

**Executive Support Systems
and the Nature
of Executive Work**

John F. Rockart
David W. DeLong

90s: 86-020

April 1986

CISR WP #135
Sloan WP #1775-86

© Massachusetts Institute of Technology

Management in the 1990s
Sloan School of Management
Massachusetts Institute of Technology

Management in the 1990s

Management in the 1990s is an industry and governmental agency supported research program. Its aim is to develop a better understanding of the managerial issues of the 1990s and how to deal most effectively with them, particularly as these issues revolve around anticipated advances in Information Technology.

Assisting the work of the Sloan School scholars with financial support and as working partners in research are:

- American Express Company
- BellSouth Corporation
- British Petroleum Company, p.l.c.
- CIGNA Corporation
- Digital Equipment Corporation
- Eastman Kodak Company
- Ernst & Young
- General Motors Corporation
- International Computers Ltd.
- MCI Communications Corporation
- United States Army
- United States Internal Revenue Service

The conclusions or opinions expressed in this paper are those of the author(s) and do not necessarily reflect the opinion of the Massachusetts Institute of Technology, the Management in the 1990s Research Program, or its sponsoring organizations.

According to Keen and Hackathorn, "A central theme in decision support is that one cannot improve something one does not understand. The act of 'supporting' a manager implies a meshing of analytic tools into his or her existing activities" (Keen and Hackathorn, 1979:4). Similarly, the development of a computer-based executive support system requires an understanding of what it is that executives do. Unfortunately, there is no position in the organizational hierarchy that is less understood than that of the senior executive. Virtually all existing studies of senior executives at work have been comprised

either of small samples or have covered very limited periods of time -- or both. What top managers actually do remains somewhat of a mystery.

The purpose of this paper is to review the existing literature on executive work and to note areas of agreement between the literature and the practice which we have observed in our recent research (De Long/Rockart, 1984, 1986) in the area of computer-based executive support systems (ESS). Studies of more than 25 corporations with some type of ESS in place¹ suggest that currently executives are trying to do three things with these systems:

1. Implement applications generally associated with office automation, including systems such as electronic mail and word processing.
2. Improve systems which support the organization's planning and control processes.
3. Develop, clarify, or enhance the individual manager's mental model of the firm's business environment.

1. An average of slightly less than a day was spent in each organization. An interview outline guided discussions with technical and staff people involved with the systems, as well as executive users. The interview outline was used primarily as an evocative device aimed at having the subject describe his or her impressions of the system. Emphasis was placed on the reasons for, and value of the systems, as well as their design elements and implementation characteristics.

Research which seeks to develop categorizations like these is difficult at best. The literature on executives implies a need for many different types of executive support systems, as well as none at all. As researchers we must take into account Weick's (1984) warning against seeing only those facts which support our own implicit models. Nevertheless, the field evidence does point toward the three major uses of ESS noted above, and the literature provides a solid case for them.

To illustrate that case, this paper is divided into three parts. First, we will review the work of those theorists who provide insights into the work of senior executives. In particular, we will focus on three researchers -- Mintzberg, Kotter and Isenberg -- whose work is aimed specifically at understanding the role of the senior line executive. We have also drawn heavily on the work of two other researchers -- Anthony and Jaques -- whose findings provide particularly useful insights into top management work with regard to the use of ESS. The second part of the paper provides some evidence from our field research to illustrate the major uses noted above. The final section relates the research on executive work outlined in part one to the three types of ESS identified by the field research.

There are several well known conceptions of the executive's job. Each one provides a different perspective. Mintzberg's model of management roles is probably the best known characterization of the activities of senior executives. Anthony's planning and control

framework offers a functional view, while Kotter's studies of top management work provide a useful behaviorally-oriented framework for studying ESS. All three of these conceptions, however, merely describe what can be perceived of executive work by an external observer. They lack a cognitive perspective. Therefore, we will also draw heavily on work by Jaques and Isenberg for several concepts that focus on cognition as a major aspect of the management function. Other contributions to the relatively sparse academic literature on senior executives will also be cited where appropriate.

Mintzberg's Activities View

Mintzberg is best known for his role theory which, based on his study of five chief executives, categorizes executive activities -- what top managers do -- into ten distinct roles. Mintzberg's (1973) research on the work of top management is rooted in a view of managerial research that believes in systematic analysis of the characteristics and content of managers' work activities. The father of this school is Sune Carlson (1951) whose study of nine Swedish executives is considered the first significant empirical study of managerial work. Carlson used a diary method to gather data on the characteristics of executive work, i.e., time allocations, communication patterns, etc.

Mintzberg, however, relied on structured observation of five executives to develop a description of the content of managerial work. He subsequently categorized executive activities into ten distinct roles, a categorization that probably remains the most influential framework defining the work of senior executives. Mintzberg's ten roles are divided into three groups: interpersonal, informational, and decisional. The roles, and the fundamental activities carried out by the executive in each, are:

Interpersonal Roles

Figurehead -- Carries out a symbolic role as head of the organization, performing routine duties of a legal or social nature.

