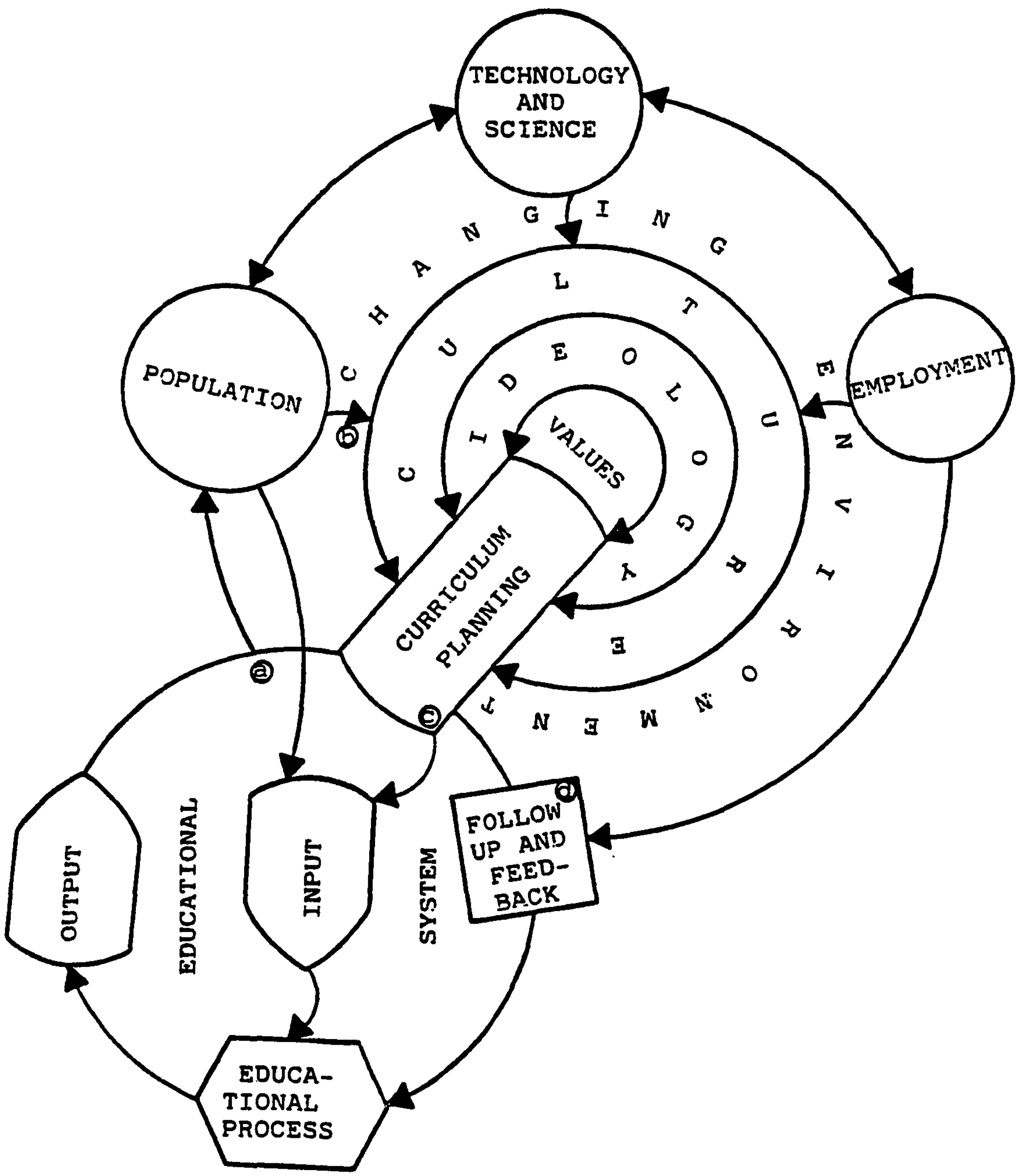
[1]Beauchamp, Curriculum Theory, p. 108.

[2]Hector Correa, "Models for Decision-Making in Educational Planning and Administration," in Education in National Development, ed., Don Adams (New York: David McKay Company, Inc., 1971), p. 206.

[3]Ibid.

Figure 13. A framework for curriculum planning in developing countries.



produces people who possess knowledge, skills, as well as attitudes, beliefs and ideas that the curriculum brought to their attention.

(b) Those educated people interact with their changing environment. This interaction may affect the material and ideological aspects of their culture. For instance, the technology influences the social and economic life through its effect on productivity, jobs, the size of groups in work and the pattern of interpersonal relationships. The ideas of people can be affected by such influence. And, in turn, the meaning of values which shape their behavior can be changed.

(c) Curriculum planners have to make decisions on developing new curriculum and on changing existing curriculum. Decisions on new curriculum are required in a case like introducing MIS curriculum into developing countries. Decisions on changing curriculum are required to cope with the changing needs of society. In all cases, curriculum planners need to consider the effect of the interaction among the environmental and cultural factors on their decisions of determining goals, scope and sequence of curriculum and courses. The decisions are input to the education system.

(d) Curriculum planners follow up the implementation of their decisions through feedback from society and feedback to the educational process.

A Conceptual Framework for Planning MIS Curriculum in Developing Countries

Any initiative as complex as curriculum planning requires some kind of theoretical or conceptual framework of thinking to guide it.[1] It was the target of this investigation to develop such a framework to guide planning MIS curriculum in developing countries.

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[1]Taba, Curriculum Development, p. 413.

The development of the framework involved three stages:

Stage 1. Conceptual factors of MIS were identified in Chapter II. The identified factors were used to develop a theory base for MIS in Chapter IV.

Stage 2. Environmental and cultural factors influencing curriculum planning were identified in Chapter II. The major factors were used to develop a framework for curriculum planning in developing countries, in Chapter V.

Stage 3. This section presents a coherent conceptual framework for planning MIS curriculum in developing countries. This framework consists of the integration of stages (1 and 2).

Figure 14 presents the integrated stage of developing the framework. The upper part of the figure presents five conceptual factors of MIS which constitute dimensions of a theory base for MIS. The five dimensions are essential components of MIS curriculum.[1] The lower part of the figure presents a framework for curriculum planning in developing countries.[2]

The diagram illustrates the evolvement of MIS in developing countries through education. Five major components of MIS curriculum can be introduced to developing countries in a manner that promotes the development process. The choice of appropriate information technology can help in the solution of employment and educational problems in developing countries.

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[1]For detailed explanation, see Chapters II and IV. For brief explanation, see pp. 112-14.

[2]For detailed explanation, see Chapters II and V. For brief explanation, see pp. 130-33.

