"a good MIS is to an executive what a good scalpel is to a surgeon; both increase the chance of success but are certainly not substitutes for ability and know-how. . ."

Management Information Systems— Boon or a Bane to Business?

by

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Introduction

All data processing systems are devoted to recording data, manipulating it in some way, and producing meaningful results. The results are usually called "information". This information is used by personnel at various levels within the organization as a basis for action and decision making. Thus, every company now in business already has a management information system of some sort.

However, the management information system (MIS) is viewed in different ways by different persons. Data processing managers think they are already providing most of the information required for management and that they readily could provide the rest if management "would just tell us what they want." Management consultants and system designers emphasize elaborate computer-based systems of information storage and retrieval which allow executives to "find out anything they want to know just by pushing a button." Top executives, some of whom have been victimized in the past by over-enthusiastic promoters of sophisticated hardware and software systems, occasionally become wary of automation and place their faith in tried-and-tested manual methods.

This paper was not written to inform the reader on how to do an MIS. It is the purpose of this paper to try to examine the problems and misconceptions about MIS. This will be done by identifying the basic elements of MIS, the tools and techniques of MIS and then by looking at some of the problems and objections about MIS and what can be done about these to improve the image of MIS.

Characteristics of an MIS

Because there are so many different views of MIS, it is not surprising that

there is no generally accepted definition, nor is there even a single term by which this system is labeled. It has been variously called "total information system", "total management system", "integrated data processing system", and "management controlled information system". It has even been defined as "a totally integrated synergistic analog control system, with digital input and output characteristics, which categorically differentiates the data sets in alternate axes and provides random and sequential access to all planning, operating, financial, and other quantifiable nonquantitative transactions in past, present, and future data planes in conjunction with selective interrogation of the stratified data matrix contained within the computerized data bank with discriminate differentiation of the magnitude of variance limits of the multiple control variables, providing accurately time-phased exception reports for management decision and executive action." This merely goes to show to what lengths of verbal gymnastics people will go to define MIS.

Gobbledygook aside, MIS has been defined as "a combination of people, data processing equipment, input/output devices, and communications facilities. It supplies timely information to both management and non-management people for the planning and operation of a business." MIS also has been called a regular review of operations in a concise format. It translates data both from the environment and from within its own components as its input. It supplies information needed by management at all levels for decision-making functions. It is a network of automatic memory.

A common thread runs through these various definitions: the attempt to involve the computer directly in the decision-making process. No manager can remember all the facts he or she needs to consider in daily and long-range plans. The computer has many facts available about the business as a by-product from its regular applications in making payrolls, billing, inventory, and budgeting. Other facts may be introduced from other sources. Massive files of data can be accumulated and processed rapidly by computer in such a way that the information extracted meets predetermined tests for significance. Even if the utopia of "total information" seems beyond reach, there is no question that computers can be used more effectively in doing what they are supposed to be doing today and in reaching into new areas of competence and assistance to management.

Elements of a Management Information System

Companies vary in their expectations from MIS as well as in their definitions of it. Some want it simple; others want it complex. Some want to build it into their present data processing system; some want it as a completely separate entity. Regardless of one's expectations, however, each MIS requires at least three elements:

*Reporting by Exception

This is the method of reporting to management those things that require attention so that the managers do not have to wade through mountains of data reporting routine details that demand no special or unusual attention. This system is based on the exception principle, meaning that only those items that differ significantly from pre-established standards need to be reported. The standards may vary from one management level to another depending on the criteria set by management.

The reporting system should also permit management at appropriate levels to inquire into the status of anything deserving attention. The inquiry system is usually thought of as a terminal having either a keyboard, a display screen, or both. Such a terminal is by no means necessary, but the system must be promptly responsive to management requests for specialized information.

*The Data Base

A complete data base is needed which can readily provide information of concern in time for action to be taken. The data base must be continually collected, summarized, and made available to the proper persons for analysis and action. Much of the data comes from regular processing activities and should be in such detail as is required by management at each particular level within the structure.

If the data base is to contain "all" information needed by management to make decisions, it must include many elements not developed from within the company through normal data processing activities. Much information is obtained directly by the manager, through conversations, conferences, newspapers, and journals – even through listening to scuttlebutt and the grapevine. Such external information is often difficult to quantify, code or relate to internal information in a meaningful way.

*External Data

This includes an expansion of input stations to include data from outside the company as well as from within. Data should be captured as close to the source as possible. It can then be processed and evaluated through programming. If it has significance in terms of established standards, it can be reported out for appropriate action. Some of the input stations can be used by managers themselves or their secretaries to enter external information that they have gained in some way. This information, like that developed from within the company, can be subjected to analysis or comparison against pre-determined standards.