Leader -- In the most widely recognized managerial duty, responsible for motivation and activation of subordinates, as well as staffing, training, promoting.

Liaison -- Develops and maintains personal network of external contacts who provide information and favors.

Informational Roles

Monitor -- Seeks and receives a wide variety of special information to develop a thorough understanding of the organization and the environment. In this role, the executive serves as the nerve center of internal and external information about the organization.

Disseminator -- Transmits information received from outsiders or from subordinates to other members of the organization. Information ranges from factual information to value statements designed to guide subordinates in decision making.

Spokesman -- Communicates information to outsiders on the organization's plans, policies, actions, results, etc.

Decisional Roles

Entrepreneur -- Searches the organization and environment for opportunities and initiates "improvement projects" to bring about change; supervises design of certain projects as well.

Disturbance Handler -- Responsible for corrective action when the organization faces important, unexpected disturbances.

Resource Allocator -- Allocates organizational resources of all kinds.

Negotiator -- Represents the organization in major negotiations. (Mintzberg, 1973)

Working in the decade prior to the rise of end user computing, Mintzberg, of course, saw no direct use of computers by the executives he studied. His focus was on the observable characteristics of executive work. He reported brevity of attention to any activity, fragmentation of effort, and an emphasis on verbal communication. Observing very little use of hard, quantifiable data in his research, he wrote:

I was struck during my study by the fact that the executives I was observing -- all very competent by any standard -- are fundamentally indistinguishable from their counterparts of a hundred years ago (or a thousand years ago, for that matter). The information they need differs, but they seek it in the same way -- by word of mouth. Their decisions concern modern technology, but the procedures they use to make them are the same as the procedures of the nineteenth-century manager. Even the computer, so important for the specialized work of the organization, has apparently had no influence on the work procedures of general managers. In fact, the manager is in a kind of loop, with increasingly heavy work pressures but no aid forthcoming from management science. (1975:54)

Mintzberg saw no executive computer use a decade ago, and his findings are often used to argue against automation in the executive suite. When looked at more carefully, however, Mintzberg's model actually does disclose reasons why information technology might be used to support many of the executive's roles. This is because of the pervasive impact of information on virtually all of the roles. The monitoring and disturbance handling roles, for example, both represent activities where access to hard, structured information is extremely useful and, in organizations of any size, readily available today. In carrying out both of these roles, the presence of monthly, weekly and sometimes daily reports, most often in paper form, is quite usual.

Further, Mintzberg says that executives use the information they collect in four ways: (1) to disseminate it to others; (2) to develop value positions for the firm; (3) to identify business problems and opportunities; and (4) "to develop mental images -- 'models' of how his organization and its environment function..." (1973:70)

Mintzberg contends that these mental models help the executive deal with the complexity inherent in his or her job. He says, "In effect, the manager absorbs information that continually bombards him and forms it into a series of mental models -- of the internal workings of his organization, the behavior of subordinates, the trends in the organization's environment, the habits of associates, and

so on. When choices must be made, these models can be used to test alternatives." (1973:89)

He concludes, "The effectiveness of the manager's decisions is largely dependent on the quality of his models." (1973:90)

Mintzberg not only recognizes the importance of mental models, but also acknowledges the potential role of computer support in enriching these models. He states, "One way to improve the manager's models is to expose him systematically to the best available conceptual understanding of the situations he faces. A key role of the management scientist could be to put good models into the manager's head....The manager will develop models of these things anyway; by explicit focus on them, the management scientist can help ensure that the models are the best ones possible." (1973:157)

Anthony's Planning and Control Framework

An expanded view of the executive's monitoring role is clearly evident in Anthony's model of planning and control (1965), which provides a functional view of management. His framework consists of three categories:

Strategic planning -- is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the

policies that are to govern the acquisition, use, and disposition of these resources.

Management control -- is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.

Operational control -- is the process of assuring that specific tasks are carried out effectively and efficiently. (1965:16-18)

Anthony concedes that the lines between his three categories are to some extent blurred and that certain activities will not fit clearly under any of the three headings. He does point out, however, that activities listed under strategic planning are heavily oriented toward planning activities, that those labelled management control are a combination of both planning and control, and that operational control activities are almost exclusively concerned with control.

Examples of activities that fall under the three major framework headings are shown in Exhibit I.