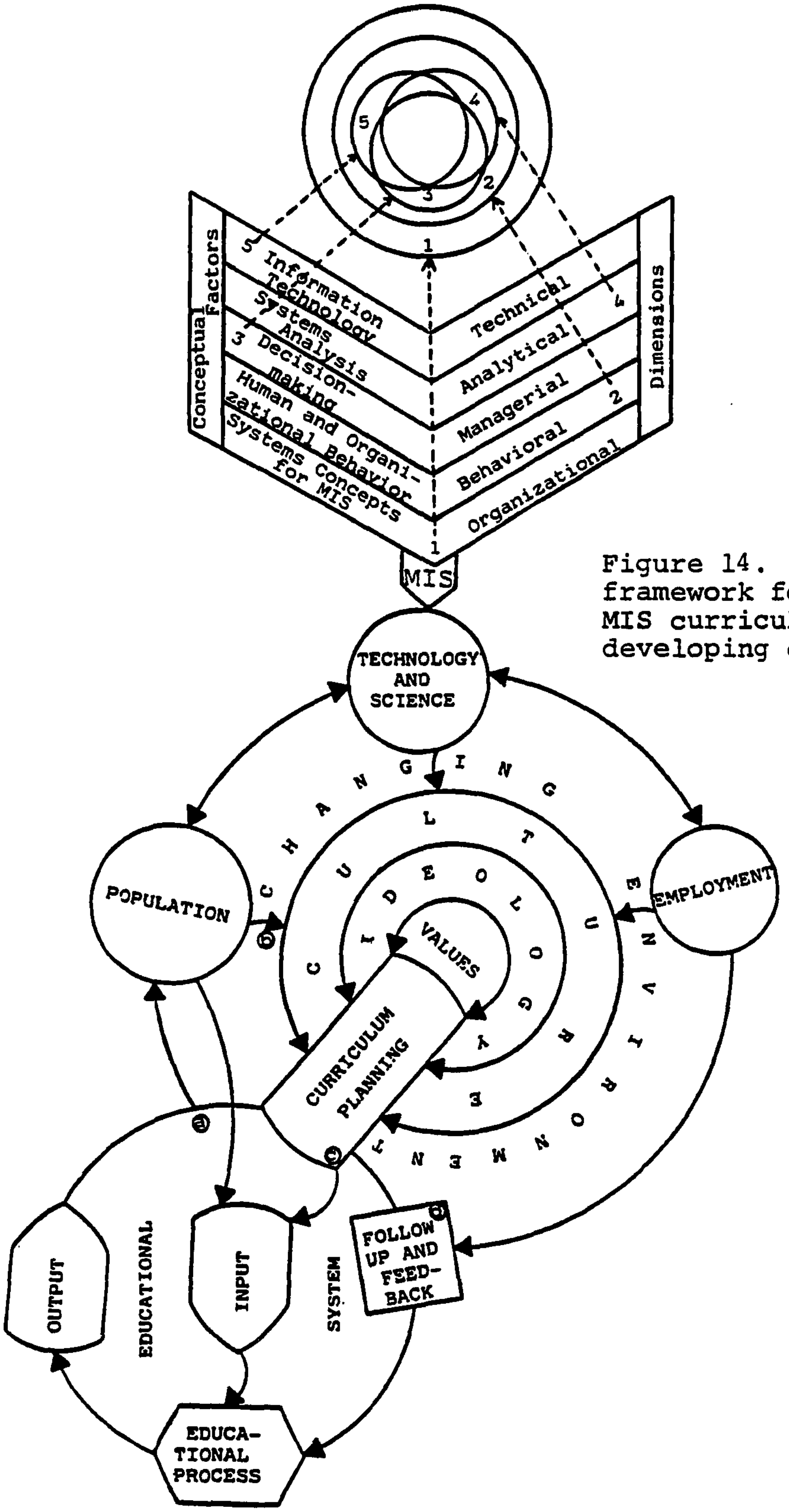

Figure 14. A conceptual framework for planning MIS curriculum in developing countries.

The five components of MIS can be diffused through curriculum planning that considers the environmental and cultural factors in society.

The writer developed Figure 14 to provide a pictorial presentation of a conceptual framework for planning MIS curriculum in developing countries. The figure also provided a summary of the chapter. The next chapter provided a summary of the dissertation.

CHAPTER VI

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

This investigation was a library research project which was conducted through the use of written materials obtained from libraries located throughout the United States. The investigation was concerned with the educational development in management information systems for developing countries. The purpose of the investigation was directed to introduce the different techniques of MIS to the needs of developing countries.

The problem of this investigation was the development of a conceptual framework to enable curriculum planners in developing countries to adopt and adapt MIS conceptual factors to the needs of managers. More specifically, the problem involved three significant aspects:

1. Identification of conceptual factors of MIS and establishing a theory base for MIS.
2. Interpretation of the dynamic nature of curriculum planning.
3. Development of a conceptual framework for planning MIS curriculum in developing countries.

The solution of the problem required four aspects of investigation. First, a tentative bibliography of related research and professional literature was prepared. The bibliography was compiled utilizing the following sources:

1. Dissertation Abstracts
2. Current Index to Journals in Education (CIJE)
3. Educational Resources Information Center (ERIC)
4. Business Periodicals Index
5. Business Education Index
6. Education Index

Second, data were collected. An exhaustive search was made in an effort to secure a copy of each item in the bibliography. The sources of data included the following:

1. Doctoral dissertations
2. Reports of professional organizations
3. Research reports in management and organization
4. Research reports in education
5. Textbooks of MIS
6. Articles in creditable periodicals

Third, the information was analyzed, classified and synthesized. The findings in research reports were analyzed to determine the basic conceptual factors of MIS and the major factors influencing curriculum planning. As a result of this analysis the conceptual factors of MIS were classified as follows:

1. Systems concepts for MIS
2. Human and organization behavior
3. Decision-making
4. Systems analysis
5. Information technology

The major factors influencing curriculum planning were classified into environmental and cultural.

The finds pertaining to each of the factors were carefully studied, and a synthesis was presented of the composite findings for each factor. The synthesized findings were utilized to develop a conceptual framework for planning MIS curriculum in developing countries.

Fourth, the final report was prepared. The report of this investigation was divided into the following six chapters:

1. The Problem
2. Literature Review
3. Methodology and Procedures
4. A Theory Base for MIS
5. Planning MIS Curriculum in Developing Countries
6. Summary, Findings, Conclusions and Recommendations

Findings

In this section the findings of the investigation were presented utilizing the following headings: the developing countries needs for MIS, MIS characteristics, a theory base for MIS, and planning MIS curriculum in developing countries.

The Developing Countries Needs for MIS

The literature indicated that developing countries are facing many problems which can be solved through development. A successful development requires growth and change that progress from within. The people of developing countries themselves must understand the goals of development and work for them. It is not the artificial transfer of technology that can solve their problems, but it is the planned diffusion of the appropriate technology that may achieve their goals.

Human resources development was found to be one of the most serious problems which drain human and economic resources of developing countries. The problem was created by the poor planning and disproportionate amount of education, while these countries are in urgent need for high-talent manpower.

An aspect of the human resources problem is the shortage of managerial and administrative skills which represents a bottleneck inhibiting development in the developing countries. This shortage is due to the lack of the appropriate professional education for management.

Decision-making is the heart of the management process. Decisions are needed for the construction, authorization and operation of all economic, social and political programs in developing countries. Effective decisions cannot be made without adequate information. It was found that the production of information for decision-making is not less important than the production of physical commodities. This production of information is simply the purpose of management information systems or MIS. The literature of MIS does not have any reference to developing countries.

MIS Characteristics

The following characteristics of MIS were found in the literature.

1. MIS is an information system which is useful for and used by decision makers in an organization.

2. MIS functions include collection, storage, processing, retrieving and communication of information about all components of the management process that deal with all resources of an organization at the different managerial levels and regarding all functions of the organization.[1]

3. The purpose of MIS is to provide all decision makers in an organization with relevant information in the proper time-frame to assist in making effective decisions.

4. The sources of information for MIS include formal as well as informal channels.

5. A variety of techniques ranging from simple manual ones to highly sophisticated techniques can be employed in the development of MIS. The uses of computer, decision-models, and data base are characteristics of an advanced MIS.

6. MIS design approaches are contingent on the internal and external environment of an organization.

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[1]Components of management process are planning, organization, directing and controlling. Resources of an organization are numerous such as manpower, technology and assets. Functions of an organization depend on the nature of the organization. Examples of these functions are production, marketing and financing.

A Theory Base for MIS

A theory base for MIS was developed to provide the essential components of MIS curriculum. Five conceptual factors were found to constitute dimensions of the theory. A synthesis of findings pertaining to each factor is summarized below.

The first factor was systems concepts for MIS. A system was defined as "a set of complex interacting components forming a purposeful unitary whole in which the performance is directed to achieve a mutual goal." The elements of this definition as well as other related concepts were explained.

MIS was illustrated as a system which starts its operations with inputs of data from internal and external activities of an organization as well as feedback resulting from output of information. The system processes the data according to certain procedures. For processing, the system may use previously stored data and it may store new data for future use. The output resulting from processing is communicated to decision makers. The output of information is compared with standards to determine deviations which are fed back to the system for control purpose. Figure 4 illustrates this process.

MIS was found to be an organization system which is a mix of different types of systems including conceptual and physical, deterministic and probabilistic, natural and man-made, social and man-machine, and closed and open systems.

The second factor was human and organizational behavior. The total behavior of humans in a formal and informal setting was found to constitute the organizational behavior. Three dimensions of organizational behavior were found to be needed for successful implementation of a new MIS or modification of an existing one. The three dimensions were the formal organization system, the individual system and the social system. Each of the systems was defined in terms of the three major components of a system: input, process and output.

The third factor was decision-making which was found to be the main purpose of MIS. Findings pertaining to how and where decisions are made in an organization were utilized to develop a framework for decision-making. The framework was developed to serve as a base for the analysis and design of MIS. The framework presented horizontal classification of managerial activities as well as vertical classification of functions in a typical organization. The process of decision-making was explained in terms of the different managerial and functional activities. Non-programmed (open) and programmed (closed) decision models were explained as a part of the framework. The information requirements for the different levels and types of decisions were classified according to certain characteristics of information. This framework for decision-making which includes five coherent parts was illustrated in Figure 9.

The fourth factor was systems analysis. For the purpose of MIS, systems analysis was found to include information analysis and systems design. Ten steps for systems analysis were found to be used in each phase of the MIS development cycle. The ten steps were presented in a form of iterative cycle of systems analysis. Figure 10 illustrates this cycle.

The phases of MIS development cycle were synthesized in six phases: (1) feasibility study, (2) project management, (3) analysis of information requirements, (4) systems design, (5) development and testing and (6) implementation. The sequence of these phases with their feedback loop, the steps of systems analysis and the approach of MIS development were illustrated in Figure 11.

