Management Reporting Systems

James M. McKeever

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Wiley Business Data Processing Library
edited by Richard G. Canning and J. Daniel Couger

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In Collaboration With Benedict Kruse

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Management Reporting Systems

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Editors: **Richard G. Canning and J. Daniel Couger**

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Series Preface

The Wiley Communigraph Series on Business Data Processing is intended for professionals and for persons desiring to improve their competence in business/management applications of the computer. Within each of some twenty subject areas, publications will be provided over a range of technical depth. The objective is a series of publications that enable readers to gain an understanding in specialized subject areas.

The term "communigraph" was coined to reflect this philosophy —succinct treatment of specialized subjects. A communigraph requires only a modest investment in time on the part of the reader. The communigraph format has also allowed many authorities in the computer field—persons who have too many demands on their time to allow them to write full-length books—to participate as authors.

The series is designed to cover three levels of interest for detailed technical information:

Red Titles. For data processing managers, business programmers, analysts, and others who wish to gain background information about this subject.

Blue Titles. For business programmers and analysts, and data processing managers, who have some experience in this subject and who wish to study it in more technical depth.

Gold Titles. For senior business programmers and analysts, and data processing managers, with extensive experience in the subject, who wish a highly technical discussion of it.

The increase in breadth, complexity, and the dynamic characteristics of the computer field make a series such as this imperative—for training and for reference. The breadth is illustrated by the many subject areas covered in the series: from data base design to business planning by way of simulation; from hardware-software evaluation

and selection to personnel considerations for business data processing. The growth of complexity is apparent in each of these subject areas; for instance, the variations in data base design and data management systems are increasing almost weekly. The dynamics of the field are obvious, with the multitude of new hardware and software products reaching the market each year.

In the face of this growth in depth and complexity, practitioners encounter the problems of developing and maintaining technical competence. The novice must upgrade his competence to reach the experienced practitioner level. The experienced system analyst and programmer must strive to reach senior levels. The professional must broaden his knowledge to include new specialties that adjoin his areas of technical competence.

Training, updating, and upgrading professionals in the computer field will be a continuous problem. We hope that the communigraph series will be an effective method in helping to cope with this problem.

Richard G. Canning
J. Daniel Couger
Series Editors

Preface

On-line management reporting capabilities are in the process of triggering major changes in the information processing environment.

From a management standpoint, the impetus is loud and clear—strong and unmistakable. Management, at the top level, is becoming increasingly vocal in its demands for fingertip access to computer-digested information.

On the hardware side, multiprogramming computers are becoming commonplace. Systems combining multiprogramming hardware and data communication capabilities, while not yet commonplace, are definitely a current preoccupation. They already display the earmarks of a strong trend.

The software, or implementation, end of this business is just emerging from a maze, finding its way toward logical future directions.

It is in the area of implementation of management information systems that a tremendous informational and educational gap exists. The need is present among several distinct stratum of operational and executive personnel:

Programmers. The industry is at a point where most companies with substantial past investments in batch data processing systems have pools of experienced programmers. However, whole new sets of concepts and working rules must be applied if these people are to make the transition into the entirely different specialty of on-line information system programming.

Systems Designers. These people, both at the consulting and employee level, have similar, though somewhat more sophisticated, problems. They need a complete education in data communications and in interfacing between communications networks and computers. These people also must acquire an overview type of understanding of executive and communications software and of the special needs of on-line application programming.

Data Processing Management. The need for understanding at this level is twofold. (1) Data processing managers must be technically upgraded so that they have a grasp of current concepts and equipment. (2) Data processing managers must integrate more solidly into the corporate structure and must, above all, be able to communicate with every level of line, departmental and top management within a company.

Line and Departmental Management. This is one of the prime areas of need. These are the people with line responsibility for generating and applying data. They are the ones who must interface with on-line computer systems at an information input and/or utilization level. More than at any time in the past, these people must know about the workings and, more specifically, the functional requirements of computer systems.