Exhibit I

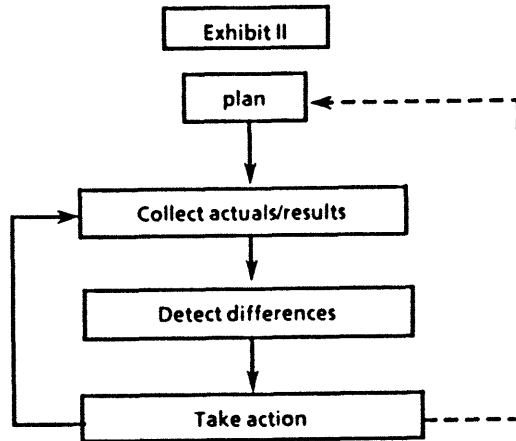
<u>Strategic Planning</u>	<u>Management Control</u>	<u>Operational Control</u>
Planning the organization	Planning and monitoring staff levels	Controlling hiring
Setting financial policies	Working capital planning and control	Controlling credit extension
Acquiring a new division	Measuring, appraising, and improving management performance	Measuring, appraising, and improving workers' efficiency

Note: adapted from Anthony (1965)

For ESS purposes, it is Anthony's concept of "management control" that is most significant. He contends that the several activities it includes are carried out, in part, by senior management. In practice, managerial control is observable in budgeting, sales quotas, personnel control, and other widely-used fundamental management systems involving both planning and control activities.

Anthony's model is drawn from the broader school of cybernetic theory developed by Weiner (1948) and Beer (1959). It is really a cybernetic model representing a feedback loop.

The basic steps in the feedback loop are shown in Exhibit II:



The reasons for each step are fairly obvious. Control without a knowledge of desirable results is meaningless (Merchant, 1985), so management needs a plan. But a plan without follow-up is also of

little value. Thus, planning and control are intimately joined in both a pure cybernetic model and in the world of management practice.

This framework of planning and control is, of course, not a complete model of management. It offers only a limited perspective on the work of top managers because it focuses on just one of the several roles -- monitoring -- that Mintzberg attributes to executive work. But it is clearly a critical role, and one in which information plays a vital part.

More recently, others have worked to provide more specific and alternate views of the control process (in which planning in all cases is either explicit or implicit). Best known among these are Merchant (1985), who expands on diverse measures for results, actions, and personnel controls; Ouchi (1979) who builds on the work of Thompson (1967) and approaches the control process from an organizational perspective; and Williamson (1975), whose economic theory of markets and hierarchies dictates a control strategy based on agency theory. Although their various theoretical and/or pragmatic approaches differ, all, like Anthony, acknowledge the need for information to control and organize.

Kotter's Process View

While Mintzberg clearly has an activities view of executive work, and Anthony offers a functional model, Kotter (1982) presents more of

a process model. Using data gathered from in-depth interviews and structured observation of 15 general managers, Kotter concludes that executives' efforts center around two key processes: (1) agenda setting and (2) network building.

Agendas are loosely connected goals and plans, addressing a wide range of financial, product/market, and organizational issues. According to Kotter, they cover short, medium, and long-term responsibilities (1982b:160). Drawing from his research on 15 general managers (GMs), Kotter notes:

...the GMs' agendas always included goals, priorities, strategies, and plans that were not in the written documents. This is not to say that the formal plans and the GMs agendas were incompatible; generally, they were rather consistent. They were just different in at least three important ways. First, the formal plans tended to be written mostly in terms of detailed financial numbers; the GMs' agendas tended to be less detailed in financial objectives and more detailed in strategies and plans for the business or the organization. Second, formal plans usually focused entirely on the short and moderate run (three months to five years); GM agendas tended to focus a bit more on a broader time frame, including the immediate future (1-30 days) and the longer run (5-20 years). Finally, formal plans tended to be more explicit, rigorous, and logical, especially regarding how various financial items fit together; GM agendas often contained lists of goals or plans that were not as explicitly connected. (1982a:61)

According to Kotter, the other major management function is network building. This means developing cooperative relationships with all those people who may play a role in providing information for development and implementation of the executive's emerging agenda.

The network consists not only of direct subordinates and superiors, but also of many other people at all levels in the manager's organization. Included are external suppliers, customers, politicians, bankers, and others, whose support can be helpful in defining and implementing the executive's agenda. The executive's network often includes hundreds or even thousands of people with a variety of types and intensities of relationships.

Kotter's concept of network building provides a very strong indication of the importance of communication to executives. To Kotter, communication, either formal or informal, is half the game.

Mintzberg, Anthony and Kotter all have useful conceptions of top management work, but they leave out one important element -- cognition. How do executives think about what they do? This is critical because many believe that the primary difference between top executives and middle managers is in their cognitive approaches to work.