The fifth factor was information technology. Three categories of information technology were presented: manual, semi-automated and computer technology. The aspects and capabilities of each were discussed and compared with the others. The following six functions of MIS were found to be essential under any kind of information technology.

1. The acquisition of data (the input component).
2. The arithmetic and logical analysis and synthesis of data (the processor component).
3. The instructions for data processing (the procedures component).
4. The classification and arrangement of data in files for easy access and retrieval (the storage component).

5. The retrieval and dissemination of information to users (the output component).

6. The users understanding of information and their feedback to the system (the communication component).

The six functions were illustrated in Figure 4. The change which results from technology is that the processing of data is performed by humans when using manual technology. The humans are aided by machines when using semi-automated technology. When using a computer, the computer is the processor. The different kinds of technology do not change MIS functions, but they affect the efficiency of MIS in terms of speed, accuracy and quantity of available information.

The interrelation among the five conceptual factors of MIS was explained. The factors were presented as interlocking and interactive concepts which constitute dimensions of a theory base for MIS. These dimensions were illustrated in Figure 12.

Planning MIS Curriculum in Developing Countries

The literature review of human resources development in developing countries indicated that there are different levels of development in these countries. Each level is faced with different problems that determine the priorities of educational development. Real growth in educational development depends on the content and the impact of what is taught in the curriculum.

The process of curriculum planning was found to be "a process of deciding on goals, scope and sequence of curriculum and courses; on changes in the curriculum." Many factors influencing curriculum planning were found such as social, economic, demographic, political, psychological and technological factors. The factors were classified as environmental and cultural to study the complex interrelationships among the factors. The characteristics that distinguish developing countries in the world were used to determine the major environmental factors influencing curriculum planning in these countries. The major factors were technology and science, employment, and population. Major cultural factors which influence curriculum planning were values (the roots of culture) and ideology (the framework for interpreting values).

The environmental and cultural factors were used to develop a framework for curriculum planning in developing countries. The framework was illustrated in Figure 13. The framework was developed to utilize the theory base for MIS, which was presented earlier, for planning MIS curriculum in developing countries.

Conclusions

Based on the findings obtained in this investigation, the writer made the following conclusions:

1. Education in developing countries is the best way for transferring technology into these countries. There are some other ways such as

direct investments by multinational corporations, the use of licenses and patents, and equipment suppliers. These ways of transferring technology are less effective and of limited relevance to the needs of developing countries because their purpose is to achieve higher economic returns regardless of the real needs or capabilities of developing countries to absorb the technology.

2. The failure of curriculum planning in developing countries is due to neglecting the cultural and environmental factors influencing the planning process.

3. The conceptual framework for planning MIS curriculum in developing countries is a practical guide for introducing MIS techniques to the needs of developing countries. The following factors supported this conclusion:

   a. The framework provided the essential components of MIS curriculum.

   b. The framework provided different alternatives of MIS techniques which enable curriculum planners to adopt and adapt what is appropriate to the developmental level of a developing country.

   c. The framework recognized the gap between what is theoretically possible and what is operationally feasible by emphasizing the consideration of the environmental and cultural factors. This consideration accounts for the political, economic and social obstacles in developing countries.

Recommendations

The writer has the following recommendations for implementing the framework of this investigation:

1. Specification of MIS skills needed in each developing country should be determined through studying the needs of governmental and private organizations in society. The

study should be concluded with formulating objectives of the curriculum plan.

2. The selection and organization of the content of MIS curriculum should be based not only on the framework, but also on the nature of the learning process as well as the consideration of appropriate methods of teaching.

3. The first MIS curriculum in a developing country should be a graduate curriculum to prepare instructors and researchers.

SELECTED BIBLIOGRAPHY

PART I

MIS CONCEPTUAL FACTORS

Books

Alexandar, M. J. Information Systems Analysis: Theory and Applications. Chicago: Science Research Associates, Inc., 1974.

Anthony, Robert N. Planning and Control Systems: A Framework for Analysis. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1965.

Beer, Stafford. Cybernetics and Management. 2nd edition. London: The English Universities Press Ltd., 1967.

Birkle, John, and Yearsley, Ronald, eds. Computer Applications in Management. New York: Brandon/Systems Press, 1970.

Black, Guy. The Application of Systems Analysis to Government Operation. Washington, D. C.: National Institute of Public Affairs, 1966.

Blumenthal, Sherman C. Management Information Systems: A Framework for Planning and Development. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969.

Bourne, Charles P. Methods of Information Handling. New York: John Wiley and Sons, Inc., 1965.

Bower, James B.; Schlosser, Robert E.; and Zlatkovich, Charles T. Financial Information Systems, Theory and Practice. Boston: Allyn and Bacon, Inc., 1969.

Buckley, Walter. Sociology and Modern Systems Theory. Englewood Cliffs, New Jersey: Prentice-Hall, 1967.

Burch, John G., and Stanter, Felisc R. Information Systems: Theory and Practice. Santa Barbara, California: Hamilton Publishing Company, 1974.

Carzo, Pocco, Jr., and Yanouzas, John W. Formal Organization, A System Approach. Homewood, Illinois: Richard D. Irwin, Inc., and Dorsey Press, 1967.

Cleland, David I., and King, William R. Systems Analysis and Project Management. New York: McGraw-Hill Book Company, 1968.

Coleman, Raymond J., and Riley, M. J., eds. MIS: Management Dimensions. San Francisco: Holden-Day, Inc. 1973.

Couger, J. Daniel, and Knapp, Robert W., eds. Systems Analysis Techniques. New York: John Wiley and Sons, 1974.

Davis, Gordon B. Management Information Systems: Conceptual Foundations, Structure, and Development. St. Louis: McGraw-Hill Book Company, 1974.

Ein-Dor, Philip, and Segev, Eli. Managing Management Information Systems. Lexington, Massachusetts: D. C. Heath and Company, 1978.

Emery, James C. Organizational Planning and Control Systems, Theory and Technology. Toronto: Callier-MacMillan, Ltd., 1969.

Fahey, Robert J.; Love, Douglas A.; and Ross, Paul F. Computers, Science and Management Dynamics. New York: Financial Executives Research Foundation, 1969.

Forrester, Jay W. Industrial Dynamics. Cambridge: The M.I.T. Press, 1973.

Greenwood, William T., ed. Decision Theory and Information Systems. Dallas: South-Western Publishing Company, 1969.

Herbert, Theodore T. Dimensions of Organizational Behavior. New York: Macmillan Publishing Co., Inc., 1976.

Hussain, K. M. Management Information Systems for Higher Education. Paris: Organization for Economic Co-operation and Development, 1977.

IBM Corporation. Business Systems Planning--Information Systems Planning Guide. White Plains: Technical Publications/ Industry, 1975.

Katz, Daniel, and Kahn, Robert L. The Social Psychology of Organizations. 2nd edition. New York: John Wiley and Sons, 1978.

Kerlinger, F. N. Foundations of Behavioral Research. New York: Holt, Rinehart and Winston, 1964.

Kirk, Frank G. Total System Development for Information Systems. New York: John Wiley and Sons, 1973.

Kish, Joseph L., Jr., and Morris, James. Microfilm in Business. New York: The Ronald Press Company, 1966.

Knezevich, Stephen J. Administration of Public Education. 3rd edition. New York: Harper and Row, Publishers, 1975.

Krauss, Leonard I. Computer Based Management Information Systems. Chicago: American Management Association, Inc., 1970.

Ligon, Helen H. Successful Management Information Systems. Research for Business Decisions, no. 9. Research Press, 1978.

Litterer, Joseph A. The Analysis of Organizations. 2nd edition. New York: John Wiley and Sons, Inc., 1973.

Melcher, Arlyn J., ed. General Systems and Organization Theory. Kent: Kent State University Press, 1975.

Meltzer, Morton F. The Information Imperative. American Management Association, 1971.

Methlie, Leif B. Information Systems Design: Concepts and Methods. New York: University of Columbia Press, 1978.

Morphet, Edgar L.; Johns, Roe L.; and Reller, Theodore L. Educational Organization and Administration. 3rd edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

Murdick, Robert G., and Ross, Joel E. Information Systems for Modern Management. 2nd edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975.

________. eds. MIS in Action. New York: West Publishing Company, 1975.

Prasand, S. Benjamin, ed. Management in International Perspective. New York: Meredith Publishing Company, 1967.

Rogers, Everett M., and Agarwala-Rogers, Rekha. Communication in Organizations. New York: The Free Press, A Division of MacMillan Publishing Company, Inc., 1976.

Rosove, Perry E. Developing Computer Based Information Systems. New York: John Wiley and Sons, Inc., 1967.

Ross, Joel E. Modern Management Information Systems. Reston, Virginia: Reston Publishing Company, Inc., 1976.