Historical Development of MIS

For a fuller understanding of MIS, we might examine some of the historical perspective out of which it has grown. We must not imagine that, just because the term MIS is of fairly recent origin, managers only recently have been confronted with the need to make decisions on information from a variety of sources. From earliest times, before even such relatively simple mechanical aids as calculators and adding machines were available, managers had to use quantitative information from the records of their business along with non-numerical information from outside to plot their courses of action.

The introduction of unit record equipment and first generation computers permitted the application of advanced technology to small, independent problems involving only numeric data. Processing was transaction-oriented, with practically no references to a master file. As computers were developed with larger internal storage capabilities, it became possible to enlarge files to contain more data about a single subject.

Further, the so-called information explosion brought forth a new demand for non-numeric processing. Technical abstracts, library listings, intelligence reports, catalogs, and other alphabetic data brought the need for new techniques of data handling. Such data required variable length records. Indices giving reference to the content of information had to be developed. Cross-references under a variety of topics required special data definition tables, listing each place where reference to a given topic might be found. Free-form text, using periods and commas to separate the various data elements and parameters, came into use. It soon became apparent that these techniques could be applied to non-numeric management data.

Historical development of the MIS has passed through four recognizable stages, roughly parallel to the development of computer systems generally:

1) Sequential batch processing, which uses many independent transaction-oriented tasks to summarize inputs in order to produce reports.

2) Direct access batch applications, which makes use of addressable mass storage devices to retrieve records directly without searching through entire files.

3) On-line processing, which uses the direct-access storage devices to place the data base within convenient reach of the ultimate user through a terminal.

4) The integrated data base, with a highly developed system of pointers and structures to permit data to be associated together in many combinations and relationships. This stage also adds the ability to perform special management

techniques for planning, modeling, and doing simulations.

Tools and Techniques Used in MIS

In recent years, beginning about the time of World War II, the field of OPERATIONS RESEARCH has been growing rapidly. Operations research, which is sometimes called "management science", is the application of mathematics and computer techniques, together with a particular methodology, to complex problems arising in the management of large systems of people, machines, materials, and money.

Operations research should be directed primarily toward complex management problems. The problems also should be relatively large scale so that they are economically significant.

The methodology involves the following five steps:

1) View the problem area in its large context.

2) Develop a mathematical model.

3) Seek the best solution within the framework of managerial constraints.

4) Test and implement the solution.

5) Evaluate the solution after implementation.

The preceding five steps bear a similarity to those involved in the development of other systems. The chief way in which operations research differs from other forms of system development is in the use of a MATHEMATICAL MODEL.

Operations research has produced a group of special mathematical applications which can be employed to give management a greatly expanded use of the MIS. Some of these specialized areas include:

***Linear Programming**

A technique concerned with the allocation of resources among various alternative products or services to achieve the maximum over-all profit or minimum over-all cost.

***Queuing Theory**

The study of waiting lines or queues.

***Inventory Theory**

The study of the points at which inventoried materials are periodically depleted and replenished.

***Simulation**

A general technique for exploring the effect of various courses of action, primarily through the use of the computer.

***PERT/CPM**

Program Evaluation and Review Technique/Critical Path Method: a specialized planning and scheduling technique well adapted to the use of computerized methods.

***Advanced Statistics**

A field involving analysis of the frequency of occurrence, the distribution of items, sampling techniques, probability, and other analytical tools.

Common Pitfalls Encountered in MIS Design

There are numerous examples of businesses that have not achieved economic gains from their MIS. In one case, a utility company estimated that an information system would cost $2.5 million to develop and would achieve economic benefits sufficient to apply for this investment over a 4-year period. The project was abandoned, however, after $7 million in development costs had been incurred and it was then estimated that an additional $8 million would be required to complete the system. Dismal examples such as these are not limited to businesses. It is estimated that the data processing operations of the federal government of the United States annually wastes millions of dollars because of poorly conducted systems studies. According to a survey conducted in the United States among 147 financial and data processing executives, only 30% of these executives reported that they were satisfied with the economic return on their information system investment.

These gloomy facts support the contention that MIS acquisition and use can be risky. The costs associated with acquiring and using a computer can be hard to predict. The difficulty is not caused by the hardware rental or purchase costs, for these costs are known. Rather, the difficulty is caused by the unpredictability of software and operating costs (which are likely to be much larger than hardware costs).And when expenses are hard to pin down, tangible savings resulting from the system becomes equally difficult to predict.

Financial loss may be the end result of failure to conduct an appropriate MIS study. In the past, numerous mistakes made by business managers have

contributed to this undesirable end. To avoid the mistakes of past managers, a list of common pitfalls is given below to warn the unwary that the path to MIS is not an easy one.

Common Pitfalls

1) **Lack of Top Management Support.** Top executives have often failed to provide the needed leadership and have sometimes been antagonistic to systems solutions proposed by specialists who speak in terms they do not understand.