Jaques' Cognitive View

Jaques presents one cognitive view of management (1976). His stratified systems theory of organizations identifies seven levels common to bureaucratic hierarchies, with the boundaries between each level, or stratum, representing qualitative shifts in the nature of

Exhibit III

<u>Time Span</u>	<u>Stratum</u>	<u>Organizational Level</u>	<u>Main Activity</u>	<u>Level of Abstraction</u>
20 years	VII	Corporation	Providing overall strategic direction	?
10 years	VI	Corporate group of subsidiaries	Creating strategy & translating it into business direction	Institution Creating
5 years	V	Corporate subsidiary and top specialists	Redefining goals and determining field operations	Intuitive Theory
2 years	IV	General mgt. and chief specialists	Creating methods of operation	Conceptual Modeling
1 year	III	Departmental mgrs. and chief specialists	Organizing Programs into systems of work	Imaginal Scanning
3 mths	II	Front line managerial, professional and technical	Generating programs of work	Imaginal Concrete
1 day	I	Office and shop floor	Doing concrete tasks	Perceptual-Motor Concrete

Chart adopted from "A General Theory of Bureaucracy," by Elliot Jaques, 1976, p. 153

Abstract Indirect or General Command

Concrete Direct Command

work at each level. The seven strata are defined by relative shifts in the "time span of discretion." Jaques says that time span of discretion is established by measuring the task with the longest target completion time in the role (1976:109). His seven levels of work in organizations are shown in Exhibit III. Also described here are the primary activities of each level in the organization from shop floor to chairman of the largest corporations. The activities represent the primary tasks at each level that differentiate it from the level below.

Paralleling the different time horizons with which individuals can work, according to Jaques, are differences in levels of abstraction, as represented in the last column of Exhibit III. He uses abstraction in the sense of the ability to work on more general problems without the need for direct contact with specific examples or situations. Jaques postulates that "how any two people perceive the same problem or activity will be different according to the differences in their level of abstraction" (1976:139).

The difference in the "quality of abstraction" is particularly noticeable between levels three and four, the latter being the first level of general management. The first three levels of abstraction represent work that involves relatively concrete types of thinking. "Perceptual-motor concrete" is a mode of work that involves direct perceptual contact with the physical output, such as a stockroom clerk

filling an order, or a secretary typing a memo. The second level, "imaginal concrete," requires the use of imagination in constructing a project, but deals with projects for which the final output can be visualized in concrete terms. A foreman at this level would, for example, plan and implement a training program for workers who will operate new machines being installed. The third level of abstraction is "imaginal scanning" which involves a position such as sales manager, in which it is impossible to fully comprehend an entire area of responsibility at once, although the whole can still be mentally scanned, one piece at a time.

Jaques emphasizes that between levels three and four there is a "profound change in the quality of abstraction used in carrying out tasks: it is a change from the concrete to the abstract mode of thought and work." (1976:147) He also says, "The qualitative jump from level three [departmental manager] to level four [general management] is that at level four neither the output nor the project can be foreseen in concrete terms, even by imaginal scanning. The project cannot be completely constructed. It remains a combination of a conscious subjective picture, incomplete in itself, whose specific total form and content are unconsciously intuitively sensed but cannot quite be consciously grasped." (1976:149)

The fifth level of abstraction is called the level of "intuitive theory" because it is based on the intuitive theories an individual

has developed out of his or her experience. Jaques says executives at this level are preoccupied with shaping the future and they tend to delegate current operations based on plans and policies already specified.

Jaques concedes that above level five insufficient empirical work has been done to characterize the qualitative differences in the modes of work at levels six and seven. He does say, however, that where technology allows, there is a shift away from coordinating the activities of subordinates to management by policy setting. Thus, where levels six and seven exist, the management of organizations becomes the creation of new organizations as enterprises are restructured into a series of independent subsidiaries.

Isenberg's Cognitive Overview

In an unpublished work, Managerial Thinking: An Inquiry Into How Senior Managers Think, Isenberg argues that "managerial cognition" is a critical variable for understanding the management process. Unfortunately, he points out, virtually all the major studies of executive work have treated cognitive capabilities as a background issue. One reason for this lack of attention is that there is no one well-accepted cognitive view of management. Acknowledging this, Isenberg provides multiple perspectives on executive cognition. Three of these are particularly informative.

One cognitive perspective identified by Isenberg is "Manager as Decision Maker." This has been a popular concept of management, particularly among those seeking to support executives with traditional decision support systems technology (DSS). Isenberg, however, finds this conception flawed.

He contends that rarely can the actual moment of decision be observed. Executives do not usually make major decisions as individuals by choosing from a set of predetermined alternatives. In fact, able executives make very few decisions and virtually none that have not been extensively worked upon over a period of time by staff and subordinate line managers. Isenberg cites Barnard's (1938) familiar passage to support his point:

The fine art of executive decision consists in not deciding questions that are not now pertinent, in not deciding prematurely, in not making decisions that cannot be made effective, and in not making decisions others should make. (p.194)

Isenberg's view finds support in the work of a wide range of researchers, e.g., Simon (1957) and Keen (1976). The point is that decision support systems are designed to support decision makers in semi-structured tasks. Most executive decisions, however, involve problems that are unstructured, very complex, and influenced by many people. Isenberg, with support from researchers like Simon and Keen,

leads one away from thinking of the "executive as decision maker" as a fundamental design strategy for senior management systems.