Top Management. In terms of the text at hand, top management performs two functions. (1) In many cases, top management people are creating the impetus leading the development of management information systems. (2) In other cases, top management people are the ones who must be sold on or educated to on-line reporting systems. In any case, the very presence of on-line management reporting systems calls for a closer degree of coordination than at any time in business history between top management and data processing activities.

This communigraph is aimed, with some reservations, at fulfilling this entire spectrum of information needs. The level of the text material makes certain broad assumptions:

1. Readers are assumed to be conversant with data processing systems and terminology—particularly with the general principles of multiprogramming and on-line systems.
2. The content of this work is aimed particularly at persons with a direct interest or involvement in the development of systems with management reporting objectives.
3. If line or top managers not directly involved in data processing plan to use this communigraph, they should have taken a familiarization course or read a basic text before undertaking this work.
4. This material is, however, designed for multidiscipline use. One of its themes is the necessity for coordination by people with widespread interests and responsibilities in the implementation of a successful management information system.

James M. McKeever
Benedict Kruse

El Segundo, California
Tujunga, California
June 1970

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SECTION 1

The MIS Challenge

A management information system of some type is a corporate necessity. Every company has one.

Specifically, a management information system (MIS) is a collection of facts, procedures, people, and machines which develop information designed to serve as a basis for decision making and policy formation.

Depending on the nature of the company, its operating charter, and the personalities or philosophies of its top executives, an MIS can take several forms. For the purposes of this discussion, four frames of reference can be established:

1. An MIS can be clerically implemented. That is, clerical pencil-and-paper techniques are used in the distillation of decision-level information—even if a computer is involved at operational levels.
2. An MIS can be implemented on the basis of printed reports generated by and distributed from a batch-type computer installation without on-line access capabilities.
3. An MIS can be geared to direct interaction between management and the computer system through remotely located, on-line terminals. In such situations, the computerized MIS is said to be responsive to management requirements.
4. A computerized management information system could ultimately be developed to recognize and present pertinent data on situations requiring management attention. An MIS would then also be assigned the capability for presenting data through some graphic display technique, possibly a large, projected display of the type used in military "war rooms" or management control centers.

This study concentrates on the third type of system. It also covers portions of the fields in the second and fourth categories in terms of their relationships to the primary area of interest,

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either as stepping stones toward an on-line, interactive system or as logical future extensions.

This focus is based on observations indicating that the combined factors of technological development and available working techniques have established a developmental stability under which interactive management information systems are a logical focal point for attention and activity. In addition, top executives themselves have, on repeated exposure to these concepts, reached a point of sophistication where requests are being generated for studies and implementation of interactive MIS facilities.

MIS BASICS

This subject matter is based on several presuppositions. An organization implementing a management-interactive MIS must have a large-scale computer system with considerable random access file capacity. In most cases, such computers will be used for other data processing activities as well as the MIS. Therefore, the computer either must be dedicated to MIS for a portion of the day or must be capable of multiprogramming.

Since the latter is usually the case, a multiprogramming environment is presupposed. That is, it is assumed that the central computer has both the physical capacity and the supporting software to house elements of several different programs within its main memory at any given time. It is further assumed that, based on a priority scheme resident within the computer, execution of two or more programs can be interleaved so as to optimize processing productivity within established priority rules.

From the user's standpoint, MIS interaction has the appearance of putting the complete computer facility at the disposal of each top executive, manager or designated assistants on a demand basis. The executive, or an assigned assistant (secretary, information specialist, executive, or staff assistant), should be able to address the computer system in a language or with a vocabulary which is closely related to normal company or industry terminology with which he is already familiar. The computer then responds to these executive actions, which could take the form of supplying information or asking questions. Based on the computer's response, the executive user can then react. In essence, the executive and the MIS are each responding to stimuli generated by the other. This mode of activity will be referred to in this study as "interactive."

