Successful Management Information Systems

Revised Edition

Helen H. Ligon

Successful Management Information Systems

Revised Edition

by
Helen H. Ligon

Contents

List of Tables

1

Introduction

"The Information Age" is a label given to the 1980s by journalists and academicians alike. In keeping with this theme, the idea of using information as a competitive weapon has gained much credence and popularity. Successful business operations both large and small have depended on information as a vital component. In a speech to the Society for Information Management in October 1984, Warren McFadden outlined the ways companies such as American Airlines and the American Hospital Association had attained competitive advantages over their competition by using computerized information [126].

Communication improvement, newer production methods, and the growth of computer technology and understanding have all caused companies to demand more and more information. As society has become more complex and as the sheer volume of information has exploded, both businesses and government have increasingly required more relevant information on a timely basis. To the forefront of business requirements has come a greater emphasis on having information more quickly available.

The pressures of the 1980s that give impetus to the demand for quicker information include the enormous size of business operations today, the myriad complexities involved in such organizations, and the multitude of people necessary for successful achievement of company objectives. The advent of the computer and its potential for assisting in making the necessary information available have necessitated the attempt to develop information systems for these large, diversified, and complex organizations.

Designing a large-scale management information system (MIS) is not a new problem; it is not something management has just recently recognized as being essential. However, until the possibility of using computers to assist in information acquisition came to fruition, managers placed much more emphasis on such problems as achieving efficient production or maximizing the use of financial resources. In the 1970s, many large-scale information systems simply evolved without extensive planning or without any set pattern of development. Robert Murdick and Joel Ross stated that "the pro-

duction of information is at least as important as the production of physical commodities." They further added: "The now-expanding discipline of management information systems regards information as a resource equal in importance to the traditional ones of men, money, materials, and machines" [136:239]. In the 1980s their ideas have been accepted and have been carried one step further – information is as important as the traditional four M's, and furthermore, information *can* be managed.

Study of Conceptual Design

Certainly a business is more competitive with a successful information system. In the previously mentioned speech, Warren McFarland suggested three periods in the development of computer usage:

1. Computer technology played a useful backup role in the 1970s.

2. For others, the backup tool became an "avenging weapon," allowing pricing strategies and opportunity to drive their competitors into bankruptcy.

3. In 1984 and in the near future, coordinated integration of large-scale data processing and telecommunication will make the "weapon." [126]

Murdick and Ross wrote that in the late 1970s "no other field offers such concentrated room for improvement as do information analysis and the design of information systems for decision making" [136:239]. For that time frame, no set pattern for the analysis and design of large-scale information systems existed. Reams of literature, much of it contradictory, marked the thinking about design concepts for information systems. A study of these writings, however, revealed that the majority of the articles or books of the 1970s were either "cookbook type" (how to do it), or were vague generalized ideas. At that time, a gap seemed to exist in both the literature and in practice because these were emerging concepts, not yet highly structured or finalized.

The author's original research proposed to construct a set of guidelines applicable to designing a management information system. An extensive search was made of the applicable literature, with emphasis on pertinent characteristics influencing success or failure. To management in the 1970s and currently, the design of information systems has become a vital and critical ingredient for successful business operations. Originally, selected guidelines were developed so that companies could follow them in establishing or improving their management information system.

During the time period between publication of the first edition and the present edition, numerous successful management information systems have been developed. At the time of the first writing, only a few "successful" systems existed. Three of the then-successful systems (American Airlines, AT&T, and Weyerhaeuser) were studied and compared to the guidelines. How do the current management information systems compare to these guidelines? Later chapters in this book address this question, as the three original companies are brought into the 1980s.

Applicable Definitions

"Data" were defined in my 1978 study as facts and figures not currently being used in a decision process. In contrast, "information" referred to the classified or interpreted data being used for decision making.

Although no consensus has been reached on an adequate definition of a management information system, characteristics from two definitions were the basis for the findings of this research. Gordon B. Davis of the University of Minnesota defines the MIS as "an information system that, in addition to providing all necessary transaction processing for an organization provides information and processing support for management and decision functions. The idea of such an information system preceded the advent of the computers, but computers made the idea feasible"[57:vii]. A more thorough definition is that of Walter J. Kennevan. Although Kennevan's definition was created in 1970, the ideas are completely applicable to the 1980s. He defined the MIS as "an organized method of providing past, present, and projection information relating to internal operations and external intelligence. It supports the planning, control, and operational functions of an organization by furnishing uniform information in the proper time frame to assist the decision-making process"[108:63].

Another lucid, but more condensed definition seemed briefly to present the essence of a management information system. J. D. Aron stated that a MIS was an "information system that provides the manager with *that* information he needs to make decisions" [12:233]. Aron's definition is more in keeping with the current idea of decision support systems.

