FISHER, Robert Denman, 1928-
AN INVESTIGATION OF THE STRUCTURE AND
POTENTIALITIES OF MANAGEMENT INFORMATION
SYSTEMS IN THE PUBLIC SCHOOLS AS THEY RELATE
TO EDUCATIONAL DECISION-MAKING AND REPORTING.

The Ohio State University, Ph.D., 1970
Education, administration

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1971
AN INVESTIGATION OF THE STRUCTURE AND POTENTIALITIES
OF MANAGEMENT INFORMATION SYSTEMS IN THE PUBLIC
SCHOOLS AS THEY RELATE TO EDUCATIONAL
DECISION-MAKING AND REPORTING

A DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Robert Denman Fisher, B.Sc., M.A.

* * * * * *

The Ohio State University
1970

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ACKNOWLEDGMENT

The writer wishes to express his appreciation for the guidance and assistance given by Dr. Roy A. Larmee, Dr. Donald P. Anderson, Dr. Walter Hack, Dr. Edwin G. Novak, Mr. Edward M. Fisher, and Mr. Kenneth V. Arnold in the preparation of this dissertation.
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PUBLICATIONS


## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>11</td>
</tr>
<tr>
<td>VITA</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
</tr>
<tr>
<td>I. THE PROBLEM AND ITS SETTING</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td></td>
</tr>
<tr>
<td>Justification of the Problem</td>
<td></td>
</tr>
<tr>
<td>Limitations of the Research</td>
<td></td>
</tr>
<tr>
<td>Definitions of Words and Phrases</td>
<td></td>
</tr>
<tr>
<td>Sources and Nature of Data</td>
<td></td>
</tr>
<tr>
<td>Research Technique</td>
<td></td>
</tr>
<tr>
<td>Analysis and Interpretation of Data</td>
<td></td>
</tr>
<tr>
<td>Preview of the Organization of the Remainder of the Dissertation</td>
<td></td>
</tr>
<tr>
<td>II. THE REVIEW OF THE LITERATURE</td>
<td>25</td>
</tr>
<tr>
<td>Purpose and Objectives of the Chapter</td>
<td></td>
</tr>
<tr>
<td>The Research Emphasis of the Chapter</td>
<td></td>
</tr>
<tr>
<td>Review of the Literature of Previous Research Studies</td>
<td></td>
</tr>
<tr>
<td>Review of the Literature of Selected Readings</td>
<td></td>
</tr>
<tr>
<td>General Conclusions Concerning the Structure of a Management Information System</td>
<td></td>
</tr>
<tr>
<td>General Conclusions Concerning the Potential of a Management Information System</td>
<td></td>
</tr>
<tr>
<td>III. THE INTERVIEW SURVEY OF SELECTED DISTRICTS</td>
<td>92</td>
</tr>
<tr>
<td>Research Orientation of the Chapter</td>
<td></td>
</tr>
<tr>
<td>Objectives of the Chapter</td>
<td></td>
</tr>
<tr>
<td>The Selection of Subjects</td>
<td></td>
</tr>
<tr>
<td>The Construction of the Inquiry Statement</td>
<td></td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS (Contd.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validating the Inquiry Instrument</td>
<td></td>
</tr>
<tr>
<td>The Interview Protocol</td>
<td></td>
</tr>
<tr>
<td>Method of Data Analysis</td>
<td></td>
</tr>
<tr>
<td>Presentation of Findings</td>
<td></td>
</tr>
<tr>
<td>Technical Potentialities of Management Information Systems</td>
<td></td>
</tr>
<tr>
<td>Benefit Potentialities of Management Information Systems</td>
<td></td>
</tr>
<tr>
<td>Conflict Potentialities of Management Information Systems</td>
<td></td>
</tr>
<tr>
<td>Summary and Conclusions</td>
<td></td>
</tr>
<tr>
<td>IV. THE DEVELOPMENT OF A PROTOTYPE OF A MANAGEMENT INFORMATION SYSTEM</td>
<td>131</td>
</tr>
<tr>
<td>Purposes of the Chapter</td>
<td></td>
</tr>
<tr>
<td>Materials and Methods</td>
<td></td>
</tr>
<tr>
<td>Rationale for the Development of the Prototypic Structure</td>
<td></td>
</tr>
<tr>
<td>Hazards Present in the Development of a Valid Information System</td>
<td></td>
</tr>
<tr>
<td>Sequential Phases of System Development</td>
<td></td>
</tr>
<tr>
<td>Description of System Requirements</td>
<td></td>
</tr>
<tr>
<td>Steps Taken in the Design of the Prototypic System</td>
<td></td>
</tr>
<tr>
<td>Descriptions of Some Capabilities of the Prototypic Management Information System</td>
<td></td>
</tr>
<tr>
<td>The Organization of the System in the Aggregate</td>
<td></td>
</tr>
<tr>
<td>Limitations of the Prototype</td>
<td></td>
</tr>
<tr>
<td>Major Conclusions of the Study</td>
<td></td>
</tr>
<tr>
<td>Limitations of the Findings and Conclusions</td>
<td></td>
</tr>
<tr>
<td>Questions or Problems, Related to the Investigation, Most Needing Research</td>
<td></td>
</tr>
<tr>
<td>APPENDIX</td>
<td>209</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>216</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Problems in Education Appropriate for Electronic Data Processing</td>
<td>35</td>
</tr>
<tr>
<td>2. Operational Status of Components of Management Information Systems Found in the Data Processing Organizations of Five Selected School Districts</td>
<td>122</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>The Sequence of Development Phases</td>
</tr>
<tr>
<td>2</td>
<td>A Representation of the System Design Process</td>
</tr>
<tr>
<td>3</td>
<td>Flow Chart of Steps in the Design Process</td>
</tr>
<tr>
<td>4</td>
<td>Typical Tasks Appropriate to a Management Information System Categorized by Administrative Task Areas</td>
</tr>
<tr>
<td>5</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Finance-Administrative Task Area</td>
</tr>
<tr>
<td>6</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Staff Personnel-Administrative Task Area</td>
</tr>
<tr>
<td>7</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Student Personnel-Administrative Task Area</td>
</tr>
<tr>
<td>8</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Plant-Administrative Task Area</td>
</tr>
<tr>
<td>9</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Instruction-Administrative Task Area</td>
</tr>
<tr>
<td>10</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Business-Administrative Task Area</td>
</tr>
<tr>
<td>11</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Planning-Administrative Task Area</td>
</tr>
<tr>
<td>12</td>
<td>Examples of Typical Sub-System Operative Capabilities of the Community Relations-Administrative Task Area</td>
</tr>
</tbody>
</table>
LIST OF FIGURES (Contd.)

Figure

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Summary of the Development of the Prototypic Management Information System</td>
<td>197</td>
</tr>
<tr>
<td>14. Summary of the Description of the Prototypic Management Information System</td>
<td>199</td>
</tr>
</tbody>
</table>

Chart

<table>
<thead>
<tr>
<th>Chart</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Relationship between a School System's General Information System and Its Management Data Base</td>
<td>54</td>
</tr>
<tr>
<td>2. Development of a Management Information System from a Single Data Bank</td>
<td>54</td>
</tr>
<tr>
<td>3. Steps in Measuring and Reporting University Operations</td>
<td>63</td>
</tr>
<tr>
<td>4. Data Organization</td>
<td>66</td>
</tr>
</tbody>
</table>
CHAPTER I

THE PROBLEM AND ITS SETTING

It is conceivable that the educational institution, as it is known in this country, is at one of its most intriguing crossroads. Two major influences have brought it to a position which may require profound adjustments in direction and operation. One influence, which can be characterized as a combination of external sociological forces, is a result of disturbances and dysfunctions which are actively requiring drastic changes in the educative process and product. The second influence, which can be described as technological, has been the emergence of promising and powerful systematic methods and machines for attacking problems related to the educative process.

The uniqueness of the potential relationship and the almost simultaneous emergence of these disparate influences, one reflecting social tragedy, the other technological triumph, provided the impetus for this investigation.

This study has grown out of the major assumption that improved educational decision-making and reporting, derived from the medium of a management information system and the recognition of its potentialities, will facilitate
making more adequate responses to the demands of contemporary educational problems.

**Statement of the Problem**

The general problem of the investigation consisted of two parts or sub-problems. These were:

I. To investigate and describe the potentialities of management information systems operating in the public schools as they relate to educational decision-making and reporting.

II. To develop and describe a prototype for a management information system suitable for a public school setting.

**Analysis of the Sub-problems into Their Constituent Elements**

Part I was concerned with inquiry about three categories of potentialities. These are listed below with brief statements describing their specific thrusts.

A. Technical potentiality

1. Relationships of the capabilities of educational data processing systems to the needs and capabilities of management Information systems.

2. Present and future technological potential of management information systems.

B. Conflict potentiality

1. Conflicts concerning definition.

2. Conflicts of scope.

3. Conflicts of utility.

4. Impeding factors.
C. Benefit potentiality

1. Improved educational decision-making.
2. Improved educational planning.
3. Improved reporting to outside educational agencies.
4. Improved reporting to political agencies.
5. Improved reporting to communities and groups.

The various potentialities were interrelated with each other and with the decision-making and reporting process under study. The general handling of point I of the problem statement can be conceptualized as follows:

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Processes</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical related potentiality</td>
<td>Decision-making to Reporting</td>
<td>Conclusions Findings</td>
</tr>
<tr>
<td>Conflict potentiality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefit potentiality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Part II of the general problem, the research was concerned with developing a prototype of a management information system, which is generalizable, to some degree, to management requirements of public school settings. Obviously, specific requirements for such a system vary in detail from district to district. Therefore, the resulting structure must be considered to be suggestive and modifiable to meet local conditions. This development pursued two major ends:
A. To Identify the major concepts, processes and components appropriate to a management information system.

B. To Develop an integrated framework or prototypic system of the above.

Purposes of the Study

In summary, the prime purposes of Part I was to describe and interrelate major categories of potentiality of management information systems as they pertain to educational decision-making and reporting.

The essential purpose of Part II was to present a prototype of the totalized concept of a management information system, including its major concepts, processes, and components, in a form which is understandable to educators, does not lean upon pure narrative in order to communicate to the reader, and which will adequately define the system.

Questions to be answered by the investigation

At the completion of the investigative phase of the study, four research questions were answered. The answers serve to summarize the entire undertaking by bringing together the findings and conclusions of Parts I and II of the Problem statement in a collective fashion. They are:

1. What are the major conclusions that can be drawn concerning the improvement of the educational endeavor as the result of the utilization of management information systems for educational decision-making and reporting?
2. What type of a structure for a management information system is typical and generalizable to some degree to management requirements in public school settings?

3. What new questions have emerged from review of the collected data, findings, and conclusions?

4. From the new questions that have been uncovered which would seem, in the light of the investigation, to most warrant further research and/or development?

Justification of the Problem

Validation of the importance of the problem

The problem to be investigated was validated from the dual standpoints of: (1) the background information concerning current educational issues and problems which indicate the magnitude of the present and approaching educational crisis with its management overtones, and (2) from consideration of the emergence of sophisticated data processing systems, their related technology, and the potential for educators.

Background of educational issues and problems

The issues and problems impinging upon the educational system can be said to be of two types: those that originate within the establishment itself, and those that come from the outside.
The school is a pervasive social institution, one upon which many kinds of forces bear and one that directly or indirectly is woven into much of the social fabric of the nation. Thus, the school as an institution has always been subjected to external influences to some degree. Operationally, however, it has been more akin to a "closed system" made up of fairly discrete units of government existing without strong centralized leadership. Recently it has been threatened with the destruction of the closed system, to which it has been accustomed, by outside forces. Additionally, in the last decade it has been buffeted by administrative and educational problems that have also threatened to weaken and destroy its internal organization.

Typical incidents which highlight the external forces which have come into play are the civil disturbances. These were particularly numerous between 1963 and 1967. In 1966 alone, in the United States, there were 43 riots or disorders.¹ These disturbances were not directed exclusively at the school. Segregated housing, police brutality, and other unfair practices were more overt issues. However, since the school is a cog in the social machinery of the nation and thereby reflects its mores there can be little doubt that school issues were present.

Recently, the Oceanhill-Brownsville issue in New York City emerged bringing both internal and external pressures, of particular stringency, to bear upon school managers. The problems were particularly pernicious because of the deprivation of educational opportunity for almost one million students for an extended period of time. More than community pressures were felt. Issues of professional rights and interests of teachers were present. Issues involving school organization and whom and how the school serves were at stake.

External pressure, of another dimension, involving the financing and product assessment of schools, has been reported by Rhodes:

Said Congressman John J. Rhodes of Arizona, who placed the Jencks Reappraisal (updating the Coleman Report) in the Congressional Record: "I think that Congress cannot continue to appropriate virtually unlimited funds for education without at least an awareness of what a responsible body of educators has to say about the cause and effect relationship between money and educational quality."  \(^2\)

Goodlad has pointed out that the pressures are intense and their exercise upon the schools is a resultant of the awareness by many, both within and without the institution, of the strategic importance of education. He said:

National attention is now focused on the strategic importance of education. At home there are prob-

lems of economic growth, prejudice and racial
unrest, even poverty and unemployment; a dozen
hot-spots call for never-ending vigilance; beyond,
outer space beckons us. Our educational institu-
tions are expected to produce personnel capable
of meeting our myriad exigencies today and tomor-
row, somehow, of leading the way to a better, calmer
way of life lying beyond. The last decade has
witnessed pressure on our schools of a kind and
intensity not experienced before. . . .

Coombs provides a similar picture but one more broad
in scope. He definitely believes that educational problems
and the resultant pressures are not unique to just a few
countries. Rather, the sickness they bring is worldwide and
is precipitating a crisis that threatens the foundations of
mankind. He states that at the time of the Williamsburg
Conferences, in late 1967, the number of adult illiterates
belonging to UNESCO's member states exceeded 460,000,000 or
almost 60% of their active populations. This was despite
rapid educational development throughout the world and was
a partial resultant of rapid population growth.

Coombs suggests that two general trends are discerni-
ble. One began in the early 1950's and witnessed the ex-
pansion of educational systems throughout the world.

---

3John I. Goodlad, John G. Caffrey, and John F. O'Toole,
Jr., Application of Electronic Data Processing Methods in
Education, p. 5. A report supported by the Cooperative Re-
search Program of the Office of Education, U.S. Department of
Health, Education, and Welfare, Project No. F-026. Pro-
cessed by Department of Education, University of California,
Los Angeles, 1965.

4Philip H. Coombs, The World Educational Crisis: A
Systems Analysis (New York: Oxford University Press, 1968),
p. 3.

5Ibid., p. 3.
Concurrently a second trend was also underway which involved drastic environmental changes. In his view, environmental changes outdistanced educational expansion and development, causing disparities to emerge between educational and social structures resulting in a world-wide crisis. ⁶ From these trends, and from data generated from Coombs' analysis of other factors, he has recapitulated the forces that he believes are sweeping civilization. They are:

1. The student flood
2. Acute resource scarcities
3. Rising costs
4. Unsuitability of output
5. Inertia and inefficiency of managerial arrangements

Culbertson's view, for the United States at least, appears to be more optimistic. He believes it is likely that expenditures will continue to rise rapidly, perhaps approaching $85.9 billion annually by 1975. ⁸ This would partially negate items 2 and 3 mentioned by Coombs. But, it is also his opinion that citizens paying the tax bill will be asking more questions involving not only the efficient usage of current investments but also regarding the

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⁶Ibid., p. 4.
⁷Ibid., p. 164.
⁸Jack A. Culbertson, "Identifying the Emerging Administrative Technology and the Underlying Concepts," Columbus, Ohio: The Ohio State University, 1967, p. 5. (Mimeographed.)
adequacy of the planning and assessing of future investments—with high quality education being the prime objective rather than economy.⁹

Coombs has summarized the sources of internal and external pressures being felt by the educational institution. He has also related these to questions regarding managerial arrangements which is apropos to this dissertation:

A host of organizations and people have a hand in managing at least some aspects of an educational system. They include government agencies at all levels, churches and other private bodies, politicians and civil servants, administrative heads of university and local schools, professors and teachers, students and parents, and endless critics of every stripe. . . . however, we are less concerned with the foregoing people than with the management milieu within which they function. . . . The issue instead is whether the managerial arrangements [italics in the original] of educational systems are adequate to the tasks before them. . . . Do those responsible for major decisions and direction of the system have the right kind of specialized help and information flows?¹⁰

Emergence of data processing systems and the related technology

There has been rather startling growth in the field of data processing systems and the related technology since the beginning of the fourth decade of this century. Undoubtedly logistic requirements of the first world conflict had a part in its genesis. The second world war provided

⁹Ibid., p. 5.

¹⁰Coombs, op. cit., p. 120.
an impetus that caused this young technology to break out of its rather narrow bounds. Concurrent with its development throughout this period, and to the present, there has been related growth in the theories, research, systems, and mechanisms necessary to support and nurture it.

Historically, the machine aspects of the data processing technology began their development with, first, mechanical, and then electro-mechanical machines in the early 1920's. Electronic machine development began in the early 1940's. Significant industrial use of both varieties of equipment began in the 1950's. Federal agencies followed suit. State and local governmental units, including school districts with some exceptions, were the last to employ equipment.\footnote{Caffrey and Mossman, \textit{Computers on Campus}, pp. 11, 17.}

The systems aspect of the technology apparently arose within the military establishment of Great Britain in the late 1930's, although it is claimed by some that there were instances of its use in this country during the first great war. England formalized the procedures in 1939 and by the 1950's had applied it to numerous industrial applications.

The first conference on the subject in the United States was held in 1951. By 1960 approximately one-third
of the 500 largest corporations in this country were applying similar systems techniques to their operations.\textsuperscript{12}

Currently, the machine or data processing portion of the technology would seem to be the better developed of the two facets. This is reflected by the present availability of what are called "third generation computers," those that use discrete, solid state components in their construction, and possess very flexible application potential. These are currently being used in some school districts for educational data processing. Fourth generation machines, barely out of the laboratory, will provide an order of magnitude of improvement in memory, programming, and processing.

The "systems" portion of the technology does not seem to have fared as well from a developmental standpoint. Problem areas exist which are concerned with the designing of new concepts and methods. Solutions would have startling potential for expanding the number of benefits to be gained by users.

In recent years there has been startling growth in the use of sophisticated data processing technology by the public schools. The portion of the total educational data processing technology to which this investigation is addressed is the management information system. The AASA

Commission on Administrative Technology has recently spoken concerning the importance of this system:

The increasing complexity of modern school systems by itself has generated a flow of information that threatens to engulf school executives. . . . These data must be stored, processed, and retrieved as needed. There can be no effective systems administration without efficient means of handling data. No organizational leader can remain effective for long without the basic, comprehensive, and detailed data required to maintain the pulse of the organization and to make prudent decisions. 13

Significance for education

Previous materials have suggested that there is an expanding requirement for educational services, that heavy pressures are being exerted upon the educational establishment from the inside and from the outside, and that changes are being forced upon the educational institution to which it finds response difficult. It has also been shown that data processing technology has, from a capability standpoint, made rapid strides in recent years.

It is believed that the investigation has made a number of contributions relating to the environment of the educational manager, administrator, teacher, student, and researcher. These contributions:

1. Provide an extension and refinement of existing knowledge through the exposure of new ideas and the synthesis of new concepts.

2. Furnish students an accessible source of organized reference materials regarding a topic which is

13Knezevich, op. cit., p. 44.
assuming much importance. Teaching in the area will also be facilitated.

3. Generate findings and conclusions which are almost certain to lead to additional related research that will have the potential for furthering the objectives of education.

4. Assist practitioners in the field who will be able to use the synthesis of ideas, bibliographical references, and other data to launch field projects and procedures that may provide solutions to certain management problems with which they are confronted.

Limitations of the Research

Scope of the Research

The investigation was concerned with research problems and questions, previously noted, related to the structure and potentialities of a management information system. However, the concept of a management information system for educational administrators must be considered within the framework of an educational data processing system technology. A management information system exists as part of a system which in turn has a number of interconnected, but discrete, components and capabilities. Therefore, it could not be studied fruitfully in complete isolation from the balance of the system. Research activities have been focused as much as possible on the management information system itself.
Depth of the research

Essentially the investigation has emphasized the systems aspect rather than the machine aspects of the management information system. The depth of inquiry was sufficient to provide descriptions of concepts, processes, and structures, and potentialities in enough detail so that research objectives could be fairly met and promised contributions delivered. The detail required to fully describe the operational implementation of a management information system is staggering. Coupling this fact with the probability that each user will require a somewhat different system suggests that the most fruitful course has been to provide depth sufficient to adequately conceptualize the structure and potentialities, stopping at the point where excessive detail was likely to confuse the research issues.

Limitations of generalizeability

The outcomes of the study, resulting from an investigation utilizing descriptive and integrative techniques, cannot claim to be generalizeable or applicable in all situations. On the other hand, these modes of research are strong from the standpoints that they permit the researcher to study entities in their natural circumstances, diagnose situations, and develop and propose new and possibly better programs. Therefore, the strength of this research does not lie in generalizeability but in the synthesis of new concepts which it promises.
Definitions of Words and Phrases

Many of the words and phrases related to the research topics may be quite understandable to the worker in the educational data processing field. On the other hand the casual reader may not have accurate definitions at his fingertips. Also, some words and phrases have a jargon or argot about them and in some cases the researcher has used them in an unusual manner. To minimize misinterpretation of meanings the following definitions are established:

1. **Management Information System**—A communications process in which data are recorded and processed for operational purposes. The problems are isolated for higher-level decision making, and information is fed back to top management to reflect the progress or lack of progress made in achieving major objectives.\(^{14}\)

2. **Information System**—The network of all communication methods within an organization. Information may be derived from many sources other than a data-processing unit, such as by telephone, by contact with other people, or by studying an operation.\(^{15}\)

3. **System**—An organized assemblage of interrelated components designed to function as a whole to achieve a predetermined objective.\(^{16}\)

4. **Data**—A general term used to denote any or all facts, numbers, or letters and symbols that refer to or describe an object, idea, condition, situation, or other factor. It connotes basic elements of information which can be processed

\(^{14}\)Knezevich, *op. cit.*, p. 171.

\(^{15}\)Ibid., p. 171.

\(^{16}\)Ibid., p. 171.
or produced by a computer. Sometimes data are considered to be expressible only in numerical form, but information is not so limited.\textsuperscript{17}

5. Reporting—The process of communicating information or knowledge to points within or without the educational institution. Purposes of the communication may include, but are not limited to, justification of action, presentation of alternative plans of action, serving a public relations function, relating to community and governmental agencies, providing information for decision-making, meeting legal information requirements, and generating priority statements.

6. Educational Decision-Making—The process of making decisions concerned with problems and developments arising from within or without the educational establishment that affect its operation and effectiveness. These decisions might be related to, but not limited to, such items as finance, achievement of objectives, instruction, planning, scheduling, prioritizing, setting objectives, and allocating resources.

7. Technology—... a set of systematic techniques and related knowledge; it may or may not call for machines of various degrees of sophistication. Technology is a means to an end; it is pursued not for its own sake but to solve practical problems. It assumes that the basic knowledge exists and that there is a creative mind that can apply pertinent information to a given situation.\textsuperscript{18}

8. Potentialities—The inherent capacity for development or accomplishment stated in such terms as power and qualities. . . .\textsuperscript{19}

9. Structure—A framework, skeleton, outline, profile, list of components, organization, or

\textsuperscript{17}\textit{Ibid.}, p. 163.

\textsuperscript{18}\textit{Ibid.}, p. 17.

arrangement which describes the essential qualities of an object or entity.20

Sources and Nature of Data

The data has been selectively sought from two sources: (1) books, bulletins, periodicals, reports, surveys, previous research, through specialized bibliographies, and (2) structured interviews with appropriate personnel from selected Ohio school districts.

Data was considered appropriate for the investigation that reflect ideas, opinions, structures, developments, research, methods, techniques, schemas, influences, rationales, profiles and organizations of materials.

From a time-scale standpoint data was collected that relates to the past, present, and future. However, the time frames of the research problems are concerned primarily with "what is" and "what may be."

Much emphasis has been placed upon the professional literature in regard to the potentialities of a management information system and its structure. Interview data has also made a large contribution.

Research Technique

The research design

The inquiry has taken the form of an "investigation." The research techniques used can best be described as "integrative" and "descriptive."

Guba has categorized and defined a number of classes of inquiry. An investigation is one of these classes. In regard to this mode, he has said, "the 'investigative' type of inquiry is strong in that it permits us to study elements in their natural circumstances."21

The integrative and descriptive research techniques have been discussed by McGrath. He said:

The integrative technique stresses reviewing, synthesizing, pulling together, or summarizing existing or completed studies. . . . Thereby it becomes plausible to establish trends, to examine status, or to indicate the direction a field of knowledge is taking.22

In regard to the descriptive approach he pointed out:

. . . it emphasizes present status, it describes a current situation, or it studies facts and conditions as they exist . . . norms, standards, or patterns are established, and data discovered in descriptive approaches are compared to them . . . the data derived in descriptive research can be meaningful and helpful in diagnosing a situation or in proposing a new and better program.23


23Ibid., p. 78.
The foregoing discussion has attempted to pinpoint and clarify the general type of research design implemented and the research techniques used.

