A NEW APPROACH TO DEFINING THE CHIEF EXECUTIVE'S INFORMATION NEEDS

He could have been the President of any one of a number of successful and growing medium-sized corporations in the electronics industry. He had spent the previous day working to salt away the acquisition of a small company which fitted a key position in the product line strategy he had evolved for his organization. Most of this day had been spent discussing problems and opportunities with key managers. During both days he had lived up to his reputation of being an able, aggressive, action-oriented chief executive of a leading company in its segment of the electronics field.

Unfortunately, the President had chosen this time in the late afternoon and early evening to work through the paper massed on his desk. His thoughts were not pleasant. His emotions ranged from hopeless amusement to sardonic anger as he plowed through the papers. "Why", he thought, "do I have to have dozens of reports a month and yet very little of the real information I need to effectively manage this company? There must be a way to clearly identify the information that I need to run this company!"

In effect, he was expressing the thoughts of many other general managers - and especially CEO's - whose needs for information are not as clearly determined as are those of many functional managers and first-line supervisors. Once one gets above the functional level, there is a wide variety of information which one might possibly need; and, each functional specialty has an interest in "feeding" particular data to a general manager. As in this case, therefore, a massive information flow
occurs. This syndrome is spelled out with differing emphases by the recent comments of two other corporate presidents:

The first thing about information systems that strikes me is that one gets too much information. The information explosion crosses and criss-crosses executive desks with a great deal of data. Much of this is only partly digested and much of it is irrelevant.... (1)

I think the problem with management information systems in the past in many companies has been that they're overwhelming as far as the executive is concerned. He has to go through reams of reports and try to determine for himself what are the most critical pieces of information contained in the reports so that he can take the necessary action and correct any problems that have arisen. (2)

It is clear that a problem exists with defining exactly what data the chief executive (or any other general manager) needs. My experience in working with executives for the past decade or more is that the problem is universally felt - with individual frustration levels varying, but most often, high.

In this article, several current major approaches to the definition of managerial information systems needs are first discussed. We then turn to a new approach developed by our research team at M.I.T.'s Sloan School of Management. This last approach stems from some early work done by Daniel and Anthony and is based on an executive's identifications of his "critical success factors" and the information needs which flow from these factors. Experience in the last year with this approach suggests that it is highly effective in aiding executives to define their significant information needs. Equally important, it has proved efficient in terms of the time needed to explain the method and to zero in on information needs. (For most executives, the time needed totals three to six hours.) Most critical, executive response
to the method has been excellent both in terms of the process and its outcome. Until recently, the method had been used only with an organization's top executives, but our current work makes it clear that it is useful for any general manager with multi-functional responsibilities.

Current Methods of Determining Top Executive Information Needs

In effect there are four current approaches to determining executive information needs. We term these the by-product method, the null approach, the key indicator method, and the total-study method. Below is a brief synopsis of each of these and a discussion of their strengths and weaknesses. A fifth approach which has many desirable characteristics is then described. Termed the "critical success factors method", this approach is being actively researched and utilized today at our Center. Its use in one major case is described in detail.

The By-Product Method. In this "method," little attention is actually paid to the real information needs of the chief executive. The organization's computer-based information systems development process is centered on the development of operational systems which perform the required paperwork processing for the company. Attention is focused, therefore, on systems which process payroll, accounts payable, billing, inventory, accounts receivable, etc. The information by-products of these transaction-processing systems are often made available to all interested executives, and some of the data (e.g., summary sales reports, year-to-date budget reports, etc.) are passed on to top management. The by-products which reach the top are most often at a heavily aggregated level (budget/actual for major divisions), or they are exception reports of significant interest (e.g., particular jobs now critical by some pre-set standard). All reports, however, are essentially by-products of a particular system initially designed primarily to perform routine paperwork processing.
 Where the information sub-system is not computer-based, the reports reaching the top are often typed versions of what a lower level feels is useful. Alternatively, they may be the on-going periodically-forthcoming result of a previous one-time request for information concerning a particular matter initiated by the chief executive in the dim past.

Of the five methods discussed, this is probably the predominant method. It leads to the welter of reports noted in the introductory paragraphs of this article. It has the paperwork-processing tail wagging the information dog.

The approach is, however, understandable. Paperwork must be done and clerical savings can be made by focusing on automating paper-processing systems. It is necessary to develop this class of data processing system to handle day-to-day paperwork. However, other approaches are also necessary to provide more useful management information.