TERMINALS AND DISPLAYS

The executive activity itself is, of course, far removed from the central computer installation. This removal is generally psychological as well as physical. In general, top executive offices are located at some distance from data processing facilities. However, even if the top executive happened to be in the next room, he would never be concerned with physical operation of the computer. Rather, he would have a device available which would serve, for him, as a sort of "information window." Computer people know these devices as terminals, increasingly supplemented by large-screen displays. For the interactive MIS, terminals and displays provided for executives can be of several types:

- A typewriter station.
- Cathode ray tube (CRT) terminals with alphanumeric capabilities only.
- CRT terminals with alphanumeric and graphic capabilities.
- CRT terminals with full video, gray-scale rendition capabilities.
- Large, projected displays presenting selections of previously developed, static data.
- Large-screen displays of computer-generated

information available for display following direct, on-line access.
- Large-screen dynamic displays presenting interpreted, graphic information of the type used for military status boards.

Specific applications for different types of executive terminals and displays will be discussed in further detail as appropriate. For introductory purposes, however, it is important to realize that many types of devices exist and that it is basic to an MIS that the system be adapted to the needs, personalities, and working habits of the executives who will be using them.

THE TOP MANAGER AS DP "CUSTOMER"

In considering management information systems, it is important to realize that the data processing professional is dealing with a special type of "customer." A management information system is, of necessity, personalized. In terms of traditional techniques which have been used to develop data processing systems, an MIS is atypical.

Conventionally, most data processing applications have started with conversions. Data processing people have had a history to look at—from manual procedures, to punched card operations, to computers. Computer systems themselves have tended to fall into three categories: punched card, magnetic tape, and random access. Traditionally, there has been so much catching up to do on established, demanded applications that it has been impossible to afford the luxury of interoperational overview. It has been apparent for some time that transactions in one phase of a business impact many other operational aspects. An obvious example is the chain of events set off when merchandise is sold. Inventory levels must be updated. This information, in turn, bears on production and/or procurement activities. In addition, manpower planning and other aspects of the business—ranging from credit files to advertising budgets—are also impacted. But practicalities and economics have tended to enforce a segmented approach to problem solving and application processing.

The one-job-at-a-time approach worked fine until (1) multiprogramming facilities made some application interrelationship operationally desirable and (2) top management people began to realize the potential of computers for providing customized information for decision making and policy formation. Thus pressures toward integrated management information systems have come from two directions. On the one hand, data processing people have realized the feasibility and, in most instances, the desirability of synchronized processing for interrelated applications. On the other hand, management has learned that the computer represents a potential for substituting fact for intuition in the decision-making process. The coincidence of these two trends has created new and different requirements in data processing development and utilization for both systems and management people. Each of these areas is worth brief, initial investigation at this point.

GENERAL MIS REQUIREMENTS AND VALUES

In terms of system development, the big difference introduced by an MIS is that preconception of problems and/or solutions will just not work. No matter how experienced a data processing manager or system designer may be within any given company, it is important to realize no management information system can work without *top executive involvement.*

Involvement is a basic requirement.

Without it, an MIS will never really be fully functional.

Operationally, this makes for a different starting point in system development. Traditionally, data processing conversions begin with a problem. A given job is too massive or too expensive or perhaps too slow to be handled under existing techniques. Reduced to basics, most managers whose applications are converted to computers have their eye on the balance sheet. Almost before a systems man has a chance to look at a job, he is pressured to come up with an estimate on how much money he can save. The computer, in effect, becomes a factory within a factory. Performance measurements are based on costs of information production rather than potential values of information.

This was borne out in a study by the American Management Association (AMA). In a survey of 288 companies, AMA learned that 176—more than 60 percent—installed computers exclusively for cost reduction. Only three—a bare 1 percent—used management assistance values as their chief criteria.

The great majority of data processing people have been aware that these basically unjust standards have applied for some time. Data processing has been an ultimate stronghold for management by expense reduction rather than value received. As a direct parallel, a company which finds itself in a cash-flow bind could probably save more money if it eliminated its entire sales force. Certainly, costs would be cut—drastically. But this type of approach is not practical because it would have an adverse effect on the profitability of the company as a whole.