The implementation of the research project

It was believed that research objectives could be adequately met if information furnished by both the interviews and the literature were used, as directed by the research design, to provide for their development. The literature review and the interview questions were used to elicit and categorize activities, experiences, and concepts pertinent to the purposes of the research.

Ohio school districts, in which interviews were held, were identified as having particularly innovative, well-organized, or state-of-the-art programs.

Individuals within these districts who were interviewed had been identified as being capable of providing unique, timely information, about concepts pertinent to the study, that are operational or under development.

Construction of the inquiry instruments

It has been previously stated that interviews were utilized for the gathering of information in addition to the literature search. It was desirable to bring as much uniformity as possible, from a research standpoint, to the interviewing.
A great difficulty with interviewing is that it is difficult to receive objective and parallel responses from and between interviewees. It is also difficult to record verbal data since it is delivered rapidly and sometimes in a disorganized fashion. In order to minimize these objectives two things were done: (1) interviews were recorded, openly, on a tape recorder, and (2) a rather rigid interview protocol was devised as a guide for the interviewer.

The tape recorder, in some interview situations, tends to repress the quantity and honesty of responses. In this case it was the writer's opinion that the increased data yield due to the utilization of the tap recorder would off-set the repression of desired responses.

The interview protocol contained both open-end and closed-end questions. Open-end questions were the main interview tools. Closed-end questions were used as probes where necessary.

The items or questions to be used were drawn from two sources. First, items were designed to elicit answers applicable to the concerns of the constituent elements of sub-problems I and II of the investigation. Secondly, items were constructed around the expected outcomes established by the AASA Commission on Administrative Technology when a "systems approach" is implemented. By building some of the questions around these expected outcomes, for interviewing purposes, and using the outcomes as criteria when perusing
the literature, it was expected that the effectiveness of the data gathering process would be facilitated. Using them provided some assurance that the data collected would be neither so delimited as to miss an element of the broader view nor so extensive as to go beyond the research problem.

**Analysis and Interpretation of Data**

The general design of the proposed inquiry has stressed its investigative nature. The descriptive and integrative research techniques have been advocated as providing the potential to produce the most adequate response to the general problem statement.

Because the general problem of the investigation was broken into two parts (i.e., investigating the potentialities of a management information ..., and developing a typical structure ...) the analysis and interpretation of data was broken into two sections. The results of the literature search and interviews contributed to both sections.

It is noted that the nature of the concepts of the descriptive and integrative research techniques are, respectively, somewhat parallel in meaning to analysis and interpretation of data. "Describing" and "analyzing" infer the examining of parts critically. "Interpreting" and "integrating" infer the unfolding and bringing together in a larger sense.
It was planned that the analysis and interpretation of data would be organized to take advantage of this close relationship to the research techniques. Analysis and interpretation took place either during or at the end of the respective sections.

**Preview of the Organization of the Remainder of the Dissertation**

A brief preview of the organization of the remainder of the dissertation is as follows:

Chapter II reviews the literature from two standpoints. First, literature is reviewed consisting of research studies that have a close relationship to the topics being investigated. Secondly, selected and more general readings are reviewed, derived from books, periodicals, bulletins, articles, and reports, which are germane to the concerns of the study. Some contributions from both types of review are utilized to draw conclusions at the close of the chapter concerning the potentialities and structure of management information systems suitable for the public school setting.

In Chapter III the interview survey is discussed concerning its objectives, design, administration, analysis, and findings. Since the interview survey is concerned with both portions of the problem statement, the findings and conclusions arrived at are related to both the potentialities of management information systems and its structure.
Chapter IV is primarily devoted to the development and description of a prototypic framework of a management information system. The major inputs to this are the findings and conclusions from the literature and interview surveys. In addition some selected resources directed at the development of management information systems are presented and applied to the task. Findings and conclusions of the chapter are presented in terms of the prototypic structure and, additionally, the most important conclusions of the balance of the investigation. Limitations of the research are discussed. A portion of the chapter is devoted to suggesting items needing further research and development.
CHAPTER II

THE REVIEW OF THE LITERATURE

Purpose and Objectives of the Chapter

The data base of this dissertation consist of material generated from two sources. One source was the interview survey and the other was the review of the literature.

It is the general purpose of this chapter to selectively review the literature portion of the data base and to present it in such a way that the reader could experience, first-hand, the subject development which led to some of the pertinent findings and conclusions.

Additional objectives, more specific in nature, are assigned to this chapter. These are briefly listed below as operational statements:

1. To categorize. Literature is presented in this chapter in two sections. One section is devoted to research studies which are either directly or closely related to the problems of the dissertation. The other section is concerned with selected readings, having less of a research emphasis, which are closely related to the same concerns.

2. To select. Within each category, materials have been selected that are most appropriate to the investigation and so that the reader may develop the kind of insights that hopefully will build his
comprehension of the major parameters of the problem and increase his understanding of their interrelationships.

3. To analyze. Each study or reading is analyzed in a five-step process which attempts to extract and portray the maximum amount of information in the most efficient fashion. These five points are concerned with defining the major problems or topics, discussing major procedures or positions, identifying significant findings or aspects, presenting conclusions, and evaluating the study.

4. To describe the relationship of the literature to the dissertation. Studies and readings are discussed in regard to their contribution to the dissertation.

The Research Emphasis of the Chapter

For clarity the reviews are highlighted at their beginning by a complete bibliographical entry. This establishes the starting point of each review.

The main emphasis of this chapter was concerned with investigating some of the potentialities and structural qualities of management information systems. The relatively specific findings and conclusions drawn from the literature review, consisting of contributions from both sections, are summarized in the form of general conclusions at the close of this chapter. Additional contributions of the materials reflected by the reviews, particularly
in regard to the structure of the prototypic management information system, were utilized in later chapters of the dissertation.

Review of the Literature of Previous Research Studies


This is a report of a study on recent developments and present status of the implementation of management information systems in 107 gas and electric utility companies in the United States. This study was concerned with determining the proportion of the companies queried who were either planning a management information system, or who had completed implementation in at least some respects of one, and who were applying innovative management science techniques.

A detailed questionnaire was used to generate information. A definition of a management information system, used for the purposes of the study, was supplied. A management information system was defined as a completely integrated, computer-based, system of data gathering, data
storage, data retrieval, and information communication to all levels of management. In addition, the defined system required a multi-dimensional approach to data acquisition so that information would enter the system only once in a form acceptable and responsive to the requirements of different managers for completely different purposes. In addition to providing information for managers, the system was required to be capable of meeting information needs of stockholders, the public, and regulatory bodies.

Fifty, of the 107 companies queried, replied. Twenty-seven said they were at work on a management information system; 23 said that they did not have a management information system.

Hallgren noted that the replies of the latter indicated that some companies could not meet the full requirements as outlined in the definition or were in very preliminary planning phases. For instance, three companies reported being in an early planning phase, three reported that their system might develop to this stage in the future, and several companies stated that they did not answer because their information system did not meet the qualifications of the definition.
The application of innovative management science techniques was reported by approximately 50 per cent of the companies working on management information systems. Linear programming was reported most often, 13 of the 27 companies using it on some occasions. Simulation and probability statistics were tied for second place and were used by 11 companies. Reliability analysis and econometrics were somewhat less popular being used by 7 and 6 companies, respectively.

Hallgren concluded that the research indicated that a significant number of companies, whose personnel are members of the National Association of Electric and Gas Utility Accountants, are interested in new ways to provide management with information to aid in decision making. Furthermore, although most of these companies have started in a modest way they are anticipating a fairly sophisticated system at some future date. They are organizing specifically for a management information system and are devoting substantial efforts to complete such a system.

This study would seem to indicate that, on a commercial basis, a management information system is considered to be a desirable component of the management process. Unfortunately, the research design did not provide for a full membership response. However, it did provide some insights regarding the viability of system concepts as potentially aiding management in a number of direct fashions.
The content of this book is directed primarily toward the concerns of the commercial and industrial interests rather than the educator. Likewise the case studies, making up three-fourths of the book, are drawn primarily from actual experiences of companies involved in such activities as banking, production of consumer products, and life insurance. The book is of value in the present context because the preponderance of material presented deals with actual case histories detailing the application of various versions of management information systems. Three-fourths of the case histories are an outgrowth of field research involving real companies and their problems. In addition, a small portion of the book is devoted to discussions of management techniques and allied problems related to computer usage.

Case histories were selected for their unique features and for their educational value as a basis for class discussion in a course given at the Harvard Graduate School of Business Administration entitled "Management Information Systems."

Findings were made in two areas. The first area was concerned with the classification of information, and the impact each classification had when analyzing the information requirements of a business in an environment of automated management decision-making. The findings were as follows:
1. Action, recurring, documentary, internal, historical information is the prime candidate for automation. In fact, this classification of information will form the "data base" for most automated information systems.

2. The timing and accuracy of action information is usually important.

3. Precise timing usually is not a factor in reporting of non-action information.

4. Non-action information is a prime candidate for elimination.

5. Non-documentary information is just about impossible to control.

6. Non-recurring information usually is not subject to automation.

7. The higher the management decisions, the more important become external information and future projections.¹

The second set of findings were concerned with computer adaptability to the demands of different kinds of management information sub-systems. These were as follows:

1. Logistics information systems are the best adapted to automation. The payoff from an automated logistic system comes from better performance (e.g., smaller inventories) as well as reduced costs of data handling.

2. Financial information systems are usually adaptable to automation because of the large amount of data that is handled. The payoff from automating the financial control system is largely from cost reductions in processing the data.

3. Personnel information systems usually are the least adaptable to automation and, consequently, the payoff tends to be the smallest.

4. Routine data processing systems are sub-systems of larger management information systems that may be isolated because they provide no specific management information. These systems are prime candidates for automation, but the payoff is almost exclusively in the cost savings of handling the data.\(^2\)

Conclusions reached in the text portion of the study, which serves as the background to the presentation of the case histories, is that business information is not homogeneous in character. Rather, different kinds of information or data must be treated differently. Consequently it is useful to divide information into a number of different classifications. Therefore, in order to effectively handle the information that is entering, circulating, being generated, and leaving a business it is necessary to organize logical systems to handle these differences.

No conclusions were reached by the authors concerning the case studies. The purpose of these studies was purely descriptive.

The primary value of the work on the whole was that concepts were established which might serve as discussion points or background as the case studies are later reviewed. The total book is of value because various basic starting points for conceptualizing management information systems were suggested and the case studies place the reader into a number of vicarious situations where application of these concepts is challenged.

\(^2\)Ibid., p. 16.
A study by a number of educational institutions and organizations of uses, problems, issues, and promising directions for research and development in electronic data processing in education. A thorough yet somewhat diffuse presentation. Among the significant outcomes of the study were certain structures around which concepts and implementation of an educational data processing system could be built.

The procedure for implementing the study was to bring together for a conference a number of specialists in educational data processing, teachers, curriculum and guidance specialists, administrators, psychologists and research workers. Twelve different organizations, directly interested in the concerns of the study, were represented. Data were collected from the resources represented by the participants in the conference in the form of opinions, position papers, discussion notes, and generally available educational statistics.

Findings were of three types. First, the report of the study portrayed some of the major concerns that exist in the field of education today and their relationships to computer and systems technology. Examples of these concerns
were: (1) trial-and-error curriculum reform, (2) imprecise programming of instruction, and (3) problems in effectively implementing innovative forms of school or instructional organizations. Essentially the findings attempted to delineate the root problems inherent in these concerns.

Secondly, a matrix was constructed outlining three levels of problems appropriate for educational data processing techniques and five realms of educational activity. Because of its pertinency for this study it is reproduced in its entirety as Table 1.

Table 1 depicts the range of tasks for which electronic data processing procedures might be appropriate. In the left-hand column are shown five realms of educational activity; across the top are three levels of conceptual complexity. Level one calls for the processing of large quantities of data; level two for pulling out relationships among categories of data; level three for formulating research designs and making major decisions. Setting up the data processing system demands, presumably, higher level cognition at level three than at level one. The categories on either axis could be extended and arranged differently; they serve simply to conceptualize a range of possible uses for data processing in education.

Relative to these categories, Goodlad said:

The educational activities listed under level one parallel a long list of activities in business, industry, and the military which are now commonly
### TABLE 1

PROBLEMS IN EDUCATION APPROPRIATE FOR ELECTRONIC DATA PROCESSING

<table>
<thead>
<tr>
<th>General Policy and Administration</th>
<th>Level 1 Raw Data</th>
<th>Level 2 Relationships Among Data</th>
<th>Level 3 Decisions and Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Codification and systemization of school laws, sources of funds, health and safety regulations, etc.</td>
<td>Effect of new policies on school health and safety records.</td>
<td>Studies into the relationship between policies and teacher and student effectiveness.</td>
</tr>
<tr>
<td></td>
<td>Results of polls on citizens' expectations for their schools.</td>
<td>Patterns of relationships among sub-publics and types of expectations for schools.</td>
<td>Conceptualization of possible new relationships and simulation of the consequences of effecting these relationships administratively.</td>
</tr>
<tr>
<td>Faculty, Staff and Students</td>
<td>Comprehensive inventories of teacher and pupil background.</td>
<td>Relationships among types of administrative problems and processes used in decision-making.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long-term collections of data on student achievement, attendance, health, dropout, etc.</td>
<td>Relationship between factors in school achievement and factors in students' health.</td>
<td>Prediction of students' success in school from longitudinal data, followed by deliberate manipulation of the environment and analysis of the consequences.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Level 1 Raw Data</th>
<th>Level 2 Relationships Among Data</th>
<th>Level 3 Decisions and Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget and Financial Support</strong></td>
<td>Statistics on school costs broken down into budgeted categories.</td>
<td>Relationship between financial support and various evidences of school productivity.</td>
<td>Decisions pertaining to school bond elections and building construction in relation to alternative predictions of population growth and financial support, together with calculations pertaining to how much new industry will be attracted by new and better schools.</td>
</tr>
<tr>
<td></td>
<td>Maintenance of assessed evaluation statistics and data pertaining to proportion of district's income going to education.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Cost statistics on all aspects of school construction and maintenance.</td>
<td>Relationship between costs of various types of construction and costs of maintenance.</td>
<td>Manipulation of facilities to test hypotheses growing out of observations at Level 2.</td>
</tr>
<tr>
<td>Curriculum, Instruction, and Materials</td>
<td>Level 1 Raw Data</td>
<td>Level 2 Relationships Among Data</td>
<td>Level 3 Decisions and Research</td>
</tr>
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<tr>
<td></td>
<td>Numbers of students in various patterns of curriculum</td>
<td>Relationships between students' high school curricula and later academic and work careers.</td>
<td></td>
</tr>
<tr>
<td>Students' responses on programmed lessons and courses</td>
<td>Relationship between responses and age, I.Q., past achievement, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage and retrieval of data on students' assignments to individual instruction, large groups, small groups, etc.</td>
<td>Relationship between students' assignments and various aspects of students' success</td>
<td></td>
<td>Manipulation of the instructional-grouping environment to test hypotheses growing out of observations at level 2.</td>
</tr>
</tbody>
</table>

being managed by computers. Consequently, there are few new problems here in seeking to apply data processing techniques in the field of education. Similarly, the processes implied under level two are now routine in many enterprises. There are far fewer models for level three tasks and so we can anticipate the emergence of new approaches, some of which will contribute to fields other than education, as educators make use of EDP in coping with this category. ³

The third category of findings consisted of the production of a list of organizations, associations, and agencies which were promoting the cause of data processing in education and a list of 27 institutions representing a broad cross-section of types of educational data processing implementation, hardware sophistication, size, and political relationship.

A large amount of material was presented which dealt with some of the concerns expressed by participants concerning the development of data processing systems for educators and the avenues of research that would facilitate this endeavor.

Two major conclusions were resultants of the study. First, it was the opinion of the study team that the most formidable block to progress in educational applications of data processing was not the state-of-the-art of data processing itself but the understanding by educators of education as it presently operates and is likely to

advance—especially their insights into the relationships between the actors involved and the vast accumulation of organizational, instructional, and various ad hoc techniques that presently constitute the educational system.

Secondly, it was concluded that the most promising channels for research and development in educational data processing lie in determining:

a. those basic items of information which might be involved in cooperative data processing systems,
b. in standardizing nomenclature and definitions, in providing for system and sub-system compatibility,
c. in resolving inter-face problems between educational processes and technological processes,
d. investigating the potentiality of automation as an aid to education and innovation and experimentation,
e. in studying and effecting instructional decisions, and
f. in demonstrating tested procedures which might serve as models.

This study was quite extensive in that it attempted to attack many of the major issues found in the area of educational data processing. Its great value, in the opinion of the writer, lies in its provision of a comprehensive view of the problems inherent in applying data processing techniques to an establishment as complex as education.


4Ibid., p. 46.

Nearly three years ago the United States Office of Education initiated a nationwide experiment intended to discover whether systems analysis has a legitimate role in educational reform. Over a million students in 18 different states, and several million dollars in research and development money, have been involved in a major demonstration effort. These three articles are status report on the progress of the research effort.

Objectives and basic procedures have been formulated for this project but since the project is not complete, at this writing, only tentative conclusions can be reported.

The problems before the groups and agencies involved in the "ES'70 project" (Educational Systems for the Seventies project) are to achieve the following:

1. A learner-centered curriculum, highly relevant to the adult roles which the student would be expected to play upon graduation.
2. Individualization or "customized" education for each student.
3. Utilization of appropriately tested and educationally oriented technology.
4. Employment of suitable organizational and administrative patterns.
5. Economic practicality within available resources.5

Each of the ES'70 schools is at work on specifying performance objectives for its own programs. Each will

attempt to state in measurable terms those objectives which a student is expected to achieve by the time he completes his high school education or in terms of specific, short term objectives which will lead to the achievement of the "terminal" objectives. The educational goals for ES'70 have been grouped under four broad categories:

1. occupational
2. civil or leadership
3. parental
4. personal-social

The strategy that is being followed provides for the formulation of the proper curriculum materials based upon the specific performance objectives called for and requires the development of learning modules; that is, specific instructional units prepared in printed, audio visual, program, computer-based, or other instructional form. Each module will be tested and validated within a school setting, made part of a data bank, and readied for call-up by a teacher-controlled computer program. The presentational mode, the sequencing, and the method of evaluating student performance will all be stored and retrieved through a computer-managed instructional system. Prototype systems are now under development.

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6Ibid., p. 201.
Although the research project has not been completed, Rhodes has drawn some tentative conclusions which are apropos to this study. He said:

1. It is increasingly obvious in the ES'70 demonstration that to deal realistically with the schools as total environments, organizations, or systems that affect children, requires the means to perceive the environment as a whole and to anticipate, plan, and allocate resources in light of overall objectives.

2. The systematic operation of an educational process is a problem of a different dimension and cannot be assumed to follow automatically from an overall analysis and plan.

3. The operation of an organization as a total system requires the interactive ties between all parts that will permit this functioning--links that are not part of current administrative frameworks.

4. Once operating as a part of a systematic process, an organization can build upon, reinforce, or modify this linkage. But this cannot realistically be done until it is operating. (Italics in the original.)

This project is an example of a research effort operating in an action mode in an on-going field setting. Although it is not reported by the authors in detail since, of course, the study has not been completed, it is pertinent to the requirements of this immediate research because it demonstrates and reports on an attempt to utilize a systems approach to solve educational problems. Objective number four, in particular, contains overtones (suitable organizational and administrative patterns) which are directly

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related to the purposes of this study concerning management information systems. It should be noted that the objectives bring together five important facets of the educational venture: (1) the learner-centered curriculum, (2) individualization, (3) utilization of technology, (4) proper organizational and administrative patterns, and (5) economic practicality. This study is obviously a significant attempt to attack the giant problems of education in a comprehensive and systematic fashion.


This is a summary document of a study prepared for the Ohio Department of Education and funded with Title V money under the auspices of the Midwestern States Educational Information Project. In general, the purpose of the study was to generate a plan for a financial information system that would be usable by all school districts in the state. Not only was this information to be generated and organized for the use of school districts and management internally but provisions were to be made for interface with outside institutions such as governmental bodies. Elements of program oriented budget accounting were to be integrated into the total system concept. Essentially the data handling methods were to be computer based.
A number of concerns have been frequently voiced by school districts concerning financial management. The most consistently stated problem had to do with the inability to satisfy a rapidly increasing demand for sophisticated information, especially financial information. This demand was related to certain environmental changes that had occurred, especially in the larger districts, during the past few years. These changes had to do with explosive growth in most districts, increasing difficulty in acquiring needed local funds, a more informed public, the availability of federal funds and subsequent need to report on their use, sociological problems in the urban areas and, finally, better trained and more demanding school administrations. These changes cried out for more complete, consistent and relevant information.

The concerns most frequently voiced were:

1. A lack of information, especially cost information on which to base sound management decisions.
2. Variation of information between different sources (e.g., local districts and state reports) that confused the public.
3. Variations in definitions between districts, and accounting methods that were confusing to the public, and made meaningful exchange of information difficult.
4. Inconsistent reporting periods and reporting formats required by local, state and federal agencies.⁸

A set of specific objectives for the development of a system had previously been formulated in a pilot study to attack these concerns:

1. The system should be standardly applicable to all districts.
2. The system should incorporate several levels of sophistication so that a district could implement the level best suited to their needs and expand in the future.
3. The system should be based on consistent and relevant definitions.
4. The chart of accounts must be acceptable to the Auditor of State, either in exact form or as translated.
5. The system should support a need for better isolation of costs.
6. The system should accommodate new management and budgeting techniques.
7. The system should fill the need for financial evaluation and control.
8. The system should permit information exchange.
9. The system should effectively interface other data elements in a total information system.
10. The system should effectively interface internal applications such as purchasing, accounts payable, inventory control, etc.
11. The system should implement economically.
12. The system should provide for the use of a computer.\footnote{\textit{Ibid.}, pp. 4,5.}

The methodology designed to complete this study in light of these concerns concentrated on achieving and maintaining consensus, and independent, objective system design. The importance of consensus was stressed because the success of the project was dependent on both a broad understanding of problems common to all districts, and also on wide acceptance of the system proposed. In addition to the need to achieve consensus among the districts, there was a
need to coordinate with the Ohio Department of Education, the Ohio Department of Finance, and the Ohio Bureau of Inspection and Supervision.

Specifically, the data collection procedure of the study incorporated the following elements:

1. On-site studies of the financial systems of eight school districts of varying sizes, but including the six largest districts in the state.
2. Periodic meetings with representative of all of these districts to review progress and strive for consensus.
3. Submission of a written questionnaire to 100 school districts, of which 78 were returned and analyzed.
4. A series of meetings covering several days with a committee of clerk-treasurers and assistant superintendents to develop specific recommendations for revision of the statewide chart of accounts and to discuss accounting principles.
5. A series of meetings with representatives from the Ohio Department of Education, the Ohio Department of Finance, and the State Auditor's Office to review progress and discuss the specific interests of each of these departments.
6. Continuing coordination with the State Auditor's Office and the Ohio Department of Education.
7. Review and analysis of existing studies in this area and coordination with the U.S. Office of Education on future guidelines and information requirements.10

Findings were made in two major areas. One described the characteristics of financial accounting systems in the districts studied. The other area provided a description of the needs that a new system would be required to meet. Highlights of these are reported below:

A. Characteristics of financial systems of the districts.

10Ibid., pp. ii, iii.
1. All of the districts studied used traditional fund and appropriation accounting techniques, and encumbering techniques.

2. All of the districts used function and object in their account coding structure. Only one district currently codes for activity, program or cost center. Three districts code for location (i.e., specific school).

3. All of the districts studied used key-driven equipment and ledger cards although one system uses a computer to encumber; and a second is currently converting to a fully mechanized system. None of the districts used an accrual method of accounting.

4. Although all of the districts budget centrally, two districts provide for participation in the budgeting process by school administrators, and one reports actual vs. budget to the individual schools.

5. All of the districts use a central warehouse and all but one do purchasing centrally. Only one district accounts for the utilization of supplies by school.\textsuperscript{11}

B. Requirements defining a new financial system.

1. The basic discipline of appropriation accounting is significant and should be continued.

2. Major modifications to most charts of accounts should be considered in order to provide:
   
   a. More relevant information to support local decision-making
   b. More appropriate and relevant information for the public
   c. Greater facility in providing reports
   d. A better base for cost studies or other forms of financial research.

3. Techniques for isolating costs should be available.

4. Better understanding of financial reality internally is needed, both to be able to predict the adequacy of appropriations as early in the year as possible and to compare on some valid basis the current year to previous years.

5. More information exchange is needed.

6. Financial information exchange is enhanced by the availability of information in other areas, i.e., personnel, enrollment, space utilization, etc.

\textsuperscript{11}\textit{Ibid.}, pp. 5,6.
7. The computer is necessary in making significant improvements to existing systems.\textsuperscript{12}

Conclusions resulting from integrating these findings have led to the development of concepts underlying a new kind of financial information system utilizable by both large and small school districts in Ohio. This system will be able to serve a variety of needs. Conclusions were:

1. The system as proposed is feasible.
2. It will supply traditional accounting reports.
3. It will supply financial information to a wide range of users.
4. It provides a basis for more sophisticated studies performed either by the districts themselves or by the state agency.
5. The program budget accounting method devised would seem to overcome some of the alleged weaknesses of PPBS.\textsuperscript{13}

The system itself is a set of procedures which will organize and manipulate data in a fashion that will satisfy the needs in various quarters for information. The source of data for this system is traditional accounting data. The system will accept information from already existing internal documents, organize it and "reformat" it into both traditional accounting reports and financial information reports.