Semprevivo, Philip C. Systems Analysis: Definition, Process, and Design. Chicago: Science Research Associates, Inc., 1976.

Shaw, John C., and Atkins, William. Managing Computer System Project. New York: McGraw-Hill Book Company, 1970.

Simon, Herbert A. The New Science of Management Decision. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977.

Thierauf, Robert J. Systems Analysis and Design of Real Time Management Information Systems. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975.

Thompson, James D., et al., eds. Comparative Studies in Administration. Pittsburgh: University of Pittsburgh Press, 1959.

Trent, Robert H., and Wheeler, Thomas L., eds. Development in Management Information Systems. Encino, California: Dickenson Publishing Co., Inc., 1974.

Voich, Dan, Jr., and Wren, Daniel A. Principles of Management: Resources and Systems. New York: Ronald Press Company, 1968.

von Bertalanffy, Ludwing. General Systems Theory. New York: George Braziller, 1968.

Wadia, Maneck S. Management and the Behavioral Sciences. Boston: Allyn and Bacon, Inc., 1968.

Williams, William F. Principles of Automated Information Retericual. Elmhurst, Illinois: The Business Press, 1968.

Willoughby, Theodore C. , and Senn, James A. Business Systems. Cleveland, Ohio: Association for Systems Management, 1975.

Wrightsman, Lawrence S. Social Psychology in Seventies. Monterey, California: Brooks/Cole, 1972.

Periodicals

Ackoff, Russell L. "Management Misinformation Systems." Management Science. Ser. B. 14 (December, 1967): 147-156.

________. "Towards A System of Systems Concepts." Management Science. 14 (July, 1971): 661-671.

Ashenhursit, R. L., ed. "Curriculum Recommendations for Graduate Professional Programs in Information Systems." A Report of the ACM Curriculum Committee on Computer Education for Management. Communications of the ACM. 15 (May, 1972): 363-398.

Couger, J. Daniel. "Curriculum Recommendations for Undergraduate Programs in Information Systems." A Report of the ACM Curriculum Committee on Computer Education for Management. Communication of the ACM. 16 (December, 1973): 727-749.

Dearden, John. "How to Organize Information Systems." Harvard Business Review. 43 (March-April, 1965): 65-73.

________. "MIS is a Mirage." Harvard Business Review. 50 (Jan./Feb., 1972): 90-99.

Glaser, George R. "Are You Working on the Right Problem." Datamation. 13 (June, 1967): 22-25.

Gorry, G. Anthony, and Morton, Michael S. Scott. "A Framework for Management Information Systems." Sloan Management Review. 13 (Fall, 1971): 55-70.

Hoos, Ida R. "Information Systems and Public Planning." Management Science. Ser B. 17 (June, 1971): 658-71.

Igersheim, Roy H., and Swanson, Lloyd A. "Management Information Systems Curricula: State-of-the-Art." Decision Science. 5 (April, 1974): 284-291.

Kast, Fremont E., and Rosenzweing, James E. "General Systems Theory: Applications for Organizations and Management. Academy of Management Journal. 15 (December, 1972): 447-465.

Kenneran, Walter J. "MIS Universe." Data Management. 8 (Sept., 1970): 62-64.

King, William R. and Cleland, David I. "The Design of Management Information Systems: An Information Analysis Approach." Management Science. 22 (November, 1975): 286-297.

McFarlam, Warren, and Nolan, Richard L. "Curriculum Recommendations for Graduate Professional Programs in Information Systems: Recommended Addendum on Information Systems Administration." Communication of the ACM. 16 (July, 1973): 439-41.

Miller, James G. "Living Systems: Basic Concepts." Behavioral Science. 10 (July, 1965): 193-237.

Miller, William B. "Fundamentals of Project Management." Journal of Systems Management. 29 (November, 1978): 22-29.

Rappaport, Alfred. "Management Misinformation Systems--Another Perspective." Management Science. Ser. B. 15 (December, 1968): 133-36.

Reeves, Gary R., and Busson, Robert S. "Information Systems Curriculum." Journal of Systems Management. 30 (March, 1979): 18-21.

Schneyman, Arthur H. "Management Information Systems for Management Science." Interfaces. 6 (May, 1976): 52-59.

Schneyman, M. K. "MIS Planning." Datamation. 16 (Sept., 1970): 8-31.

Scott, William G. "Organization Theory: An Overview and an Appraisal." Academy of Management Journal. 4 (April, 1961): 7-26.

Shell, Richard L., and Stelzer, David F. "System Analysis: Aid to Decision-Making." Business Horizons. 14 (December, 1971): 67-72.

Teichroew, Daniel, ed. "Education Related to the Use of Computers in Organizations, Postion Paper--ACM Curriculum Committee on Computer Education for Management." Communication of the ACM. 14 (Sept., 1971): 573-588.

Vazsonyi, Andrew. "Information Systems in Management Science: The Information Systems Option in Master of Business Administration Degree Program." Interfaces. 4 (Aug., 1974): 12-17.

Wilson, Charles Z., and Alexis, Marcus. "Basic Frameworks for Decisions." Academy of Management Journal 5 (Aug., 1962): 151-164.

Zani, William M. "Blueprint for MIS." Harvard Business Review, 48 (December, 1970): 95-100.

Unpublished Doctoral Dissertations

Cerveny, Robert Paul. "The Effects of Computerized Management Information System on Managerial Behavior and Attitudes: A Comparative Study of Corporate Risk Manager Subscribers and Nonsubscribers." Ph.D dissertation, University of Texas at Austin, 1976.

Gehrman, Raul R. "A Study to Identify Contingent Functional Relationships Between an Organization's External Environment and Its Design of Effective Management Information Systems." Ph.D. dissertation, University of Nebraska, Lincoln, 1976.

Kirkpatrick, Donald Clay. "General Systems Theory as a Framework for Management Information Systems." Doctoral dissertation, University of Colorado, 1976.

Milano, James Vinson. "Development and Implementation of a Management Information System." Doctoral dissertation, The George Washington University, 1969.

Rodriguez, Jaime Ivon. "The Design and Evaluation of a Strategic Issue Competitive Information Systems." Ph.D. dissertation, University of Pittsburgh, 1977.

PART II

CURRICULUM PLANNING

Books

Beauchamp, George A. Curriculum Theory. 2nd edition. Wilmette, Illinois: The Kagg Press, 1968.

Brameld, Theodore, and Elam, Stanley, eds. Values in American Education. Bloomington, Indiana: Phi Delta Kappa, Incorporated, 1964.

Clark, Leonard H.; Klein, Raymond L.; and Burks, John B. The American Secondary School Curriculum. 2nd edition. New York: The Macmillan Company, 1972.

Gagné, Robert M., and Briggs, Leslie J. Principles of Instructional Design. 2nd edition. New York: Holt, Rinehart and Winston, 1979.

Inlow, Gail M. The Emergent in Curriculum. New York: John Wiley and Sons, Inc., 1966.

King, Arthur R., Jr., and Brownell, John A. The Curriculum and the Disciplines of Knowledge. New York: John Wiley and Sons, Inc., 1966.

Lodge, George C. The New American Ideology. New York: Alfred A. Knopf, 1975.

Miel, Alice. Changing the Curriculum. New York: Appleton-Century-Crofts, Inc., 1946.

Nicholls, Audrey, and Nicholls, S. Howard. Developing a Curriculum: A Practical Guide. Boston: George Allen and Unwin, 1978.

Smith, Othanel B.; Stanley, William O.; and Shores, J. Harlan. Fundamentals of Curriculum Development. Revised edition. Yonkers-on-Hudson: World Book Company, 1957.

Taba, Hilda. Curriculum Development: Theory and Practice. New York: Harcourt, Brace and World, Inc., 1962.

Taylor, Philip H., and Richards, Colin M. An Introduction to Curriculum Studies. Atlantic Highlands, New Jersey: Humanities Press, Inc., 1979.

Periodicals

Bowers, Norman D. "Psychological Factors Influencing Curriculum Decisions." Review of Education Research. 33 (June, 1963): 268-277.

Shaw, Frederick. "The Changing Curriculum." Review of Educational Research. 36 (June, 1966): 343-352.

Vars, Gordon F., and Lowe, William T. "Social Forces Influencing Curriculum Decisions." Review of Educational Research. 3 (June, 1963): 254-67.

PART III

EDUCATIONAL PLANNING FOR DEVELOPING COUNTRIES

Books

Adams, Don, ed. Education in National Development. New York: David Mckay Company, Inc., 1971.

Adiseshiah, Malcolm S. It is Time to Begin the Human Role in Development: Some Reflections for the Seventies. Paris: UNESCO, 1972.

Callaway, Archibald. Educational Planning and Unemployed Youth. Paris: UNESCO, International Institute of Educational Planning, 1971.