A second cognitive perspective identified by Isenberg, and useful in comprehending the role of executive support systems, is "Manager as Sensemaker." This conception focuses on how managers impose cognitive structures on their environments. Using this cognitive model, Brief and Downey (1983) drew on case studies to argue that Henry Ford and Alfred Sloan's differing mental models resulted in very different business strategies and organizational structures at Ford and General Motors. In similar fashion, Donaldson and Lorsch (1983) studied the goal formulation and strategic decision making processes in a dozen Fortune 500 companies. They found that "strategic decisions are not the product of simple economic logic alone. Because these decisions often depend on forecasts of future events, they involve considerable uncertainty and ambiguity. To analyze these complexities, top managers draw upon their experience and judgement -- judgement that has been shaped by the shared beliefs passed on to them by their predecessors." (Donaldson and Lorsch, 1983:9). This concordance of shared beliefs, experience and judgement suggests a "world view," which strongly affects the management of an organization.

Weick (1979) has also been very influential in developing this "Manager as Sensemaker" school. His concept of "enactment" holds that organizational members impose a cognitive structure on an ill-defined

stream of organizational events, then act as if this mental model were the true organizational reality.

Although Isenberg does not explicitly use the term, implicit in some of his earlier work is the concept of "Manager as Organizational Process Designer." In a study of 12 division managers, he found that executives tend to think about problems of two kinds: (1) how to create effective organizational processes, and (2) how to deal with one or two critical issues, or very general goals (1984:82). These findings roughly correspond to Kotter's networking and agenda building activities.

Isenberg contends, as many previous studies have shown, that the executive mind is "imperfectly rational." But, he says, the problem with abandoning our rational ideal of management ignores the fact that even if executives do not think systematically and logically, organizations still must try to act rationally in pursuit of the firm's goals. He concludes:

One alternative to the vain task of trying to rationalize managers is to increase the rationality of organizational systems and processes. Although organizational behavior is never completely rational, managers can design and program processes and systems that will approach rationality in resource allocation and employment.

Decision support systems are one such source of organizational rationality. These generally computerized routines perform many functions ranging from providing a broad and quantitative data base, to presenting that data base in easily understandable form, to modeling the impact of decisions on various financial and other criteria...." (1984:88)

EVIDENCE FROM THE FIELD

It is overwhelmingly evident that the applications of computer-based systems at senior management levels are diverse. Each is targetted at fulfilling specific needs of a particular executive. Yet the bulk of the applications which are viewed as successful by the executives involved do appear to fall within one of the three categories mentioned at the outset. The applications themselves are reviewed in more depth elsewhere (De Long/Rockart forthcoming). For purposes of this paper a brief summary of the type of computer use found in each area is presented here.

Improving Office Systems

Efficiency applications, generally related to office automation, are the first general category of ESS use. The most significant of these is electronic mail. The CEO of a midwestern insurance company claims his ESS has increased his productivity 10-15 percent. He uses electronic mail daily to communicate with his subordinates, and finds the system most useful for keeping in touch with his staff when he travels.

A limited number of senior managers use word processing to draft their own memos and speeches. A larger group keeps data about the

organization's personnel and/or customers in a readily accessible on-line file. And many are finding the computer's capability of maintaining a "tickler" file or tracking correspondence to be quite valuable. Systems which provide access to external information sources (e.g., Dow Jones) are also included in this category.

These "efficiency applications," although limited in the management functions which they provide, are becoming more and more common. There are two prime reasons for this. First, they are being marketed more actively by major computer vendors such as IBM (PROFS), DEC (ALL-IN-ONE), and others. Second, to install them requires relatively little management time.

Redeveloping Organizational Planning and Control Systems

By far the largest category of "successful" ESS are those designed to improve the organization's planning and control processes. These systems provide either new information to senior managers or supply the existing data faster, in more detail, or in a more useful format (e.g. graphics vs. tabular, or data plus text).

The most common benefit for executives is getting information on actual performance faster from the firm's control system. One vice president in a major aerospace company was frustrated with getting 30-day-old program cost data that had been heavily massaged by

subordinates. An ESS now provides that data direct from the cost collection system in two days. In another aerospace organization, the general manager demanded and eventually received, despite obvious foot-dragging on the part of many subordinates, daily data and explanatory text concerning all changes in program status.

In a diversified electronics corporation, the president has agreed on a standard set of monthly performance reports that both he and his group vice presidents will receive. Thus, his monthly meetings with them no longer involve arguments over who has the right numbers. Instead, the focus is on more strategic questions dealing with the performance and future of the divisions.