The Null Approach. This approach is characterized by statements which might be paraphrased in the following way. "Top executives' activities are dynamic, ever-changing, and therefore, one cannot pre-determine exactly what information will be needed to deal with changing events at any point in time. These executives, therefore, are and must be dependent on future-oriented, rapidly assembled, most-often subjective, informal information delivered by word-of-mouth from trusted advisors." Proponents of this approach point to the uselessness of the reports developed under the by-product method noted just above. Having seen (often only too clearly) that (1) the existing reports used by the chief executive are not very useful and that (2) he, therefore, relies very heavily on oral communication, advocates of this approach then conclude that all computer-based reports - no matter how they are developed - will be useless. They look at inadequately designed information systems and curse all computer-based systems.
Proponents of the null approach see managerial use of information as Mintzberg does:

...it is interesting to look at the content of managers' information, and at what they do with it. The evidence here is that a great deal of the manager's inputs are soft and speculative - impressions and feelings about other people, hearsay, gossip, and so on. Furthermore, the very analytical inputs - reports, documents, and hard data in general - seem to be of relatively little importance to many managers. (After a steady diet of soft information, one chief executive came across the first piece of hard data he had seen all week - an accounting report - and put it aside with the comment, "I never look at this.") (3)

To some extent, this school of thought is correct. There is a great deal of information used by top executives which must be dynamically gathered as new situations arise. And, most certainly there is data which affects top management which is not computer-based and which must be communicated in informal, oral, subjective conversations.

There is, however, also data which can and should be supplied regularly to the chief executive through the computer system. More significantly, as we note later, it is also important to clearly define what informal (not computer-based) information should be supplied to a top executive on a regular basis.

The Key Indicator/Method. A clear contender today for the fastest growing school of thought concerning the "best" approach to the provision of executive information is what we term the "key indicator" approach. The approach is increasingly based on three concepts, two of which are necessary and the third of which provides the glamour (as well as a few tangible benefits).

The first concept is the selection of a set of "key indicators" of
the health of the business. Data is collected on each of these. The second principle is "exception reporting" - the ability to make available to the manager, if desired, only those indicators where performance is significantly different (with "significance levels" necessarily predefined) than expected results. The executive may thus peruse all the data available or focus in only on areas where performance is significantly different than planned.

The third leg of this school is the expanding availability of better, cheaper, and more flexible visual display techniques. These range from computer consoles (increasingly with color displays) to wall-size visual displays of computer-generated digital or graphic material.

The "key indicator approach" is a school heavily espoused by some chief executives.

... we want everything condensed down so that we see the key item bits of information, not the total reports themselves. For example, we want to see how well a profit center did compared to plan, current month, year-to-date... we want to see the material exceptions or variances from plan shown by the reports.

(Dougherty MIS Quarterly, 3.77, p. 1)

What I want from my information system, particularly from my financial information system, is simplicity. I had to design, for my own edification, a "high spot" statement which gives one a snapshot -- a statement of what is happening and the key ratios in all of our affiliates all over the world on a monthly basis. This is the primary document by which I manage my business. In other words, what I want the information system to throw up to me is the exceptions.

(O'Reilly MIS Quarterly, 3.77, p. 7)

A paradigm of these systems is the one developed at Gould, Inc. under the direction of William T. Ylvisaker, chairman and chief executive officer. As Business Week reports:

Gould is combining the visual display board, which has now become a fixture in many boardrooms, with a computer information system. Information on everything
from inventories to receivables will come directly from the computer in an assortment of charts and tables that will make comparisons easy and lend instant perspective.

Starting this week Ylvisaker will be able to tap three-digit codes into a 12-button box resembling the keyboard of a telephone. "SEX" will get him sales figures. "GIN" will call up a balance sheet. "MUD" is the keyword for inventory.

About 75 such categories will be available, and the details will be displayed for the company as a whole, for divisions, for product lines, and for other breakdowns, which will also be specified by simple digital codes.

At Gould, this information is displayable on a big four foot by five and a half foot screen in the boardroom. It is also available at computer terminals. Data is available in full, by exception, and graphically if desired.

As in most similar "key indicator" systems we have seen, the emphasis at Gould is on financial data. In an article entitled, "How the President Satisfies his Information Requirements", Daniel T. Carroll, reporting on Gould's system in mid-1976, describes the system's "core report" (7). The report, available for each of Gould's 37 divisions provides data on each of the 40 operating factors noted in Exhibit 1 (8). For each factor, current data is compared with budget and prior year figures on a monthly and year-to-date basis. The report, as noted by the author, is ever-changing, but its orientation toward Profit and Loss and Balance Sheet Data, as well as ratios drawn from this financial data, is evident.