Another area where this type of thinking can be paralleled is research and development. The computer industry itself holds a good lesson in this area. The computer age, as we have come to know it, was launched in the early fifties when General Electric made the first large-scale commitment to install a UNIVAC computer for business data processing. At that time, IBM found itself with no computer on the market. During the early fifties, before anything approximating a computer industry ever existed, IBM management adopted a policy which ultimately saw the company putting $100 million per year on the line for research and development. Certainly no one in IBM management expected to reduce costs through these expenditures. But the whole world knows today how these decisions paid off.

Similarly, back in the days when the Haloid Corporation was a small, struggling manufacturer of photographic supplies, management committed most of its resources to the development of a new process known as xerography. Again, the dimensions of this decision reached far beyond cost considerations. The results did, too. The company wound up taking its name—Xerox—from the process.

These examples illustrate a vital characteristic of data processing activities—a major potential value of computers is in the largely unexplored regions of increasing corporate profitability through better-informed, more-responsive management activity.

This is where MIS comes in. In effect, an MIS is a tool for profitability surveillance. Much as radar protects our skies, signals received and emitted by a management information system can provide protection against avoidable losses or guidance in capitalizing on new opportunities.

Consider this point of protection against the unforeseen first. At the Omaha headquarters of the Strategic Air Command (SAC) of the U.S. Air Force, commanders are advised and reaction alternatives delineated within a matter of seconds after a potentially hostile airborne vehicle is detected. In business, where the same type of electronic equipment is generally available, it is not uncommon for a "hostile" market

or production situation to exist for several months before it is brought to top management attention. Then it is also not uncommon for the situation to exist for another two, three, or more months before corrective action is implemented.

Herein lies one of the basic values of an MIS. Situations requiring corrective management action are detectable sooner and more clearly. For example, the profitability of a manufacturing company's product line may be attacked at several peripheral points, all of which, in themselves, are of minor significance. Labor costs can increase minutely at the same time that freight rates go up, both in the face of new competition from other companies. Environmental factors also vary in their influence. Tight money could influence marketability or place restrictions on support inventory for manufacturing operations. Unseasonal weather could change a company's picture completely. The possibilities, obviously, are almost infinite—at least too great for all influencing factors to be evaluated and interrelated intuitively. An MIS, in effect, can provide the scope necessary for both tactical and strategic surveillance of corporate operations.

Detection, of course, is just one side of the picture. Detection of either problems or opportunities calls for decisions. Evaluation of the implications and results of decisions is a critical area of potential MIS value.

Underlying every decision are bound to be some uncertainties. The bigger the decision, the more desirable it becomes to predict and offset the risks. As a management decision begins to impact a company's current operations, an effective MIS should be able to provide almost immediate feedback. Management knows, sooner, the results of its actions. Adjustments or corrections—either to stem losses or to capitalize on opportunities—can be made on a more timely basis than is conventionally possible.

JUSTIFYING THE MIS

The profit potential of an MIS in the areas of both operational surveillance and decision evaluation can be illustrated with a relatively simple example. Consider the area of a company's expenses. Traditionally, top management would get a report reviewing expenses, according to budget accounts, sometime between the 10th and 15th of each month. Management got this report—and associated demands for its attention—whether or not it seemed pertinent to the problems of the moment. Then, if a problem was detected, correction was unavoidably well behind the fact.

To illustrate, assume that management found overall expenditures for overtime pay to be out of line. If this situation was revealed on February 15 in a report covering January operations, the abuses could have existed for as much as 45 days before the trend was recognized. Then, suppose a new policy was enunciated and put into effect on February 20. Normally, the March 15 report on February operations would not reflect a valid measurement of the new policy. It would be April 15, therefore, before management had any measure for knowing whether a situation dating back to January was being corrected. If adjustments had not been satisfactorily executed—or if the decision to reduce overtime had created other problems—a whole new 90-day cycle would have to be initiated. And another 90-day waiting period would be launched.