All of these ESS-driven changes in planning and control systems alter the information flow in the organization. They, thus, significantly affect the way in which the organization is managed. These ESS require extensive thought and effort to be designed and implemented well. But these systems appear to have clear payoffs both in providing useful information for the executive and, probably more significantly, conveying to the organization a sense of what is important to that executive.

Enriching Mental Models

The enhancement of an executive's mental model was cited only once in our case studies as the primary motivation for the development

of an ESS. But it lurks in the background of many systems. Executives have a high need to ensure that their conception of their business environment is reasonably close to reality. The one executive for whom improving his mental models was an explicit goal is a Ph.D. physicist who heads a high technology firm. He has developed computer-based models of his company's operations, the industries in which the firm competed, and the U.S. economy. He first embedded his views in the models and then adjusted his thinking in light of what he learned by watching the flow of data through the models.

Alternately, one president of a small bank developed a system to access and browse through current information on all the bank's customer accounts. As a result, the bank president contends that he has developed a much different sense of the dynamics and trends in his business.

In another instance, the chairman of a large manufacturing firm uses economic models he has had developed to test the company's sales forecasts. This allows him to go back and challenge the assumptions of his subordinates and helps ensure that their forecasts are as realistic and accurate as possible.

EXECUTIVE WORK AND ESS

It is apparent the conceptions of top management work put forth by Mintzberg, Anthony, Kotter, Jaques, and Isenberg and others provide

some evidence to support the above conclusions about what is happening with executive support systems. Let us examine the three major uses of ESS in the context of the different conceptions of executive work described earlier.

Support for Mental Models

Mintzberg, Kotter, Jaques, and Isenberg all provide insights into the concept of executives' mental models. Mintzberg acknowledges the existence and importance of mental models but, because his focus is on executive activities, he does not try to relate the significance of mental models to an understanding of executive work.

Kotter does not explicitly recognize the concept of mental models, but his process view of executive work implicitly depends on the existence of such a concept. Agenda building really offers an applied view, that is a perspective on the development and uses of mental models. Like any model, these cognitive agendas are constantly tested and refined as new feedback is collected through the executive's network.

Executives begin the process of developing these agendas immediately after starting their jobs, if not before. They use their knowledge of the businesses and organizations involved along with new information received each day to quickly develop a rough agenda -- typically, this contains a very loosely

connected and incomplete set of objectives, along with a few specific strategies and plans. Then over time, as more and more information is gathered, they incrementally (one step at a time) make the agendas more complete and more tightly connected.

...GMs make agenda-setting decisions both consciously (or analytically) and unconsciously (or intuitively) in a process that is largely internal to their minds. Indeed, important agenda-setting decisions are often not observable (1982:161).

Isenberg makes the link between agendas and mental models when he develops the case for "managerial cognition" as a critical element in understanding executive work.

He points out that, "Kotter's (1982) notion of the manager's agenda is by definition a cognitive structure for organizing the manager's many tasks..." (1985:12)

Isenberg also observes:

...Managers have an organized mental map of all the problems and issues facing them. The map is neither static nor permanent; rather, managers continually test, correct, and revise it. In the words of one CEO, the executive takes advantage of the best cartography at his command, but knows that that is not enough. He knows that along the way he will find things that change his maps or alter his perceptions of the terrain. He trains himself the best he can in the detective skills. He is endlessly sending out patrols to learn greater detail, overflying targets to get some sense of the general battlefield." (1984:87)

"Manager as Sensemaker" is one of several views of managerial thinking identified by Isenberg. This view, which focuses on how executives impose cognitive structures, or mental maps, on their environments, includes several different perspectives on cognitive

structure. Cognitive mapping is a complex and little understood area, but one of increasing interest to management researchers. Our case studies strongly suggest, however, that the process of building and questioning the continuing validity of a top manager's mental model is a major force in the development of many executive support systems.

Jaques indirectly focuses on the critical importance of mental models. He points out that the key cognitive difference between level 3 departmental managers and level 4 general managers is, in fact, the need for modeling at the fourth level. Identifying the need for conceptual modeling at levels 4 and above helps explain why some executive users would, consciously or unconsciously, try to apply information technology to their model building processes. Jaques' insights into the cognitive differences between levels of management also suggest that differences should exist between executive support systems and those designed for lower level managers.

Reviewing the literature on executive work we learn several things about mental models relevant to our understanding of ESS. There seems to be agreement among researchers that the concept of mental models is critical to understanding executive work. Kotter's concept of agenda building would be impossible without it. And, in

fact, Jaques seems to argue that the work of general managers requires mental modeling.

Finally, it is somewhat ironic that Mintzberg, whose research on one level seems to argue against executive computer use, was the first to suggest that computer support could enrich top management models of the business. Mintzberg's idea was that the technology would be used by management scientists on the staff to help make the executives' models more explicit, testable, and, thus, easier to communicate. What he did not foresee was that executives would actually be using the technology directly to help them think about their businesses.