The Total-Study Method. A fourth approach to the development of executive information is the "total information needs" approach. In this approach a widespread sample of managers is queried about their information needs and the resultant "needs" are compared with the existing
EXHIBIT 1

Operating Factors

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information systems. The subsystems necessary to provide the information currently unavailable are identified and prioritized. This approach, clearly, is a reaction to two decades of data processing during which single systems have been developed for particular uses in relative isolation from each other and with little attention to management information needs. In effect, this approach was developed by IBM and others to counter the "by-product approach" noted above.

The most widely used formal method to accomplish the "total study" is IBM's Business Systems Planning (BSP) methodology. BSP is aimed at a "top-down" analysis of the information needs of an organization. In a two-phase approach, tens of managers are interviewed (usually 40 to 100) to determine their environment, objectives, key decisions, and the resulting information needs. Several IBM-suggested network design methods and matrix notations are used to present the results in an easily visualized manner. The objectives of the process are to develop an overall understanding of the business, the information necessary to manage the business, and the existing information systems. Gaps between information systems which are needed and those currently in place are noted. A prioritized plan for new systems implementation to fill the observed gaps is then developed.

This "total understanding approach" is expensive in terms of manpower, and all-inclusive in terms of scope. Studies we have seen have required several person-years of effort. The amount of data and opinions gathered is staggering. Analysis of all this input is a high art form. It is difficult, at best, to determine the correct level of aggregation of decision-making, data gathering, and analysis at which to work. Yet the study output tends to be highly useful in most cases. The exact focus of the results, however, can be biased towards either top management information, functional management information, or paperwork processing
depending on the biases of the study team. We have not seen a BSP study in which top executive information was given priority in the study's output. The design, cleaning up, and extension of the paperwork processing "information network" is too often the focus of the study team.

The Need For a New Method

All of the above approaches have their advantages and disadvantages. The "by-product method" does focus in on getting paperwork processed inexpensively, but it is far less useful with regard to managerial information. It too often results in a manager's considering data from a single paperwork function (e.g. payroll) in isolation from other data which supplies meaning to it (e.g. factory output versus payroll dollars). The emphasis in this approach simply is toward the completion of necessary paperwork, not toward assisting busy managers to think through their real information needs.

The "null approach" has probably saved many organizations from building useless strategic planning information systems in its single-minded harping on the changeability, diversity, and "soft" environmental information needs of a top executive. It, however, places too much stress on the executive's strategic and person-to-person roles. It overlooks the management control (9) role of the chief executive which can be, at least partially, served by means of routine, often computer-based, reporting.

The "key indicator method" does provide a significant amount of useful information. By itself, however, the "key indicator method" often results in many, undifferentiated, heavily financial variables' being presented to a management team. It tends to be financially all-inclusive rather than on-target to a particular executive's individual current specific needs. The information provided is objective, quantifiable, computer-stored data. Thus, in the key
indicator approach the perspective of the "information needs" of the executive is a partial one - oriented toward "hard data" needs alone. More significantly, in its "cafeteria" approach to presenting an extensive information base, it provides the assistance to executives in thinking through their real information needs.

The "total study method" is comprehensive and can pinpoint missing systems, However, it suffers, as just noted, from all of the problems of "total" approaches. There are problems concerning expense, the bewildering amount of data collected (making it difficult to discern the forest from the trees), designer bias, and a difficulty in devising reporting systems which serve any individual manager well.

The Critical Success Factors Method

The Critical Success Factor (CSF) method is an attempt to overcome some of the shortcomings just named. It focuses on individual managers and on each manager's current information needs - both "hard" and "soft". It provides a method - which appears to be logical to the executives with whom we have worked - which zeroes in on information needs in a clear, managerially-meaningful way. Finally, it recognizes fully that information needs will vary from manager to manager and that these needs will change with time for a particular manager.

The approach is based on the concept of the "key variable" or "critical success factor" first discussed in the management literature by J.R. Daniel in 1961 (10). Although a powerful concept in itself for other than information systems thinking, it has been heavily obscured in the outpouring of managerial wisdom in the last two decades. Although it appears in somewhat cloudy form elsewhere, it has been elevated and clarified to the best of our knowledge only in the writings of Anthony, Bearden, and Vancil (11).
What are "critical success factors?" They are, for any business, the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where "things must go right" for the business to flourish. If results in these few significant areas are good, the business will be successful. If results in these areas are not adequate, the organization's efforts for the period will be less than desired.

As a result, the critical success factors are areas of activity which should receive constant and careful attention from management. The current status of performance in each area should be continually measured, and current status information should be made available.