The key to expanded use of this data is more detailed description. This is a coding process. Coding for posting

\textsuperscript{12}Ibid., p. 7.

\textsuperscript{13}Ibid., p. 21.
to conventional ledgers has always been done. It will now be expanded to permit extended use of the data.

Clearly the computer becomes a necessary implement in this procedure if maximum use of the data is to be made. (It is timely that an era is being entered where computers are becoming widely available. In Ohio, plans are already underway to make computers available on, at least a shared basis, to virtually every school district in the state.)

The report also discussed interface of the proposed system with other possible management information system elements. Considerations of inter-district cooperation and possible areas of conflict were highlighted. A great number of contacts were made with the groups and individuals who had interests in the outcomes of the study. These reactions, and the requirements generated, pinpointed problems of system analysis—providing, in the opinion of the writer, a significant example of applied research, both as to its potentials and pitfalls.


This is an investigation by a blue ribbon group of educators of current efforts to adapt emerging or existing systems technology to educational administration. Major topics covered were concerned with management information systems, the history of the "systems" movement, harnessing
information sources, operations analysis, and a general exploration of the potential and the realities of the "technology" situation.

The American Association of School Administrators' Commission on Administrative Technology, upon creation, had, as its purpose to: (1) identify recent developments in administrative technology in other fields, (2) determine the feasibility of adapting what has been successful elsewhere to school administration, and (3) facilitate dissemination of concepts of this technology that are pertinent to the profession.

The commission traveled to many locations and contacted a variety of specialists to gain first-hand information on current efforts to adapt technology to educational administration. Economists, mathematicians, systems analysts, and project directors met at various times with the commission.\(^\text{14}\)

Of particular importance to the issues of this dissertation were topics outlined in Chapters 2, 3, and 5. These chapters were concerned with the basic concepts of system technology, administrative utilization of data and information, and implications for administrative staffing and organizational arrangements.

Pertinent findings are summarized in the study at the close of each chapter. They are paraphrased within the following paragraphs.

Chapter 2, concerned with the history and basic concepts of systems technology, indicated that the study had placed greater emphasis upon what is called intellectual technology than what might be known as, in contrast, machine technology. The commission believed that the evolving techniques were reflective of new styles of public and private planning and new styles of problem-solving and choosing. In general, they considered the techniques to be future-oriented and mission-focused. They have recognized that the effective application of administrative technology demands vigor, talent, and time, and that its uses in industry, government, and military contexts have, in some quarters, not always been considered productive or successful. Additional findings of this chapter may be summarized as follows:

Even though the new technology has limitations, it also offers considerable hope and promise to those in education.
1. It does this by placing a premium upon the use of logic and imagination in organizational decision-making.
2. It assumes that decision makers can do much better than they are now doing in controlling organizational consequences and in shaping educational futures.
3. By providing tools for systematically examining the status-quo and for projecting ways to go beyond it, it opens the way to greater rationality in education administration.15

15Ibid., pp. 42, 43.
Chapter 3, which was concerned with the administration of management information systems and the impact of improvements in automated equipment, provided findings relative to both the problems of administration and the effects of this equipment. Regarding problems of administration the commission found that:

The responsibility for the administration and control of the management information system must be determined if the technology is to have maximum value.

1. Computer professionals with little or no administrative experience should not be given sole responsibility over a technology as important as the management information system.

2. First- or second-echelon administrators should be responsible directly for the systems and data-processing work.

3. Top school administrators must take a long hard look at the technology related to the computer and its basic information systems if the potential that resides therein is to be achieved. 16

Summarizing the impact of developments in automated equipment, it was found that:

The advent of third-generation computers and improved peripheral equipment has materially advanced the art of management information reporting.

1. It has enabled the development of an administrative information technology.

2. New systems which are using the data contained in the organization's basic information system and adapting it to the particular needs of management are commonplace and are helping administrators discharge their functions more effectively.

16 Ibid., p. 62.
3. Still in the experimental stages are management information systems which permit the administrator to communicate directly with the computer and receive information instantaneously in varied forms.

4. There is little doubt that the next 10 years will bring dramatic changes in ways in which the computers supply information to management.

5. The evolvement of management information systems, through careful planning and adaptation of sophisticated equipment (will provide), the data base for the systems technology.

Two charts were presented, designed to show the relationships between a school system's general information system and its management information system. Chart 1 is a generalized presentation that the commission developed for conceptualization purposes. Four major data banks are shown on the left. As shown in the two right hand columns, managers given the responsibilities of operation, policy formation, evaluation, and planning may then tie into the same banks.

Chart 2 shows a more detailed breakdown of the "pupil data" portion of the total data bank. Routine record keeping and accounting outputs are listed, and outputs for the management information system are presented.

\[17\text{Ibid., pp. 62, 63.}\]
<table>
<thead>
<tr>
<th>Data Banks</th>
<th>Routine Record Keeping and Accounting</th>
<th>Management Information System</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUPIL</td>
<td>Scheduled reports for teachers, business office, state and federal government agencies, etc.</td>
<td>Management information for assistant superintendents, principals, supervisors, and others with operating responsibilities</td>
</tr>
<tr>
<td>STAFF</td>
<td></td>
<td>Policy, evaluation and planning, management information for superintendent and selected top staff</td>
</tr>
<tr>
<td>FACILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINANCE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chart 1.—Relationship Between a School System's General Information System and Its Management Data Base (from Administrative Technology and the School Executive, p. 51).

<table>
<thead>
<tr>
<th>Pupil Data Bank</th>
<th>Routine Record Keeping and Accounting</th>
<th>Management Information System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Elements for Each Pupil</td>
<td>Mailing list</td>
<td>Middle Management Information (Operating Level)</td>
</tr>
<tr>
<td>Name</td>
<td>Attendance reports</td>
<td>Pupil attendance percentages by class and by teachers</td>
</tr>
<tr>
<td>Birthdate</td>
<td>Grade reports</td>
<td>School attendance percentages compared to previous years</td>
</tr>
<tr>
<td>Sex</td>
<td>Class-size reports</td>
<td>Grade summaries by class, subject, and teacher</td>
</tr>
<tr>
<td>Address</td>
<td></td>
<td>Summary of achievement test data by subject area</td>
</tr>
<tr>
<td>Parents—Occupation</td>
<td></td>
<td>Summary of pupils' academic aptitude by class and by teacher</td>
</tr>
<tr>
<td>Handicaps</td>
<td></td>
<td>Summary of class sizes by teacher</td>
</tr>
<tr>
<td>Attendance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schools attended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardized achievement test results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic aptitude test results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class sizes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College attendance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College performance (Excellent, Average, Poor)</td>
<td>Class-size reports</td>
<td></td>
</tr>
<tr>
<td>Degrees</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chart 2.—Development of a Management Information System from a Single Data Bank (from Administrative Technology and the School Executive, p. 54).
The commission has attempted to define management information system. This definition is as follows:

A management information system can be differentiated from more broadly based general information systems. Data in this storage bank is relevant to the school's administrative functions. This includes data necessary in the basic functions of planning, evaluating, organizing, controlling, and executing. . . . A management information system is a sub-set of the general information system which may be developed for the organization as a whole. The information processing system translates data from the surrounding environment as well as data generated by the system into inputs important to decision-making. The data within a general information system considered important to the operation of an organization provides the basis for the management information system.18

Chapter 5 which is concerned with implications for staffing and organizational arrangements has also summarized findings and drawn conclusions regarding the concepts and potentialities of administrative technology. These are shown, partially abbreviated, below:

1. Rising expectations as to what public schools can and should accomplish is causing a profound impact on school administrators. The nature, number, and scope of problems besetting school systems today necessitates a look at new methods of problem solving decision making, and long-range planning. Administrative technology holds forth real promise in these areas.

2. Before there can be successful introduction and implementation of administrative technology in any school, the administrator must have a clear concept of the total systems approach: its purpose, nature, elements, and interrelationships.

3. The conceptual framework presented for consideration is based upon improving the decision-making process of administration, thereby improving the efficiency of the total school

18Ibid., pp. 50, 51.
system in producing its end product: the educated person. With this basis, certain components of a conceptual framework are considered. These are:

a) clearly defined goals
b) file management.
c) flexible input coefficients.
d) cost cognizance.
e) effective communication.
f) improved tools for decision making.

4. Implementation of administrative technology is not a one-time or single year's effort but must be carefully planned and executed over a relatively long time span. Operational systems such as the ones discussed in this volume do not emerge overnight in viable form, capable of self-support.

5. Because of the nature and scope of problems of implementation, it seems desirable for administrators to establish their own order of priorities for action in their individual school systems. Suggested priorities meriting consideration are:

a) (developing) preservice preparatory programs.
b) organizing for change.
c) (developing) total staff participation.
d) development of administrative and board commitment to a systems approach.
e) sharpening of administrative responsibility.
f) (developing of) improved means of foreseeing future problems.\(^9\)

In concluding the committee stated that, in general, effective implementation of administrative technology depends upon:

a) Clearly defined and measurable goals
b) Wholehearted acceptance of the systems approach by boards of education, administrators, and teachers.
c) Flexibility in moving toward innovation
d) Staff competencies in systems development
e) Greater and more skillful use of electronic and mechanical devices
f) Efficient file management

\(^9\)Ibid., pp. 122, 123.
g) Collaboration with other systems and agencies in research and development.  

They further concluded that when a systems approach is implemented and operational, the following beneficial outcomes may be expected to appear gradually:

a) Improvements in decision making.
b) Increased number of facts and alternatives available as basis for sound decisions.
c) Improvements in handling of problems.
d) Better detection of mounting pressures on the school system, both internally and externally, and their validity (Here the systems approach performs a radar function.)
e) Foreseeing future problems in time to prepare possible courses of action.
f) Making available many alternative strategies and solutions to anticipated problems.
g) Improvement in long-range planning.
h) Greater acceptance of innovations.
i) Freeing of administrative time for innovative thinking.
j) Provision of means for evaluating innovations being tested.
k) Improvement of efficiency of total operation of school system.
l) Monitoring of the total school system.
m) Obtaining accurate feedback.
n) Establishment of "flag points," i.e., points at which corrections should be made.
o) Improvements in communications within school system and between school and community.

This study is of major value because the materials presented have been developed by educators themselves, seeking insights into the potential of administrative technology for the solution of educational problems. While the materials are general in nature, they have been

20 Ibid., p. 124.
21 Ibid., pp. 124, 125.
fairly well critiqued and edited. The result is a distilled and succinct portrayal of major technological thrusts of importance for the school administrator.


It should be noted that this study is not directly related to a public school setting. However, the thrusts of this investigation are closely related to the same problems, those of the structure and potentialities of management information systems, that are now arising in the public schools.

This report is the result of an effort by representatives of eight universities, under the sponsorship of the National Science Foundation and the National Institutes of Health to "devise and test systems of measuring and reporting activities in colleges and universities." It was not its intention, nor did it pretend to spell-out, the ultimate system but rather developed: (1) the problem, (2) the rationale, (3) the main features which must be included in a data and management information system, and (4) suggestions regarding the specific items of data needed.

This project was conceived after discussions at regional meetings called by the National Science Foundation to review, with university representatives, the questionnaires which the Foundation used in its college and university surveys.
The major problem which generated the idea for this project involved the increasing need for accurate, current statistical data concerning the activities of colleges and universities. These data were urgently needed by federal agencies and also by the institutions of higher learning themselves.

A number of months were spent exploring how to find a solution to the problem. A study was designed to devise and test systems for measuring and reporting these activities, including all major components of such institutions and all fields of activity. Originally it was to have been a study about internal information systems, with concern that such systems have broad compatibility between institutions. Later the study was broadened to reflect communication needs of agencies external to the institutions.

All the cooperating institutions contributed, via their representatives, the materials which have gone into this report. Various committees had major responsibility for development of different areas of the study, and various individuals assumed major responsibility for compiling and writing particular sections.

The content of all substantial areas of this report was officially reviewed by each of the participating institutions and was given general approval. However, the finished report cannot be taken as conforming exactly to the views of any one university or any one individual. On most
points a general agreement was reached but not complete unanimity.\textsuperscript{22}

A systematic approach had already been undertaken in some information areas. The project group concluded that it would be neither practical nor wise to ignore those areas in which systems existed. It was decided, that every effort would be made to investigate whatever had already been done, and, where possible, to incorporate it into the total picture which was to emerge from this investigation.

One area in which considerable sophistication and a considerable degree of conformity had been achieved was that of "student data." The project group undertook to integrate such work into the total information pattern being developed in the project. No such standardization had been achieved in the other areas of university data but wherever usable materials already existed, they were adapted as far as possible and incorporated into the total study.

It was found necessary to make a thorough examination of the nature of the university, as such, and attempt to understand the essential purposes and the nature of the functions and the activities which constitute its life. A great deal of time and thought went into the analysis of

the human agents of university achievement. A twofold criteria of "objective reality and relevance" was used so that the resulting information system would relate intrinsi­cally to the activities and purposes of the university.\textsuperscript{23}

Since this study was developmental in nature, findings seemed to accumulate as the study progressed.

An important finding was the development of a definition of an "information system." A distinction was made between that and a "total information system." These definitions were:

\begin{quote}
Broadly defined, an information system may be described as a combination of human, material, and equipment or technological events integrated and coordinated expressly to accumulate, integrate, analyze, and disseminate information for a purpose.
\end{quote}

\begin{quote}
A total information system is an integration of several information subsystems that handle routine matters such as payroll, registration, grade reports, etc., as well to process data relating these on a daily basis. In addition it provides reports for administrative officers in which they learn about current operations. The latter is most important from the viewpoint of management. Information about current facts is essential to good administration.\textsuperscript{24}
\end{quote}

It was found that to achieve a workable total information system or management information system three principal conditions must be met:

1. The coordination of all administrative activities and the establishment of decision-making policy that takes into consideration the overall institution without regard for the barriers of organizational segments or departments.

\textsuperscript{23}Ibid., pp. vii, 19, 20, 22.

\textsuperscript{24}Ibid., pp. 227, 229.
2. The collection of all data needed for the operation and management of the institution at the points of origin in a manner that will avoid duplication in the collection effort.

3. The recording and processing of data in a relatively fast, efficient manner, using manual or automated techniques or both.\(^{25}\)

It was found that as an institution gathers its procedures into a total information system, it should consider the following questions:

1. Does the institution have a blueprint of its desired information system?

2. Does the information system provide for the collection of all data at the points of origin and for assemblage in files in a manner that will avoid duplication of effort?

3. Can the basic data files be grouped into definable major systems with recognized classes (or their equivalent), of operational data, historic data, special data and control data?

4. Is the information system based on specific definitions for all data and information in all major systems?

5. Does the information system employ a single code system for each class of entity (individual, item, or thing) in the system?

6. Can the information system produce a series of control and analysis reports in each major system in addition to routine operational reports?

7. Does the information system link the coordination of the entire system to institutional research and the development of new measures of quantity and quality? (Institutional research, as used here, is the deliberate effort of university administrators to understand the university process.)\(^{26}\)

A chart was developed (Chart 3) which conceptualized the ordered steps, necessary to take, to measure and report university operations.

\(^{25}\)Ibid., p. 238.

\(^{26}\)Ibid., pp. 260, 261.
Chart 3.--Steps in Measuring and Reporting University Operations (from National Science Foundation. Measuring and Reporting Resources and Activities of Colleges and Universities, No. NSD 67-15, p. 228).
Findings were made concerning the responsibility of management for managing information activities. The study group said:

The management of information is ultimately the responsibility of top administrators. Top levels of administration must establish priorities within the data system, decide what information will be generated and maintained, to whom it will be distributed, in what amounts, and at what times.

The information system, then, must be optimum for the entire organization not ideal for any single department, whether it is engaged in scholarly pursuits or supporting services. The system must aid in planning for and controlling the total organization. Top administration must give priorities to elements within the system that reflect the purposes of the institution. The system must be built by people who have the perspective of the institution as whole.

The highest levels of administration have the task of translating data into information. By giving meaning to data, by transforming symbols into usable forms, and by relating their meanings to lower levels, effective management can take place. Top management, through a total information system, can furnish information to lower levels. The best system for any institution is one that transmit information to lower levels, and in turn provides feedback to the highest levels.27

In view of the foregoing and in consideration of the fact that institutions must be organized in a manner capable of meeting increasing demands, internal and external, for accurate and current information, the committee found that the following steps are desirable. These points are tied together by Chart 4. It was recommended:

27 Ibid., p. 231.
1. That cognizance be taken of the need to relate the people, facilities, activities, and financial capabilities of an institution to the specific purposes of the institution and to the over-all social contribution to be made by the institution. The conceptual "model" of the institution, resulting from the interrelationships so obtained, should be basic to the actual organization of institutional data.

2. That the organization of institutional data be based upon a coherent pattern of data gathering and processing that is consistent with the operation and structure of institutions. One method for constructing such a pattern, as well as for displaying the interrelationships referred to above, is visually represented by the Data Organization chart (Chart 4).

3. That, as part of the constructing of a coherent pattern of data gathering and processing, particular attention be given to the matter of relating institutional resources and institutional activities. In this connection, the classification and definition of institutional activities are especially important.

An interesting facet of Chart 4 is that it was the study group's attempt to present a model projecting a fundamental organization of the university, systematically bringing together its nature, structure, and purposes. This basic view of an educational institution may, in the opinion of the writer, be a fundamental contribution to questions of structure and potentiality of management information systems.

Another finding, quite interesting, was in the area of management's responsibility related to goals and operations of an institution. They said:

28Ibid., p. 232.
Chart 4.—Data Organization (from National Science Foundation. Measuring and Reporting Resources and Activities of Colleges and Universities, No. NSF 67-16, p. 18.)
Goals may be stated in terms of enrollment figures, total budgets, salaries of faculty, or numbers of buildings. Clearly, an information system will provide this information to an administrator. Other goals that are more important, however, are those that compel an administrator to decide, for example, in favor of constructing a nuclear reactor instead of a library, or adding a faculty in psychology rather than in machine design.

It is possible to devise an information system that will reduce present operations to better management. It does not necessarily follow that these are the most appropriate operations for the university or that their improved management will achieve what should be the university's goals.

The conclusion of these observations is that at present the university information system cannot be related to goals entirely, because the nature of the goals is still being clarified. Nor can the information scheme be tied to operations entirely, except as operations may be viewed as actions in the process of evaluation.

The proposed information system will, it is hoped, permit a more complete description and measurement of what is occurring so that goals can be better defined and operations can be more effectively designed.\(^{29}\)

Five major and general conclusions were presented by the study team. It was their belief that these conclusions were applicable even beyond the subject matter of the project. Major highlights of them are presented below:

1. **Generalization of (a) "Comprehensive" Approach.**

   A general implication of the investigation itself, together with this report, is that the comprehensive attack on administrative problems of higher education, rather than the more usual piecemeal approach, is not only possible but promising and warrants further application.

\(^{29}\text{Ibid.}, \text{pp. }246, 247, 248.\)
2. Need for Institutional Self-analysis. . . .
A clear implication of the Project effort is that institutions should formulate their educational objectives and analyze their operations and use of resources in the light of their objectives. It is on this basis that they should justify the collection and systematization of data.

3. Evaluation of Educational Effectiveness. . . .
A basic resource of higher education is students and these same students are a basic resource of society. Hence, the value of a university to society lies in great measure in the kind of students it graduates and, ultimately, in the contribution which these graduates make to society.

4. Impact on Organizational Relationships and Structure. . . .
The Project findings indicate that, when the problem of intrauniversity communication of data is attacked in accordance with the guidelines of this report, communication of data will take channels that are more horizontal than presently found in most universities. Since organizational structure is intimately connected with information flow, the setting up of a complex information system may have a slow but significant effect on the organizational pattern of the institution. Clearly implied here is a need for formal analytical study of university structure from the standpoint of data communication.

5. Generalization of the Dual Perspective of this Project.
An underlying dual concept in the Project was to the effect that any philosophy of the modern university must be infused with such wisdom as is within the capability of man, and that practical but advanced procedures must be found to assist the realization of philosophical purpose. In general, the Project investigators insisted that these two dimensions must be maintained simultaneously, and kept, as it were, in the same picture. This particular conceptual duality creates, to be sure, a precarious balance, but it also provides stimulus towards innovation, crosschecked by constant efforts to find practical solutions. There is a fruitful interaction
between philosophical exploration of purposes and ideals and the search for methodologies to achieve and test them. . . . 30

This study is an extremely valuable one for two basic reasons. First, it was obviously executed very thoroughly and with a high degree of sophistication. Secondly, although the study involved concerns of higher education, these same concerns are for the most part pertinent to the public school setting. The issues, structures, and potentialities studied are in the main exceptionally apropos to the same concerns regarding management information systems in public school settings.

Review of the Literature of Selected Readings

This portion of the review of literature is concerned with readings which may be considered to be somewhat less research-oriented than the studies reviewed previously. These provided more of an author's personal point of view, reflected as opinions, rationales, experiences, or schemas. As noted in the opening statements of this chapter the writer has analyzed each reading from the standpoints of defining the major topics of the reading, discussing the major points or positions taken, identifying significant aspects, drawing conclusions, and evaluating the study in light of its pertinency and contribution.

30Ibid., pp. 33-36.

In this article Hartley defines systems analysis and critiques it by identifying major limitations to this approach. He has identified the four major areas in education in which systems analysis activities are applicable and he has provided an example of a systems activity in each of these areas. In contrast to many other readings in the field of systems analysis this article is critical rather than descriptive.

Essentially he focuses his attention upon 25 items which he believes limit or restrain the applicability of systems analysis in education. These are listed below:

1. Confusion over Terminology
2. Problems in Adapting Models
3. A wisdom Lag
4. Illusions of Adequacy by Model-Builders
5. Inadequate Impetus from States
6. Centralizing Bias
7. Unanticipated Increased Costs
8. Goal Distortion
9. Measuring the Unmeasurable
10. Cult of Testing
11. Cult of Efficiency
12. Spread of Institutional Racism
13. Political Barriers
14. Conventional Collective Negotiations Procedures
15. Lack of Orderliness for Data Processing Models
16. Monumental Computer Errors
17. Shortage of Trained Personnel
18. Invasion of Individual Privacy
19. Organizational Strains
20. Resistance to Planned Change
21. Antiquated Legislation
22. Doomed to Success
23. Imagery Problems
24. Defects in Analysis
25. Accelerating Social Change Rate

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Hartley identified four areas of action within the educational sphere, noted a typical activity that takes place within each sphere of action, and provided an example of a systems technique appropriate to the area. These were portrayed as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>Activity</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy Formulation</td>
<td>Strategic Planning</td>
<td>Planning, Program-management, and Budgeting System</td>
</tr>
<tr>
<td>2. Management</td>
<td>Administrative Exec-</td>
<td>Management Information System</td>
</tr>
<tr>
<td></td>
<td>ution-Control</td>
<td></td>
</tr>
<tr>
<td>3. Instruction</td>
<td>Learning and Evaluation</td>
<td>Computer Assisted Instruction</td>
</tr>
<tr>
<td>4. Research</td>
<td>Pure and Applied Projects</td>
<td>Program Evaluation and Review Techniques(^{32})</td>
</tr>
</tbody>
</table>

In justifying the systems analysis, he said:

because of the propensity of the human mind to oppose order on what actually may be random events, individual tend to associate their observations with some sort of system. Systems analysis is a mode of thinking. It provides a framework that permits the judgments of experts in numerous fields to be utilized so as to yield results which transcend individual judgment. It enables persons to achieve solutions and raise probing questions in a universal language, i.e., systems analysis.\(^{33}\)

Hartley both justifies and explains the increase in the application of management systems techniques and decries almost simultaneously the literature which describes them.

\(^{32}\)Ibid., p. 516.

\(^{33}\)Ibid., p. 515.
He further notes that,

As might be expected, most of the literature describing this new generation of interrelated management processes is rather long on persuasion and short on critical appraisal. The net result is that educators often do not have sufficient information with which to judge the relative work of competing systems techniques.\(^3\)

His basic objectives in this article were to consider some of the major limitations of systems procedures for education and thus to reduce the gap between expectations and achievement.

A number of limitations mentioned by Hartley appear to the writer to have particular pertinency to the potentialities of a management information system. Such limitations, with appropriate comment from Hartley, are as follows:

1. Confusion Over Terminology. The term systems analysis possesses nearly as many definitions as there are persons who advocate its use. One indication of the confusion that surrounds the topic is the fact that there are at least 60 different code names and acronyms for approaches on management controls. . . .

2. Problems in Adapting Models. Generic models should be altered to fit specific situations. Models and procedures formulated in one context may not be transferable to another. . . . In terms of quantitative analysis, schools are much more complicated than any system yet devised by the military, which is where systems analysis was largely developed. There appears to be a more clear-cut mission and decision process for defense than for education.

\(^3\)Ibid., p. 515.
3. A Wisdom Lag. The quantum jump of technology and science far transcends any comparable advance in human wisdom. A wisdom lag is apparent. We can analyze intricate educational problems with computers but often times we cannot estimate the value and relevance of data.

4. Illusions of Adequacy by Model-Builders. . . . Operations researchers, in particular, seem to suffer from "illusions of adequacy" in their modeling of educational systems. Elaborate analysis may be based upon poor data or questionable premises.