By "large-scale" information systems, this writer refers to those systems which are computer-based, process voluminous amounts of data, consolidates these data, and makes the condensations available to managers for decision-making purposes.

Proposed Objectives and Related Methodology

First, this study chronologically traces the evolution of data processing in business, with emphasis on information handling for decision making. The present edition brings in newer concepts such as information centers, microcomputers, spreadsheets, workbenches, automated design tools, structured design, fourth-generation languages, and prototyping.

The examination was conducted through a search of pertinent literature related to changing management methods for recording and utilizing business information. Data bases and their current applications are also included in this edition.

A second objective is to evaluate analytically the changes in concepts toward management methods for obtaining information. To meet this objective, the methodology entailed a literature search. However, more emphasis is given to "how" and "why" management concepts have changed. After the "total" concept is discussed, emphasis is given to the interest-disillusionment syndrome that businesses experience after becoming disenchanted with the "total" systems approach. Richard Nolan's classic, "Stages of Growth," is related to current practices and updated to include current thinking. Contemporary concepts about information systems are also evaluated, with a discussion of possible reasons for their evolution.

Next, we compiled a consensus of the ideas of well-known writers and practitioners in the information systems field. In the original study, particular attention was given to the design concepts applicable to these phases of the systems development life cycle:

1. Feasibility study

2. Requirements analysis

3. Systems specifications

4. Systems design

5. Coding and programming

6. Testing

7. Documentation

8. Implementation

Findings are presented as of 1978, when the first research study was completed.

With these same steps as the basis of analysis and design, a follow-up has been made to determine how thinking has changed as more experience

has been gained in developing successful information systems. From writings of both academicians and businessmen in the MIS field, we selected a set of criteria which forced better design planning. The original set of criteria was a composite of the thinking of recognized, well-known experts in the MIS field. Such criteria have been updated to reflect current ideas concerning MIS development.

The Delphi technique was used in the original study to determine whether the criteria obtained from the literature search were "reasonably likely," in statistical terminology. Through the Delphi method, a composite of experts in the information system field was questioned. Included in this group were both well-known business authorities and accomplished writers. The Delphi method was used to determine whether or not these experts agreed or disagreed as to the "reasonableness" of the criteria developed through the literature search. Details of the Delphi questionnaires are presented in the Appendix.

In 1984, the Delphi was "revisited," i.e., the same survey was sent to the original participants and then enlarged to include other people prominent in the MIS field. A comparison and a contrast was made of the thinking of these experts, as more and more successful management information systems have been developed.

Originally, the Bell Telephone System's BISCUS/FACS (Business Information System Customer Service/Facilities Customer Service) System was examined in a field study. During this study, particular attention was given to Bell's problems and progress in implementing BISCUS/FACS. Criteria obtained from both the literature search and the Delphi Study were applied to that system for comparison. As part of this examination, interviews were held with Bell employees who worked on the proposed BIS (Business Information System) and who converted the Dallas office to BISCUS/FACS in 1975.

In 1982, the Bell System was separated into independent operating companies, one of which was Southwestern Bell Telephone Company. Where BISCUS/FACS has gone since the 1975 implementation was discussed with employees at the Dallas office. How divestiture has affected the flow of information within the Bell system and how this original information system has evolved were also discussed.

Originally the American Airlines' SABRE system and the Weyerhaeuser Company's information system were examined, with the criteria as guidelines. Much information about these two companies came from published literature concerning the two systems, since their successes have been well documented. In addition, involved personnel from both companies discussed the development of their management information systems

with the author. Again, criteria obtained from the research were applied to the systems for comparison.

American Airlines is one of the companies that has been heralded as using its information system to gain and maintain a comparative advantage. Since deregulation of the airline industry, the company has been harassed for the manner in which it has used its system. Discussion of both the pros and cons of usage of such a system are presented.

Finally, all of the above-listed information was applied in the original study to conclusively test the hypothesis that large-scale information systems *do* possess certain common characteristics for the conceptual design phase. A subhypothesis was that these characteristics were related to the success of such systems. The culminating evaluation applied characteristics found in the various systems either to refute the hypothesis or to give credence to the belief that common characteristics for successful systems existed and could be delineated.

A study of literature published since the original book was written verifies the truth of the hypothesis. Out of the developmental work on management information systems has come an almost-universal set of common characteristics. Guidelines for the development of such systems have been created by several of the major accounting firms doing consulting work for large firms. Current literature verifies that guidelines have been developed and are working in successful information systems. What was once a mystique has since become something that can be developed and taught.