As Exhibit 2 notes, critical success factors support the attainment of organizational goals. Goals represent end points which an organization hopes to reach. The critical success factors, on the other hand, are the areas in which adequate performance will ensure attainment of the goals. Information on the status of goal attainment is a "scorekeeping" activity. If goals are not being met, the particular cause must be established and other action must be taken. Information on the status of a CSF, however, provides data which leads to targeted direct action (or lack of action if all is going well) in a key area.

The Literature. Discussions of the critical success factors concept are few and limited in the information systems literature. The first reference to these factors appears to have been made by Daniel. He observed that many company information systems appeared to be static, while both the company's environment and its organization often changed. A changing business structure, he noted, led - with a static information
EXHIBIT 2

GOALS

CRITICAL SUCCESS FACTORS

EPS ↑

"THE KEY AREAS OF THE BUSINESS IN WHICH HIGH PERFORMANCE IS NECESSARY IF THE GOALS ARE TO BE MET."

MARKET SHARE ↑

ROI

NEW PRODUCT SUCCESS

ETC.
system - to a wide gap between the information needed to run the business and the information available. Citing three examples of major corporations, Daniel concluded:

...in retrospect, it is obvious that these three companies were plagued by a common problem: inadequate management information. The data were inadequate, not in the sense of there not being enough, but in terms of relevancy for setting objectives, for shaping alternative strategies for making decisions, and for measuring results against planned goals. (12)

To draw attention to the information actually needed for these managerial activities, Daniel introduced the concept of critical success factors. He stated:

...a company's information system must be discriminating and selective. It should focus on "success factors." In most industries there are usually three to six factors that determine success; these key jobs must be done exceedingly well for a company to be successful. Here are some examples from several major industries:

- In the automobile industry, styling, an efficient dealer organization, and tight control of manufacturing costs are paramount. *
- In food processing, new product development, good distribution, and effective advertising are the major success factors.
- In life insurance, the development of agency management personnel, effective control of clerical personnel, and innovation in creating new types of policies spell the difference.

The companies which have achieved the greatest advances in information analysis have consistently been those which have developed systems that have (a) been selective and (b) focused on the company's strengths and weaknesses with respect to its acknowledged success factors. By doing this, the managements have generated the kind of information that is most useful in capitalizing on strengths and correcting weaknesses. (13)

* (In 1978, we would also add compliance with energy regulations.)
Daniel also stressed the inadequacy of traditional accounting systems to provide the type of data necessary to monitor critical success factors. In a paragraph worth repeating 15 years later, he states:

In the minds of most executives the accounting system exists primarily to meet the company's internal data needs; yet this is often an unreasonable and unfulfilled expectation. Accounting reports rarely focus on success factors that are non-financial in nature. Moreover, accounting practices with respect to allocation of expenses, transfer prices, and the like, often obscure rather than clarify the underlying strengths and weaknesses of a company. This inadequacy should not be surprising since the raison d'être of many accounting systems is not to facilitate planning but rather to ensure the fulfillment of management's responsibility to the stockholders, the government, and other groups. (14)

Daniel thus introduced the concept and focused on one category of CSFs - those critical success factors which are relevant for any company in a particular industry. We term these industry-based critical success factors (later we discuss other types of CSFs). Exhibit 3 lists the automobile industry CSFs and adds two other sets of industry-based CSFs. It should be noted that information concerning many of these CSFs is usually not available from the data stored in a formal computer-based information system. In fact, some industry-based CSFs are heavily oriented toward subjective, non-computer-based information. For example, to measure his CSFs, (Exhibit 3), the Dean of a Graduate School of Management in a University must track some very subjective information. It is true that one CSF, student quality, can be easily and fairly objectively assessed (through entrance examination scores, college grades, etc.). Yet, equally as critical to the success of a Management School are the quality of the faculty
EXHIBIT 3

CRITICAL SUCCESS FACTORS

AUTOMOTIVE
- STYLING
- QUALITY DEALER SYSTEM
- COST CONTROL
- MEETING ENERGY STANDARDS

SCHOOL OF MANAGEMENT
- QUALITY FACULTY
- QUALITY STUDENTS
- REPUTATION

GROCERY
- PRODUCT MIX
- INVENTORY
- SALES PROMOTION
- PRICE
and the opinion of the school held by others. These latter two must be measured by a heavily subjective process. If any of the three factors, whether formally or informally measured, however, dips to unacceptable levels, action must be taken - hopefully before the slide has made much progress.

To the best of our knowledge, written emphasis on the CSF concept lay dormant after Daniel's seminal work until a decade later. It was picked up by Anthony et al in their work on the design of management control systems.