6. Centralizing Bias. . . . How to balance the advantages of efficiency obtained from centralized decision making against the human survival values of individual decision making at the "point of stress" is a basic problem of public school governance in our time.

8. Goal Distortion. Unfortunately, there is a tendency for organizations to place greater emphasis on those goals that are easily measured, such as cognitive mastery, and to neglect the more important goals that cannot be quantified and measured, such as moral perspective. . . .

9. Cult of Testing. Testing that is based on poor instruments, disputable assumptions, incorrectly interpreted data, and purposely manipulated data can offset the advantages afforded by systems procedures. . . .

10. Cult of Efficiency. Systems analysis may place too much emphasis upon economic savings. As a result, preference is given to saving at the expense of accomplishment. Critics of economic policy point to current urban wastelands as examples of how humane concerns often give way to economic efficiency with disastrous results.

13. Lack of Orderliness for Data Processing. . . . The primary difficulty in adapting an information storage and retrieval model in educational administration, as in the behavioral sciences, is one of orderliness of content. Information retrieval usually implies organized information so the discreet data may be easily located. Educational administration frequently lacks a comprehensive theory, and thus it also lacks the orderliness of a uniform scheme for classification, storage, and retrieval of information.
Defects in Analysis... A consequence of the difficulties and complexities of the particular question or issue... The human mind possesses what has been called a "rage for order." Man may attempt to impose order on what are simply random events. If we interpret random events as nonrandom, our analysis is likely to be defective and produce no predictive value.35

Hartley concludes that the 25 limitations of systems analysis he described fall into three basic categories. Those that are conceptual (problems of theoretical definition), those that are operational (problems of administrative execution), and those that are societal (problems of environmental relevance). He believed that understanding the shortcomings illicit, and being aware of the major categories in which difficulty is found, may provide insights to educators which may permit them to implement procedures more successfully that may be very useful. He further concluded that it would be easy to exaggerate the extent to which systems concepts can assist educators. On the other hand, he felt that the limitations he described are far outweighed by the potential advantages to be gained. And finally, he believed that, in the final analysis, the success of systems procedures is dependent upon the art of the user.

This is a valuable article because of the precautionary notes expressed, in a critical tone, to educators, who

have urgent problems, are seeking solutions through utilization of new systems, and wish to steer around as many obstacles to their implementation as possible.


Kornbluh and Barnett have written about the necessity and the quality of the involvement of educational administrators in systems development efforts. They have been concerned that the quality of participation by management in their own systems may be at a level which degrade or blunts the effectiveness of tools which were designed to facilitate processes, which in final essence, are management's responsibility.

The authors point out that educational institutions are currently making substantial investments in automated equipment and procedures in an attempt to improve their administrative operations. They note that in many cases the money and time invested in these efforts are greater than the benefits derived. They believe that the basic reasons for total or partial failures is that managers, during the design of the systems, do not participate as fully as required to assure their success.

They have noted that in the past work standards were set by the managers themselves. However, now the systems approach is changing this because it is requiring them to expand their technical proficiency, work more
closely than previously with details of operations, supervise "different types" of people, manage new tasks, and redefine and resequence management procedures.

They note that managers should want to have a strong voice in the development of their systems if for no other reason than to insure their status within the improved system.

Kornbluh and Barnett have taken the position that a two-step procedure can improve the situation. The steps are:

1. Making the administration, at all levels, aware of the factors that are conditioning their attitude (i.e., that systems development work is only for systems people).

2. Giving the administration the proper systems education to change their attitudes and to enable them to cope with their new responsibilities.36

The writers believe that there are four factors which may be identified, as noted in item 1 above, having to do with the prevailing attitudes of many administrators towards systems development. They are:

1. The Understanding Gap—The understanding gap simply means that the educational administrators and systems people find it difficult to talk to each other.

2. The Fear of the Computer—Educational administrators frequently are "over-awed" by the physical and operational capabilities of a computer system.

3. The Concern over Status--Educational administrators are frequently concerned about losing status if they participate in systems development. They become anxious about losing supervision over workers presently under their jurisdiction.

4. Misguided Complacency--Many administrators return after formal EDT training programs "fired-up" about the potential of the computer but possess little knowledge of the systems considerations necessary to plan for and implement this "hardware".

There was concern in the second of the two-step procedure that administrators must be substantially educated to inhibit negative attitudes and ineptness toward systems structures. They suggested three steps:

1. Define and illustrate the entire process of systems development.
2. Define the specific roles of educational administrators within the process.
3. Present the technique educational administrators use in playing their roles of this process.

In regard to the second point the authors identified 10 phases of the systems development process which administrators must be familiar with. These were:

1. Planning 6. Economics
2. Analysis 7. Implementation
3. Technology 8. Evaluation
5. Modeling 10. Long-range planning

The article concluded that the educational administrator has a role to play in each of the ten phases of systems development.

37 Ibid., pp. 11-12.
38 Ibid., p. 12.
39 Ibid., p. 12.
activity noted above, although level of participation will vary from activity to activity. Secondly, in order for the administrator to actively and meaningfully play his role in a systems development effort, he must be willing to obtain and accept whatever technical training is necessary to allow him to manage fruitfully. Thirdly, it was concluded that when this plan is followed, administrators and managers become meaningfully involved in the processes, may overcome their negative or ineffective attitudes, and become the masters of their own system.

This article is clearly presented and seems to be conceptually sound. The analysis of the various processes involved in any kind of system development, be it a management information system or other, provides guidelines for identifying potential trouble spots in a manager's personal training, and provides guidance for overcoming inadequacies in areas which may undermine the structural soundness of a potentially adequate system.


This reading is a review of the position and findings of Robert A. Frosch, Assistant Secretary of the Navy as presented in a recent paper. He discussed what he considers to be "real progress" and how it comes about in the "real world" contrasted with the results of implementing management procedures and approaches that have become popular in
recent years. (The latter can be described as the "systems" approach.)

He claims to be able to identify a high correlation between one graph, reporting a rising tide of costs, cost overruns, and unsatisfactory performance, with a second graph upon which is plotted the rise in talk, directives, and the use of "systems engineering," and "systems analysis."

His fundamental position is that this difficulty has arisen because many have become entranced with the system approach and are using it as a general technique. He said:

I believe that the fundamental difficulty is that we have all become so entranced with the (systems) that we think entirely in terms of procedures, systems, performance charts, PERT diagrams, reliability systems, configuration management, maintainability groups, and the other minor paper tools of the "systems engineer." 40

He has reacted critically against current practice in the systems field. His reactions all have in common his distinction between life and the real world and the limited set of possibilities that are taken into account in new management approaches involving "systems." He provided three examples to support his position. These contrast what he called the "real world" with qualities of the new practices.

1. Paper versus People—In most cases where a system is about to get into trouble, a competent manager knows all about the problem and is well on his way to fixing it before his management systems ever indicate that it is about to happen. . . . A project manager who spends his time in his Management Information Center instead of roving through the places where the work is being done is always headed for catastrophe.

2. Linearity versus Non-linearity—The practice of breaking down a problem into sub-problems, the separate solutions of which are then combined, frequently fails because the real world is highly non-linear, and the interaction terms may be as large as the sub-problems.

3. Serial versus Iterative Models of Development—Tools such as the PERT diagram constrain managers into thinking projects in terms of "step A, then step B, then step C." Anyone who has ever carried out a development or a design is well aware of the fact that the real world proceeds by a kind of feedback iterative process that looks more like a helix than like a line. . . . 41

Frosch has concluded that the solution is rather simple. He said:

The only thing I know that works is to obtain a competent man and his assistants, and make sure they understand the problem— not the specifications of the problem, not the particular scenario written down, but what is really in the minds of those who have a requirement to be solved. Then give them funds, a good choice of managerial and system engineering tools, and let them work at it with reasonably frequent conferences with those who have the requirements.42

His final observation is quoted in entirety

From time to time I am briefed on the results of a systems analysis or systems engineering job in

41Ibid., pp. 24-28.
42Ibid., p. 62.
a way that prompts me to ask the questions "That's fine, but is it a good system? Do you like it? Is it harmonious? Is it an elegant solution to a real problem?" For an answer I usually get a blank stare and a facial expression that suggests I have just said something really obscene.\(^3\)

This reading was of interest because of the violence of its attack on the systems approach. Here, the efficacy of a management information system, which is particularly complex, is impugned. Mr. Frosch can be considered a reliable source. Despite the political connotations that may be present, one is inclined to give some credance to his cautionary notes regarding the limitations of a systems approach. The major implication is that the human element must be present in the systems equation for it to be workable.


This is a monograph which attempts to describe the current state of the art regarding management information systems from multiple standpoints. The author uses data from a number of sources. Some may be considered philosophical or conceptual. In some cases the author is recording information that is his personal opinion or that he has gleaned from the literature. In addition, he has used descriptive research methods utilizing data received

\(^{43}\)Ibid.
as a result of visiting firms directly and data received in a written form from 22 additional establishments.

The author noted that since the 1950's there has been wide discussion of the concepts concerned with the management of information. A number of ideas have been advanced for increasing the value and amount of information available to managers by the application of certain systems. Two major concerns can be identified. One deals with organizational problems, the other with changes in the information system concept.

One of the touchstones of Stollenberger's monograph is his definition of a management information system. He goes to some length to distinguish it from a data processing system. The essentials of his concept are as follows:

1. The system must give significant weight to the needs of management and to the potential service it can render to the decision-making process without being pre-occupied with procedures. The systems and sub-systems, however, must be well documented and precisely defined.
2. The designers of management information systems must consider information as a valued resource and not solely as an overhead cost.
3. The system (should be) an intrafirm system incorporating internal and external data resources alike.
4. The system is presumed to require large amounts of data inputs and to use facilities capable of handling these volumes. Integration of data inputs, development of data banks, and multifunctional use of information are assumed. In most cases computerization is implied.
5. A distinction between an automated decision process and the information system is made to establish the information system as a component sub-system of the firm along with other sub-systems, such as production, distribution, and
personnel. The data systems are a service to the decision-making centers and do not include the decision process.  

Sollenberger has noted that managers are showing a growing interest in proper information handling which is a result of changing systems concepts. He identified these as follows:

1. The purposes of an information system have not changed; however, the formal objectives and goals appear to be more clearly identified.
2. No longer is faster reporting the major factor in the managers' reporting time requests.
3. The administrative and control activities appear to be lessened at higher management levels because of decreased manual data manipulation and searching, allowing more time for analysis and planning activities.
4. Although difficult to identify at this time, major revisions in organizational structure appear to result from the removal of many serious communication constraints, such as data nonversatility and inaccessibility.
5. The design of an information system implies greater managerial acceptability to supporting detail, which increases the utility and flexibility of the data in the information system.
6. The physical and managerial centralization of data handling services occurs as a fundamental part of comprehensive management information systems.
7. A company-wide approach to information handling is necessary to provide adequate data services to all managers dependent upon the firm's data resources.
8. The data handling duties formerly assigned systems and accounting departments appear to be evolving into a major functional area.
9. The popularity of the concept of information systems, the recognition of the need for improved communications networks, and the availability of funds appear to be channeling larger investments into the development of comprehensive management information systems.

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10. The time schedules for broad systems studies have lengthened considerably over the job- or single area-oriented projects previously used. Stollenberger concludes that changing management information system concepts, as identified previously, cause changes in the kinds of problems reported by users. These have an impact on the structure and potential of the management information system. The results of these impacts are:

1. The information network can be independently identified and separated from the responsibility-authority channels in firms which have developed management information systems.

2. Improvements in communications provide the opportunity to increase centralized control over lower levels of management.

3. The unit cost of information handling has been cut; however, total data costs generally cannot be reduced significantly.

4. Equipment constraints in the form of cost and capabilities made wide use of several needed techniques impractical for many firms.

5. The responsibility of collecting data became more important in integrated system.

6. With increased ability to distribute data at the time, in the form, and to the place needed, duplicate files and multiple recordings can be reduced significantly.

7. Standardization of data systems and use of uniform procedures were often major objectives of the systems study, thus the revised systems tended to increase comparability and managerial flexibility.

45 Ibid.
8. A thoroughly developed information system permitted the manager to analyze more of the factors affecting the decision to be made.

9. Increased use of exception and inquiry reporting appeared to be the major improvement in reporting format.

10. The ability to generate reports and distribute information in less time benefited operational control areas more than other management levels.

11. Systems studies caused the job descriptions and responsibility assignments to be clarified to a much greater extent than had existed previously in most of the observed firms.

12. Greater functional coordination, encouraged by improved communications, increased cooperation between separate units.

13. Employment of managers displaced by the information system generally did not present difficulties.  

The author of this monograph, through the integration of large amounts and varied types of data, has provided significant and timely input applicable to studies of the structure and contemporary potentialities of management information systems.


Rosove has devoted an entire chapter of his book to the problems of management in the information system development process. He has attempted to describe what he believes to be the salient management problems in this

46 Ibid., pp. 106-107.
area. He notes that many have suggested that innovations in management techniques have not kept pace with scientific and technological achievements. Thus, our abilities to organize the human and physical resources necessary to utilize these advancements effectively have not been forthcoming. In a sense, we have not been able to adapt our industrial, commercial, and public organizations to the extent necessary to keep up with scientific and technological progress. He notes that many of these problems are derived from three closely related sets of conditions:

1. The widespread lack of familiarity of managers and administrators with the development process for information systems.

2. The use of an irrelevant model of hardware system development for the management of the information system development process.

3. The incompatibility between existing management organizations and administrative procedures and the unique nature of the information system development process.  

In regard to Rosove's first concern he notes that a complex operation calls for an equally sophisticated information system which in turn requires sophisticated technology. Therefore, management may avail themselves of a specialist to develop this complicated system. This causes an alienation of management since they are not directly involved in the formative process.

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The second point, concerned with the use of an irrelevant model of hardware system development, is concerned primarily with the rigidity of management. Rosove has indicated that the typical potential user of an information system has been accustomed to buying hardware and has some familiarity with computers, due to experiences with conventional data processing systems. However, it is not uncommon to find that the typical use of an information system does not know what kinds of sciences play a role in the design and production of information systems software, but that he may have a bias or be prejudiced against what are commonly called the "soft" sciences. Social psychology might be an example of such a science. Since the software output of the social sciences is less tangible than the hard sciences, the user tends to be reluctant to pay for it and falls back upon non-appropriate models.

Item three clearly infers that management organizations are not able to relate procedurally to the unique requirements of the systems development process. An example of this, is that many times the higher levels of the organizational hierarchy are insulated from some of the mundane details and trivia of the operation of their organization through purposeful communication blocks. The difficulty with this state of affairs, in the development of a management information system, is that if communication is
formalized through restrictive administrative procedures, the development process is not optimum.

Rosove concludes that the maximum effectiveness of any given management information system rests on removing developmental constraints. He believes that as administrators become oriented to, and thus more familiar with, the development of information systems the first difficulty can be removed. By establishing a model which reflects the development process more adequately it follows that there will be less dependence upon previous habits of hardware selection. He believes that new management structures and administrative procedures must be designed which will be compatible with the nature of the information system and its development. He infers that this last task is the most difficult.

The previous comments are significant because they imply that the construction of adequate management information system structures and the development of their full potentialities rests, in great measure, upon the quality of the total environment established by management.

General Conclusions Concerning the Structure of a Management Information System

General conclusions may be drawn that can be categorized as having primary significance for the structure of a management information system. They are as follows:
1. Data and information are not homogeneous in character.
   a. They must be divided into a number of different classifications in order to be effectively collected, processed, and reported.
   b. It is necessary to organize logical systems to handle these differences.

2. The most formidable block to progress in educational applications of data processing is the lack of understanding by educators of the total educational process, as it presently operates, and as it is likely to operate in the future.

3. School systems can be most effectively dealt with as total environments. To deal realistically with the schools as organizations, or systems, that affect children requires the means to perceive the environment as a whole and to anticipate, plan, and allocate resources, in light of overall objectives.

4. Institutions should formulate their educational objectives, analyze their operations, and use of resources in light of these objectives. It is on this basis that they should justify and implement the systematization of data.

5. The setting up of a complex information system may have a significant effect on the organizational pattern of the institution. Therefore, there is a need for a thorough analytical study of institutional structure from
the standpoint of data communication before the structure of the information system is decided upon.

6. The human element must be present in any educational systems equation for it to be workable. Systems operating in educational arenas exist to assist in the realization of philosophical purposes. This interaction between man and systematic procedures is a duality made up of philosophical explorations of purposes and ideals, and the search for methodologies to achieve and test them.

General Conclusions Concerning the Potential of a Management Information System

Additional conclusions may be drawn that have primary significance for the potentialities of a management information system. They are:

1. The nature, number, and scope of problems presently besetting school systems necessitates a look at new methods of problem solving, decision-making and long-range planning. Administrative technology promises significant advances in these areas.

2. A comprehensive attack on the administrative problems of education rather than the more usual piecemeal approach, using systems techniques, is not only possible but promising.

3. The efficiency of the total school system may be heightened by improving the decision-making process of administration.
4. A significant number of private and public organizations are interested in innovative ways to provide management with information to aid in decision-making.
   a. Though most organizations have started in a modest way they are anticipating a sophisticated system.
   b. They are devoting substantial efforts and resources to complete such systems.
5. The construction of adequate management information systems and the development of their full potentialities rests, in great measure, upon the quality of the environment established by management.
6. The analysis and study of the various processes involved in any type of system development, be it a management information or other, provides guidance for overcoming the inadequacies of managers as they related to a potentially adequate system.
7. The extent to which different systems concepts can assist education is easily exaggerated, but the limitations of these systems are far outweighed by the potential advantages to be gained.
8. In the final analysis, the success of systems procedures is dependent upon the artistry of the user.
CHAPTER III
THE INTERVIEW SURVEY OF SELECTED DISTRICTS

Research Orientation of this Chapter

The purposes of the interview survey was to elicit and categorize activities and experiences, as identified by personnel working in the field, in order to describe potentialities and structural qualities of management information systems. This chapter is devoted to discussing the objectives, design, and administration of the survey. An analysis of the responses is also presented.

Objectives of the Chapter

A number of objectives are undertaken in this chapter regarding the interview survey. Some of these are to describe:

1. The methods used for the selection of subjects.
2. The construction and validation of the inquiry instrument.
3. The procedures involved in the total interview protocol.
4. The method of data analysis and exposition that were utilized.

Additional objectives are to present the findings that have
resulted from the interviews in an organized and readable fashion, and to draw appropriate conclusions.

**The Selection of Subjects**

To enable the researcher to visit and make direct contacts with the subjects to be interviewed it was necessary to find appropriate sources of data. A pilot survey was conducted to attempt to identify potential sources within Ohio. During the pilot survey phase, a number of people were interviewed to aid in the selection of subjects.

Four criteria were advanced, as being appropriate to the purposes of the investigation, for choosing the specific public school settings to be studied. These were:

1. Choosing districts where electronic data processing techniques were being used of at least third generation capabilities.

2. Choosing districts of different sizes and sophistication so that somewhat of a cross-section would be queried.

3. Choosing districts where facilities were utilized in an innovative manner.

4. Choosing districts where progressive leadership exists within the data processing organization and where relationships with the balance of the school organization are on a high level.

The results of the pilot survey indicated that the most fruitful selection of districts could best be made through the auspices of the Department of Education of the State of Ohio. Information was available concerning the qualities of data processing operations in school districts throughout the state.
Subjects were finally selected utilizing two distinct sources of information to apply the criteria. First, the results of a survey conducted by the State Department were perused. The survey was designed to elicit information concerning the sophistication of the equipment, programs, and applications in use. It provided firm data concerning the first two criteria. Secondly, personnel of the State Department provided estimates of the qualities reflected in the last two criteria. The writer made the final decision on the choice of districts, and the district representatives on the basis of the information presented to him.

Five selected potential districts were queried, through their chosen representatives, as to their willingness to take part in the study. All representatives acquiesced and it was not necessary to utilize alternate subjects.

The source of specific data generated in the interview situations has been kept confidential, at the request of district representatives, due to the sensitive nature of some of the questions. However, no restriction was placed on simply listing the subject districts, the district representative, and general supporting information.

The school settings, chosen by the writer to participate in the interview survey, are indicated below. Certain information is provided in brief form detailing each choice. This information consists of: (1) the name of the school district (subject), (2) the name of the district represen-
tative interviewed, (3) an indication of the type of equipment utilized, and (4) succinct comments justifying this particular choice.

List of subjects

Subject A
1. Cleveland Public School System, Cleveland, Ohio.
2. Mr. Karl Becker.
3. IBM 360/40 (4 tape and disc drives).
4. One of the largest operations in the state. Well planned, and aggressively supported by the administration. Elements of a management information system.

Subject B
1. Toledo Public School System, Toledo, Ohio.
2. Mr. Galen Lahman.
3. IBM 360/25 (32,000 storage positions).
4. Very capable personnel. Interested in development of a management information system. On the way to a Planned Programmed Budgeting System.

Subject C
1. Mentor City School System, Mentor, Ohio.
2. Mr. Larry Nicholson.
3. Honeywell 110 (16,000 storage positions).
4. A small city district doing a lot on a small computer. Elements of a management information system.

Subject D
2. Mr. Howard Schertzinger.
3. IBM 360.

4. A transitional operation moving from second to third generation equipment. Operation under control of Assistant Superintendent for Business Affairs. Very capable personnel who have good ideas.

Subject E

1. Parma Heights Public Schools, Parma, Ohio.

2. Mr. Steven Kosmos.

3. Equipment being changed.

4. A relatively small district serving a number of needs. Doing a lot on limited equipment. Operation has been actively supported by the administration.

The Construction of the Inquiry Instruments

The inquiry instruments, consisting of open-end questions, closed-end questions, and a checklist, were designed to elicit and categorize activities and experiences, pertinent to the purposes of the research, to be obtained in the interview situations with the district representatives (see Appendix). Basic emphasis was placed upon the use of open-end questions and the checklist. The closed-end questions were reserved for probing purposes, i.e., where it was necessary to prod the interviewee into a more pointed or pertinent response.

The open-end questions were derived from sub-statements appearing in Chapter I describing the concerns of Part I of the general problem. These were related directly to the three categories of potentialities of management
information systems being investigated ("Technical," "Benefit," and Conflict").

The checklist was developed from a catalogue of subsystems, having potential application in a management information system, constructed by the writer during the literature review phase of the study. It was directed at identifying management information system components in the subject district.

The closed-end questions were designed by modifying statements regarding expected outcomes, as established by the AASA Commission on Administrative Technology, when a systems approach is implemented.¹

The total interview instrument, consisting of the three parts, is found in the Appendix.

Validating the Inquiry Instrument

The inquiry instrument, originally designed, was considered to be tentative and subject to refinement. It was pretested in totality from the standpoints of quality of content, appropriateness of technique, and timing.

Dr. Roy A. Larmee, Chairman of the Department of Educational Administration at Ohio State University, reviewed all the materials and suggested modifications in content and administration.

Mr. Edward McKinney, formerly Director of the Data Processing Center of the Washington, D.C. Public School System, pretested the questions by engaging in a simulated interview situation and subsequently noting his comments as to both the qualities of the interview and the questions themselves.

Mr. W. D. Staats of the Research and Evaluation Section of the Columbus Public Schools commented upon the questions from the standpoints of clarity and quality of design as related to the purposes of the study.

The format, content, and method of presentation were modified to meet the suggestions of this group.

The Interview Protocol

Personal interviews were held in the districts listed with the chosen representatives. An attempt was made to structure the total interview in as uniform and answer-eliciting a fashion as possible. To this end the following procedures were followed:

1. An appointment was arranged with the selected representative of the school district at a time convenient with him during business hours.

2. Approximately one-hour and thirty minutes was requested for the interview.

3. A letter of verification and explanation, and a list of questions and topics to be discussed were mailed to the interviewee after the appointment was made.

4. It was agreed that responses to all questions and reactions to topics were to be kept strictly
confidential in regard to the exact source and school district involved.

5. No remuneration was provided for the interviewee. However, he was informed that his personal contribution would be acknowledged and that an abstract of that dissertation would be mailed to him.

6. Questions and topics posed by the researcher and responses of the interviewee were tape-recorded at the time of the interview. These materials were later transcribed into written form for analysis.

The actual interview situation consisted of the following steps which were discussed with the district representative at the beginning of the interview.

1. A description of the research being undertaken.

2. An appreciation for the contributions the subject was making.

3. A general description of the kinds of responses that were desired.

4. A short description of the protocol format.

5. The presentation of the protocol format.
Method of Data Analysis

Approximately 140 pages of data resulted from the transcription of the interviews. In analyzing this large amount of data, to develop findings that can be efficiently communicated to the reader, it has been necessary to summarize the extensive responses to produce a readable format. This permitted certain efficiencies in that duplicate responses are shown only once. The plan of data analysis has therefore been to consider the 18 open-end questions as "key questions" and to extract from the transcribed data "key responses" which, in the opinion of the researcher, best represent the findings in that particular case, viewing the interviews as a whole.

While a number of the key questions were designed primarily to discover the potentialities of a management information system there were a number of questions which delve into the matter of structure. Responses to these questions are reported in the normal course of events in the section following, which analyzes the data in an expository fashion. Responses to the status checklist, which are concerned with the present systems application structure of the districts queried, are shown in Table 2, directly before the "summary and conclusions" section of this chapter.