We know enough about mental models to talk about them as a critical factor in executive work and, thus, ESS. Cognitive modeling remains enough of a mystery, however, that consciously designing an ESS to help enrich an executive's mental model is still very difficult. To date, systems that do this have almost always been designed with other more concrete goals in mind. Yet, in interviews, many executives return time after time to points which indicate significant ESS use to support or test their cognitive maps.

Improving Organizational Systems

Anthony, Mintzberg, Kotter and Isenberg all have something to contribute to our understanding of how ESS are used to improve

organizational systems. Early research in executive support (Rockart/Treacy, 1982) reported on the use of computer support by individual executives. The first ESS were designed to support top managers alone, with little regard for the system's impact on the organization. Our recent research, however, indicates that this has changed. Indeed, many of the systems perceived to be most successful today are those that have affected changes in the organization's planning and control processes.

Several of the roles identified by Mintzberg, specifically entrepreneur, monitor, leader, disturbance handler, and resource allocator, all clearly show a need for structured "hard" data. However, standard reporting systems, usually covering from one month to a year, are often inadequate for top management. As Jaques and Kotter point out, top managers have a broader time horizon than that covered by the average formal planning and control system. Executives are interested in information that covers periods ranging from very short term (1-30 days) to 20 years. Working with the newly available information technology, many are striving to change both the information they personally receive and that which is available and disseminated through the organization. In this latter way, they are changing the planning and control system.

There seem to be two reasons that improving organizational systems is an objective of ESS. First, executives need more timely

and better quality data to fulfill today's increasingly demanding roles of monitor and resource allocator. Speeding up the handling of information closes the feedback loop identified by Anthony, and thus increases control in these roles. Increased control can serve to reduce uncertainty, an objective long ago identified by Cyert and March (1963) as a fundamental objective in organizations. Nowhere is managing under uncertainty more a factor than in top management functions.

The second reason is that developing more rational organizational systems enables top management to focus on other more undefined and uncertain strategic issues. Isenberg says:

...Rational systems free senior executives to tackle the ambiguous, ill-defined tasks that the human mind is uniquely capable of addressing.

...In fact, it may seem paradoxical that managers need to create rational systems in order to creatively and incrementally tackle the nonrecurrent problems that defy systematic approaches. (1984:89)

In one sense, the development of executive support systems can be perceived as an attempt by management to rationalize through automation as many of their tasks as possible. This allows more time for the highly uncertain and non-systematic functions, which should take up most of their time. There are some tasks which top managers must periodically repeat, such as determining executive compensation, or reviewing monthly sales figures, so systems are set up to support

these tasks. The primary benefits are usually time saved and better information available for decision making.

This reasoning has received support from other researchers. Huber, for example, offers this related observation:

We recognize, of course, that a good deal of the information relevant to top management will not be available through computers. Certainly a good deal of politically or socially sensitive information will not. What C² [computers and communications] technology will do, however, is reduce the amount of time needed to scan less sensitive environments and thus produce more time for chats and gossip sessions that provide the soft and sensitive information that the manager needs to complete his or her mental model. (1984:947)

Huber recognizes the link between organizational systems and mental models. One of the important insights from our research is that executives are using ESS to communicate their own mental models of the business to the rest of the organization, usually by changing the planning and control systems. These enhanced systems, in turn, help enrich the executive's mental model. Thus, it is an interactive process. Developing an ESS to improve planning and control processes will often enhance the top manager's way of thinking about the business which will, in turn, lead to the development of better systems which further enhance the mental model.

Office Applications

Many researchers have reported on the time pressures executives experience. But, unlike with mental models and organizational systems, management theorists doing research on executive work have had little to say explicitly about improving efficiency or effectiveness at the top management level through improved office systems.

It is ironic, therefore, that improving routine office workings is the area that so far has received the most attention from ESS developers and computer vendors. Perhaps, this is because "saving time" is the need executives can most easily articulate to their I/S departments. For whatever reason, making the executive more efficient has become the initial objective of many ESS projects.

These applications, which generally fall into the domain of office automation, usually do one of two things for the users: (1) improve communications, or (2) help organize information.

Virtually all of Mintzberg's roles argue for communications support. Communications also pervades Anthony's framework for planning and control, and Kotter's concept of developing a network inherently implies a need to improve communications capabilities. Given these needs for better communication, it should not be surprising that electronic mail is one of the most common ESS applications.

Mintzberg also recognizes that information continually "bombards" the executive. Thus, help in organizing this information is one form of support that is needed. In like manner, Isenberg contends that executives try to rationalize organizational systems. This particular tendency would logically extend to their own personal support systems. Tickler files, automated Roladexes, electronic mail, calendaring, and word processing are all evidence of this drive to rationalize as many personal systems as possible.