Anthony and his colleagues pointed out three "musts" of any management control system.

The control system must be tailored to the specific industry in which the company operates and to the specific strategies that it has adopted; it must identify the "critical success factors" that should receive careful and continuous management attention if the company is to be successful; and it must highlight performance with respect to these key variables in reports to all levels of management. (15)

While continuing to recognize industry-based CSFs, Anthony et al. went a step further. They placed additional emphasis on the need to tailor management planning and control systems to a company's particular objectives, and its particular managers. That is, the management control system must report on those success factors which are perceived as appropriate to the particular company by the company's managers. In short, CSFs differ from company to company and from manager to manager.

In discussing the CSF concept, Anthony et al stress the need to have "simple measurements" of the critical success factors in the management control system. Like Daniel they emphasize that accounting data by itself is inadequate.
Managers need and use simple measurements of the critical success factors in their business. The designer of a management control system must attempt to supply these data in the most useful form. Frequently, such measurements are physical (the ratio of subscribers renewing) rather than financial or economic. Physical data have the virtue of being both tangible in an operational sense and, in some cases, of being available more frequently and more promptly than accounting information. In such cases, the reporting of key variables should not be delayed until the monthly accounting statements are prepared. Special reports on critical physical ratios should be issued on a natural cycle, the frequency of which is determined by the physical activity itself. (16)

The Origin of CSFs

Thus far, we have discussed CSFs which are applicable to any company operating in a particular industry. Yet Anthony et al. suggest that a management control system also must be tailored to the company, its particular objectives, and its particular managers. This suggests that there are other sources of CSFs than the industry alone. And, indeed, there are. In our work thus far, we have isolated four prime sources of critical success factors. These are:

1. The Structure of the Particular Industry. As noted to this point, each industry by its very nature has a set of critical success factors which are determined by the characteristics of the industry itself. Each company in the industry will ignore these factors at its peril, and most of these factors will appear on every CEO's critical success factors list.

2. The Organization's Strategy, Position Within the Industry, and Geographical Location. Each company in an industry, however, is in an individual situation determined by its history and current competitive strategy. For smaller organizations within an industry dominated by one
or two large companies, the competitive actions of the major companies will often produce new and significant problems for the smaller companies. It may mean establishing a new competitive niche, getting out of a product line completely, or merely redistributing resources among various product lines. Thus, for small companies, "competitor x's actions" is often a CSF. For example, in the computer industry, IBM's competitive approach to the marketing of small inexpensive computers is, in itself, a CSF for all minicomputer manufacturers. Just as differences in industry position can dictate CSFs, differences in geographic location and differences in strategies can lead to differing CSFs from one company to another in an industry.

3. Environmental Factors. As the gross national product and the economy fluctuate, as political factors change, and as population waxes and wanes, critical success factors can also change for various institutions. At the beginning of 1973, virtually no chief executive in the U. S. would have listed "energy supply availability" as a critical success factor. Following the embargo, however, for a considerable period of time this factor was monitored closely by many executives - since adequate energy was now problematical and vital to organizational bottom-line performance.

4. Temporal Organizational Factors. Internal organizational considerations often lead to "temporal" critical success factors. These are areas of activity that are significant for the success of an organization for a particular period of time because they are below a threshold of acceptability at that point in time (although in general they are "in good shape" and do not merit special attention). As an example, for any organization, the loss of a major group of executives in a plane crash would make the "rebuilding of the executive group" a critical success factor for the organization for the period of time...
until this was accomplished. Similarly, while inventory control is rarely a CSF for the CEO, a very unusual situation (either for too much or for too little) stock might, in fact, become a high level CSF.

The above multiple sources from which critical success factors are generated suggest that a simple list of "industry-based" key variables is not enough for management use in determining information needs. For any organization, its situation will change from time to time, and factors which are dealt with by executives as commonplace at one period of time may become "critical success factors" at another time. The key here is for the executive to clearly define at any point in time exactly those factors which are crucial to the success of his particular organization in the period for which he is planning. These success factors will differ from organization to organization, from time period to time period, and from manager to manager as each has differing responsibilities.

An example of differing key variables for similar organizations. One would expect, therefore, that organizations in the same industry would exhibit different CSFs as a result of differences in strategy, geographic location, environmental, and temporal factors. A study by Mooradian (17) of the critical success factors as perceived by the top management of three similar medical group practices bears this out. The medical group practices - each a group of participating physicians - were heterogeneous with regard to many of these factors. All, however, were seen to be well-managed with a dynamic and successful administrator in charge.