Presentation of Findings

In this section the findings are presented. For convenience of the reader the format reporting the findings parallels to some extent the questionnaire format found in
Appendix A. The content of findings parallel as closely as possible the actual responses of the representatives as receiving during the interview, although editorial license has been taken by the writer to combine like statements and to remove extraneous materials. In some cases direct quotes are used.

Technical Potentialities of Management Information Systems

1. Regarding the Existence of a Management Information System in the District

All respondents indicated that they understood the concepts of a management information system but none considered themselves to be operating a full-fledged management information system. Comments in regard to this were as follows:

a) "We are working towards getting one. Our current objective is to get involved heavily. We have a PPBS system which you may call a cost benefit system. PPBS includes some of the same objectives."

b) "Simulation is part of such a system. We do simulation, such things as projecting salaries for the forthcoming year. We do not have a total system. We cannot do everything at this time."

c) "I would say we have some aspects of it. We don't have the management information system that I would like to have. We have a system that gives us a lot of information on people. It gives information about budgets, and as far as costs are concerned, but it doesn't give us this information on a timely basis. A real key to this system is to have access to data, a vast amount of it, on a demand or on call basis. We do have a number of systems that are running and we'd like to 'marry' these systems together. I need a real-time system in which information is available immediately."
"To a small degree. We are just now getting in to financial work and for the first time management has started to get monthly reports that give them information. Facts and alternatives are available but nobody at the management level has really taken the time or realized just what they could do with them, or even tried. It's like everybody is too busy running their own show and nobody has time to look at the reports."

2. The General Objectives of the Management Information Systems Used in the Districts

Answers to this question seemed to be conditioned by the fact that no district had a full-fledged system although development was, in every case, underway. Full conceptualization of objectives was not forthcoming but a number of objectives were identified:

a) To create a total information system to provide the capability of being able to react to situations that may arise.

b) To be able to identify children in difficulty.

c) To provide for interaction between data files so that relationships may be seen between discrete bits of data.

d) To enhance the total educational process.

e) To help management make the right decisions at the right time—and faster and sooner than before.

3. Outputs of the System Which are Considered to be Directed Toward Helping Managers or Administrators Make Decisions

The general tenor of the responses was that most of the present outputs were available to be used by managers for decision making—or at least this was the emphasis of
the design of the data processing systems. Table 2, which utilizes data from the Status Checklist of System Applications, provides details, in this regard, by districts. Some additional items were also mentioned where decision-aiding capabilities were claimed:

a) Class load reporting

b) Room utilization reporting.

4. Developments in Educational Data Processing or Management Information Systems which are Forthcoming

Future developments were reported by the districts on the status checklists of system applications and in the interviews. Table 2 shows a number of sub-systems that are planned for the future. Additional items were mentioned in interviews. These are listed below:

a) The establishment of a master index of students with complete historical data which is displayable either on a Vidicon Readout Unit or as a print-out.

b) The combination of certain sub files, such as payroll, wage administration, and skilled inventory file.

c) The provision of real-time or on-line access to a comprehensive file of student records.

d) The provision of data terminals in peripherally located school offices so that records in the computer center may be updated immediately.

e) Establishment of comprehensive property and equipment inventories.

f) Building and maintaining historical-type supply records.
5. Technical Concerns Regarding the Operation of the System

Respondents were asked to describe their technical concerns regarding hardware, software, technical conceptualization, and technical understanding by the EDP staff, administrators, and others. The essential nuances of the responses were reported as follows:

a) Concerns Regarding Hardware

(1) Smaller systems report no trouble with hardware except that the speed of processing is oftentimes not adequate for peak loads.

(2) It is very reliable.

(3) Cost was mentioned as a consideration although educational systems, it was noted, are given discounts.

(4) Some districts reported that they fared exceptionally well because they were located near commercial enterprises with similar equipment where they could turn for help which might be required due to machine failures.

b) Concerns Regarding Software

(1) No difficulties were reported with existent software.

(2) Only limited amounts of sophisticated programs are available to meet the problems of the schools.

(3) Computer companies emphasize their relationships to industry and problems of education suffer, from a software standpoint.

c) Technical Conceptualization

(1) Technical conceptualization by data processing staff members was considered to be good to excellent.
(2) Technical conceptualization of problems by administrators was characterized by one respondent as follows, "They're inclined to come up with the best possible solution before having thought out what the problem really is."

(3) The majority of the districts interviewed reported adequate technical conceptualization on the part of administrators.

(4) Some technical conceptualization difficulties were reported when relating to middle administrators such as principals, teachers, and others in a position of power below the topmost levels.

d) Technical Understanding. Concerns regarding technical understanding by:

(1) EDP staff

a. No extensive inadequacies were identified except in some cases personnel were hired, because of civil service regulations or because employment agency fees could not be paid, who were poorly trained. These hiring conditions were considered to be a constraint to hiring people who were properly trained. Products of civil service employment policies were mentioned frequently in a negative vein.

(2) Administrators or managers.

a. It was alleged that although many administrators make no problems regarding their levels of understanding, since they do not understand technical matters, neither can they interact creatively in problem-solving situations.

b. Technical understanding varies among and between administrators and administrative levels. This causes communication problems for the data processing employees.

c. Administrators will not follow the rules of the data processing center. They seem to be quite independent and disregard procedures of data processing even after extended experience with these methods.
(3) Technical understandings by others

a. One district reported difficulty training para-professionals to fill out data forms properly.

b. One opinion was that technical understanding is not a requirement below the principal level.

c. Two districts reported that students had poor comprehension of data processing operations before taking related course work.

d. Business education teachers do not emphasize appropriate data processing technique in classroom instruction, nor do they seem to understand that when data processing is taught that children must be taught the portions of the science that are within their ability.

6. Descriptions of Major Technical Problems

Respondents were asked to indicate to their major technical problems. In this case, answers came quickly and vehemently. The major technical problems cited were:

a) A lack of understanding of the technical environment in which the data processing operation exists, by those outside the department.

b) Educating people with "education backgrounds" to the simple technical concepts that are required so they can interact fruitfully with the data processing department.

c) Difficulties in obtaining adequate technical staff quickly. This is not a problem, however, if time is available to train personnel.

d) If there is a requirement for speed in development of new concepts major problems are focused around obtaining adequate technical staff quickly and getting reasonable early delivery on articles of hardware.
e) Administrators not being knowledgeable enough about technical matters to be able to make decisions that are required in a timely fashion.

Benefit Potentialities of Management Information Systems

7. Identification of Significant Benefits that Have Accrued to the Districts that Have Been Derived from Management Information Systems

Responses and comments were accepted whether they referred to educational data processing systems or management information systems because, as has been established previously, the operations upon which the answers could be based had to be drawn from the type of system which provided the significant benefits. A number of significant benefits were identified having genesis in both types of systems:

a) Saving a considerable amount of time in the maintenance of permanent records containing grades, attendance indications, and citizenship marks.

b) A reduction in the number of errors made by school personnel in the handling and recording of data.

c) An improvement in the speed of completion of test scoring and score processing, with the added advantage of being able to handle the large amount of data necessary to compare achievement test data with intelligence test data, and prepare summary reports with the detail required by different levels of administration and for other users.

d) A systemization of the financial reporting system that will alert those interested when funds are at danger levels in certain accounts.

e) A system of notification, in the case of payroll items, that alerts the clerk-treasurer when such expenditures are made without proper appropriations.
f) A reduction of work load for guidance counselors, who were formerly spending an excessive amount of time obtaining information from records, and for their reports, which permits them to counsel more students because of significant savings in time.

g) Reducing the problem of identifying the costs and quantities of books that are needed for different subject areas.

h) Helping counselors identify the potentials of their clients by being able to pinpoint their weak points or good points.

i) Helping buildings check for errors in their master schedules through a system of attendance reporting.

8. The Facilitation of Educational Decision-Making

There were a number of interesting responses to this query. Most of those questioned felt that improving decision-making was a prime purpose of their department, but indicated that unfortunately full utilization was not being made of this potential. A number of opinions and examples were expressed regarding the efficacy and means of currently utilizing the educational decision-making function:

a) Many superintendents don't realize that the data processing organization has the means to help him in his day-to-day problems of keeping the schools open and solving problems.

b) Testing of innovative high school schedules, on a simulation basis, has been utilized for decision purposes.

c) Salary schedules have been simulated by arbitrarily changing variables to arrive at costs under different salary structure conditions.

d) Plans are underway to project enrollments for as much as five years into the future.
e) A significant area is in regard to curriculum changes which are made due to the results of doing test item analysis for teachers.

f) The analysis of master schedules results in better utilization of teachers in instructional spaces and improved identification of facilities which are vacant and are therefore available for meeting purposes.

g) By implementing a massive testing program which scores and analyzes answer data, prepares it in an educational research format, and makes appropriate information available to different kinds of decision makers such as parents, students, and school personnel.

9. Upon Whom the Educational Decisions Impinge, Which are a Results of Outputs from Management Information Systems or Data Processing Systems

A major reason used to justify the implementation of system approaches to data and information handling has been to improve decision making. It is of interest to note whom these educational decisions affected. The respondents reported on whom they believed educational decisions, made as a result of their work, impinged.

a) Upon students. It is more difficult to change a grade or a grade card that has been processed by a data center.

b) Students have been affected because counselors make decisions that impinge directly on them.

c) Indirectly the principal has been affected in a number of ways by new techniques in educational decision-making. As an example, his position, as a power person, has been degraded since information for decision-making has in some cases been derived from centralized sources. This changes the principal's role, somewhat.
d) New modes of decision-making impinge upon teachers from the standpoint of class load, schedule, and paper work procedures that are required of them.

e) The lack of making the correct educational decision, even though the data is present, has impinged upon the taxpayers.

f) Decisions made by counselors impinge upon teachers in addition to the students.

10. The Attitude or Response of the Recipients of Educational Decisions

The attitudes and responses generated in recipients of educational decision-making appear to be somewhat nebulous in the minds of the subjects. Answers were received which would have perhaps been more pertinent to questions concerning attitudes or responses toward outputs of certain management information systems that were being utilized. This was obvious from the responses received:

a) Teachers took a negative approach to reading analysis reports. Some teachers understood these to mean that they could be categorized and rated as a result of this output. It was reported that after achieving familiarity with the report the attitudes of the teachers changed.

b) Personnel responsible for curriculum such as directors of elementary and secondary education are much appreciative of test scoring facilities and the reports that are generated. This is because these reports can provide immediate information as to students' progress.

c) There is a certain amount of disbelief over the information that has been forthcoming and therefore a feeling of disbelief about the decisions that resulted, although these decisions were made as a result of the output available.
d) Where management by objectives for students is the goal this generates negative attitudes from individuals who are concerned about only their personal building or classroom.

e) There is surprise, at the result of the findings, that education is not effective considering all the dollars that are being paid.

f) Resentment directed at administrators has been shown for making subjective decisions not based on information available from the data processing center.

11. Benefits that Have Been Received in Regard to Educational Planning

The concept of planning did not seem to loom large in the minds of the respondents. Responses were limited and a number of them referred to future considerations regarding a planning function as an appropriate mission of either a management information system or data processing system output.

a) This is an emerging concept. Some are getting the idea that help can be provided in this area but some administrators don't understand that planning can help them in their day to day problems.

b) Salaries have been projected for next year for financial planning and for negotiation purposes.

c) A system for pupil enrollment projection, utilizing a number of basic assumptions, is under development.

d) One district claims it is receiving no planning benefits.

e) Counselors can plan better for students because of improved data processing techniques that are available to them. First, major planned decisions are easier to implement using scan sheets; secondly, they now have more time to spend as planners.
f) It is possible to plan ahead for certain requirements such as the number of rooms needed, and the number of teachers needed for various subject areas. This is an assist to the personnel department.

g) It is possible to predict costs, in the future, on the basis of projected enrollments, present per pupil costs, inventory level, and equipment, overhead, and building costs.

12. Benefits that Have Accrued in Reporting to Local, State and Federal Agencies

Respondents discussed this topic from the standpoint of techniques that were beneficial to their districts directly:

a) The state is getting the same information as before but the district is not spending hundreds of hours calculating it.

b) Report cards are being prepared on the computers and mailed directly to parents. "All of a sudden some parents are getting report cards they've never gotten before."

c) Effective reporting to local, federal, or state agencies will be more of a factor in the future. The reports they receive are the same as before; benefits accrue to us in speed and accuracy of preparation.

d) The district has benefited because more consistent and accurate data is available with which to use to make reports. Translation coding is used, in the case of accounting reports, so that the local accounting system becomes adaptable to state and federal requirements.

e) Reports are more timely and accurate than they were under manual systems but even this will be improved in a management information system when data is available on-call or on-line.
The Facilitation of Educational Decision-Making in the Future

The subjects were quite future oriented, relative to their total responses, and were eager to discuss at every opportunity, their plans. In some cases they envisioned improvements in what might be termed conventional data processing operations, but in many cases they referred to the development of management information systems as a desirable, ultimate goal. They identified a number of their pending plans for future development:

a) Curriculum will be planned much more completely and accurately than has been done in the past.

b) Teaching materials will be analyzed from a number of standpoints such as age, relevance and effectiveness.

c) Curriculum will be developed that can meet national objectives, in some areas.

d) Decision-making will be much more comprehensive from accounting standpoints. Financial models are not out of the realm of possibility for school districts.

e) State agencies will provide subsidy to develop financial systems that will be part of the management information system.

f) The cost of education will be reduced through tighter inventory control of supplies and materials. Items that are dormant from a use standpoint will be identified.

g) School facility needs will be more adequately recognized and provisions will be better made to provide instructional spaces for students.

h) Vehicular scheduling programs provide better service for those that are transported.
The electorate will be able to be more significantly involved in making school decisions since better information will be available to them as to costs.

Voters will have the opportunity to vote for levies on the basis of alternatives for which there is sound data involving actual costs and benefits to be realized.

Teachers will be able to make better decisions about the effectiveness of the educational program they are supporting by having test data available when they need it.

A student will be able to pick courses more wisely because he will be able to see his particular learning profile and be able to relate it to his vocational needs and capabilities. Matching of student to job properly can reduce the ultimate cost of education to the society.

Progress in the area of sharing of information between agencies is being made. Improvements in the mediums used for transfer of information is forthcoming.

Some requirements for improvement in decision-making were noted:

(1) Improvements in the technology of the transmission of information.

(2) The development of techniques for building better master schedules and thus improving school scheduling techniques.

(3) Development of systems that integrate all aspects of the transportation function from bus maintenance to optimum route scheduling.

Conflict Potentialities of Management Information Systems

Description of "Forces" that Impede, Conflict with, or Are Detrimental to the Present or Future Use of Management Information Systems or Data Processing Systems

The locus of conflicts that occur has been conceptual-
ized for survey purposes as being basically of three types. The conflicts that occur within the data processing organization, those that arise between data processing departments with other agencies or personnel employed by the school district, and those that arise from outside the school district. Responses were requested relative to these three categories and are cited below:

a) Conflicts that Arise Within the Educational Data Processing Organization:

(1) The pride of the kinds of people that work in data processing organizations causes conflict. The resultant of this pride is manifested sometimes in jealousies between staff members who are highly motivated to complete their work and to climb within the organization. These difficulties are due to the types of people who are hired, people who are highly motivated but also somewhat high-strung.

(2) Conflicts caused by the requirement that the Civil Service organization controls hiring seems to provide less than adequate employees.

(3) Employees hired through Civil Service are hired for a particular job description. There is often a conflict between the job description and the definition of the job as seen by the site administrator. Carried to the extreme, this does not allow the use of an individual to his fullest potential and stifles the organization's effectiveness to some extent.

(4) The Civil Service does not allow for merit type increases in salary. The result is that the man who works harder may simply allow the "slacker" to work slower.

(5) The inability to find and hire adequate staff to man data processing facilities. First, there is a shortage of qualified personnel; second, salaries in the public sector generally cannot match those in industrial enterprises.
(6) Civil Service salary policies are an impediment. For example, good key punchers are lost because public school salary schedules cannot compete with those of private organizations. The problem is a question of arriving at flexible salary arrangements which allow for competitive hiring and holding.

(7) Facility considerations are a constraint. Data processing is a "come-lately." There is a general lack of storage and operating space available. Expansion and differentiation of space as required for different procedures are two major problems.

(8) There are small assignment problems, occasionally, that arise when people become used to working certain equipment and the policy is to train all personnel on all equipment.

b) Conflicts that Arise with Agencies or Personnel Outside the Data Processing Department but Within the School District.

(1) Two districts reported an absence of conflict.

(2) Relationships with older people who have been using manual methods for a number of years.

(3) Relationships with well-educated colleagues who are proud and know manual methods well but feel that procedures for preparing data for processing are trivial.

(4) Refusals by teachers to utilize data input forms because they consider it a menial task.

(5) Communication barriers arise due to the difficulty in communicating the objectives and the processes to follow in the data processing venture. Oft times this leads to impasses.

(6) A lack of training procedures in outlying school units which means that, as people leave or are reassigned, no one remains that is familiar with data processing procedures that have been used on that site in the past.

(7) A reluctance on the part of professional field personnel to attend classes on data processing.
(8) Misunderstandings with field people as a result of too little effort on the part of DP personnel to clarify requirements through written procedures and manuals.

(9) Refusals on the part of field personnel to work with data processing employees due to age disparities.

(10) The rapidity of the development of the data processing operation and the slowness of administrative figures in understanding its concepts and potentials.

c) Conflicts that Arise with Agencies or Personnel Not Employed by the District.

(1) Difficulties with the electorate—but really due to administrators who do not believe in the data and refuse to release it.

(2) Budget constraints that restrict system development, due to a cutback in state funds as a result of new state-originated financial policies.

(3) Where cooperative services are provided to other school districts, difficulties in establishing job priorities and suspicion from these cooperating districts that they are not receiving the attention their financial contribution deserves.

(4) Misunderstandings of mission and purpose when relating to outside agencies such as the North Central Association and the State Department of Education. (Examples here are requirements of the North Central Association regarding reporting certain categories of semester hours which could not be justified, and the requirement that the type of teaching certificate be listed on state reports when these certificates had originated with the agency requiring the information.)

15. Additional Factors that May Impede the Development of Educational Data Processing or Management Information Systems

Among the additional factors that may prove a detriment to systems' development are the ones highlighted
Comments made in regard to these are listed:

a) Time

(1) Time is not a problem if planning has taken place and the proper resources have been allocated.

(2) Adding new applications requires a certain slowness since absorbing necessary understandings is required both in and outside the data processing center.

(3) Constraints due to time can be minimized if the systems previously implemented in other districts can be adapted to local needs.

(4) Administrators must realize that the gestation period for a new development may be lengthy. An example would be computer assisted instruction which cannot be implemented over night.

b) Costs

(1) An expansion of the data processing endeavor into some forms of management information systems could be so costly on a single system basis that it would not be practical.

(2) Money is a consideration that must be considered in light of time requirements, availability of hardware, and adequate programming. It must all be considered together.

(3) Cost is an impediment but the computer is not the main item here. The cost constraints will be felt most sharply when the purchase of peripheral terminals and development of sophisticated programs becomes more necessary.

(4) Cost is a serious consideration but cooperation between a number of districts may ameliorate this factor to some extent.

c) Programming

(1) Programming costs can be reduced drastically by developing sharing opportunities between school districts with similar requirements.
d) Conceptualization Requirements

(1) One of the largest problems is systematizing projects for computer application. In addition to this, difficulties are experienced in getting users to think in systems terms. Both of these factors are severe constraints and are conflict producing.

(2) Conceptualization is a significant part of systems development. It is time consuming but a proper administrative atmosphere minimizes this problem.

(3) The innovation and creativeness reflected by adequate conceptualizations are usually rigidly constrained by financial considerations.

(4) A major problem is simply defining a problem. A lot of time can be wasted in this activity.

e) Quality of Personnel

(1) Quality of personnel have not impeded system development in the past but it may in the future. Good people are becoming scarce and, in addition, Civil Service requirements are making recruitment of quality employees more difficult.

(2) Small districts have difficulty affording salaries required by capable people compared to those salaries that industry and larger districts can pay. However, personnel are obtainable and in some cases seem to be better trained than previously.

f) Commitment of Personnel

(1) Generally people within the data processing organizations are highly dedicated to the operation.

(2) One of the biggest stumbling blocks is lack of commitment on the part of some of the highest administrators and other administrators under him.
16. Conflicts of Organizational Structure that Blunt the Effectiveness of a Systems Approach

There were a number of different kinds of responses in regard to this topic. These are noted below:

a) Conflicts can be minimized by taking time to explain what it is that is trying to be done and why it is being attempted instead of demanding compliance.

b) There are elements of conflict that emanate from the formal organizational structure that reduce system effectiveness. A lot of tasks could be easier if stronger support was available from the top administrator.

c) Significant barriers are set up by departmental organizations. Conflicts arise between departments and, as the data processing organization finds it necessary to relate to these departments, it seems to become party to the conflicts.

d) Conflicts of organizational structure damage the effectiveness of the systems approach. It is a question of conflict between departments and a question of priority of departments when certain decisions need to be made. Favored departments can demand that their work be completed first. This causes a problem in relations, at best, and completely upsets data processing schedules, at worst.

17. Conflicts Arising in Regard to Priority or Other Factors in Regard to the Locus of the Management Information System Activities within the E.D.P. Organization

a) Some lower level administrators such as principals have a different concept of what portion of the E.D.P. operation should get priority than does the top administration. Top administration would probably give highest priority to the management information system operation; the principals would give highest priority, as an example, to problems concerned with class scheduling. In any event, it is difficult to establish any priorities or hierarchy within an E.D.P. organization. This has been attempted and the results were
unfavorable. Guidelines, in lieu of priorities, seem to be a better solution to any difficult situations that may arise.

b) Some data processing operations set their own priorities on the basis of internal considerations involving scheduling, load, and other considerations they deem pertinent.

18. Evidence that the Development of Management Information Systems Have Been Restrained because of Fear About the Information that These Systems May Generate

Some concern has been noted in the literature for situations where employees are concerned that information that was formerly privileged, for one reason or another, may be let out. Secondly, there has been evidence of some fear that the unique powers of a management information system may produce information that will be embarrassing to the recipients and their purposes. Responses to queries in this vein are noted below:

a) Some superintendents have shown a reluctance to make certain information freely available. Considering the information in question there seems to be little basis for this.

b) There is definitely evidence that some school districts would like to repress information. There are a number of concrete examples of this. A larger restraining force, however, has been a lack of understanding as to the power of a management information system rather than fear as to the kinds of information it might generate.

c) The philosophy of some superintendents is to hold back information rather than to attempt to solve problems.

d) There is no evidence that fear restrains development.
TABLE 2
OPERATIONAL STATUS OF COMPONENTS OF MANAGEMENT IN THE DATA PROCESSING ORGANIZATIONS OF FIVE SE

<table>
<thead>
<tr>
<th>Item System Application</th>
<th>Presently Operate</th>
<th>Plan to Operate</th>
<th>Do Not Plan to Operate</th>
<th>Item System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Payroll</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>19. Computer</td>
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<td>2. Financial Accounting</td>
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<td>3</td>
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<td>20. Profiling</td>
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<td>4. Resource Allocation</td>
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<td>22. Pupil Sc</td>
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<td>a. Physical inventory</td>
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<td>b. Supply inventory</td>
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<td>b. Modul</td>
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<td>c. Staff records</td>
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<td>23. Buss Sc</td>
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<td>5. Pupil Accounting</td>
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<td>24. Projecti</td>
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<td>6. Pupil Permanent Record Maintenance</td>
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<td>2</td>
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<td>25. Provision for F</td>
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<td>7. Processing of Student Transcripts</td>
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<td>26. Provision for D</td>
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<td>8. Student Census</td>
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<td>27. Reportin</td>
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<td>9. Test Scoring (standardized)</td>
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<td>a. To loga</td>
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<td>10. Transportation Records</td>
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<td>11. Retirement Records</td>
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<td>c. To oth</td>
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<tr>
<td>12. Staff Contracts</td>
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<td>3</td>
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<td>28. Program</td>
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<td>13. Pupil &quot;Guidance&quot; Service</td>
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<td>a. Conver</td>
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<td>b. Modul</td>
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<td>c. To oth</td>
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<td>14. PERT (or other precedence diagrams)</td>
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<td>2</td>
<td>29. Program</td>
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<td>15. PPBS (Planning, Programming, Budgeting System)</td>
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<td>a. To log</td>
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<tr>
<td>16. Simulation</td>
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<td>3</td>
<td>b. To pu</td>
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<tr>
<td>17. Retrieval Systems (library or specialized)</td>
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<td>2</td>
<td>3</td>
<td>c. To oth</td>
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</tbody>
</table>

*Non-tabulated responses:
Item 4: 1-No response, 1-Not sure; Item 5: 1-High School only
### TABLE 2

**STATUS OF COMPONENTS OF MANAGEMENT INFORMATION SYSTEMS FOUND IN PROCESSING ORGANIZATIONS OF FIVE SELECTED SCHOOL DISTRICTS**

<table>
<thead>
<tr>
<th>Number Reporting Indicated Status</th>
<th>Item</th>
<th>System Application</th>
<th>Number Reporting Indicated Status</th>
</tr>
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<td>Plan to Operate</td>
<td>Do Not Plan to Operate</td>
<td>Presently Operate</td>
</tr>
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<td>Maintenance Transcripts</td>
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<td>1</td>
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<td></td>
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<td>2</td>
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<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>1</td>
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<tr>
<td>19. Computer Assisted Instruction</td>
<td>1</td>
<td>1</td>
<td>3</td>
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<tr>
<td>20. Profiling (school and community profiles)</td>
<td>1</td>
<td>1</td>
<td>3</td>
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<tr>
<td>21. Gaming</td>
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<tr>
<td>22. Pupil Scheduling</td>
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<tr>
<td>a. Conventional</td>
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<td>b. Modular</td>
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<tr>
<td>23. Buss Scheduling</td>
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<td>1</td>
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<tr>
<td>24. Projecting</td>
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<tr>
<td>a. Enrollments</td>
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<td>b. Financial</td>
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<tr>
<td>25. Provision of Real-time Data for Forecasting</td>
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<td>2</td>
<td>2</td>
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<tr>
<td>26. Provision of Real-time Data for Decision-making</td>
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<td>27. Reporting Systems</td>
<td>5</td>
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<tr>
<td>a. To local, state or federal agencies</td>
<td>5</td>
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<tr>
<td>b. To pupils (grade cards)</td>
<td>3</td>
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<td>c. To other groups</td>
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Summary and Conclusions

This chapter has described the objectives, design, and administration, and presented the findings of the interview survey of selected field sources.