Curle, Adam. Educational Strategy for Developing Societies. London: Tavistock Publications, 1963.

de Souza, Anthony R., and Philip W. Porter. The Underdevelopment and Modernization of the Third World. Washington, D. C.: Association of American Geographers, 1974.

Hanson, John W., and Brembeck, Cole S., eds. Education and the Development of Nations. New York: Holt, Rinehart Winston, Inc., 1966.

Harbison, Frederick, and Mayers, Charles A. Education, Manpower, and Economic Growth: Strategies of Human Resource Development. New York: McGraw-Hill Book Company, 1964.

Hauser, Philip M., ed. World Population and Development--Challenges and Prospects. Syracuse: Syracuse University Press, 1979.

Lewis, W. Arthur. The Principles of Economic Planning. London: Allen and Unwin, 1952.

Muhsam, Helmut V., ed. Education and Population: Mutual Impacts. Belgium: International Union for the Scientific Study of Population, 1975.

Rosenblatt, Samuel M. Technology and Economic Development: A Realistic Perspective. Foreward by Harlan Cleveland. Boulder, Colorado: Westview Press, 1979.

Spencer, Daniel L., and Woroniak, Alexander, eds. The Transfer of Technology to Developing Countries. New York: Frederick A. Praeger, Publishers, 1967.

Spindler, George D. Education and Culture--Anthropological Approaches. New York: Holt, Rinehart and Winston, 1963.

Susskind, Charles. Understanding Technology. Baltimore: The Johns Hopkins University Press, 1973.

APPENDICES

APPENDIX A

OBJECTIVES OF C^3EM CURRICULUM RECOMMENDATIONS FOR GRADUATE PROFESSIONAL PROGRAMS IN INFORMATION SYSTEMS[1]

(a) people

ability to hear others, as well as listen to them;

ability to describe individual and group behavior and to predict likely alternative future behavior in terms of commonly used variables of psychology and economics;

ability to describe and predict task-oriented, time-constrained behavior in an organizational setting.

(b) models

ability to formulate and solve simple models of the operations research type;

ability to recognize in context of appropriate models for situations commonly encountered.

(c) systems

ability to view, describe, define any situation as a system—specifying components, boundaries, and so forth;

ability to apply this "systems viewpoint" in depth to some class of organizations—manufacturing firms, government bureaus, universities, hospitals, service providers, etc.;

ability to perform an economic analysis of proposed resource commitments (includes ability to specify needs for additional information and to make a set of conditional evaluations if information is unavailable);

ability to present in writing a summary of a project for management action (suitable to serve as a basis for decision);

ability to present in writing a detailed description of part of a project, for use in completing or maintaining same.

(d) computers

knowledge of basic hardware/software components for computer systems, and their patterns of configuration;

ability to program in a higher-level language;

ability to program a defined problem involving data files and communications structures;

ability to develop several logical structures for a specified problem;

ability to develop several different implementations of a specified logical structure;

ability to develop specifications for a major programming project, in terms of functions, modules and interfaces;

knowledge of sources for updating knowledge of technology;

ability to develop the major alternatives (assuming current technology) in specifying an information processing system, including data files and communications structures,

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[1] R. L. Ashenhurst, ed., "Curriculum Recommendations for Graduate Programs in Information Systems," Communications of the ACM, 15 (May 1972), pp. 370-71.

to the level of major system components;
ability to make an economic analysis for selecting among alternatives above, including identification of necessary information for making that analysis, and also to identify noneconomic factors;
ability to make "rough-cut" feasibility evaluations (in terms of economic and behavioral variables) of proposed new techniques or applications of current technology, identifying critical variables and making estimates and extrapolations;
ability to develop specifications for the computer-based part of a major information system, with details of task management and data base management components.

(e) <u>organizations</u>
knowledge of the function of purposeful organizational structure, and of the major alternatives for that structure;
knowledge of the functional areas of an organization--operations, finance, marketing, product specification and development;
ability to identify in an ongoing organizational situation the key issues and problems of each functional area;
knowledge of typical roles and role behavior in each functional area;
ability to identify possible short-term and long-term effects of a specified action on organizational goals;
ability to identify information needs appropriate to issues and roles above;
knowledge of how information systems are superimposed on organizational patterns, on the operational control, and planning levels;
knowledge of techniques for gathering information;
ability to gather information systematically within an organization, given specified information needs and/or specified information flows;
ability to specify, given information needs and sources, several alternative sets of information transfers and processings to meet needs;
ability to make "rough-cut" feasibility evaluations of such alternatives;
ability to develop positive and negative impacts of a specified information system on specified parts of an organization;
ability to develop specifications for a major information system, addressing a given organizational need, and determine the breakdown into manual and computer-based parts.

(f) <u>society</u>
ability to articulate and defend a personal position on some important issue of the impact of information technology and systems on society (important, as defined by Congressional interest, public press, semitechnical press, etc.);

ability to develop several positive and several negative impacts on a specified information system in a specified part of society;

ability, given such specifications of impacts, to perform a "rough-cut" feasibility analysis of them in terms of behavioral and economic variables.

APPENDIX B

THE CONTENTS OF THE THIRTEEN COURSES WHICH WERE RECOMMENDED BY THE C^3EM FOR GRADUATE PROGRAMS IN INFORMATION SYSTEMS[1]

A1. Introduction to Systems Concepts

Prerequisite: elementary economics.

Approach: This course lays the groundwork for the curriculum by presenting the systems approach to understanding of both organizational and technological functions.

The method is a combination of a series of lectures, a few cases on particular systems, and an accounting simulation project. Out-of-classroom study can be spent in analyzing the behavior of simulated systems to obtain an acquaintance with a variety of structures. A project for the accounting portion might be the development of a cash flow simulation model by the student. This model could rely upon a case study as the foundation for understanding what is being modeled and to provide a basis for discussion.

Content:

1. <u>The systems concept</u> (20%)

States, transformations, inputs, outputs, hierarchical structure. System objectives. Systems with complex/conflicting/ multiple objectives: methods of resolution. System boundaries. Open and closed systems. Open systems: properties, negative entropy, adaption. Elements (subsystems) (subunits) (components). Interfaces. Subsystems: independence/dependence, methods of decoupling. Suboptimization, side-effects. Deterministic systems; probabilistic systems. The feedback concept: maximizing, "satisficing," "adaptivizing," adjusting to change. Control in a system: standards as predicted output, feedback (open-loop, closed-loop), cost of control. General Systems Theory.

Examples of systems: ecological, medical service, transportation, manufacturing, logistics, etc.

2. <u>Defining a system</u> (10%)

Models as representations of systems. Complex versus simple models. Formal and informal systems; interaction between them. System structure: alternative structures. The identification problem. Tools: block diagrams, flow graphs, decision tables. Degrees of aggregation for systems.

3. <u>Systems analysis</u> (10%)

Selection of a "best" course of action from many possible alternatives: advantage versus disadvantage, benefit versus cost. Determination of appropriate elements, cost-benefits, criteria. Modeling. System design: improving an existing system, developing a new system. The process of system design:

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[1] Ibid., pp. 383-98.

problem identification and definition, alternative solutions, selection of a "solution," synthesis of the proposed system, testing of the system, refining the system. System optimization.

4. Management systems (15%)

Hierarchical structure. Interaction among subunits and within subunits. Human beings as elements in a system. "The Management System": the operations system, the decision system, the control system, time relationships and information flows. Information systems for the management system (as subsystems of the management system). Information system elements: managers, computer hardware and software, communication network, data bases, etc. Functional systems: accounting, procurement, inventory, etc.

5. Management information systems (15%)

Role of information systems in an organization. Delineating informational needs from traditional organizational structure; from nontraditional structure. Interface between man and system; man-machine systems. Information systems as operational (or production) processes. Distinction between logical and physical systems. Planning information systems. Approaches to the development of information systems.

6. Financial and cost accounting systems (30%)

Basic accounting concepts. Coding structures: the chart of accounts, reporting hierarchies. Statements. Transactions. Financial flow. Capital budgeting; inventories; depreciation; working capital; cash management. Short and long term sources of funds. Financial planning and control. Cost accounting concepts. Classification of costs. Volume relationships. The cost accounting cycle. Cost centers. Responsibility accounting. Absorption costing. Standards and standard costs. Inventory costing. Variance analysis. Cost control. Control of nonmanufacturing costs. Marginal income analysis. Interface with financial accounting.

A2. Organizational Functions

Prerequisite: A1.
Corequisite: B2.
Approach: This course is structured on a balance of lecture and case material to describe and discuss organizational functions. (The business firm is emphasized in this outline, but alternatively the context could be other types of enterprise.)

Case discussions are used to develop understanding of the information needs necessary to manage particular functions. Simulation exercises are suggested for the logistics, inventory and cash flow sections. The financial systems and marketing management sections could use a variety of analytical models. A computerized simulation game might be used throughout the course to provide illustration of concepts, or at the end of the course to give students an understanding of the process of integration of management functions in the operation of the total enterprise.