The CSFs were defined through open-ended interviews with the administrator of each group practice. The managers were asked to define their critical success factors and to order them from most important to
least important. To verify the factors selected, the opinion of others in the organization were also obtained.

Exhibit 4 shows the administrator's key variables for the three group practices. They are ranked in order as perceived by the managers of each institution. It is interesting to note that several of the same variables appear on each list. Several variables, however, are unique to each institution.

One can explain the difference in the critical success factors chosen by noting the differences in the stages of growth, location, and strategies of each clinic. The first clinic is a mature clinic which has been in existence for several years, has a sound organization structure, and an assured patient population. It is most heavily concerned with government regulation and temporal or environmental changes (such as rapidly increasing costs for malpractice insurance), which are the only factors which might upset its high current favorable status quo.

The second group practice is located in a rural part of a major state. It is dependent upon federal funding and also on its ability to offer a type of medical care not available from private practitioners. Its number one CSF, therefore, is its ability to develop a distinctive competitive image for the delivery of quality care and comprehensive care. The final practice is a rapidly growing, new group practice which was - at that point in time - heavily dependent for its near term success on its ability to "set up" an efficient operation and bring on board the correct mix of staff to serve its rapidly growing patient population.

In looking at these three lists, it is noticeable that factors 1 through 4 on Practice #1's list, appear on the other two lists also.
CRITICAL SUCCESS FACTORS FOR THREE MEDICAL GROUP PRACTICES

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<td>Governmental regulation</td>
<td>Quality and comprehensive care</td>
<td>Efficiency of operations</td>
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<td>Efficiency of operations</td>
<td>Federal funding</td>
<td>Staffing mix</td>
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<td>(3)</td>
<td>Patients' view of practice</td>
<td>Governmental regulation</td>
<td>Governmental regulation</td>
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<td>(4)</td>
<td>Relation to hospital</td>
<td>Efficiency of operations</td>
<td>Patients' view of practice</td>
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<td>(5)</td>
<td>Malpractice insurance effects</td>
<td>Patients' view of practice</td>
<td>Relation to community</td>
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<td>(6)</td>
<td>Relation to community</td>
<td>Satellites vs. patient service</td>
<td>Relation to hospital</td>
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<td>Other providers in community</td>
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<td></td>
<td></td>
<td>Relation to hospital</td>
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(least important)
These, it can be suggested, are the all-encompassing industry-based factors. The remaining factors, which are particular to one or the other of the practices, but not all, are generated by differences in environmental situation, temporal factors, geographic location, or strategic situation.

**CSFs at All General Manager Levels ... And Their Benefits**

To this point, we have talked about CSFs from the viewpoint of the top executive of an organization alone. Indeed, that is the major focus of our current work. It is, however, clear from studies now going on that CSFs, as might be expected, can be arrayed hierarchically and used as an important vehicle of communication for management - as well as a design for the construction of useful information systems.

There are several significant benefits of taking the necessary time to think through - and to record - the critical success factors for each general manager in an organization. These are:

- First, it helps the manager to determine those factors on which s/he should focus management attention. The process helps insure that these significant factors will receive careful and continuous management scrutiny.
- Second, the process forces the manager to develop good, adequate measures for each of these critical factors and to seek reports on each of these measures.
- Third, the identification of critical success factors allows a clear definition of the amount of information which must be collected by the organization and tends to limit the costly collection of more data than is necessary.
- Fourth, the identification of CSFs tends to
move an organization away from the trap of building its reporting and information system primarily around data that is "easy to collect." Rather, it focuses attention on that data which might otherwise not be collected, but which is significant for the success of the particular management level involved.

- Fifth, the process acknowledges that some factors are "temporal" and that CSFs are manager-specific. This suggests that the information system should be in constant flux with new reports being developed as needed to accommodate changes in the organization's strategy, environment, or organization structure. Rather than changes in an information system being looked upon as an indication of "inadequate design," they must be viewed as an inevitable and productive part of the process of information systems development.

- Finally, the process provides a simple four-step sequence for the development of information systems as shown in Exhibit 5. This is a "top-down" approach starting with the definition of CSFs. The second step is the recognition of those measures which indicate progress (or lack of it) with regard to particular CSFs. The third step is the design of reports which will provide information on the current status of each measure to the manager. Finally, only at this point, does one concern oneself with "The MIS" - which, after all, is only a system for gathering and transforming data. Unfortunately, the current process for the development and design of most
EXHIBIT 5

TOP EXECUTIVE REPORTING NEED ANALYSIS

CRITICAL SUCCESS FACTORS

MEASURES

"REPORTS"

DATA PROCESSING SYSTEMS
reporting systems is exactly the opposite. Starting from
the bottom up, an MIS group designs a transaction processing
system to do billing, payroll, etc. and then asks executives
what data "they need" from this system. This backwards approach
leads to the outcomes noted in the first part of this paper.