The original study developed an emerging pattern of selected guidelines useful to a company planning to install a management information system. How these guidelines apply to systems developed in the 1980s is discussed in this edition. Current technology and advances in computer usage, especially with micros, are other valuable developments detailed here. Features that are desirable and factors to be avoided are also outlined in this study.

2

Evolution of Data Processing in Business

Change is a way of life in commercial organizations. Similarly, since the advent of the computer, organizational concepts toward information gathering and utilization have also changed. This book chronicles such concepts from the late 1950s through the middle 1980s, with emphasis on computer utilization in handling business information.

Early Business Data Processing

Any chronology of computer usage in business may begin with the idea that records were an important facet of business survival even before the computer arrived on the scene. Consequently, small businesses usually had simple records, with much of the vital business information being maintained in the the mind of the owner rather than in an accessible, readable form.

From the inception of business, information has been an essential element — some call it the lifeblood of an organization. As George Steiner stated, "Information flows are as important to the life and health of a business as the flow of blood is to the life and health of an individual [182]."

People lived on earth for many centuries before they felt the necessity for keeping records. However, development of trade and commerce along with the growth of cities brought the need for more details coupled with a system for recording these details. Early in the life cycle of business, some method of collecting necessary information was undertaken. First efforts to obtain information entailed no particular method of data collection. With the passage of time, however, a systematic, orderly method of collecting vital information evolved. One of the earliest examples of record keeping was that of the Chinese. By the 1400s, Venetian business owners, managers, and financiers all utilized Pacioli's double-entry system of recording business information for future references. In discussing other early innovative manual record-keeping techniques, Donald Sanders also listed the record

audits of the Greeks and the banking systems and budgets of the Romans [167].

In the twenty years following the Civil War, manual methods were the predominant techniques for data recording in the United States. Clerks were the data processors and their tools included pencils, rulers, worksheets, journals, and ledgers. As Sanders stated, "Such complete reliance upon manual methods resulted, of course, in information which was relatively inaccurate and often late" [167].

Punched Card Applications

The 1890 census brought a major milestone in record keeping. Dr. Herman Hollerith devised punched card equipment for expediting the counting of the census so that the enumeration could be completed before the time for the next census. Gradually these same machines were utilized in business since companies had the same problem as the census bureau — the rudimentary system that worked for small operations "got tired and careless under high volume conditions. And during the next 40 years volume was to become the byword of American industry" [167].

Computer Technology Applied to Business

No revolutionary changes were evident in information collection and dissemination until the advent of computers. Their introduction into the business world called for changes in information-keeping methods. However, the first applications of computers in business were no more than the manual methods converted "as is" to computer processing. In most instances, very minor changes were made in the method of record keeping as companies merely put their current manual record system in computerized form.

Initially, when the unit-record methods were converted to computerized ones, programming was simple. The problems involved with programming, along with the "state of the art" during this period of time, influenced many businesses to avoid making drastic changes in their information-keeping methods. Robert Head remarked that "even if efficient, high capacity random access storage had been available . . . it is doubtful whether it could have been exploited very effectively given the kinds of applications then being converted to computers" [87]. In two of his books, Donald Sanders referred to this era as the "Victorian Period" [165, 167]. R. George Glaser epitomized this period in his statement that "these routine applications could be justified economically by relatively straightforward extensions of known cost factors, and apart from some procedural adjustments, little in the company had to change" [76].

Commercial applications then branched into more sophisticated usage, but all of these were considered to be separate or isolated methods. According to Cyrus Gibson and Richard Nolan, this stage of growth was principally marked by a proliferation of applications in all of the functional areas of business [73]. A 1958 article in *The Franklin Institute Journal* described the use of the computer for repetitive business operations [98]. In 1958, C. S. Knox emphasized how the computer could simplify purchase decisions [112], while a paper in the *Oil and Gas Journal* from this same year enumerated ways in which computers worked on "tough problems for Socony's world-wide operations" [47].

A majority of the computer articles in this time period described either scientific, engineering, statistical, or operations research applications, such as production control, product design, or simulations [9, 58, 65, 112, 113, 138, 149, 151]. In a discussion about this era, Glaser commented that "the next era of computer applications saw the rise of business systems for inventory control, production scheduling, cash management, and the like. At the time these applications were designed and implemented they were considered to be very complex" [76]. In a slightly different vein, a 1957 article proclaimed that the computer was a "new giant brain for businessmen" [67], while a 1958 discussion portrayed the computer as an aid in economic studies [65].

Indicative of either reluctance to accept the computer as a major catalyst for change or to recognize the impact the computer was having on business operation and organization, is the manner in which the technical indices handled this new technology. Although the first computer acquired for business data processing was installed at General Electric's Appliance Park in Louisville, Kentucky in 1954, not until the 1965 issue of *Applied Science and Technology Index* were computers listed as a separate category. Prior to 1965, computers were listed under "calculating machines," with only a cross-reference under the title "computer."