The largest portion of the chapter has dealt with the presentation of findings. The reporting format used paralleled the interview questionnaire.

Findings were extracted from the extensive responses received from the subjects during the interviews. They were summarized to some extent, also. It is obvious after reading them that there was a broad range of response on most topics even after the extractive and summarization processes were completed. To summarize the findings to a further degree would be pointless, and even dangerous, since it could lead to the drawing of false conclusions.

Some general conclusions can be drawn as a result of reviewing the findings. They can be categorized as having primary significance for either the structure or the potentialities to be found in a management information system operated in a public school setting.

General Conclusions Concerning the Structure of a Management Information System

1. The representative of each district were reasonably knowledgeable about the management information system concept. They conceived of it as a total system. The major parameters of the structure, which they identified,
were integration of subsystems, interaction of subsystems, real-time access to information, and a master control potentiality.

2. All districts had system elements in operation which could be considered as potential components of a management information system. In no case were the structural parameters fully present.

3. The general tenor of the responses indicated that the present data processing system in use in each district was designed to facilitate management decision-making and reporting. However, no evidence was presented as to whether this facilitation was expressed in terms of improved decision-making and reporting or in such qualities as timeliness, reduced cost, or in increased scope.

4. All respondents desired to upgrade present data processing operations to more sophisticated levels. All mentioned projected changes in automated structure which would meet at least one parameter of a management information system in at least one subsystem. These changes were:

   a) To combine related sub-files.

   b) To establish and maintain a historical master index with real-time access capability.

   c) To establish and maintain a comprehensive master index with real-time access capability.

   d) To provide data terminals in peripheral locations for up-date and read-out purposes.
General Conclusions Concerning the Potentialities of a Management Information System

Technical Potentiality

1. Hardware, either in terms of availability or reliability, is not a concern in developing more sophisticated data processing and management information systems. A constraint is imposed in terms of cost, particularly in cases where system design requires extensive machine memory.

2. Software is available, or can be developed, to meet future challenges without technical stress. One qualification is that, to this point in time, significant program development effort on the part of computer companies has not been forthcoming.

3. Adequate technical conceptualization to meet requirements of sophisticated concepts was judged not to be a problem, either at the highest administrative levels or within the data processing staff.

4. Concern about technical understandings required to operate and relate to present systems was described with mixed opinions. Generally, no severe inadequacies were reported within the E.D.P. center. A variation in understanding by administrators was the most significant major cause of difficulty at the management level. Some existence of weakness in technical understanding were identified as causing difficulties when para-professional and teachers related to technical problems.
5. The major technical problems were involved with (1) relating the technical requirements of the system to users in the field, and (2) obtaining adequate technical staff and early hardware delivery in cases where system development must be expedited.

Benefit Potentiality

1. A large measure of the benefit identified was found in the management of the educational affairs of students. This includes: (1) test scoring, interrelating, and summarizing for varied users, (2) improving guidance activities by improvement in identification of qualities of students, implementing workable schedule changes, and time savings for counselors, and (3) saving time and reducing errors in maintenance of student records.

2. Business operations have been improved through a systemization of financial reporting that will alert personnel when certain funds are at danger levels or when certain expenditures are made without proper appropriation.

3. Significant changes in curriculum are foreseeable because of the capability of doing test item analysis for teachers.

4. Using simulation techniques to analyze and test high school schedules result in improved decisions regarding schedule problems, utilization of teachers, and assignment of spaces.
5. Educational planning in the broad scope is still under development. Specific items mentioned as under development involved comprehensive facility planning, long-term enrollment projections, and financial modeling involving a number of variables.

6. Reporting to other agencies has benefited because more consistent and accurate data is available. These benefits have accrued to the district as time savings.

7. Report cards prepared by computer are a valuable data source and are processible for mail delivery.

8. In regard to facilitating educational decisions in the future, through the medium of management information systems, the school representatives identified eight areas of predicted impact, frequently. These were: (1) curriculum planning, (2) financial accounting, (3) inventory management, (4) vehicular scheduling and service costing, (5) guidance services, (6) sharing information with outside agencies, (7) cost-benefit programs, and (8) public relations.

Conflict Potentiality

1. Impediments within Educational Data Processing Organizations often center around difficulties in recruiting desirable personnel. This difficulty is the result of the inability of some districts to compete with industrial counterparts and the requirement that Civil Service channels must be used for hiring.
2. Forces that impede or are detrimental to the E.D.P. center as it relates to school employees outside its department are as follows:

a) Difficulties in motivating people to utilize the required data input procedures.
b) Communication problems resulting from the necessity of clearly transmitting instructions.
c) Lack of adequate training of field users coupled with variations in training levels.
d) The slowness of administrative figures in understanding rapidly developing operations.
e) Inadequate effort on the part of data processing personnel in providing clear instructions.

3. Conflicts that arise with agencies or personnel not employed by the districts arise from:

a) Inadequate financing due to bond issue failures and changes in state support programs.
b) Priority concerns of other districts linked in cooperative ventures.
c) Reporting requirements of other agencies which are considered to be unjustifiable.

4. Miscellaneous factors that may impede the development of new systems may result from:

a) Unrealistic time allotments for development.
b) Adding new applications before the clientele is capable of acceptance.
c) Excessive costs incurred due to unique hardware, exotic programs that have not been used elsewhere, and time pressure.

5. One of the most difficult problems that impedes systems development is the requirement that new projects must be adequately systematized to be effective. The most noteworthy constraints to this are inadequate definitions of the problems and financial considerations.

6. High quality E.D.P. personnel have been available to the schools in the past. Good people may be more difficult to recruit in the future because of shortages and Civil Service requirements.

7. Administrators, at all levels, have been frequently mentioned as being an impediment to system development.

8. Some elements of conflict with E.D.P. purposes were identified as emanating from organizational structure. Major difficulties seemed to be a result of barriers between departments, and attempts to impose data processing priorities.

9. Questions of operating priority within data processing installations are difficult ones because of pressures exerted by outsiders with vested interests in certain subsystems. Choices of priority are not easy to arrive at by the data processing department.
10. There is very little evidence that fear of the unique powers of management information systems has restrained their development.
CHAPTER IV

THE DEVELOPMENT OF A PROTOTYPE OF
A MANAGEMENT INFORMATION SYSTEM

Purposes of the Chapter

The general purposes of this chapter are to develop and describe a prototypic management information system suitable for a public school setting and to present, at its close, the major conclusions of the entire study, the limitations of the study, and suggestions for further research.

The first and larger portion of the chapter is devoted to the description and development of the structure of a management information system that can be considered somewhat generalizable and which contains the operational potential suitable for the needs of educational managers.

The word "prototype" is used in this chapter to describe the structure under study which is being developed in a form comparable with previous models and examples, primarily found in industrial and commercial settings. Development infers the explicating of the structure from lower to higher degrees of organization and concurrently identifying the related concepts, processes, and components.
Materials and Methods

The major inputs to this chapter have been drawn from the literature survey and the interviews. Additional sources have been used which provided information concerned with the process of system development and technical possibilities. The integration of the material has provided the basis for the development of the management information system structure which follows.

Rationale for the Development of the Prototypic Structure

School systems do not exist as carbon copies of each other. They are managed by men who have differing sets of values, serve students with disparate needs and abilities, utilize teachers with varied talents and commitments, are found in communities with a multitude of expectations, and command resources that vary greatly in range. There is a staggering amount of variability reflected in the previous statement. It would be illogical to expect that any particular kind of management information system would, in fact, be generalizable to school organizations which serve this degree of potential variation. What follows, however, in light of this variability, is that a final and detailed system structure must be tailored to the total needs and resources that are found in the particular situation encountered.
The writer believes that a case can be made that even with all the variability that exists between districts, certain processes and information requirements can be identified as being basically similar and amenable to handling through the use of systematic approaches. What is being developed in this study is not a final system. It is a prototypic structure, reflecting a general systematic approach, containing operational elements that previous findings of the study have indicated are typical of the needs of educational managers.

Some will question the definition of the word "manager." To forestall misunderstandings, the writer defines a manager as any person who engages in a management task. Engaging in a management task is considered to be planning, organizing, directing or controlling activity. Obviously, under this definition a teacher planning for students and a school bus supervisor organizing bus schedules are considered to be managing—right along with the superintendent.

The scope, comprehensivity, or pervasiveness of management information system activities may reasonably be expected to vary from district to district for many reasons. It is not likely that a prototype will spawn exact duplicates of itself. Resource limitations and differing needs might be reasons for this. The writer can think of no justification for requiring a particular level or complexity
of information system operation before the M.I.S. level can be applied. However, there seems to be ample reason to develop a relatively comprehensive system for a prototype. Therefore the developed prototype will meet Hallgren's definition as being:

... a completely integrated, computer based, system of data gathering, data storage, data retrieval and information communication to all levels of management. It requires a multidimensional approach to data acquisition so that information will enter the system once in a form acceptable and responsive to the requirements of different managers for completely different purposes.¹

The actual boundary or limits of operation will be essentially those of the school district, except that input and output tentacles will occasionally cross this boundary.

Although strategies may vary,² the major development phase of an information system normally terminates with the creation and final integration of physical entities such as building facilities, computers, programs, operative personnel, and communications and miscellaneous equipment.³ However, the development in this chapter will terminate after the establishment of requirements of the system, the description of the design of the prototype, and after


³Ibid., p. 67.
integrative methods have been used to establish the basic structure and to make the operating potential as clear as possible.

Hazards Present in the Development of a Valid Information System

It would be unrealistic not to note to the reader at this point that certain hazards are present that may make the development of a valid information system a difficult enterprise. These should be understood before progressing into more detailed conceptualization.

Previous materials have clearly indicated that a prime objective of such a system is the decision aiding mission. Secondly, data is to be absorbed and processed to form information outputs. These missions generate certain hazards for the system. The largest hazard is probably posed by the possibility of underdeveloping the model, as mentioned by Hartley.\(^4\) There are a number of reasons for this. The most obvious is that an educational M.I.S. usually must fit a complex school system operation. An operation is normally difficult to define when other than simple tasks are at issue. This has been highlighted by Mager\(^5\) who has convincingly demonstrated that describing even simple objectives, in what he calls behavioral terms,


is difficult. Mager's position, though recent, was not original. Bridgman, early in this century, reported that some concepts, though seemingly logical, may be meaningless. The test is whether or not operations may be found to describe them. If one accepts that a M.I.S. is a concept of a system then operations must be found to describe it. When one considers that Shannon and Weaver, researchers in communication theory, have been unable to describe "information" operationally then it follows that a system may not be designable which adequately fits actual information requirements.

The parameters surrounding the act of decision-making may also pose dilemmas in information system design. Obviously an information system exists for some purpose. A major stated purpose is to aid in and improve decision-making. But improved information may not be the panacea that will remediate current decision-making dilemmas. Saloma has stated this very well in regard to political decisions involving public policy:

There are limitations (to decision making) that go well beyond information.

The problem of values. ... it is clear that the central problem of politics is one of values, not information. Decision making involves values at all

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stages. Choice activity, especially, requires value criteria for decisions.

It may be possible at certain program levels to compare alternatives and choose a more efficient means for achieving an agreed-upon objective such as disease control. . . . But can improved information help a decision maker weigh dissimilar program alternatives such as an antiballistic missile system or a domestic Marshall plan. . . ? Only insofar as such information gives the President . . . better understanding of what X million dollars allocated to program A or B will actually buy in benefits. In government, budgeting is a political activity, and the problem of choice or allocation ultimately remains one of values.

The act of "reformatting" data in numerous ways to provide different kinds of information has been previously mentioned as a desirable function of a management information system. Comparisons, for example, can be made. The function then becomes analytical. The complexity of certain decision-making situations may require the consideration and interaction of a large number of variables through complex analysis. The structure of the information system is challenged at this point but the effects of the imponderable human element may be the most important quality by far in the decision making process. Saloma said:

. . . Data must be structured or organized before it becomes meaningful. Predetermined data structures can help, but the decision maker himself must constantly synthesize knowledge in an interdisciplinary fashion. He must interpret, project, and interconnect fragmented information. The political decision maker has a natural tendency to select and

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adapt information and to screen out that which is "politically undigestable."

In a decision making environment where resources are relative plentiful and where the decision maker has the analytical and information-processing capabilities to structure in advance innumerable alternative solutions, the value perspective of the decision maker will become increasingly important.9

Downs has critiqued the potentialities claimed by "urban information system" enthusiasts. He questions "the intuitively plausible but actually misleading assumption that better data in urban decision-making would have huge final payoffs, because . . . better information would reduce both the frequency and magnitude of planning mistakes." He has argued that three factors make it difficult to prove that better data will lead to more effective decisions. These are: (1) difficulty in measuring the effectiveness of decisions, (2) variances in effects caused by factors other than data inputs, and (3) the problem of whose values to use in calculating payoffs. He also infers that large investments in information systems may be required to make what will "probably seem like only marginal gains in final payoffs."10

These points are quite pertinent for educators who work directly with the implementation of public policy, make decisions committing extensive resources to its

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9Ibid., p. 228.

implementation, and who are, at least psychologically, "failure-ridden." There has been the hope, exhibited in some school districts, that systematic approaches to decision making and problem solving may provide substantial improvements in the various kinds of educational operations. But the points noted above must be soberly considered. For it is possible that expectations of management information systems may be held too high. Certainly the design of such systems must be undertaken with these considerations in mind. A trite system design promising significant benefits, without proper qualification, may do an extensive amount of damage to a bedrock institution—when it is unable to deliver.

Saloma has sensed this conflict between the benefits and hazards of developing valid systematic approaches to facilitate decision making. His summary of the situation and his rationale are as follows:

... the combined and cumulative impact of the new information technology suggests some radical changes in the environment of governmental decision making. The shift will be from a negative to a positive orientation toward problem solving. The incrementalist's view that "public policy problems are too complex to be well understood, too complex to be mastered" and that decision makers develop "a strategy to cope with problems, not to solve them" will be replaced with a more optimistic perspective. The decision maker will have analytical techniques and information-processing capabilities that will give him new understanding of governmental and social systems and confidence that he can manipulate and control them. When the incrementalists have rejected "the impossible prescription to be comprehensive" in favor of a more
manageable strategy of "outright neglect," the new information technology will enable the decision maker to develop a more rational and aggressive strategy of problem solving. The distinction is fundamental.\footnote{Saloma, op. cit., pp. 231-232.}

The hazards should be kept in mind, conditioned by Saloma's optimism, as the more specific structural development that follows is viewed.

**Sequential Phases of System Development**

The orderly development of a management information system must obviously be planned. It must be systematic so that the completion of the system can be envisioned as the final step in a step-wise process. It must be categorized into sequences of like kinds of development so that the proper planning resources may be applied at the appropriate times and places. The entire process must be flexible enough to provide for changes to be made in the work that may already be completed due to the emergence of new considerations, ideas and constraints. The total development scheme must be understandable and logical to those who will implement it. These are the challenges that face those who would develop a management information system.

Rosove has said that the development of an information system must pass through what he calls five phases in its life history. They are:
He notes that there are a number of qualities to their proper usage. These qualities are demonstrated in Figure 1.

![Diagram of Development Phases]

**Fig. 1.**—The Sequence of Development Phases (from Perry E. Rosove, *Developing Computer-Based Information Systems*, p. 18).

Note that there is a temporal relationship with "Requirements," for example, being developed before "Operations." There is also an overlap between phases which notes concurrent development activities. A feedback loop indicates the continual iteration of and modification of previous phases in the sequence. Generally speaking, the goals of each phase may be defined as follows:

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1. Requirements—The establishing of the characteristics which the system or one of its elements should possess if the system is to accomplish a given objective.

2. Design—The transformation of system requirements into system tasks and system elements leading to a flow diagram of the overall system design process. Final design effort is shown as a document consisting of many kinds of presentations.

3. Production—The design of computer programs necessary to support the information system. This also includes many housekeeping chores in regard to programs such as testing and coding.

4. Installation—The period of time in which the physical components of the system are placed in their operational environment and are readied for operational responsibility. Equipment, programs, and personnel are brought together.

5. Operations—The actual operation of the management information system. Initially, many changes may be required which may be reflected in the necessity to recycle any or all of the previous phases.13

In the actual development of an information system in the field it would be necessary to complete, in sequence, all the phases mentioned above. In addition, much recycling within and between phases would have to be engaged in to optimize the system. However, the major essence of the information system, from a descriptive format, is found at the completion of the design phase. It is here that the tentative system is documented.

The first two phases, "requirements" and "design," will be used in this chapter as a basic part of the

structure in developing the prototype of a management information suitable for a public school setting.

**Description of System Requirements**

As noted previously, the "requirements" phase of the development effort is to ascertain what the management information system is to do. This identifies the broad parameters of the problem and must precede the actual design. The question of how it is to operation, in detail, is handled beginning in the actual "design" phase and is a concern all the way through to the "operations" phase.

Rosove has mentioned some typical questions that may be asked in the "requirements" phase. These are reproduced below. The writer has supplied brief answers appropriate to the management information system which is under development. These answers are primarily derived from the findings of the interview survey.

1. **Why is the system needed?** The present methods used to provide information in the school district are slow, inaccurate, incomplete, expensive, and are not tapping all the data sources that are available.

2. **What is its purpose or purposes?** Its purposes generally are to utilize all local sources of data that are reasonably available, utilize some external sources of data, provide reasonably quick access to the data, reformat it in a form usable by managers for decision making, and to provide the means to prepare reports on a local, state, and national basis.

3. **What is it supposed to do?** It is supposed to operate rapidly and flexibly, to check for errors of

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14Ibid., p. 67.
input and output, monitor its own capabilities, store data in data banks, maintain security of certain data, respond to priority statements, and be capable of utilizing varied input and output formats.

4. What problems is it supposed to solve? Its major problem is to be able to provide information in a form that is suitable to managers who need to make a wide variety of educational decisions. Additional problems it is to solve are the preparing of reports in formats required by inside and outside agencies, monitoring scheduled input-output dates, and completing all routine data processing activities while it extracts pertinent data or information for its data banks.

The answers to these questions are not sufficient to completely define the system being developed. However, they define the general aspects and provide the starting point for further conceptualization.

Concurrently with the development of general requirements is the need to develop a strategy for the implementation of the system. This is a required input into the next phase, the design phase, and is appropriately considered during the requirements phase. A number of strategies, with a large number of variations, are available. Essentially, for clearer understanding, Rosove believes they may be dichotomized as follows:

1. Should the entire system be designed at one time as a total system, or should it be designed in a series of iterations each one of which would result in a more sophisticated and complete operational configuration?

2. Should the new system be designed upon the basis of the old system via an inductive approach, or should a completely new system be built by using a deductive approach?\(^{15}\)

\(^{15}\)Ibid., p. 80.
It has been pointed out previously that a great amount of variability among school districts exists in regard to resources, style of management and needs. Further, there seems to be, as noted during the interview survey, a large range in the sophistication of the data processing operations visited. From a practical standpoint it seems reasonable to suggest a generalized strategy which can best build upon these variabilities. Such a strategy is outlined by Rosove:

A Combined Strategy: Planned Evolution. Planned evolution is defined as an approach to system development in which a fully integrated system concept is created with a plan whereby the integrated system will be attained in a series of stages through a process of development iteration. In this approach, a study is conducted on an organization-wide or corporate-wide basis to determine which functions should be automated. The implementation of the initial stage of the system is based upon a selection of certain functions which are assigned priority. The first stage of the system, or the "initial operational capability" tends to be regarded as a prototype or experimental model, although it can be used for operations. Through experimentation and operational experience, successive stages of the system are designed and produced, each stage representing an addition to and an improvement upon its predecessors.16

The suggested use of this strategy does not infer the rejection of all other strategies. It is recognized that the choice of strategy belongs to management and it should be chosen on the basis of optimizing information system development in the environment in which the development must take place.

16 Ibid., pp. 89-90.
The final point to be noted is that before the development of a management information system can enter the second phase, the design phase, the broad system requirements must have been identified and the development strategy must have been arrived at. In this section the requirements of the system under study have been listed and a strategy has been suggested. In the next phase the actual design of the system is undertaken.

**Steps Taken in the Design of the Prototypic System**

It is necessary to provide a framework or series of steps upon which the development of a management information system may be organized. It was noted previously that the design phase of the system development begins where the establishment of broad system requirements leaves off and concludes with a design document which is an actual description of the prototypic management information system. In an actual development situation in the field, this document would be further modified by feedback, or results of recycling the design phase, brought about by findings and adjustments made in the production, installation, and operations phases. However, for practical purposes it is the writer's intention to complete the development and description of the management information system under study at the close of the design phase when, what might be called the tentative system, is documented.
Presentation of a Model of Steps in the Design Process

In order to develop and describe the prototype of a management information system for a public school setting most clearly it seems to the writer to be most advantageous to provide a flow chart which relates the process to the actual situation under study. Therefore such a flow chart outlining the steps in the process has been devised. The plan is to discuss the steps in the process and concurrently describe the inputs to the development that are related to a management information system suitable for a public school setting. The final step in the process will conceptualize the system in finality by summarizing the steps in development and by summarizing the description of the system.

Rosove has considered the system design phase as being broken down into a number of more or less discrete design processes. His flow chart for the entire design phase is shown in Figure 2. The flow chart, Figure 3, has been derived from Rosove's work and embodies many of his concepts in regard to the discrete steps shown and their relationship to each other. His conceptualization seems to be an adequate base upon which to build and portray the development and the description of the prototypic management information system.
Fig. 2.—A Representation of the System Design Process (from Perry E. Rosove, Development Computer-Based Information Systems, p. 96).
Rosove has noted, and indication is made on his chart, that a continual feedback or recycling process takes place in the design phase. It is not the intention to violate these concepts in the author's flow chart. Rather, the flow chart attempts to demonstrate the major segments in the design process and the major flow of the development (Blocks 1 through 7) leading to the description of the prototype (Block 8).

Discussion of each block and the concurrent development of the prototype

In this section of the chapter the blocks in the flow chart are sequentially discussed. Concurrently the
inputs, appropriate to the specific blocks, for the educational management information are inserted.

Block 1. Feasibility Study

This is the first block in the flow chart of steps in the design process (Figure 3). It is a set of general statements that in effect present the opinion of the investigator about whether the work envisioned can be usefully accomplished. It may also allude to the general types of services the user expects to obtain from the system.\(^{17}\) The question of strategy, developed previously, may be an input at this point and condition the output of this block.

An assumption was made earlier in this investigation that the development of a management information system suitable for public school settings was desirable. Findings and conclusions of Chapters II and III also indicate that under some conditions this is feasible. Therefore the discussion of the next block in the sequence is in order.

Block 2. Format of the Design Document

Rosove has said that usually the results of the design effort are presented to the user in the form of a document containing prose, diagrams, tables, mathematical equations, and other modes of presentation. The format for this document must be presented in advance. He believes

\(^{17}\text{Ibid.}, p. 103.\)
that the two things that all formats should have in common are agreements on vocabulary between the receiver of the system and the designer so that communication problems may be reduced in all stages of development and a rationale for the system from which the design was worked out.18

In the case of this development of a management information for educators, vocabulary development was presented in Chapter I. A rationale for the development was discussed at the beginning of this chapter. The format of the design document, consisting of closing portions of the chapter, will consist of integrating the various elements of the design by means of a summary chart. This will visually incorporate the various design processes. Previous to this, and to provide clarity, highlights of the entire development process will be reviewed and summarized by means of a similar visual presentation. Discussion is part of the format and will accompany the summaries.

Block 3. Identification of System Elements

The "system element identification block" lists the system elements that are eventually to be specified in detail in the design document. This block, coupled with the "general requirements phase" and the format block are important initiators of the design process. Together they

18 Ibid., p. 104.
define the general parameters that must be considered as the process unfolds. Rosove has identified seven system elements. These are briefly described below:

1. Data element—Those elements of the system which are eventually transformed into information.

2. Personnel element—Generally this includes the people who will operate the system.

3. Display element—This refers to any presentation of data to people by means of equipment.

4. Equipment element—Such elements are composed of engineered units, the physical devices through which all data flow.

5. Learning element—A rather abstract element concerning a capability for operational evaluation and recording of internal events.