Content:

1. Introduction to business systems (10%)

The flow of product and its transformation from raw material to purchased goods. Identification of necessary personnel, capital, cash, equipment, facilities and structure. Consideration of the budget as the usual planning and control device. The process of management.

2. Elements of a production system (20%)

Objectives of production. Design of a production system. Standards. Product design and process planning, layout maintenance, inventory (logistics) systems, and work flow.

3. Controlling a production system (10%)

Forecasting, production planning and control, capacity planning, scheduling, dispatching, control of logistics. Production information systems.

4. Financial systems (10%)

Internal system capital structure. Cyclical nature of business. Sources of cash demands and flows; external systems banking; equity money markets; cash flow analysis; sources of funds. Information systems for financial management.

5. Identifying internal needs and external sources of funds (15%)

Capital needs. Change and growth. Uncertainty. Cyclical influences. Analysis of external sources of funds--capital structure, acquiring new capital. Information flow in financial institutions.

6. The marketing function (10%)

Overview of the marketing process: consumer analysis, market dynamics, competitive analysis. Nature of pricing decisions: demand and cost structures. Channels of distribution. Marketing information systems.

7. Managing a market (10%)

Product policy decisions--the product line. Maintaining a market. Advertising, selling, distribution. Product life cycle development and introduction of new products.

8. Integration of functions through information systems (15%)

Information interface between production-finance-marketing decision systems. Planning interaction and common files; the data base as an integrating system. The budgeting process: planning, control.

A3. Information Systems for Operations and Management

Prerequisites: A2, C2.

Approach: This course deals with ways information systems are superimposed on organizational functions and may be thought of as an introduction to information analysis continued in course D1.

The method is primarily lecture and class discussion. Cases reinforce the planning and control concepts and emphasize the critical behavior aspects of decision systems. Of particular relevance are cases relying upon the analysis of the material, with interactive time shared models to improve the student's understanding of the manager/computer interaction. Research papers might require students to survey the literature on decision making in planning and control systems. A project to develop a system on a complex case study would be useful for integrating the course and preparing the student for the D courses.

Content:

1. Information requirements for an organization (30%)

Informal and formal channels of communication. Defining decisions. Decision criteria. Traditional decision making. Programmed decision making. Management-by-exception. Strategic, tactical and operational levels of decisions. External versus internal information sources and constraints. Integrating information systems. Cost and value of information. Management intelligence systems.

2. Operational level systems (10%)

Providing for information needs of operating level supervisors and their employees. Building on existing systems.

3. Tactical level systems (10%)

Providing for information needs of middle management. Planning and control systems. Varying needs of organizations: service-oriented versus product-oriented organizations.

4. Strategic level systems (20%)

Providing for information needs of executive level management. Effect of centralized versus decentralized organization structure. Strategic planning models. Analytical and simulation models in decision making.

5. Styles of interaction (15%)

Manager/computer interactive systems: technical and behavioral considerations. System outputs: printed, audio, graphic. Data base design considerations for fast response systems. Management control rooms.

6. Planning for a comprehensive information system (10%)

Project control for system development. Managing the information function. Top-down versus bottom-up approach to the overall management information system. Integrating systems.

7. Measuring the effectiveness of an information system (5%)

Setting up measures of effectiveness. Evaluating effectiveness: measuring system performance, calculating costs and performance, cost/performance trade-offs. Measuring user satisfaction.

A4. Social Implications of Information Systems

Prerequisite: A3.

Approach: This course uses a variety of instructional methods (outside speakers would be particularly useful) and draws from a number of academic disciplines. Historical analogy is used to place the computer in historical perspective. Economic analysis is used in identifying the economic characteristics of the computer industry and in measuring the social costs of computer technology. Legal, philosophical, and moral concepts are applied to the questions of privacy and quality of life. Case studies are used to explore the impact of various applications. Emphasis is on discussion of issues, implications, and possible information system and societal remedies. Student participation in the selection of specific issues or facets to study seems appropriate.

Content:

1. Historical perspective (10%)
   Technological change in the 19th and 20th centuries. Economic and social problems of technology. Historical analogies. Method of assessing social costs of technological change.
2. The computer industry (15%)
   Sales and employment in the computer industry. Growth pattern. Competition in the computer industry. Standardization. Government regulation. Employment in information processing jobs. Problem of providing training.
3. Implications for the work force (15%)
   Impact on industrial occupations. Impact on clerical occupations. Impact on managerial occupations.
4. Effects on organizational practice (20%)
   Centralization versus decentralization. Patterns of obtaining and providing services. Legal requirements. Possibilities for individualization. Effect on capacity to and rate of change.
5. Privacy and the quality of life (20%)
   Public and private data banks. Rights of privacy. Relation of the individual to organizational data systems. Consumer protection.
6. The individual and the social system (20%)
   Influence on the educational process. Influence on the political process. Systems for administering justice, welfare, health care.

B1. Operations Analysis and Modeling

Prerequisites: finite mathematics, elementary statistics, elementary computer programming.

Approach: This course is based on the use of analytical models as aids in the formulation and resolution of system alternatives. Emphasis is on problem formulation and resolution relying upon available analysis packages. The discussion of projects should focus on the decision itself and on the use of models to consider alternatives and test assumptions. Problems of data acquisition, preparation, and maintenance should be stressed.

Projects should be drawn from the information system design area. The course might conclude with each student participating in the formulation of a simulation project that includes several of the analytical models introduced early in the course.

Content:

1. Characterization of scheduling situations (20%)

Characterization of a set of interlocking activities as a network. Popular algorithms for formulating and solving critical path models. Problems of manipulating estimates and range of accuracy measurements. Job scheduling and dispatching rules. Use of network models for control of projects. Scheduling in operating systems.

2. Analysis of allocation problems with mathematical programming (20%)

Methods of formulating and solving linear programming problems using packaged computer programs. Linear programming as an aid to planning the allocation of interdependent resources. Value of models in the sensitivity testing of formulations. Evolutionary nature of large models as a decision making aid. Applications to scheduling and computer network design. Optimization of computer networks. Note: particular attention should be paid to the data management requirements of LP models allowing examination of the general notions of constraints, objective functions, and optimization in modeling.

3. Queueing models (20%)

Concept of queueing models and their general applicability to a broad range of situations. Considerations of the many queueing processes within computer systems.

4. Inventory models (10%)

Inventory models ranging from simple; single product to multiple product under uncertainty. The data base as an inventory. Possible application of LP or dynamic programming analyses to inventory.

5. Use of simulation models (30%)

Examples and class projects to explore the need for problem definition and reliance upon tailoring standard concepts to new situations, especially through dynamic models. Note: the analysis of the user and operating system parts of a time-sharing system might serve as class projects to integrate the topic with prior ones.

B2. Human and Organizational Behavior

Prerequisite: elementary psychology.

Approach: This course examines the principles of human behavior in individuals, groups, and organizations in the contexts relevant to information systems.

Behaviorally-oriented reference material relating specifically to information systems is sparse, and particularly so for the final section on implementation. The cited references have a management or engineering orientation, leaving the behavioral implications to be supplied by the instructor or by the class.

An appropriate computer game or interactive laboratory experiment could be used as an effective tool to demonstrate aspects of individual, interpersonal, and group behavior, with the student population itself as subject.

Content:

1. Individual behavior (20%)

Human sensing and processing functions. Visual, auditory, motor, and linguistic mechanisms. Perception, cognition, and learning. Human factors engineering in information systems.

2. Interpersonal and group behavior (20%)

Personality and role. Motivation, participation, and communication. Influence and effectiveness. Authority and leadership. Mechanisms for group action. The impact of information systems on interpersonal and group behavior.

3. Organizational structure and behavior (25%)

Organization theory. Impact of information systems on organizational structures and behavior. Implications for management.

4. The process of organizational change (25%)

Resistance to and acceptance of change. The management of change. Problems of adjustment to the information systems environment.

5. The implementation and introduction of information systems (10%)

Interaction between information analysis and system design groups and the remainder of the organization. Information system project teams and their management. Preparation for installation and operation. Note: this section is background for material covered more extensively in courses D1 and D2.

C1. Information Structures

Prerequisite: elementary computer programming.

Approach: The structures which may be used to represent the information involved in solving problems are presented. Both modeling structures and implementation (storage) structures are covered. Emphasis is placed on treating these structures independently of particular applications. Examples, however, particularly from information system design, should be used wherever possible. The interrealtionship between problem solving procedure, modeling structure, and implementation structure is stressed. Alternative implementations of a particular model are explored. Implementations in higher-level languages of several modeling structures are presented.