It should be stressed that the CSF approach does not attempt to deal with
information needs for strategic planning. Data needs for this management role
are almost impossible to preplan. The CSF method centers, rather, on information needs for what Anthony terms "management control" - where data needs to
monitor and improve existing areas of business can be more readily defined.
The CSF Approach in Use

Let us now turn to an example of the use of this approach. The President referred to at the start of this article is real. He is Larry Gould, Ph.D., President of Microwave Associates - a $60 million sales firm serving several aspects of the microwave communication industry.* When he first looked carefully at the "information" he was receiving, Dr. Gould found that some 97 "reports" crossed his desk in a typical month. Almost all were originally designed by someone else - someone who felt that he "should be receiving this vital data."

However, almost all of the reports provided him with nothing he could use. A few gave him some "scorekeeping data", such as the monthly profit statement. One or two other reports provided him with bits and pieces of data he wanted, but, of these, all, exasperatingly, left major things unsaid. The data was either unrelated to other key facts or related in a way that was not meaningful to him.

The concept of "critical success factors" sounded to him like one way out of this dilemma. He therefore invested two two-and-a-half hour periods of working through his goals, critical success factors, and measures. First, he noted the objectives of the company and the current year's goals. Then he went to work to assess what factors were critical in accomplishing these objectives.

* Since this was originally written, Dr. Gould has assumed the position of Chairman of the Board at MA Com - a holding company of which Microwave Associates is a subsidiary.
The seven CSFs developed are shown in Exhibit 6. Two or three prime measures are also shown for each factor (although some additional measures were also developed). It should be noted that this particular set of factors emerged only after intensive analysis and discussion. At the end of the first meeting, nine factors were on the list. By the end of the second meeting, two had been combined into one, and one had been dropped as not being significant enough to command on-going close attention.

It was around the measures for each factor that most discussion took place. Where "hard" data was perceived to be available the discussion was short. Where "softer" measures were necessary, however, lengthy discussions of the type of data needed and the difficulty and/or cost of acquiring it often ensued. Yet convergence on the required "evidence" as to the state of each CSF occurred with reasonable speed and clarity in each case. Some discussion concerning each CSF and its measures is perhaps worthwhile.

Image in Financial Markets

The company is growing and making acquisitions as it seeks to dominate a growth segment of the electronics industry. Much of the company's growth is coming from acquisitions. Clearly, the better the image on Wall Street, the higher the PER. The measure of success here is clear - the company's multiple vis-a-vis others in its industry segment.

Technological Reputation with Customers

Although it has some standard projects, the majority of the work done by Microwave Associates is on a tailored job, one-shot basis. A significant number of these jobs are state-of-the-art work which leads to follow-on
<table>
<thead>
<tr>
<th>Critical Success Factors</th>
<th>Sample Measures</th>
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<tbody>
<tr>
<td>1. Image in Financial Markets</td>
<td>- PGR</td>
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<tr>
<td>2. Technological Reputation with Customers</td>
<td>- Orders/Bid ratio</td>
</tr>
<tr>
<td></td>
<td>- Customer &quot;perception&quot; interview results</td>
</tr>
<tr>
<td>3. Market Success</td>
<td>- Change in market share (each product)</td>
</tr>
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<td></td>
<td>- Growth rates of company markets</td>
</tr>
<tr>
<td>4. Risk Recognition in Contracts</td>
<td>- Company's years of experience with similar products</td>
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<td></td>
<td>- &quot;new&quot; or &quot;old&quot; customer</td>
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<td></td>
<td>- Prior customer relationship</td>
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<tr>
<td></td>
<td>- etc.</td>
</tr>
<tr>
<td>5. Profit Margin on Jobs</td>
<td>- Bid profit margin as ratio of profit on similar jobs in this product line</td>
</tr>
<tr>
<td>6. Morale</td>
<td>- Turnover, absenteeism, etc.</td>
</tr>
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<td></td>
<td>- Informal feedback</td>
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</table>
production contracts. To a very large extent, buying decisions in the field are made on the customer's confidence that Microwave can deliver technologically. Its customers' perception of Microwave's technical ability is all-important.

Seven measures were developed for this CSF. The two shown are at the opposite extremes of hard-soft-data. Total orders/total bids can be easily measured. This measure is indicative of customers' perception of Microwave's technical ability - but also has other factors - such as "sales aggressiveness" confounded in it.