2) **Failure to Specify Objectives.** A systems study should be directed toward achieving specific goals. It is a responsibility of users to specify what they want in the way of quality management information – a responsibility that many have been reluctant to assume. Computer usage should be considered only when goals can best be reached by electronic means.

3) **Excessive Reliance on Vendors.** Computer manufacturers can provide many valuable services. But it is unrealistic to expect them to be objective if (as has sometimes been the case in the past) they are given the job of conducting the systems study.

4) **Lack of Awareness of Past Estimation-Error Patterns.** The following error patterns are among those that have been common in the past: a) initial system development time, the difficulty of training system users, and the problems associated with system implementation have generally been underestimated: b) the degree of employee resistance to change has been "surprisingly" high; c) development and operating costs have often been understated while savings estimates have been too optimistic; and d) the differences between organizations have often been underestimated with the result that hardware/software resources suitable for one firm may be unacceptable for a "similar" firm in the same industry.

5) **The Crash Program Pitfall.** It typically requires many months to design and implement a complex new information system. Yet it is not uncommon for managers to attempt a crash program in much less time because a) they do not appreciate the magnitude of the task and b) they wish to achieve immediately the benefits that the computer is supposed to provide. The system produced by a crash program generally leaves much to be desired. It often fails to meet needs; it requires that a disproportionate amount of time be spent in tuning and maintenance; and it encounters resistance from personnel who were not properly prepared for it.

6) **The Hardware-Approach Pitfall.** Executives have been known to

contract for a new computer first and then decide on how it can be used. The hardware approach typically dispenses with any meaningful systems study; an elusive intangible called prestige is its goal; and the effects of change on personnel are given little consideration.

7) **The Improper-Priority Pitfall.** One of the consequences of lack of top management support and of failure to specify objectives clearly has been that critical applications have been ignored. Processing emphasis is placed on lower-priority tasks. A thorough system study should identify the critical functions.

8) **The Inadequate-Staffing Pitfall.** Members of the study team should have an intimate knowledge of the business and/or they should be competent in the technical aspects of systems and data processing. Although their talents are often in demand elsewhere in the organizations, these people must be released from other duties if a proper study is to be made. Entrusting the study effort to an "average" group yields only average results at best.

9) **The Excessive "Pioneering" Pitfall.** There are many competitive advantages in being the first to develop a new system or application. But in the past, some pioneers have found their advantages to be only temporary while their costs were much greater than the costs of their competitors.

10) **The "Total System" Pitfall.** Attempts have been made in the past to design totally integrated and very complex systems in one major effort rather than to proceed with the less ambitious (but less risky) approach of carefully implementing system modules.

11) **Lack of Control Pitfall.** New systems have been designed, for example, without the necessary initial attention being given to provisions that will allow for the proper control of data integrity and system security. Such systems have then had to be reworked at considerable expense to incorporate the necessary data and system controls.

Myths and False Assumptions about MIS

Myths about MIS

The success of a business is largely dependent on decisions concerning future events. Such decisions do benefit from a good and timely analysis of historical happenings which a management information system can provide. But the basic ingredients of such decisions (and thus of business success) are judgement, initiative, and common sense. An MIS cannot be endowed with these ingredients. An MIS will no more ensure the success of a business than a scalpel will ensure the success of a surgical operation. A good MIS is to an

executive what a good scalpel is to a surgeon: both increase the chance of success but are certainly not substitutes for ability and know-how.

Nevertheless, the purveyors of MIS "miracles" continue to promote myths such as the following:

1) **The successful executive will soon have a computer terminal on his desk.** This is about as useful as a typewriter on his desk. A computer can provide perhaps 10% of the ingredients of a good executive decision. The executive and his human associates must continue to provide the remaining 90%.

2) **Our department heads aren't smart enough – Get outsiders to create a major new automated system.** If department heads aren't smart and flexible enough to be involved in developing an MIS, they aren't capable of doing their present jobs and should have been replaced long ago. An essential ingredient in the successful development of an MIS is knowledge of the job to be done and the understanding of the environment in which it must be accomplished. Another essential ingredient is in-house enthusiasm for a new system. It would be easier to teach department heads about computer capabilities than for a systems expert to acquire a real understanding of the business.

3) **Automated management systems are flexible – Just put data in and the computer can use it to answer almost any management question you can think of.** A computer can only answer questions you have anticipated well in advance and taught it to answer.

4) **To have a successful MIS, depend on an outside computer firm for computer services.** Most successful firms (except the smallest) have in-house computer capabilities to meet basic requirements and depend on outside capabilities to meet specialized or peak needs.

5) **Automated systems revolutionize management processes.** To date, computers have generally discouraged really major changes in management processes by making it economically feasible to continue doing things the old way.