Students should apply the techniques presented to a number of problems. Care should be taken to separate development of modeling structures from implementation; and in many instances the student's analysis of a problem can stop at the modeling structure level. For at least some of the problems, however, students should implement and test their proposed representations.

Content:

1. Basic concepts of information (10%)

Representation of information outside and inside the computer. Bits, bytes, fileds, items, records, files. Numbers and characters. Characteristics of computer arithmetics--conversion, truncation and roundoff, overflow and underflow. Names, values, environments, and binding of data. Use of pointers or linkage variables to represent structure. Identifying entities about which data is to be maintained, and selecting data nodes and structures which are to be used in problem solution.

2. Modeling structures--linear lists (10%)

Linear lists, stacks, queues, deques. Single, double, circular linkage. Strings, insertion, deletion, and accessing of list elements.

3. Modeling structures--multilinked structures (20%)

Trees and forests. Free, oriented, and ordered trees. Binary tree representation of general trees. Traversal methods --preorder, postorder, endorder. Threading trees. Examples of tree structures as algebraic formulas, dictionaries, and other hierarchical information sturctures. Arrays and tables. Storage mapping functions. Linked representation of sparse arrays. Multilinked structures with heterogeneous fields and/or nodes (plexes).

4. Machine-level implementation structures (15%)

Word packing and part-word addressing. Sequential allocation. Linked allocation and pointer manipulation. Scatter storage; hash table formats, hashing functions, methods of resolving collisions. Direct and indirect address calculation. Implementation of linked structures in hardware.

5. Storage management (5%)

Static versus dynamic allocation. Stacks and available space lists. Explicit release of available space, reference counts, and garbage collection. Coalescing adjacent free space. Variable block size--stratified available space lists, the buddy system.

6. Programming language implementation structures (15%)

Examples of the implementation of modeling structures in higher-level languages. FORTRAN, PL/I and ALGOL arrays. SNOBOL and PL/I strings, Lists in PL/I, GPSS, SIMSCRIPT, IDS. Tables and reocrds in PL/I, COBOL.

7. Sorting and searching (10%).

Radix sort, merge sort, bubble sort, address table sort, tree sort, and other sorting methods. Comparative efficiency of sorting methods. Use of sort packages. Linear search, binary search, indexed search, and other searching methods. Tradeoffs between sorting effort and searching effort. Effect of information structures on sorting and searching techniques.

8. Examples of the use of information structures (15%)

Representation of information by translators. Representation of information during execution; activation records. Implementation of higher-level language data structures.

Organization of an inverted file for document retrieval. Exaples in graphic manipulation systems, simulation packages, data management systems.

C2. Computer Systems

Prerequisites: B1, C1

Approach: Computer systems, their hardward and basic operating software, are studied, with attention to the human factors involved in computer system operation and maintenance. Types of modules and types of system function mode (batch, interactive, online, etc.) should be carefully distinguished.

Block diagrams, flowcharts, and some kind of formal descriptive language should be used to set forth the systems aspects discussed. A suitable choice for the latter would be an assembly language with macro capability. Problem assignments should involve proposing system or subsystem attributes and parameters for given performance specifications and testing the proposals by simulation. Simulation packages for evaluating subsystem configurations should be available.

Content:

1. <u>Hardware modules</u> (20%)

Processor, memory, input/output, mass storage, remote transmission modules; function and possible realization of each. Microprogramming. Styles of buffering, interfacing, communication and interrupt handling. Memory management, virtual memory. Channel management, virtual configurations. Network and multiprocessor configurations. Note: the approach of this section is conceptual, to point up the need for a comprehensive hardward/software viewpoint--the concepts are then elaborated in programming and operational terms in subsequent sections.

2. <u>Execution software</u> (20%)

General interpretive modules for execution support, e.g. list processors. Modules for memory management in real and virtual memory systems. Processor and channel modules for support of input/output, mass storage and remote transmission units in real and virtual configurations. Concepts of multiply-reentrant programs and cooperating processes.

3. <u>Operation software</u> (20%)

Loading, interrupt monitoring, diagnostic modules. Scheduling, resource allocation, performance monitoring packages. Concepts of state resurrection and interprocess protection.

4. <u>Data and program handling software</u> (20%)

Media and format conversion modules. File handling facilities. Control specifications for datasets. Translating, compiling, generating modules. Macro facilities. Editing and debugging facilities. Linkage and job control specifications for subroutines, coroutines and standard packages. Problems of identification and security. Note: this topic is background for courses C3 and C4.

5. Multiprogramming and multiprocessing environments (20%)
Levels of multiaccessing and multiplexing. Batch and interactive modes. Requirements for effective usability, operability, maintainability of operating systems. Performance monitoring and management of complex hardware/software configurations.

C3. File and Communication Systems

Prerequisite: C2
Approach: The basic components of file and communication systems are presented and analyzed. The functioning of these systems as integral components of an information system is stressed.
The instructional approach is primarily lecture and problem discussion. This is neither a project nor a programming course as such; most student assignments concern design or analysis of carefully specified and limited subprograms or subsystems. When possible, if a file management language is available, a small file system design and implementation project would be desirable.
Content:
1. Functions of file and communication systems (5%)
Role of information acquisition, storage and transmission in an organization. Typical operations in file systems: file creation, maintenance, interrogation. Typical operations using communication systems. Issues of information availability, privacy, security.
2. File system hardward (5%)
Characteristics of auxiliary storage devices. Capacity, access, cost. Device types: tape, disk, mass storage.
3. File system organization and structure (25%)
Data fields, records, files, hierarchies of files. Directories and indices, inverted files. Structure and access: sequential, direct indexed sequential, randomized, randomized with buckets. Storage allocation and control techniques.
4. Analysis of file systems (10%)
Estimating capacity and timing requirements. Tradeoffs between access time, capacity and density of use, cost. Tradeoffs between file creation/maintenance activity and access activity. Relevant formulas and tables.
5. Data management systems (10%)
Generalized data management systems. Directory maintenance, query languages, data description, job management. Characteristics of available systems.
6. Communication system hardware (15%)
Theoretical concepts; channels and channel capacity, noise, error detection and correction. Existing communication facilities; line types, exchanges; utilities, regulatory agencies, and tariffs. Pulse techniques. Transmission codes. Transmission modes. Line termination and terminal devices.

7. Communication system organization and structure (10%)
Single line point-topoint, multidrop. Networks: centralized, decentralized, distributed. Control and protocol; acknowledgment, wait-requests, contention, polling. Switched, store-and-forward. Data concentrators and distributors.
8. Analysis of communication systems (5%)
Estimating line and terminal requirements: volume and message length, speed and timing, cost implications. Bottlenecks and queues, queueing analysis, simulation.
9. Examples of integrated systems (15%)
The data base concept: integrated data approach, coordination, control, multiple use of data. The data administrator; the computer utility. System resiliency and integrity, privacy, and security considerations.

C4. Software Design

Prerequisite: C2
Approach: This course brings the student to grips with the actual problems encountered in designing, implementing and modifying systems of computer programs. The concept of programming style should permeate most of the material presented, although it appears as a specific lecture topic toward the end of the course. Careful verification of program operation and documentation of programs should be emphasized. Much of the course, particularly in the laboratory sessions, may be devoted to the actual implementation of the programs. It would be useful to have an exercise in which each student must modify a program written by someone else.
Content:
1. Run-time structures in programming languages (10%)
Textual versus execution semantics in languages. Binding of names. Examples from FORTRAN, ALGOL, PL/I, and some data management system. Run-time stacks.
2. Communication, linking, and sharing of programs and data (30%)
Separation of program and data segments Common (global) versus local data. Block structures--static and dynamic nesting, internal and external procedures. Subroutines and coroutines as linkage structures. Sharing of code--reentrancy, recursion, pure procedures. Static and dynamic linking and loading, relocatability, self-relocating programs. Table driven programs. Asynchronous versus synchronous control, cooperating processes, multiasking.
3. Interface design (10%)
Parameters, work space, automating, and documenting interfaces. Control blocks.
4. Program documentation (10%)
Self-documenting programs. Levels of detail in documentation. Automatic flowcharting methods. Motivation for documentation--maintenance and modification of programs.

5. Program debugging and testing (15%)
Automating the debugging process. Symbolic debugging aids. Automatic generation of test data and expected results. Analysis of testing procedures. Hierarchical testing. Exhaustive testing versus random sampling. Test of communications programs. Simulation as a tool. Abnormal condition handling.
6. Programming style and aesthetics (10%)
Modular programming--functional modules, breaking up of large functional modules. Central versus distributed control structures. Macro and micro modularity. Interlanguage and intralanguage communication. Clarity and documentation--block diagramming.
7. Selected examples (15%)
File handling modules. Error retry, request queueing. Communication interface modules. Polling versus contention, interrupt handling. Selected materials such as graphics programming, programming for realtime sensing devices, process control systems. Man-machine interactions.