This situation is fairly common. Under an interactive MIS, however, the results would be different. For example, a company might enter its labor statistics into its computer system on a daily basis and management could monitor this particular problem every morning. In practice, however, it doesn't generally happen this way. It is safe to say that overtime expenses will be summarized as a by-product of weekly factory

payrolls. Therefore, the most probable follow-up pattern would be a monitoring of weekly summaries on labor costs, of which overtime pay is one routine segment. Assuming also that payrolls are processed during the week following performance of work, management would be one week behind in the timeliness of the data surveyed. Even then, it is reasonable to assume that the overtime pay trend would have come to light by the third week in January, three weeks earlier than it did.

The isolation of the problem results largely from the manner in which data are available. Logically, any company using a computer for its payroll is going to produce weekly summaries of labor expense. This type of report, however, rarely reaches top management simply because the volume of paper would be too great. With an MIS, however, it is easy for top management to make a summary review of operations once a week, frequently at an operating committee meeting. It is at such meetings that out of line overtime expenses might be uncovered.

The pinpointing of problems results from the use of exception-reporting techniques. Rather than having to wade through masses of data, managers can work with abbreviated reports which isolate problems according to criteria contained within computer programs or specific inquiries.

To continue the above example, suppose that an inquiry was launched on the third Monday in January. With weekly surveillance by top management and daily checkups by middle management, it is reasonable to expect the situation to be under control and reflected in operating statistics of the company by early in February. In other words, with an MIS, it is entirely feasible that the problem can be solved before it would even have been discovered under conventional procedures.

Herein lies a basic characteristic of the management information system. It is geared to respond to the needs, attention and/or interests of the manager. It is dynamic rather than static. Conventionally, data processing systems designed for management support have specified, formatted reports as their end products. This information is delivered to management on a routine, cycled basis. It comes through on the same day each week or month, whether or not management is interested in having this information at that particular time.

In contrast, with an on-line management information system, the latest available information is always on hand. Management can access it under the dictates of its problems. Voluminous documentation is virtually eliminated, as is the expensive time management formerly had to devote to perusing largely unneeded volumes of statistics.

Although this illustration has been necessarily sketchy, it should be sufficient to dramatize that the justification basis for an MIS is different from that of a conventional computer application. An MIS takes data processing out of the realm of the documentation factory. The end product of an MIS should be sounder decisions based on more relevant and timely information. It must be stressed that the potential benefits to be gained here are far greater than those conventionally emphasized in the purely paperwork approach to data processing.

MIS DESIGN CRITERIA

Herein, then, lies the difference between an MIS and a conventional application as far as the system designer or programmer is concerned. The data processing man need not be tradition bound. He is not limited to delivering the same results through varying methods.

By and large, the actual functional techniques used within the computer system

itself will be highly familiar to the system designer. The difference is chiefly in orientation. With an MIS, management sits as judge and jury. If the system is designed to provide for the needs, habits, and preferences of a specific group of top executives, it will be used. If so, it will deliver results. These results, however, call for involvement in system definition by persons for whom such things are unfamiliar. Therefore, the system designer faces new challenges to his communication capabilities. He has, in addition to his other responsibilities, an educational job to do.

In undertaking the design of an MIS, the first requirement is an acute sensitivity to the stated and implied needs of top management. There can be no second-guessing. Neither can there be any question of altering objectives to the convenience or conditions of the computer itself.

In conclusion, it is important to understand at the beginning of any discussion of management information systems that:

1. An MIS is a specialized tool for specific managers. It must be developed on the basis of executive requirements and involvement.
2. The criteria by which an MIS should be measured are different from conventional computer applications. Results, rather than costs, are the important factor.

These characteristics form the basis for a discussion on how a management information system is initiated and implemented, to begin in Section 2.

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