CONCLUSION

The views we hold of executive work greatly influence how we think about executive support systems (Treacy and De Long, 1985). Reviewing the literature on top management work serves two purposes. First, it can point to areas in which computer-based systems can logically aid managers. Second, reviewing the literature can help ESS researchers, developers, and users become more conscious of the implicit models they have of the executive function. Only by making these beliefs explicit can we begin to reflect on their influence on ESS design.

Bibliography

1. Anthony, Robert N., Planning and Control Systems: A Framework for Analysis. Division of Research, Graduate School of Business Administration, Harvard University, Boston, Mass., 1965.
2. Barnard, C.I., The Functions of the Executive, Harvard University Press, 1938.
3. Beer, Stafford, Cybernetics and Management, Wiley & Sons, New York, 1959.
4. Brief, Arthur P., and H. Kirk Downey, "Cognitive and Organizational Structures: A Conceptual Analysis of Implicit Organizing Theories," Human Relations, Vol. 36, No. 12, 1983, pp.1065-1090.
5. Carlson, Sune, Executive Behavior: A Study of the Work Load and the Working Methods of Managing Directors, Strombergs, Stockholm, 1951.
6. Cyert, Richard M., and James G. March, A Behavioral Theory of the Firm, Prentice-Hall, Englewood Cliffs, NJ, 1963.
7. De Long, David W., and John F. Rockart, "A Survey of Current Trends in the Use of Executive Support Systems," Center for Information Systems Research, Working Paper No. 121, Sloan School of Management, MIT, Cambridge, Mass., November 1984.
8. De Long, David W., and John F. Rockart, "Identifying the Attributes of Successful Executive Support Systems Implementation," Center for Information Systems Research, Working Paper No. 132, Sloan School of Management, MIT, Cambridge, Mass., January 1986.
9. Donaldson, Gordon, and Jay W. Lorsch, Decision Making at the Top, Basic Books, New York, 1983.
10. Huber, George P., "The Nature and Design of Post-Industrial Organizations," Management Science, Vol. 30, No. 8, August 1984, pp.928-951.
11. Isenberg, Daniel J., "How Senior Managers Think," Harvard Business Review, November-December, 1984, pp.81-90.
12. Isenberg, Daniel J., Managerial Thinking: An Inquiry Into How Senior Managers Think, unpublished manuscript, 1985.
13. Jaques, Elliott, A General Theory of Bureaucracy, Heinemann, London, 1976.
14. Keen, Peter G.W., "'Interactive' Computer Systems for Managers: A Modest Proposal," Sloan Management Review, Fall 1976.

Bibliography -2

15. Keen, Peter G. W., and Richard D. Hackathorn, "Decision Support Systems and Personal Computing," Center for Information Systems Research, Working Paper No. 47, Sloan School of Management, MIT, Cambridge, Mass., October 1979.
16. Kotter, John P., The General Managers, Free Press, New York, 1982a.
17. Kotter, John P., "What Effective General Managers Really Do," Harvard Business Review, Vol. 60, No. 6, November-December, 1982b, pp.156-167.
18. Merchant, Kenneth A., Control in Business Organizations, Pitman, Marshfield, Mass., 1985.
19. Mintzberg, Henry, The Nature of Managerial Work, Harper & Row, New York, 1973.
20. Mintzberg, Henry, "Manager's Job: Folklore and Fact," Harvard Business Review, July-August, 1975, pp.49-61.
21. Ouchi, William, "A Conceptual Framework for the Design of Organization Control Mechanisms," Management Science, 25 (September 1979), pp.833-848.
22. Rockart, John F., and Michael E. Treacy, "The CEO Goes On-Line," Harvard Business Review, January-February, 1982.
23. Simon, Herbert A., Administrative Behavior, Macmillon Company, New York, 1957.
24. Thompson, J.D., Organizations in Action, McGraw-Hill, New York, 1967.
25. Treacy, Michael E., "Supporting Senior Executives' Models for Planning and Control," in The Rise of Managerial Computing, edited by John F. Rockart and Christine V. Bullen, Dow Jones-Irwin, Homewood, IL, 1986, pp.172-189.
26. Treacy, Michael E., and David W. DeLong, "Executive Support Systems Technology and Design," October 1985, unpublished paper.
27. Weick, Karl E., The Social Psychology of Organizing, Addison-Wesley, Reading, Mass., 1979.

Bibliography -3

28. Weick, Karl E., "Theoretical Assumptions and Research Methodology Selection," in The Information Systems Research Challenge, edited by F. Warren McFarlan, Harvard Business School Press, Boston, Mass., 1984.
29. Weiner, Norbert, Cybernetics: or Control and Communication in the Animal and the Machine, MIT Press, Cambridge, Mass., 1948.
30. Williamson, Oliver E., Markets and Hierarchies, Free Press, New York, 1975.