6. Retrieval element—A discrete set of programs, a unique language for man-machine communication, and special hardware to mediate requests from the human operator to the program system.

7. Programming element—This element refers to the need to consider all of the programming needs of the system during design.\(^{19}\)

These system elements will be considered again in the design process in blocks six and seven. At that time more will be known about the unique attributes that would be required of the elements. At this time the elements have essentially been established as "raw material" for the forthcoming system design process.

\(^{19}\)Ibid., pp. 105-116.
Block 4. User Requirements

The user requirements at this point in system development are usually specified in broad terms, at least in relationship to the system task specifications that follow in the next block. In this block the objectives for the educational management information system are in part specified as:

1. To communicate to points within and without the system.

2. To process data received from within and without the system.

3. To control the internal environment of the school system and its resources.

4. To establish a system design based upon the input, processing, and output requirements of an administrative organization built upon eight general task areas. These task areas are labeled:

   a. Finance
   b. Staff personnel
   c. Student personnel
   d. Plant
   e. Instruction
   f. Business
   g. Planning
   h. Community relations

This statement of objectives permits the design effort to continue to the next step by providing the initial perception of the magnitude of the management information system under development.

Block 5. System Task Requirements

In this block the task requirements of the educational information system are spelled out in detail. A large and additional mission of Block Five is to represent the data flow for each task and to trace it from entry to
exit, through all the processing and storage steps. Additionally, a composite would normally be built representing the data flow for all the tasks. The complete specification of system tasks, data flow, and composite building is not realistic in this study due to the extensive detail required.

A large number of tasks must be performed by the prototypic management information system. A number of them have been identified as desirable from the findings in the interview survey and the literature. Key phrases are shown to define tasks or task areas. Because many of these areas are general in nature they would overlap each other in a number of ways. The system must be capable of handling the tasks or task areas related to:

1. Information retrieval
2. Simulation routines
3. Personnel accounting
4. Financial accounting
5. Check writing
6. Student scheduling
7. Controlling physical resources
8. Guidance services
9. Facility inventories
10. Student accounting
11. Staff scheduling
12. Facility scheduling
13. Payroll preparation
14. Grade card preparation
15. Student testing
16. Permanent record maintenance
17. Transcript processing
18. District census processing
19. Transportation record keeping
20. Bus scheduling
21. Controlling of Planning, Programming, Budgeting Systems
22. Preparation of varied profiles
23. Game playing
24. Projecting needs
25. Preparing miscellaneous reports
26. Aiding in research
27. Monitoring functions
28. Public relations

Rosove has indicated that there is also a need to establish conceptually broad statements of system tasks in this block to make the job of subsequent analysis easier,
particularly in regard to the overlapping of tasks. They are as follows:

1. Planning to obtain resources
2. Planning use of resources
3. Assessing the environment
4. Assessing one's own resources
5. Manipulating one's own resources
6. Assessing system status
7. Changing system status
8. Interfacing with other systems
9. Surviving—protecting the system's capability

It was previously shown that the prototypic structure of the management information system results essentially from the kinds and relationships of operational elements that are contained within it and the tasks to be done. These elements are chosen as a result of the kinds of tasks that the system must perform. Thus, the task requirements must be known to approach a specific description of the system.

The tasks also define the different areas of educational endeavor with which the system will be concerned. This helps define the scope of the effort by relating the work to the various administrative task areas noted in Block Four.

Merely listing the tasks does not, however, define the capabilities of the system. The description of capability is a major input to this study in describing the prototypic system—but it is more appropriately inserted

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20Ibid., p. 121.
after the task areas are presented and before the system in
the aggregate is presented. One facet of capability will be
demonstrated through the medium of the administrative task
areas.

Many of the tasks or task areas mentioned are found
in conventional data processing systems. Conventional data
processing systems in the public schools visited perform
tasks that are information-producing and decision-aiding.
They generally, however, lack two parameters. They are not
completely integrated nor are they generally comprehensive
in scope.

Block 6. System Element Requirements

The system task requirements defined in the previous
block would have generated the need for particular elements
had the data involved been completely traced through the
processing steps. The expectation of the utilization of
certain elements was presented in Block Three. Therefore,
in this block each element is designed from the standpoints
of the characteristic actions called for and the total
amount of the data it is required to handle. Certain addi­tional mechanisms and procedures are also required and are
specified for activating the elements to accomplish the
system tasks. The actual specification of what Rosove
calls "enabling mechanisms" (equipment, computer programs,
procedures) cannot be stated until all the requirements for
every element have been obtained. After this point the ideal requirement for system elements may be specified.

Block 7. Integration of System Elements

Block Seven rationalizes, in a sense, the ideal requirements for system elements that were established in Block Six. In that previous step the ideal requirements were generated in a rather isolated fashion from the standpoints of fairly discrete system tasks. At this stage of system development the discrete element requirements must be integrated into an economical yet workable system—oriented toward practical application within the operation of the system as a whole. Rosove provides an example in which elements of display, data, personnel and architecture must be integrated. In his example the designer must concurrently rationalize: (1) the number of display interfaces, (2) size of the display data, (3) the number of data to be displayed simultaneously, (4) the number of people requiring access, and (5) the size and configuration of the physical area available.

While the integration of system elements has not been undertaken for the educational management information system, due to practical considerations, it is well for the reader to consider its potential ramifications for actual system development and description.

\[21\text{Ibid.}, \ p. \ 128.\]
Block 8. Writing the Design Document

The last step in the design phase of the management information, as noted on the flow chart in Figure 3, is the production of the design document. Rosove says it contains the official statement of what the system is going to be. In review, it should be remembered that Block Two established the format for this document. The format statement noted that the design document would provide a description of the system which would consist of the integration of materials presented in the various steps proceeding it, in the "requirements phase," and the steps that followed in the "design phase." To improve the clarity of the design and description it was said that the development process would be summarized immediately beforehand.

It was noted in Block Four and Block Five that general user requirements and system task requirements are related to what may be considered, in educational organizations, as general administrative or management task areas. These general task areas, or variants of them, have fairly well defined the formal management organization found in the larger school districts. Thus, they become handy vehicles for describing and developing aspects of management information systems. An opportunity to improve the design document, in the eyes of readers from the field of education,

22Ibid., p. 130.
is present because of the possibility of using these general task areas as a means of providing different kinds of examples of operative capabilities. There also seems to the writer to be the need to describe some general capabilities of the system from the standpoint of data flow through its inputs, processing steps, and outputs. Some general and specially unique capabilities should also be mentioned. These steps in description are necessary since it was not realistic to provide detailed system task specification in Block Five. Since a presentation of capabilities will add information to the design document, the presentation of Block Eight, as a step in the design phase, is concluded at this time. Block Eight, as a design document will be re-explored, after the presentation of capabilities, when the management information system in the aggregate is portrayed.

**Descriptions of Some Capabilities of the Prototypic Management Information System**

The presentation of the capabilities that follow is an attempt to add to the description of a management information system for educators. Hopefully it becomes more understandable because of them. Again there is a problem of how much detail should be presented. The descriptions of desirable capabilities, which can be inferred from the literature review and the survey, would require hundreds of pages to present in every detail. In order to condense these to manageable length the major capabilities that the
Global Capabilities of Sequence and General Characteristics

Input Capabilities

Data or instructions that are collected external to the system can enter the system in the form of punched cards, punched tape, magnetic type, or as outputs from optical scanners, digitized telephones, and sensor devices of external terminals.

These inputs may consist of data that have been generated locally, such as pupil schedule requests, or at some distance, such as national testing norms. They may be periodic, such as attendance reports, or aperiodic such as records of newly purchased equipment. Instructions may request the implementation of programs to cause the processing of data for reporting, decision making, or a number of other system responses. These instructions are the basic
controlling mechanism of the system. Because they control the implementation of programs, and may actually trigger part or all of the program mix, they provide flexibility to the operation of the system. These instructions are also the means to interface man and machine. They may be accompanied by data or may utilize equipment data banks.

Data and/or instructions are converted at the point of system origination into the proper format for the processing steps that follow and are transmitted for usage.

**Processing Capabilities**

Data processing steps take place in the process phase. Specific instructions implement programs which cause data to be handled by processes in specific ways. The manipulation of data through instructions to implement selected programs provides the output of the system. Internal changes in the system may take place, also, which may cause later changes in output. For instance, data banks may be updated and programs may be added or changed.

Very flexible and complete processing capabilities are provided in the processing phase of the prototype system. Essentially, the data to be utilized are selected and processed by a combination of the capabilities existing within the elements of the system. Control of the processing is exercised by the
computer with the help of its own executive programs, and according to received instructions.

The computer is capable of providing and exercising sophisticated control procedures for the entire system. For instance, it may establish task priority through a selection process, it provides a time-sharing potential for a large number of tasks, it chooses programs for the regular system functioning, and it monitors the total system on a long-term basis. Its internal processes are controlled by its own executive programs and it can integrate and optimize system performance.

The major capability of the processing phase of the prototypic management information system is the ability to integrate a complex data gathering, processing, and dissemination operation to satisfy a number of different task and system requirements.

**Output Capabilities**

The system is capable of providing a number of different kinds of outputs via a number of mediums. It can provide periodic reports for local, state and national requirements. These may be formatted as typed reports, magnetic tape, punched-cards, or images on a vidicon tube. Aperiodic reports may be produced in the same way.
**General System Capabilities**

Remote terminals are easily accessible to managers. The tasks undertaken by the system are assigned priority codes. These codes may be quickly reassigned to meet crisis conditions. High priority codes provide real-time or on-line capability. Tasks with lower priority codes may be delayed.

Outputs from the system are controlled by restriction codes in order to provide security protection for some information.

Normal data processing operations operate within the framework of the management information system. The same data may be used to perform a number of different tasks.

Data banks and programs are duplicated periodically for archival purposes, and to protect against accidental destruction of the system.

Programs that have been devised to provide management with answers to queries, periodic reports, and aperiodic reports are stored and are immediately available to the computer.

The total information system is "set-up" in an automated fashion, upon receipt of instructions to provide certain information or to perform a tasks, by the computer. Constraints to this are the priority code, the security code, and data sufficiency. These constraints are applied by supervisory or executive programs of the computer.
attempts to explore "capability" from the standpoints of commonly accepted administrative task areas. As noted in Block Eight of the system development process, general user requirements and specific system task requirements are related to what may be considered, by public school organizations, as general administrative or management task areas. These lists of task areas or variations of them, have often been used to define formal management organization in larger school districts. They, therefore, become potential vehicles for describing operational aspects of educational information systems. Certainly there are limitations to their utility in this regard since the formal organization of a school district may have little resemblance to its actual informal organization. Still, the task areas may be tangible representations in some cases and the concepts are familiar to most educators. Herein lies their value in this case.

Figure 4 is an illustration of a chart showing a number of system tasks appropriate to a management information system. They are categorized by administrative task areas. These administrative task areas were chosen by the writer to represent commonly accepted ones. No doubt some could be combined or segmented further. Some overlap others. The "business" and "planning" areas are examples where this overlap may be readily seen. However, there are variations in the way that school systems fragment their general administrative structure. Thus, it seemed most
<table>
<thead>
<tr>
<th>Finance</th>
<th>Staff Personnel</th>
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<tbody>
<tr>
<td>Financial Accounting</td>
<td>Maintenance of Retirement</td>
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<tr>
<td>Financial Bookkeeping</td>
<td>Records</td>
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<tr>
<td>Financial Analysis and</td>
<td>Preparation of Staff Contracts</td>
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<tr>
<td>Statistics</td>
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<tr>
<td>Payroll Preparation</td>
<td>Preparing Staff Schedules</td>
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<td>Financial Transaction</td>
<td>Staff Recruitment</td>
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<td>Control</td>
<td>Maintenance of Staff Records</td>
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<tr>
<td>Internal Auditing</td>
<td>Projecting Staff Requirements</td>
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</table>

Fig. 4.—Typical Tasks Appropriate to a
Categorized by Administrative 1
<table>
<thead>
<tr>
<th>Staff Personnel</th>
<th>Student Personnel</th>
<th>Plant</th>
<th>Instruction</th>
<th>Business</th>
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<tr>
<td>Maintenance of Retirement Records</td>
<td>Pupil Accounting</td>
<td>Control of Plant Construction</td>
<td>Test Scoring</td>
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<tr>
<td>Preparation of Staff Contracts</td>
<td>Permanent Record Maintenance</td>
<td>Control of Supply and Equipment Inventory</td>
<td>Modular Scheduling</td>
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<td>Preparing Staff Schedules</td>
<td>Student Admissions</td>
<td>Maintenance Scheduling</td>
<td>Grade Card Preparation</td>
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<td>Staff Recruitment</td>
<td>Transcript Processing</td>
<td>Control of Facility Usage</td>
<td>Instructional Evaluation</td>
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<tr>
<td>Maintenance of Staff Records</td>
<td>Student Census</td>
<td>Facility Scheduling</td>
<td>Library Retrieval</td>
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<tr>
<td>Projecting Staff Requirements</td>
<td>Student Data</td>
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<td>Guidance Service</td>
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<tr>
<td>Assignment of Staff</td>
<td>Student Transfers</td>
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<td>Making Instructional Decisions</td>
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<td>Student Profiles</td>
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</tbody>
</table>

General Tasks Appropriate to a Management Information System categorized by Administrative Task Areas.
<table>
<thead>
<tr>
<th>Instruction</th>
<th>Business</th>
<th>Planning</th>
<th>Community Relations</th>
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<td>Scheduling</td>
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<td>Grade Card</td>
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<td>Preparation</td>
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<td>Retrieval</td>
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<td>Instructional</td>
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<td>Purchasing and</td>
<td>Enrollment Projections</td>
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<td>Educational Specifications for new Buildings</td>
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<td>General Plant Utilization</td>
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<td>School District Profile Usage</td>
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<td>Provision of Educational Information on Request</td>
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<td>Historical Maintenance of Voting Records</td>
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<td>Administration and Analysis of Public Opinion Devices</td>
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<td>Scheduling of Community Contacts</td>
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<td>Maintenance of Political Interaction Programs</td>
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advantageous to construct the chart in the detail that is shown. The specific system tasks are derived in part from data in Block Five. The combination of the administrative task areas and the listed specific system tasks provide the genesis of the charts that follow.

Figures 5 through 12 portray the operative capabilities of the specific system tasks, within the framework of the management information system, as they relate to the general administrative task areas. Each figure presents a different task area. Within each figure the presentation identifies the task area and lists examples of tasks appropriate to the task area. These task are identified as "subsystem capabilities" to emphasize the purpose of the presentation. From that point the chart treats each subsystem capability in a way that demonstrates to some extent the system capabilities applied by the management information system. That is, from the standpoints of: (1) the typical data bases available for input into the work, (2) the process or technique to be applied by the system, and (3) the fruition of the subsystem capability through typical outputs.
Demonstrating the Operation of the Management Information System as It Pertains to a Specific Administrative Task Area

In order to strengthen the description of the capabilities of the total system it is desirable to take an additional step beyond the portrayal of the categories of the administrative task areas and the examples of the sub-system operative capabilities.

A vehicle for this purpose has been designed. It is a demonstration, which includes quite specific elements, pertaining to the staff personnel administrative task area. This task area was chosen for the demonstration because of its familiarity, in a conventional sense, to a large number of school personnel and because of the general applicability of the problems in this area to most school districts. It is the intention to provide, using the medium of the staff personnel administrative task area as an example, a more detailed description of some of the precise capabilities of a management information system.

Figure 6 presents some tasks or work packages which are identified as examples of some subsystem capabilities of the task area in question. Additionally, in the same Figure, a number of the data bases available are listed as well as a variety of processes and outputs which result as this segment of the management information system operates.
To provide a more specific description of the potentialities and operation of a management information system each example of staff personnel sub-system capability will be carried from the implementation of the tasks represented by the capability to the outputs generated by the completion of the tasks.

The capabilities, as listed in Figure 6, are enumerated and may be considered tasks or work packages for the purposes of the demonstration. The material following each enumeration explains in detail what inputs, processes and outputs are involved.

Maintenance of Retirement Records

This task area provides data and information for reporting and decision making, of interest to both managers and other employees, in regard to all matters pertaining to retirement. In some situations the task area will be organized to include matters regarding benefits elected by the employee, in general, including such matters as insurance coverage, hospitalization, and tax sheltered annuities. (This work package is a logical extension of the payroll record. The payroll record is found typically in the Financial Administrative Task Areas.)

Specifically, the retirement record, plus other records involving other benefits which may vary from district to district, will include such data as an
employee classification insurance coverage code, information regarding retirement status, amount of contributions, and dates upon which the plan or plans were begun. In some cases some or all of the information might be held by agencies other than the school district, such as state operated retirement systems, depending upon the situation—but some information needs will likely be processed locally.

Examples of inputs utilized in performing tasks in this area would include:

1. Data from the master staff personnel data file, utilizing items such as date of hiring, address, sex, salary classification, age, number and age of dependents.

2. Multi-use transaction forms to initiate changes in the data banks pertinent to the retirement and benefit records. (In some situations, transaction forms used to up-date the master staff personnel data file would routinely up-date specialized retirement and benefit files.)

3. Tables enabling the computer to "look-up" data and do calculations. These tables may be stored in a data bank, if used frequently, or be supplied by system operators if used infrequently or changed often. An example would be a table of annuity values.

4. General and supervisory programs necessary for the operation of retirement and benefit routines.
5. Instructions to implement a specific program or programs.

Processing may involve an almost infinite number of operations depending upon what has been programmed. In this work package it would be reasonable to expect that the computer would combine data, such as listing and summing the amounts of money to be paid to different benefit vendors, do any necessary calculations to figure withholding charges against salaries, and to apply the proper formats when preparing reports or providing information.

Outputs of this task area could be as varied as management desired. Typical ones might involve the production of an employee group insurance reference listing, a report of employees due to retire within a certain time period, and studies of costs incurred in benefit plans versus benefits received by employees.

Preparation of Staff Contracts

This work package may completely and accurately prepare staff contracts, both periodically, such as yearly, and aperiodically, as when a new employee is hired during the year. Routines may be available for reports prepared for federal and state agencies, and for research purposes such as preparing information to be used in professional negotiation and other types of financial requirementt projection.

Typical inputs utilized in the performance of work in this area may include:
1. Data concerning employee personnel from the master personnel data file, utilizing such items as length of service and amount of training.

2. Individual performance data which might include evaluative ratings and a record of special or noteworthy activities for which salary premiums are paid.

3. Applicable district policies and regulations, and state and federal legislation and regulations.

4. Staff assignment files that detail the specific responsibilities of the individual which may affect the provisions of the contract, e.g., assignment of psychologists to a working year of eleven months.

5. Salary schedule tables.

Processing basically involves assembling data for each individual, making necessary calculations, checking the assembled product against policies and regulations, and making proper adjustments in such ways that valid contracts can be produced by the print-out devices of the computer. Simultaneously, other processing may take place which updates the staff contract file, where one exists, and/or any number of additional files related to other tasks areas. For instance, certain payroll files may be updated.

A number of outputs of value to different departments of the district and outside agencies may be produced. Examples are listed below:
1. Special periodic or aperiodic reports that may be useful either by themselves or as they relate to each other, such as reports about teachers who have or have not met advancement training requirements.

2. Reports about employees receiving merit increases and the cost and distribution of these increases.

3. Reports about teachers receiving extra salary for extra-curricular activities.

4. Studies of salary differentials existing in the district due to special opportunities that are available due to merit, seniority, abnormal load and summer work.

5. Reports to government agencies that may be required detailing certificate(s) held, load, and salary.

6. Studies concerning relationships between level of training, salary, sex, number of emergency certificates, race, and training equivalency with job positions.

7. Studies and reports pertaining to professional negotiation such as the pricing of various union demands, the pricing of district counter offers, and the impact of changing work norms on staffing requirements.

8. Preparation of a "Periodic Personnel Reference Report" helpful to many departments of the district for their information requirements. This may consist of such items as name, address, sex, race, marital status, job classification, salary, birthday, insurance status, pension status, job location, telephone number, and other items desired.

The foregoing outputs demonstrate the large amount of flexibility and scope which may be built into staff contract preparation routines. Different applications of the routines may be programmed in fashions that provide reports periodically, such as the "Personnel Reference
Report," or aperiodically, such as studies pertinent to the negotiation process. The outputs are also pertinent and useful to departments and agencies outside the staff personnel department and reflect the variety of services that can be provided.

Preparing Staff Schedules

The purpose of this work package or capability is to prepare schedules assigning all district employees to the tasks that they are to undertake and to provide them with a written notice or document detailing their personal schedule. Obviously the scheduling requirements will vary depending upon their job descriptions. A schedule for a high school teacher may require more complex computer operations to construct than would one for an elementary teacher. A custodial schedule might merely provide one or two work locations, leaving details to the local administrator. The construction of a schedule for a bus driver may be handled somewhat differently than those above since its completion is constrained from final construction in this area. Prime responsibility for general transportation scheduling as noted in Figure 4, lies in the Business Administrative Task Area. A similar relationship with detailed preparation of teacher schedules may exist since modular pupil scheduling is the responsibility of the Instruction Task Area and may control, to a large extent,
the completion of teachers schedules. Nevertheless, in this scheme, "staff personnel" is generally responsible for staff scheduling since this task area, as will be shown later, is responsible for district-wide recruitment and staff requirement projections.

A number of inputs must be utilized by the management information system to provide the variety and detail required for the processing leading to staff scheduling, the preparation of required reports, and the updating of various files and data banks that is necessary to meet other responsibilities of the task area. Major inputs are as follows:

1. Data appearing in the Staff Capability Assignment Listing which catalogues the human resources available to the district.

2. Requests by teachers for particular teaching assignments. These may include priority requests and preferences.

3. Results of routines used to schedule pupils modularly in schools where this method is used. (Some high school teachers may have building schedules and their load computed as a result of modular pupil scheduling.)

4. Administrative assignment policies and conditions imposed by local, state, and national legislation and regulations.

5. Conditions of work as a result of agreements with teacher organizations.

6. Files describing projected staff availability resulting from recruitment efforts.

7. Necessary computer programs and instructions.

8. Inputs from the master personnel data file.
The computer processes inputs in various ways so that the requisite schedules, reports, and requests for information are made available in the format previously decided upon.

Typical outputs of this capability of the staff personnel portion of the management information system are demonstrated by the following items:

1. Schedules for district employees assigning them to work locations and providing a written notice, as detailed as desired, of their personal schedule. In the case of teachers this might include times, courses, room numbers and names of pupils.

2. Summaries of staff assignments, containing as much detail as desired by different recipients. Examples of recipients are principals, supervisors of maintenance and buses, and the community relations administrative task area workers.

3. Production of a master schedule of staff assignments by district, school and job descriptions.

4. Production of schedules for special or traveling teachers in which schedule conflicts, balanced teacher loads, and balanced school loads are provided.

5. Reports of shortages of certain qualifications of staff members needed to maintain a predetermined level in the staff resource pool.

6. Materials to update the "Periodic Personnel Reference Report" such as current job locations and job descriptions.

7. Studies of work load, relationship of assignment to certification, identification of crises in skill availability, teacher transfer requests, and impact of changing personnel policies, resulting from negotiation, on teacher utilization from year to year.
Projecting Staff Requirements, Staff Recruitment, and Assignment of Staff

These three capabilities will be considered together since they are closely related. Essentially, they are concerned with manning the school district with an adequate number of employees with the requisite skills and work habits needed to perform the work. They consist of analyzing personnel data files to inventory staff professional and non-professional capabilities, considering evaluative ratings of present staff members, identifying hiring needs for the benefit of staff recruiters, and assigning present and new staff to work positions.

Inputs to these work packages may be numerous and varied. The latitude open to a school district in planning a particular information system is well demonstrated at this point since a number of different levels of sophistication are possible. Typical inputs may be as follows:

1. Data concerning each employee obtained from the master personnel data file using such items as sex, color, amount of training, years of experience, certificates held, location of home, and areas of teaching capability or work skills, and length of service.

2. Data concerning work and location preferences of employee.

3. Files containing information regarding employees whose contracts will not be renewed, will retire, or are permanently or temporarily disabled.
4. Files containing results of teacher evaluations.

5. Files containing employee requests for transfers of job locations and classifications, with priority statements supplied by them and/or their managers.

6. Records of employees who have indicated whether or not they desire to continue their employment with the district.

7. Catalogue of job locations containing details coding the related administrator, job address(es), transportation requirements, and any other unique or identifying characteristics need to assign staff intelligently, from a location standpoint which is not taken care of in item 8, below.

8. Catalogue of job descriptions and specifications. This may consist of descriptions of the skills required for proper performance, alternate acceptable skills, minimum acceptable skill(s) levels, required certifications or licensing, specifications of personal characteristics desired such as age, race, sex, physical size, combination of skills that may be required in some situations, length of service requirements, marital status, and identification of the administrator most knowledgeable about the job if manual filling of the slot is required.

9. Data bank containing inventory of present employees. This may be a transitory file derived from a combination of items in the master personnel data file and items 2, 5 and 6 above. It might be generated as intense recruitment procures are initiated in the spring and last for from a number of hours to a few months. Alternatively it could be operated continuously by recruitment personnel or could be generated anew each time a projection, recruitment, or assignment process is undertaken. (This demonstrates the variability in the processing methods that may be used to achieve similar ends.)