6) **MIS is a myth – There are no such things.** Almost true. Mostly, there are automated clerical systems. Very few firms have successfully automated some of the more routine management functions, but to date, benefits have usually not justified the expense. A tremendous gap exists between what is theoretically possible and what is operationally and economically feasible.

False Assumptions about MIS

In establishing an MIS framework, computer specialists and managers make many assumptions. Some assumptions (those based on the relationship between

information and management) have implicit, built-in MIS requirements, which some promoters emphasize in pointing out the value of MIS. Unfortunately, the promoters thus point out assumptions, not conclusions, which (if they persist) lead to improperly defined system objectives, failure or sub-optimization. As momentum builds up, it is less likely that design efforts will change or shift to the correct dimension.

Dead-end streets in MIS development are likely to be incredibly expensive, so much so that what at first looks attractive can gradually degenerate into disaster. The project undertaken may be impossible because of what it attempts to do, the money allocated for it, the talent available to work on it, the contemporary state of the art, the timetable for implementation, or any combination of these factors. Also, disaster can result when the MIS simply does not bring about the benefits needed to justify its existence. A number of companies met with failures because they did not encompass a balance of short- and long-term payoffs. For the right mix, the functional modules of a planned MIS must be identified and ranked according to benefits to management, cost effectiveness, and other values.

At least seven false and commonly made assumptions can blind system designers to the real needs and opportunities:

1) Decision makers can express their information needs. (Management may understand its problems without knowing what information is needed to solve them or even how to state those needs lucidly and unambiguously.)

2) Decision-making will improve as more information is made available. (More wrong information cannot help; more information of any type will not help unless accompanied by more sophisticated methods of locating and retrieving what is needed. Besides, sheer bulk of information makes it difficult to separate the important from the irrelevant.)

3) Managers are starving for information. (Piles of information surround the busy administrator; what is needed is not more information but appropriate information properly presented.)

4) Information will improve communication, which in turn will improve executive performance. (Information that is not relevant to the receiver or is not clearly stated cannot be communicated. More communication, even if improved, may be a burden on the manager.)

5) Managers need the information they request. (Many managers request available information, which may not meet their needs. Some, being uncertain of their needs, may ask for a lot of information, hoping to discover something by

browsing through it.)

6) Managers get too much information. (Often true, this assumption may be spacious when viewed conversely. Less information is warranted only when it gives the manager the same message.)

7) Executives tend to get information faster. (Unless faster is related to something, this assumption falls apart.)

So an MIS fails because of the assumptions made concerning the relationships between information and management. Neither more nor different information necessarily results in better decisions, but an MIS should have better decisions as one of its goals. Few managers can pinpoint their information needs because they tend to center their requests around what they are currently receiving and what they would like to have but often fail to request either what is actually needed or to see how different information could meet their needs (projection). To solve the information dilemma, computer specialists and managers must work together to search out the dependent and independent relationships between information and management needs.

Summary and Conclusions

It would seem from the previous discussions, that this paper intends to discourage managers from the use of MIS and to go with the tried and tested method of manual systems. On the contrary, this author feels that MIS, when applied properly can and is a boon to business. What I only wish to point out to prospective users of MIS is that MIS is something that cannot be attained at the snap of one's fingers. Thorough and careful study of the system needs and requirements must be done to avert what can become a major disaster in the life of a company.

To summarize therefore, the managers must remember certain things, namely:

1) **MIS is not a supersystem.** MIS is a tool and should not be treated as a cure-all for the ills of a company. It cannot be looked upon as some miracle drug that will instantly turn a distressed company into a healthy company. Prospective users must remember that a tool is only as good as the people who use it.

2) **No manager with responsibility for a business – or a part thereof – will base important decisions on the outcome of a process which he, himself, does not adequately understand.** In other words, regardless of a manager's confidence in his "management scientist", he should never stick his neck out

unless he fully understands the reasons for doing so. He must remember that MIS is a nebulous area and that even people within the field have different views on the subject so that he must clearly understand what is going on before he risks his neck.

3) **Managers must understand the paradox of uncertainty.** This deals with the paradox one faces when designing and implementing an MIS which is this: the lack of advance knowledge of what decisions will have to be made. The job of managers is to make decisions under conditions of uncertainty. As soon as they can foresee and define the conditions they will encounter, their decisions are reduced to routine. The more procedures that can be made routine, the more vital will be the role of the decision maker in handling the exceptions. Managers want access to all the data possible. They want to be able to subject it to comparisons, projections, simulations, and even play hunches if necessary.

As a final statement, it must be remembered that a true MIS can never be attained. It will never be possible to provide management with everything necessary for making decisions, for we can never automate imagination, prejudice, whim, inspiration, stubbornness, and all other human traits. A machine is a machine; and a person is a person. Each has its place: and each has its strengths and weaknesses. The proper system will exploit the speed and reliability of the machine in order to free human beings from trivia so that they can concentrate on those things that only they can decide.

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