D1. Information Analysis

Corequisite: A3

Approach: This first course in the sequence of two that covers the system life cycle. This course emphasizes the information analysis and the logical design of the system, while course D2 covers the physical design. Emphasis should be placed on the iterative nature of the analysis and design process.

Exercises and case studies are used to give students proficiency in information analysis techniques; however, the projects course D3 which parallels this course is the vehicle for providing practical application in systems development and implementation. Field trips to organizations with sophisticated information systems are useful in reinforcing concepts.

Content:
1. Introduction to the system life cycle (5%)
Overview of the phases of system development and their interrelationships. Conception, information analysis, system design, programming, documentation, installation, reevaluation.
2. Systems life cycle management (15%)
Project control for system development. Levels of sophistication in system design. Responsibilities of system analysts, system designers, programmers, operators, and data processing management. Organizational behavior effects of system design and implementation approaches.
3. Basic Analysis tools (20%)
Steps in analysis: preliminary investigation, general feasibility study, general system proposal, detailed analysis. Techniques for analysis, such as ARDI (Philips), BISAD (Honeywell), SOP (IBM). Event-oriented organizational flowcharts, decision tables, procedence network analysis.

4. Determining system alternatives (15%)
Manual systems. Manual versus automated parts of systems. Manager computer interaction requirements; response, performance, language--including "natural" language requirements. Generalized versus tailored output; graphic versus textual, and aduio; inquiry versus automatic exception reporting; information retrieval versus specified analytical treatment of data. Disaggregation versus aggregation of data and hardware. Determining elements for common data bases. Data management alternatives. Response needs versus economic hardware/software and organizational constraints. Programmed decision making.
5. Determining system economics (20%)
Cost and value of information. Establishing measures of system performance: cost, response, accuracy, reliability, flexibility, security, capacity, quality, efficiency. Identifying and quantifying costs of system: personnel costs, equipment costs, conversion costs, installation costs. Identifying, quantifying, and measuring system advantages: direct and indirect benefits. Analyzing the improved quality of information. Allocation of costs and pricing of computer services.
6. Defining logical system requirements (20%)
Format of the system requirements statement. Distinction of logical design (of system) from physical design (of files, programs, and procedures). System output requirements: operating level, first level supervision, middle management, executive management. Information for strategic versus tactical planning and decision making. Specification of output methods and formats. System documentation requirements. System specification techniques: manual techniques semi-automated techniques: ADS (NCR), ISDOS (U. of Michigan), TAG (IBM), Yount-Kent approach.
7. Summary and introduction to physical system design (5%)

D2. System Design

Prerequisites: C3, D1.
Corequisite: C4
Approach: This course is the second covering the system life cycle, thus continuing the thrust of course D1. The lectures focus on underlying principles of system design as well as techniques. The techniques are utilized in the projects course D3. A theme to be carried throughout the course is the iterative nature of the analysis and design process. Implementation and conversion problems are also considered.
Case studies should be used as appropriate. Laboratory exercises should include the use of computer-assisted methods for system design. The human engineering aspects of system design should be emphasized.
Content:
1. Basic design tools and objectives (10%)
Review of the system life cycle. Documentation of various levels of design. Objectives of system design--system integrity.

Types of system design: batch, interactive. Budgeting and project management.

2. <u>Hardware/software selection and evaluation</u> (15%)
Equipment selection--evaluation techniques--simulation, analytical models. Detailed cost analyses: personnel, hardware, software. Competitive bidding.

3. <u>Design and engineering of software</u> (20%)
Design modularity. Design of user interfaces with automated procedures. Standardization of subsystem designs--data collection editing, processing, and retrieval. Design of subsystem interfaces. Data and production controls. Internal and external accounting within the system. Conversion subsystems. Human engineering.

4. <u>Data base development</u> (15%)
Data base construction--creation, structure, maintenance, and interrogation of data bases. Integrity of the data base. Review and use of C3 course material on data base management systems.

5. <u>Program development</u> (10%)
Selection of languages. Use of standard building blocks and common programs. Error recovery; robustness of programs. Programming standards and documentation. Review and use of C4 course material.

6. <u>System implementation</u> (10%)
Levels of testing and debugging; planning and executing conversion; management of programming, testing, and installation. Coordination of manual and automated procedures. Techniques for cutover (parallel operation, etc.): implementation schedules.

7. <u>Post implementation analyses</u> (10%)
Auditing system performance: costing of system development effort and system performance. Evaluating hardware/software performance; "tuning" systems. Redesign cycle; modifying the system. Integrating changes into a running system.

8. <u>Long-range planning</u> (10%)
Trends in information system design. Integrating several systems into a corporate MIS. Planning for commonality and transferability of programs and data. Long-range forecasting of information requirements.

D3. Systems Development Projects

Corequisite: D2

Approach: Students are assigned one or more system development projects. The projects involve the complete system development cycle: analysis, design, programming, and implementation. Students work in teams to acquire practical experience in such projects, especially regarding the behavioral considerations in systems development. They work with users to define system requirements and to prepare implementation plans and procedures.

The work parallels other courses in the final year of the degree program. If possible, it should be extended over two semesters, perhaps for additional credit. The information analysis portion of the project should begin in the first semester, as soon as the students are armed with sufficient capability to begin applying information analysis techniques. Projects should be completed and documented in the final month of the second semester. Thus, even if three hours of credit are granted only for the second semester, some of the work is done during the first.

Once a class has completed its project, the next class can expand on it, obtaining experience in the revision and sophistication of existing computer-based systems. The following are suggested alternatives for projects, the exact description of which will be dictated by circumstances.

Content:

1. Development of a system for a local firm

Under supervision of the systems analysis staff, students could develop a subsystem for one of the major modules of a computer-based management information system of a local firm. Students might also work as members of established client companies' teams.

2. Development of a system for a university/college

Under the supervision of the university administrative data processing unit, students could develop a system which would provide them experience and at the same time benefit the university. Examples are: alumni record and follow-up system, bookstore ordering/accounting, classroom scheduling system.

3. Development of a system for a hypothetical application

As an example, as case (SRA) currently available provides students with experience in each phase of system development for a hypothetical electronics firm. The material is organized into 13 assignments: orientation, documentation, written procedure, system flowcharts, gathering information, classification and coding, printed output source documents and punched cards, records design, data controls, run controls, audit trails, and file organization.

APPENDIX C

CONTENTS OF A COURSE ON "INFORMATION SYSTEMS ADMINISTRATION"[1]

A. Information Systems Administration

Prerequisites: B2, A1, C2.

Approach: This course focuses on the issues and management techniques of administering an information systems activity in the organization. The administrative issues include both those internal to the data processing activity and those concerning its relationship to the rest of the organization. Issues internal to the data processing facility include the scheduling of work through the computer room, management of systems analysts and programmers, developing of standards and project control systems. Issues external to the data processing facility include organizational structure, planning processes, and management control of the computer resource.

The method is a combination of lectures and case discussions. Lectures introduce the major concepts and the underlying principles. Case discussions provide the situational perspective on the techniques of applying principles and techniques as well as the typical problems that must be resolved.

Content:

1. Planning for information systems (10%)

Long-range information systems plans. Steering committees. Technological uncertainty. Relationship to formal planning department.

2. Computer-based systems project management (15%)

Search for computer project opportunities. Priorities. Technical audit. Cost and schedule control. Post-audit. Modular design and management. Organizing project teams. Project restructuring. Progress reporting (e.g. PERT, GERT).

3. Managing computer operations (15%)

Scheduling computers. Data entry management. System optimization techniques, hardware and software monitors, simulation. Use of technical service groups. Computer security. Internal audit of computer operations. Data base administration.

4. Managing computer personnel (18%)

Increased specialization: operators, application programmers, maintenance programmers, systems programmers, data base programmers, telecommunication specialists, data entry personnel. Leadership styles. Incentive Systems. Performance measurements. Development programs. Career paths.

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[1]F. Warren McFarlan and Richard L. Nolan, "Curriculum Recommendations for Graduate Professional Programs in Information Systems: Recommended Addendum on Information Systems Administration," Communications of the CAM, 16 (July 1973), pp. 440-41.

5. <u>Acquiring computer services</u> (10%)
Feasibility study. Determining need. Computer options. Use of simulation. Role of consultants and vendors. Computer utilities. Facilities management. Time-sharing services.
6. <u>Management control of the computer resource</u> (12%)
Chargeout, nonchargeout. Flexible pricing. Formal information systems for computer resource allocation decisions. Control decisions.
7. <u>Organizational design for information systems</u> (20%)
Organization alternatives for systems analysts, programmers, and computer operations personnel. Relationship to establish organization philosophy. New organization structure for information systems. Centralized versus decentralized information system management.