The most direct measure possible is person-person interviews. Although this measure was seen to be "soft," it was felt to be the best way for the president to understand this most critical CSF. It was decided to initiate a measuring process through field interviews by the company's top executives. (Other measures of their critical success factors included field interviews by sales personnel, assessment of the rise or fall of the percent of each major customer's business being obtained, etc.).

**Market Success**

On the surface, this CSF is straightforward. But, as shown, by the measures, it includes attention to current market success, as well as the company's progress with regard to significant new market opportunities (e.g., the relative rate of growth of each market segment, opportunities provided by new technology, and relative - not just absolute - competitive performance).

**Risk Recognition in Major Bids and Contacts**

Since many of the jobs accepted are near-or at-the state of the art, controlling the company's risk profile is seen to be critical. As noted in the exhibit, a variety of factors contribute to risk. The measurement
process designed involves a computer algorithm to consider these factors and to highlight particularly risky situations.

Profit Margin on Jobs

When profit center managers have low backlogs, they are often tempted to bid very low to obtain additional business. While this procedure is not necessarily bad, it is critical for the corporate level to understand the expected profit profile and, at times, to counter lower level tendencies to accept low profit business.

Morale

Because of its high-technology strategy, the company is clearly heavily dependent on the "esprit" of its key scientists and engineers. It must also be able to attract and keep a skilled work force. Thus morale is a critical success factor. Measures of morale range from hard data (turnover, absenteeism, tardiness) to informal feedback (management discussion sessions with employees).

Performance to Budget on Key Job

This final CSF reflects the need to control major key projects and to ensure that they are completed on time and near budget. Adverse results with regard to timeliness can severely affect CSF #2 (technological perception) and significant cost overruns can affect CSF #1 (financial market perception) similarly. In general, no single job is crucially important. Rather it is the profile of performance across major jobs that is significant.
Reports and Information Systems Design

Given these CSF's and measures, the next step (Exhibit 5) was to design a set of report formats. This step required both examination of existing information systems and data sources.

For the "soft" informal subjective measures, this process was straightforward. Forms to record facts and impressions were designed so as to scale (where possible) perception and highlight significant "soft" factors.

For some of the "harder" computer-based measures, existing information systems and data bases supplied most of the necessary data. However, in every case - even where all data was available - existing report forms were found to be inadequate and new reports have had to be designed.

Most important, however, it was found that two completely new information sub-systems have to be built to support the President's CSFs. These are a "bidding sub-system" and a vastly different automated "project budgeting and control" system. Significantly each of these systems had been requested many times by lower level personnel - who needed them for more detailed planning and control of job bidding and monitoring at the product line manager and manufacturing levels. These sub-systems have finally been placed at the top of the priority list for data processing.

Advantage of the CSF Approach

In summary, in this case the exercise of discovering information needs through examination of a chief executive's critical success factors had a number of advantages. As we see it now, the benefits are:
- The conscious listing (or bringing to the surface) of the most significant areas on which the executive needs to focus for the next several months at least. In other words, CSFs tend to provide a focus for attention.

- The design of a useful set of reports which provide the information needed to monitor on-going operations at the general executive level. (There clearly are other data needed - for the development of strategy, dealing with special situations, etc.). The CSF route, however, focuses on the data needed for the ongoing "management control" process in Anthony's terms.

- The development of priorities for information system development. It is clear that information needed for control purposes by the chief executive should have some priority. (It often will, as in this case, highlight priorities for other management levels, also.)

- The provision of a means of hierarchical communication among executive as to what the critical factors are for the success of the company. Too often, only goals provide a major communication link to enhance shared understanding of the company and its environment among management levels. CSFs provide another - and we believe more pragmatic and action-oriented means of communication. (At Microwave at the present time there is a project aimed at developing and sharing CSFs at the top four management levels.) We believe this hierarchical approach will lead to significantly enhanced communication and a clear, comprehensive plan for information system development.
Summary

In summary, the "by-product approach" gets paperwork processed and can establish a useful data base. The "null approach" provides a warning that much management data cannot and should not be formally designed and regularly generated (even by exception reporting). The "key indicators approach" can make available useful financial data ordinarily available from the company's data base. And the "total-study" method also has its time and place. Yet, for zeroing-in on a very critical area for any organization - the provision of information to its top executive for management control purposes - the "critical success factor approach" has a unique place in terms of speed, effectiveness, and completeness in performing this job.
REFERENCES


(5) O'Reilly, op. cit., p. 7.

(6) "Corporate 'war rooms' plug into the computer", Business Week, August 23, 1976, p. 65.


(15) Anthony et al., op. cit., p. 148.