10. Requests from managers for assignments of one or more employees to their areas of responsibility. (These requests might come singly or in a "batched" fashion depending upon system design.)
Processing by the information system, as it operates to provide information and solve problems involved with staff projection, recruitment, and assignment, may consist of selecting, comparing, and matching staff members with the work requirements of the district. Obviously, projection routines generally become an early responsibility and processing of a number of the inputs is required for this. Processing may continue, then, in a linear fashion as the system lists and summarizes recruitment needs. Processing may continue further to assign staff. This would typically provide more tentative outputs in the beginning and more definite outputs, later, as the opening day of a new school year approaches.

Obviously, with the multitude of inputs available, processing may proceed in varied and sophisticated ways. Examples of outputs that may be available can best demonstrate the power of these sub-system capabilities. A number of them are listed below:

1. Projection of the staffing requirements of the district at any point in the future with any of the details attached that entered the system as inputs. These projections may become inputs for other processing tasks undertaken by the business and planning administrative task areas (see Figure 4).

2. Preparation of lists describing staff that must be recruited. Priority statements may be provided indicating qualities that are desirable, such as certification and experience, and any other items available as inputs and programmed for these lists. In addition the date the staff
member(s) must be available can be noted. Detailed job and environmental descriptions may be provided to aid the recruiter; supplementary information about any particular position is readily available to the recruiter if he desires to query the system.

3. Preparation of reports that provide the name of the employee assigned to each job position. (This output may be desirable as an input to the "preparation of staff contracts" work package so that each employee may know his assignment as soon as possible and sign his contract on that basis.)

4. Summaries of staff assignments to building and department managers. Alternatively this output may be used to up-date the "Periodic Personnel Reference Report." Assignments may also be reported in such a fashion that exceptions to desired hiring practices are noted. For instance staff members teaching on emergency certificates may be noted.

5. Studies may be conducted for boards of educations indicating the success with which work positions are being filled in the district. Trends may be shown in hiring and assignment difficulties. Comparisons with previous years may be made.

6. Studies may be undertaken investigating problems and characteristics of staffing procedures. For instance, impact of proper certification upon achievement may be studied using achievement assessments from the Instruction Administrative Task Area. Rate of turnover of cafeteria workers might be investigated. Studies of the relative success of various recruitment methods could be made. The effectiveness of paying salary premiums from employees in depressed areas could be gauged from studying the relationships between levels of training, transfer requests, and achievement scores in inner city buildings.

7. Reports, pertinent to this area, that may be required by state and federal agencies may be quickly and accurately prepared.
Maintenance of Staff Records
or the Staff Personnel Data
Master File

It was previously noted, as inputs to some of the operative capabilities of the Staff Personnel Administrative Task Area were described, that the staff personnel data master file was mentioned. In some management information systems this file is the central repository of most of the information that is catalogued about employees. Therefore it may be heavily loaded with large amounts of data. Access to it for routine processing tasks may be somewhat impractical because obtaining certain kinds of data may be more time consuming than is warranted. Thus, the Finance Administrative Task Area might keep detailed salary records in another data bank, identifying the employee simply by number. Thus, the data bank utilized for employee financial records and transactions may contain only financial information and may be updated only monthly from the master personnel data file and may update the master personnel data file only periodically with "summary type" information.

It is assumed in this demonstration that it is the responsibility of the Staff Personnel Task Area to maintain a master personnel file for the district. As noted, this file is basic to the operation of the management information system in many of the other administrative task areas. It must be remembered that if the file is
extensive, as it would be in a large city district, that it may be used primarily to generate other smaller data banks. These are sometimes called "working files." (These working files may be transitory, lasting only until an infrequent task is completed, or they may last indefinitely by being periodically up-dated from the master file.) The master file is, of course, maintained or kept current by certain "inputs" it receives and by computer programs which control its processing operations. Typical inputs are as follows:

1. Transaction forms filled out by employees. These generally have multiple purposes because they are used to update the master file in a number of different ways. For instance, if an employee wishes to drop "hospitalization withholding," note the arrival of a new baby, or change his address he may use the same transaction form.

2. Memos originating with management may be used to change job descriptions, salary to be paid, or employee classifications.

3. Memos or transaction forms may be used to correct the file by system operators if errors are detected.

4. Information may be added to the file as a result of the operation of other portions of the management information system. As an example, outputs from staff assignment routines may automatically up-date the employees' job locations and descriptions.

5. Instructions or programs may be received requiring and directing the construction of the "working files" previously mentioned.

6. File maintenance programs, either stored or supplied by operators, control and implement the
maintenance function. As noted before, the master file may be large. Thus, memos and transactions may be held and processed as a "batch" allowing up-dating to proceed most efficiently from beginning to end.

7. Queries for information may be routed to the master file.

Processing that takes place in the maintenance and use of the master staff personnel data file will vary in its complexity depending upon the design of the management information system and the purposes assigned to the file. "Update" routines, triggered by transaction forms, may be utilized. Some processing may select and combine data in order to build "working files" for use in the Staff Personnel Task Area, itself. Supervisory processing programs may monitor certain relationships in the file, periodically. For instance, if an employee changes his address, did he either verify his phone number or change it? Certain queries for information may also be processed automatically through the master file when information is not available in working files. Although processing may generally be more concerned with fairly simple maintenance routines a number of important outputs may be listed:

1. Reports to outside agencies, such as records of length of employee disability that may not be available from other sources.

2. Queries requesting information concerning an employee or groups of employees. An example might be the ascertaining of the names of all teachers with emergency certifications.
3. Information used to construct the Staff Capability Assignment Listing. (This was previously noted as an input in the preparation of staff schedules.)


5. Information used in the preparation of a current employee inventory utilized in the projection, recruitment, and assignment routines, as mentioned earlier.

6. Data needed for studies done by local departments and outside agencies regarding such topics as certain characteristics of the staff or any segment of it, the construction of employee profiles, relationships between the characteristics of the staff and the achievement of students, changing facility requirements due to changing staff assignment policies, and data for additional studies not currently available from other sources in the information system.

7. Monitoring or supervisory programs may audit the arrival of expected inputs, such as salary updating or the filing of a new certificate number, and prepare warning or request notices.

8. Raw data from the master file may be supplied, via magnetic tape or over transmission lines, to outside agencies mounting large research projects, which will themselves process the raw data with their own equipment and programs.

Summary

The varied presentation of some capabilities of a management information operating in an educational setting was undertaken in an attempt to add to the descriptive materials, previously presented, as the "requirements" and "design" phases were developed. Concepts resulting from these
Fig. 5--Examples of Typical Sub-System Operative Capabilities of the Finance-Administrative Task Area.
Fig. 6.—Examples of Typical Sub-System Operative Capabilities of the Staff Personnel-Administrative Task Area.
Fig. 7.—Examples of Typical Sub-System Operative Capabilities of the Student Personnel-Administrative Task Area.
Fig. 8.—Examples of Typical Sub-System Operative Capabilities of the Plant-Administrative Task Area.
Fig. 9.—Examples of Typical Sub-System Operative Capabilities of the Instruction-Administrative Task Area.
Fig. 10.—Examples of Typical Sub-System Operative Capabilities of the Business-Administrative Task Area.
Fig. 11.--Examples of Typical Sub-System Operative Capabilities of the Planning-Administrative Task Area.
Fig. 12.—Examples of Typical Sub-System Operative Capabilities of the Community Relations-Administrative Task Area.
The Organization of the System in the Aggregate

Two steps in the system design phase of the development of a management information system are reconsidered at this time.

It was stipulated in Block Two that the format of the design document which describes the system would consist of integrating the various elements of the design by means of a summary chart or illustration. It was further noted that the entire development process would be reviewed and summarized by means of a similar visual presentation.

Block Eight, wherein the writing of the specific design document takes place, was temporarily put aside after its importance and mission, as a step in the system design phase, were described. It was noted that its mission as a design document would be implemented after the capabilities of educational information systems were explored. This section re-implements Block Eight and the presentation of the design document in the format indicated in Block Two.
Methodologies useful in developing management information systems were drawn from materials designed by Rosove. The path of the development of the prototype consisted of recognizing, defining, or implementing portions of the following concepts:

1. The Presentation of Phases in the Sequence of Development.
2. The Establishment of Broad System Requirements.
3. The Selection of a Development Strategy.
4. The Description of Steps in the Design of a System.
5. The Description of System Task Requirements.
6. The Description of System Element Requirements.

Review of the Most Salient Features Used in the Description of the Prototypic System

A number of the features found in the development process gave rise to materials which were directly involved in describing the organization and content of the prototypic management information system. These features, which may be thought of as "yield" from the development process, are briefly reviewed in the discussions that follow:

1. The Sequence of Development Phases—The prototype was constructed as a result of implementing two of the five phases normally used. The phases used were "requirements"
and "design." Implementing the additional phases would have been beyond the scope of this study.

2. Broad System Requirements—These were specified for the prototypic system. This was the first phase in the "sequence of development phases," noted above.

3. System Task Requirements—These were specified for the prototypic system either as specific tasks or as relatively specific task areas. They were outputs from Block Five which is one of the steps in the system "design" process.

4. Identification of System Elements—Elements were identified that were appropriate for the prototypic system. This appeared in Block Three. The specification and integration of system elements in detailed form could not be undertaken.

5. User Requirements—Found in Block Four, they were stipulated for the prototype. The general parameters of educational administrative organization were noted at this point.

Summary of the Development of the Prototype in Chart Form

To review and better understand the development process that was engaged in during the design of the prototypic system it is necessary to retrace the development path of typical management information systems. This has been done, with a minimum of detail, in a previous section.
The development of the educational information system is unique in one instance. Since it was impractical to trace system element requirements in a detailed fashion, which would have improved the definition of the system, another approach was utilized. A set of capabilities were developed which reflected inputs from Block Four of the design process and from the literature review and interview survey. This development of capabilities becomes part of the total development process that was utilized.

In order to sense the order and content of the development process in visual form a chart is presented which brings together in a temporal relationship the major steps taken in the development of the system (see Figure 13).

Whereas Figure 13 visually summarizes the development of the prototypic system it does not describe it. This is left for the next section.

Summary of the Description of the Prototype in Chart Form

As the regimen of the information system development process was entered it gave rise to materials and opportunities for describing such a system. This is the plan, that was implemented at the beginning of the chapter, which permitted a double mission to be accomplished. It is difficult to accurately and completely describe the content and organization of a prototypic management information system
Fig. 13.—Summary of the Development of the Prototypic Management Information System.
because it is exceedingly complex. It was for this reason, partially, that it was desirable to carry on the development phase concurrently. This provided opportunities to handle complexities in a step-wise fashion.

In a previous section the most salient features describing the educational management information system prototype were extracted from pertinent materials appearing during development. Reviewing these salient features provides a brief narrative that describes the prototypic system.

Figure 14 describes the prototypic system in chart form. It visually combines the salient descriptive features into a structure. The structure, with the "Description of the Prototypic System" at its center, attempts to show that a number of qualities are required to define the prototypic system that has now passed through the development steps. There are, of course, limitations to the adequacy of the description. Although these may be obvious to the reader and have been mentioned before, some will bear review.

Although system elements have been identified, specific task areas were not traced through these elements. Thus, system elements could not be integrated systematically and final requirements derived. However, the provision of general and specific descriptions of capability perhaps strengthens this situation. Additional questions, regarding sufficient depth of detail, may be asked about
Fig. 14.—Summary of the Description of the Prototypic Management Information System.
the three other classes of requirements that are shown in the figure.

Essentially, the chart does provide a description of a prototypic management information system suitable for a public school setting. The incorporation of the general capabilities and specific subsystem capabilities compensates for some of the weakness due to development limitations and sharpens the description as it relates to the public school setting.

This total section entitled "The Organization of the System in the Aggregate" stands as the "design document," the eighth and final step in the design and development of the management information system for educators.

**Limitations of the Prototype**

It seems to the writer that a number of factors must be considered as potentially placing limitations, in addition to those noted in the previous section, upon the effectiveness of the structure of the management information system that has been developed. They are listed below.

1. **The validity or soundness of the total conceptualization.**—The question is whether the prototypic system accurately and completely models a system that can potentially provide the kind and quantity of information required for management decision making in a public school setting.

2. **The quality or realistic state-of-the-art of the elements of the system.**—It seems to the writer that the
major limitations posed regarding the elements of the system (personnel, equipment, programming and data) lie with producing adequate programs and collecting appropriate and sufficient data. Interview findings have noted these as limitations in present systems. The large and accessible storage requirement poses another limitation.

3. The cost of the system.—Both interview and literature findings have indicated that large costs are incurred when a system is expanded to utilize remote terminals. Likewise it was found that sophisticated software can easily exceed all hardware cost. Both these elements are a requirement of the prototype. Cost may therefore be a limiting factor for all but the largest school systems.

Major Conclusions of the Study

A number of conclusions have been identified by the writer as major ones, from the major impact they make, as they relate to the overall themes of the research, the "investigation of the structure and potentialities of management information systems. . . ." It should be borne in mind, however, that these general conclusions are not sufficiently powerful to transmit the entire substance of the results of the research effort. Rather, the maximum amount of information can only be derived by closely scrutinizing the myriad findings and the conclusions to be found in Chapters II and III.
These major conclusions review and integrate the most significant ideas and information that have emerged from the study. They can serve as reference points for those who have carefully read the study by providing a prod to the memory. They are the major ideas around which the minor ideas may be more easily organized and remembered.

Listed below are the major conclusions, regarding the structure and potentialities of management information systems, which resulted from the study.

**Regarding Structure**

1. It is desirable that a maximum amount of subsystem integration be achieved in the design of a management information system. Additional major parameters should include the potential for interaction of subsystems, and real-time and on-line access to information.

2. An information system is of value in some proportion to the extent that it is comprehensive. It must encompass as broad a task-range as possible.

3. Conventional data processing operations should take place within the matrix of tasks specified for the information system.

4. There are major conceptual hazards involved in the development of a management information system. They are concerned with: (1) identifying the actual information needs of the system, and (2) recognizing limitations to
the value of the system when decisions involving public policy are at issue.

5. Three barriers may limit the possibility of implementing systems like the prototype, for use in public school districts:

   a) Questions regarding the general adequacy of the prototypic model.

   b) Questions regarding the quality or the state-of-the-art of presently available system elements.

   c) Questions regarding the reasonableness of the costs that would be incurred.

6. A school organization can be conceived of as a total environment or a system that affects children. To manage it realistically requires the means to perceive the environment or system as a whole and to anticipate, plan, and allocate resources, in light of overall objectives. It is on this basis that the systematization of data should be justified and implemented.

**Regarding Technical Potentiality**

1. The nature, number, and scope of problems presently besetting school systems necessitates a look at new methods of problem solving, decision making and long-range planning. Administrative technology promises significant advances in these areas.

2. A comprehensive attack on the administrative
problems of education using systems techniques is not only possible but promising.

3. Adequate technical conceptualization to meet requirements of sophisticated systems was judged not to be a problem at either the highest administrative levels or within the data processing staff.

4. Concern about technical understandings required to operate and relate to present systems was described with mixed opinion. Generally, no severe inadequacies were reported within E.D.P. centers. A variation in understanding by administrators was the most significant major cause of difficulty at the management level. Some existence of weakness in technical understanding was identified as causing difficulties when para-professionals and teachers related to technical problems. However, these statements may not be generalizable to management information systems.

Regarding Benefit Potentiality

1. A large measure of the benefit identified was found in the management of the educational affairs of students. This includes: (1) test scoring, interrelating, and summarizing for varied users, (2) improving guidance activities, and (3) saving time and reducing errors in maintenance of student records.

2. In regard to facilitating educational decisions in the future, the school representatives identified eight areas of impact, frequently. These were: (1) curriculum
planning, (2) financial accounting, (3) inventory management, (4) vehicular scheduling and service costing, (5) guidance services, (6) sharing information with outside agencies, (7) cost-benefit programs, and (8) public relations.

Regarding Conflict Potentiality

1. Some elements of conflict with present E.D.P. purposes, in present systems, were identified as emanating from organizational structure. Major difficulties seemed to be a result of barriers between departments, and attempts to impose data processing priorities. Administrators, at all levels, have been frequently mentioned as being an impediment to system development. However, these factors may not be generalizable to management information systems.

2. One of the most difficult problems impeding system development is the requirement that new projects must be adequately systematized to be effective. The most noteworthy constraints are inadequate definitions of the problem and financial considerations.

3. There is very little evidence that fear of the unique powers of management information systems has restrained their development.

4. The setting up of a complex information system may have a detrimental effect on the existing organizational pattern of the institution it serves. There is a need to
analyze institutional structure from the standpoint of data communication before the structure of the information system is decided upon.

Limitations of the Findings and Conclusions

The findings and conclusions of the study resulted from an investigation which utilized descriptive and integrative research techniques. These techniques were selected because the requirements of the problem statements demanded a broad approach to data gathering and analysis.

Much of the data was obtained from settings, i.e., school districts and the literature, where experiences have been closely related to conventional data processing operations rather than management information systems.

These two factors pose several constraints to the generalizability of the conclusions.

The research design was developed to provide the soundest opportunities to study the structure and potentialities of management information systems by providing opportunities to describe situations and develop ideas resulting from natural circumstances. The strength of this research was not expected to lie in generalizability to all school districts but in the synthesis of new concepts.

Questions or Problems, Related to the Investigation, Most Needing Research

This study has uncovered a number of needs for research and development regarding the implementation and
operation of management information systems in public school settings. They are as follows:

1. Identifying with precision the kinds of specific information needs that a school district requires. Associated with this would need to be the development of the definition of an adequate school district in terms of service it performs for its clientele and for society in general.

2. Investigating some presently operating management information systems that exist outside the school districts with a view toward comparing their purposes and structure to potential purposes and potential structure for such systems in education. The purpose for this being to attempt to identify break-throughs in technology applications of interest to educators.

3. Design and thoroughly simulate a full-fledged management information system suitable for educational settings. Particular attention should be paid to the questions of cost, detailed element design and interface, and relationships in regard to need and effectiveness.

4. Investigate the design of management systems of varying cost, capabilities, and complexity. The purpose being to attempt to develop applications tailored to districts of different sizes and with varying amounts of resources to expend for information purposes.

5. Investigate the potential for management infor-
mation systems operated as cooperative ventures within regions or between two or more school districts.

6. Investigate the latest proprietary developments in equipment and programming components. The purpose being to identify with more precision the "state-of-the-systems-arts" from these standpoints.

7. Develop instructional materials for educators concerning potential applications of automation to educational operations.
LIST OF QUESTIONS USED IN INTERVIEW SITUATIONS
IN THE SCHOOL DISTRICTS VISITED

General Closed-end Questions.

As an outcome of utilizing "data processing" and "systems" techniques:

1. Has improved decision-making taken place in your school district? Give example.

2. Have increased numbers of facts and alternatives become available as basis for sound decisions? Give example.

3. Have improvements in handling problems come about? Give example.

4. Has your district been better able to detect mounting pressures, both internal and external, and make better judgment as to their validity? Example.

5. Has foreseeing future problems in time to prepare possible courses of action been possible? Example.

6. Have you been enabled to make available alternative strategies and solutions to anticipated problems? Example.

7. Has there been improvement in long-range planning? Example.

8. Has there been greater acceptance of innovation in some parts of the school district or within its organization? Example.

9. Have administrators been freed from "mundane things" in order to think? Example.

10. Have provisions of means for evaluating innovations been tested or utilized? Example.

11. Has there been an improvement in the efficiency in the total operation of the total school system? Example.

12. Has the school system been obtaining improved feedback in regard to its operations? Example.

13. Have "flag points" been established, i.e., points at which corrections should be made? Example.

14. Have there been improvements in communication within the school system and between school and community? Example.
Specific Open-end Questions related to the structure and potentialities of a Management Information System.

( Technical potentiality questions follow:)

15. Would you describe briefly the general objectives of the educational data processing system operated by this district?

16. In what areas of activity is your school system utilizing educational data processing systems? (or what specific components or programs are presently operating?)

17. What developments in educational data processing systems are forthcoming in your school district?

18. ("Researcher" defines a management information system at this point and proceeds to ask a question.) Do you have what you consider to be an operating management information system?

19. If so, how do you define the concept of the management information system used in your district?

20. What are the general objectives of the management information system used in your district?

21. Describe the general outputs of this system which you consider to be directed toward helping managers or administrators of the district make decisions.

22. (Using the guide card which contains three alternative responses the respondent is here asked to provide a number which indicates the degree to which his organization is currently involved in EDP or MIS subsystems or schemas. The responses indicate: (1) full involvement, (2) experimental or occasional involvement, or (3) no involvement.)

23. What developments concerning the items above do you believe are forthcoming in your school district? (Guide card is handed to subject at this point and he checks forthcoming items in an appropriate column.)
24. Will you describe any technical concerns regarding the operation of the system in terms of:
   a. Hardware
   b. Software
   c. Technical conceptualization
   d. Technical understanding by:
      1. EDP staff
      2. Administrators (or managers)
      3. Others

25. Describe what you consider to be your major technical problems.

(Benefit potentiality questions follow:)

26. Will you identify any significant benefits that have accrued to your district that have been derived from the management information system (or educational data processing system)?

27. What kinds of educational decision-making have been facilitated?

28. Upon whom did these educational decisions impinge?

29. What was the attitude or response of the recipients of these educational decisions?

30. What benefits have been received in regard to educational planning?

31. Will you describe any benefits that have accrued in reporting to local, state, and federal agencies?

32. In the future how do you see educational decision-making being facilitated?

(Conflict potentiality questions follow:)

33. Will you describe any "forces" that impede, or directly conflict, or are detrimental to the present or future use of data processing systems (or M.I.S.) in the district? (Expansion below:)

   a. Describe such conflicts that arise within the E.D.P. organization.

   b. Describe such conflicts that arise with agencies or personnel outside your department but employed by the school district.
c. Describe such conflicts that arise with agencies or personnel not employed by the district.

34. What additional factors, other than those you mentioned above may impede the development of E.D.P. and/or management information systems? Examples of such factors might be:

   a. Time
   b. Cost
   c. Programming
   d. Conceptualization requirements
   e. Quality of personnel
   f. Commitment of personnel

35. Do conflicts of organizational structure blunt the effectiveness of a systems approach?

36. Does the locus of management information system activities within the E.D.P. organization cause conflicts to arise in regard to priority or other factors? (The factor of M.I.S. location within the E.D.P. hierarchy.)

37. Is there any evidence that the development of management information systems has been restrained because of fear about the information that this system may generate?
## STATUS CHECKLIST OF SYSTEM APPLICATIONS

(Please X appropriate column)

Checklist Administered During the Interview Session

<table>
<thead>
<tr>
<th></th>
<th>Presently Operate</th>
<th>Plan to Operate</th>
<th>No plan to operate</th>
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<tbody>
<tr>
<td>1.</td>
<td>Payroll</td>
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<td>2.</td>
<td>Financial accounting</td>
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<td>Purchasing</td>
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<td>4.</td>
<td>Resource allocation</td>
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<td>5.</td>
<td>Pupil accounting</td>
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<td>6.</td>
<td>Pupil permanent record maintenance</td>
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<td>7.</td>
<td>Processing of student transcripts</td>
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<td>8.</td>
<td>Student census</td>
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<td>9.</td>
<td>Test scoring (standardized)</td>
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<td>10.</td>
<td>Transportation records</td>
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<td>11.</td>
<td>Retirement records</td>
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<td>12.</td>
<td>Staff contracts</td>
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<td>13.</td>
<td>Pupil &quot;guidance&quot; service</td>
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<td>14.</td>
<td>PERT (or other precedence diagrams)</td>
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<td>15.</td>
<td>PPBS (Planning, Programming, Budgeting System)</td>
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<td>16.</td>
<td>Simulation</td>
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<td>17.</td>
<td>Retrieval Systems (library or specialized)</td>
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<td>18.</td>
<td>&quot;Planning&quot; Systems</td>
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<td>19.</td>
<td>CAI (Computer Assisted Instruction)</td>
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<td>20.</td>
<td>Profiling (school and community profiles)</td>
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<td>21.</td>
<td>Gaming</td>
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<td>22.</td>
<td>Pupil scheduling</td>
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<tr>
<td></td>
<td>a. Conventional</td>
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<td></td>
<td>b. Modular</td>
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</tbody>
</table>
23. Bus scheduling

24. Projecting
   a. Enrollments
   b. Financial

25. Provision of real-time data for forecasting

26. Provision of real-time data for decision-making

27. Reporting systems
   a. To local, state or federal agencies
   b. To pupils (grade cards)
   c. To other groups

Bushnell, David S. "An Educational System for the '70's," Phi Delta Kappan, LI (December, 1969), 199-203.

Caffrey and Mossman. Computers on Campus.


_______. "The Use of System Analysis and Management Techniques in Program Planning and Evaluation," pp. 11-31. (ED 123 181)


Culbertson, Jack A. "Identifying the Emerging Administrative Technology and the Underlying Concepts." Columbus, Ohio: The Ohio State University, 1967. 16 pp. (Mimeoographed.)


Franklin County Schools, Columbus, Ohio. A Systems Summary Description. Columbus, Ohio: Area Education Information Center, 1968. 58 pp. (ED 027 571).


Personal Interviews

Becker, Karl. Cleveland Public School System, Cleveland, Ohio.

Kosmos, Steven. Parma Heights Public Schools, Parma, Ohio.

Lahman, Galen. Toledo Public Schools, Toledo, Ohio.