After World War II, many of the wartime methods and discoveries used to solve battlefield and supply problems were applied to business. Also, there was an increase in control theory work during the war, with a number of leaders emerging from Hughes Aircraft Company. In a discussion of scientific discoveries and technological changes accelerated because of wartime need, Sanders remarked that "peaceful application of defense-inspired discoveries have resulted in new commercial materials and products" [167]. Included in these products were computers.

As businesses expanded in size, complexity, and financial worth, and as knowledge of computers and their utilization increased, some companies began to select particular aspects of their businesses for conversion to computerization. For example, numerous companies felt that computers would

greatly facilitate inventory control. Therefore, the inventory process was analyzed and then adapted to computerization.

Evolution of the Systems Concept

During this era, one of the evolving methods adopted by businesses was the "systems" idea. Combination of the system method with use of computers meant that the more progressive businesses seriously considered integration of previously separate computer applications. Instead of just converting manual processes then in use, several companies instigated studies of inventory methods, looking toward ways of possible improvement. Thus evolved the idea of an inventory "system." Wherever computer programs used the same source of data, attempts were made to combine these programs in order to eliminate both redundancy and unnecessary costs. Glaser discussed another problem faced by firms attempting the systems approach: "Significantly, companies began to realize that these more complex systems could raise sticky issues of corporate policy. . . . It became apparent that computer systems were introducing a new dimension of difficulty." [76].

"Total" Systems

In the 1950s there appeared a movement toward the theoretical idea of the "total" system. Much of the literature of this era extolled the virtue of an integrated system which combined all the elements of a business. Such a system would conceivably make needed information available to all management personnel. On paper, this concept sounded like the answer to all business problems. Having such information available for any business decision in a timely manner and in the form desired is indeed an ideal. The major drawback in bringing this idea to fruition in the 1950s was the "state of the art" of both computer hardware and software of that period.

Literature between 1958 and 1961 contained the term "data processing systems," but such references were really to problem solving or information gathering and reporting. The context in which the term "system" was utilized did not appear to be in a truly integrated sense. A 1958 article in *Gas Age* had the enticing title, "Total Data Processing May Number Days of the Punched Card as a Business Document" [99]. Perusal of this article, however, revealed that the term "total" as used in the article did not in any way relate to the idea of integrating business information into a unified whole. D. L. Aswen also included the term in an article in which he described an automatic data collection system [15].

The 1960s brought decreased cost of hardware and improvements in software and made a "total" system appear to be feasible. Since the "total" system concept was in vogue in the 1960s, many companies attempted to bring such a concept to fruition [65, 67, 72, 81, 83, 93, 128]. By 1961, the "systems" concept began to creep into literature listings, with the term "total" appearing in the following title: "Total Analysis Digital System for Chromatographs" [104]. Evidence of the changing attitude toward computer utilization was revealed by the title "New Information Systems," which appeared in the August 1961 issue of *The Franklin Institute Journal* [93]. In 1963 a similar article appearing in *The Journal of Petroleum Technology* had the title "Information Retrieval: A Valuable Tool or Costly Waste?" [157]; and a 1964 article by J. Moss discussed methods of "Planning a Management Information System" [134].

By 1964, the terms "total systems" and "integrated systems" appeared in numerous literature listings. One such article was in *Canadian Chemical Processing* and was entitled: "Total MIS: How It Is Achieved" [190]. Describing the atmosphere prevailing in 1964, Russell L. Ackoff commented, "Enthusiasm for such systems is understandable; it involves the researcher in a romantic relationship with the most glamorous instrument of our time, the computer" [2].

The concept of a "total" system was a dream, an ideal. Implementation, on the other hand, was difficult and utilized only in limited situations. Selected companies like those in life insurance, banking, and industrial manufacturing recognized the need for changes. As A. W. Smith stated in his 1966 article from *Administrative Management*, "Practically all companies recognize that a 'total system' is vital to long range programs" [176].

Disillusionment with MIS

As with many dreams, the dream of a "total" information system did not materialize. In a 1967 article, Glaser vividly described the prevailing situation. "Management information systems (especially the "total" or "integrated" variety) are currently much in vogue. . . . Of course, only a few zealots would seek to realize this objective literally. More practically systems designers realize that it would be technically impossibly and economically untenable to collect *all* the relevant data" [76]. Storage costs were still too high for any but the largest corporations to afford. Furthermore, even though great advances had been made in hardware, gaps still existed for those who dreamed of a "total" information system.

Among reasons why such a concept did not work were these: