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EXECUTIVE SUPPORT SYSTEMS: AN INNOVATION

DECISION PERSPECTIVE

by

VERN EDWIN HASENSTEIN

B.S., University of Wisconsin, 1978

**A thesis submitted to the
Faculty of the Graduate School of the
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of the requirements for the degree of
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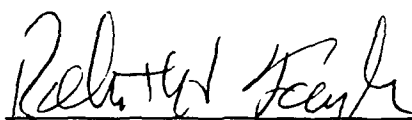
Department of Management Science

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by


James C. Brancheau


Robert H. Taylor

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Executive Support Systems: An Innovation-decision
Perspective

Thesis directed by Assistant Professor James C.
Brancheau

Executive use of information technology (IT) is spreading. These top managers are discovering the value of strategic information in the profitability and competitiveness of their companies. By delivering timely, concise, and relevant information directly to these executives, an executive support system (ESS) allows more effective analysis, control, planning, and decision making. Automated improvements to the management process have the potential to highly leverage the executive's effectiveness.

An ESS is a concept, a clustered IT, and an innovation, especially to the executive user. A true ESS combines three areas of IT: decision support, personal productivity tools, and communications. Innovation-decision theory provides a theoretical framework to characterize the adoption of ESS. A better understanding of the key personal factors and related management issues positively affecting ESS

adoption will help managers better anticipate and forestall problems before they begin. ~~There is a~~

A high level sponsor, aware and enthusiastic toward emerging IT, champions the creation of an ESS. An ESS is a "partner" and must support and change with the needs of the executive, who is responsive to the critical success factors (CSFs) of the business. An "alive" system, it needs constant nourishment by a dedicated multi-talented support team to chase changing and oft times elusive CSFs. The user drives the prototype and learns the real requirements with time. As modules of functionality are released, each user can start small and buy-in at a rate comfort and interest allow.

Whether built or bought, the technology is now adroit and performs well enough to yield enhanced communications and fast access to relevant "what is" information in the same way executives work. The sharing of information, perceived by some as threatening at first, leads to better decisions and appreciation of the marketplace. Once in place, the ESS is rapidly adopted as executives see it as a progressive management technique. A facilitator of organizational change for now, the focus of ESS is shifting toward the future as users see just what IT can do and developers learn what it should do.

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CHAPTER I

INTRODUCTION

An executive support system (ESS) is an example of an information technology (IT) that is increasingly being used by our senior corporate leadership. A true ESS combines three areas of IT: decision support systems, personal productivity tools, and communications. An ESS supports the executive functions of status access, query and analysis, and communication and coordination. The most common applications involve office support, planning and operational control, and strengthening the executive's vision or mental model of the business environment. An ESS is also an innovation, especially to those in the executive suite whom have little experience with computers. Certainly executives have an existing information/support system via their staff. So, an ESS is not really a new process, but an automated improvement to the existing one.

The diffusion of ESSs is a trend that is gaining momentum. Why? First, today's volatile business environment makes timely information and analysis necessary for competitive edge. Top managers have the responsibility of relating their organization to the outside business environment, including competitors, after receiving information from the organization's monitoring systems [Hage, 1988, pp. 85-86]. Executives will have to increase their contacts with outside organizations as the trend toward interorganizational relationships increases. New use of IT, like electronic mail and executive workstations will make it easier for top managers to get and evaluate relevant information. Globalization demands the use of IT to free the firm of the existing constraints of time and place in order to communicate. One aspect of leadership is the maintenance of high standards, which is only upheld when a manager has timely knowledge of both successes, especially those critical success factors (CSFs) in the industry, and failures in his/her company. An ESS helps managers more effectively meet their leadership and control responsibilities without jeopardizing their strategic role.

Second, faster and cheaper hardware has teamed up with very user-friendly software to give managers a relatively easy tool to implement. Pilot Executive Systems President, Thomas P. McAuliffe estimates that a whopping 70% of large U.S. companies have either installed an ESS or are actively considering one. According to International Data Corp., sales of host-based ESS products in 1988 grew over 50% from 1987, to about \$34 million. However, never before has the technology had to be so integrated, transparent, and fast; the ability to sit down and immediately go to work with an off-the-shelf ESS is not a reality yet. PCs allow managers to do quick and cheap, speculative and exploratory work without involving scarce mainframe programming resources [Davis, 1984]. The systems can start small (less than \$100,000), providing support to a single user, and grow only as additional individuals "buy in". Unlike the huge classic data processing systems, ESSs can evolve by increments in step with the distinct needs of each corporate office.

Next, distributed data base technology and management has made data more available, both internal and external; although aggregating and

accessing data across an organization remains the biggest physical roadblock to ESS development.

Additionally, more of today's managers are computer literate and feel automation is inevitable and necessary to stay competitive. A bank executive sums it up, "I spend two hours a day at the keyboard, about equal to the time spent with the two foremost life-changing devices of the modern age, the car and telephone" [Nulty, 1984, pg. 38]. Moore [1987, pg. 215] reports that while U.S. industrial productivity rose 85% during the 1970s, white collar productivity claimed only a 4% improvement. Thus an ESS may help managers be more efficient with the non-managerial tasks and allow them to be more productive in what they were hired for - managing.

Executives should be interested in an ESS for several other reasons. Decision making involves high stakes and any improvement in the quality of their decisions is likely to impact the bottom line. The increasing pressure from the external business environment as well as the internal increase in workload means letting the IT handle the quantitative chores of several probable scenarios, while letting the executive use his/her true talent of judgement

and intuition. The effects of executive actions ripple throughout the organization. The impact of an ESS is highly leveraged both in direct effects and as executives become opinion leaders in their own right and encourage subordinates to work smarter by influencing the use of IT [Meyer and Boone, 1987, pg. 206].

Use of an IT, like ESS, has the potential to improve both the efficiency and effectiveness of the executive. This results in two different types of benefits: cost-displacement and value-added. Cost-displacement applications, like office support, make him/her more productive or efficient and is the traditional means of assessing the benefits of the IT. Executives perform relatively unstructured work with the structured tasks generally being the least relevant to their business success. Therefore, a focus on efficiency will result in minor productivity gains and a weak justification for the system. The real pay-off for ESSs refer to the "value-added" applications which focus on individual and organizational effectiveness. An ESS builds effectiveness three ways: it frees time by relieving the executives of the administrative tasks; it frees

thinking by allowing the manager to quickly capture and work with information and ideas, and consider alternatives; and it enhances collaboration by expanding communication circles and enlarging span of control. These value-added benefits strike at the heart of management - to allow the manager to do business, rather than the administrative processes that support it. These benefits are measurable in both "soft" dollars and hard ones. The value-added benefits are harder to measure and usually involve the "soft" dollar metrics such as increased market share, better decisions, reduced risk, and competitive edge [Meyer and Boone, 1987, pp. 7-13]. The benefits usually cited by top management include improved communications, better (timely and relevant) information, an evolving understanding of information requirements, and cost reductions.

Despite these forces, computer-based support for top management is controversial and reasons exist to disparage ESSs [Deardon, 1983]. An ESS does not fit with the personal work style of all executives. Managers differ in individual cognitive style and work habits in dealing with the unstructured and abstract nature of their work. Secondly, executives

rely on "soft" information - only obtainable via personal observation and discussion - to effectively carry out their jobs. Executives whose personal work style calls for a lot of face-to-face communication, and whom leave analysis to their staff, will continue to resist an ESS. Another point involves the possible negative impacts on the organization. Use of the computer-based models may cause an executive to lose sight of reality. As with any innovation, there is a real potential for misuse especially if the user pays little attention to unintended and unwanted organizational side-effects. David DeLong argues that at least half of the attempts to implement an ESS end in failure, or at best, give users with slightly more value than an extra coat hook [DeLong and Belcher, 1989]. Finally, numerous examples of ESS failures exist due to poor conception and implementation - as with any system.

The concept of ESSs has only begun to emerge in the 1980s, hence it can be called an innovation. For this research, a subset of diffusion of innovation (DOI) theory - the innovation-decision process - is applied to better understand the technology-transfer process of ESSs. The innovation-

decision process is the way which an individual, or adopting unit (organization), passes from initial knowledge-awareness of an innovation, to forming an attitude toward it, to deciding to adopt or reject it, to putting it into use, and to confirmation of this decision.

Based in studies in sociology, communication, marketing, and education, diffusion research is a prominent field of knowledge within the social sciences. Prior investigations of the salient behavior of individuals, organizations, and political parties has provided important insight into significant social activity and consequences surrounding innovation diffusion. According to Rogers [1983, pp. 88-91], diffusion research applies to a wide variety of social science disciplines. It has high practical appeal in solving problems of research utilization. The diffusion model allows scholars to generalize their findings to a higher dimension. It is also straight forward method to gather data and analyze it.

While much research has been done in diffusion of innovations (DOI) in other fields (Eg., agriculture, medicine, and education), very little

work has been done in the IT field overall, specifically in ESS. In a review by Rogers [1983] of some 3085 publications, not a single mention is made of MIS. Most work done primarily addresses diffusion of IT at the organizational level [Huff and Munro, 1985; Zmud, 1984; and McKenney and McFarlan, 1982], not at the level of individual adoptors. Brancheau and Wetherbe [1989], and Zmud [1984] have also shown the application of DOI theory to spreadsheet software and modern software practices, respectively. Even though the basic theory applies generally to all innovations, scholars have shown the theory has definite limitations in regards to IT and modifications and extensions are in order - for examples see Brancheau and Wetherbe, or Bayer and Melone. Hackathorn found for the most part, executives do act and feel similar to others in regards to end-user computing. Hackathorn's results also implied executives were not passive end-users, but were quite active in using this technology to perform their jobs. In the context of IT, confirmation is best understood as occurring during utilization. Roger's innovation-decision model becomes knowledge, persuasion, acquisition (assumes a

positive decision to adopt), trial use, limited use, and full utilization.

As a framework, the innovation-decision process may help develop the management techniques necessary or useful at various points during ESS adoption. Managers responsible for facilitating the use of an innovation, like an ESS, may better understand the technology-transfer process and predict outcomes (benefits and risks) due to adoption. Without accurate descriptions of adoption behavior (the innovation-decision process), the manager makes uninformed decisions on allocating limited resources. The need for the research is validated by the results of a recent Delphi survey of the most important issues facing IS executives. IS and general managers ranked "facilitation of organizational learning and use of information technology" and "facilitation and management of end-user computing" among their most critical issues [Brancheau and Wetherbe, 1987, pg. 2]. The classical innovation-decision model (per Rogers) provides a theoretical framework for proactive, versus reactive, management of the introduction and spread of ESSs.

This research gathers and analyzes data on the question:

What critical factors positively influence this innovation-decision process in the context of ESS?

An alternative title to this thesis could be, "What key personal and related managerial issues lead to the positive adoption of an ESS." The research examines some of the underlying mechanisms that cause an individual to move through the stages from unawareness through full utilization. It also sheds some light on two of the limitations, or further refinements of the theory, identified by Bayer and Melone as follows:

1. Distinguish between acquisition/authorization at the organizational level and the actual "form" of adoption at the user level. The "form" of adoption reflects the degree of reinvention required during implementation.

2. Determine the effect of a mandate, or the authority decision type, on adoption and use. The influence mandates have on the evolution and spread of the ESS is likely to be dependent on how the mandate is specified and the observability of compliance or noncompliance.

Finally, a major barrier to effective development of ESS is the lack of a well understood implementation process. Due to the embryonic nature of ESS, the confirmation stage (Eg. discontinuance) is not examined other than to get a feel for salient impacts. Of course, the actions of executives profoundly affect the behavior of the entire organization. Both personal and organizational impacts occur during use and are looked at in the study.

CHAPTER II

EXECUTIVE SUPPORT SYSTEMS

LITERATURE REVIEW

Executive Support Systems

In the most general sense, an executive support system (ESS) is the use of information technology (IT) by senior executives. Definitions of executive support systems are as varied as the organizations that are researching, buying, building, or using them. The systems constantly change and evolve in response to the dictates of the competitive concerns of the executives they support [Rinaldi and Jastrzembski, 1986, pg. 42]. Rockart and DeLong [1988, pg. 16] define an ESS as:

The routine use of a computer-based system most often through direct access to a terminal or personal computer, for any business function. The users are either the CEO or a member of the senior management team reporting directly to him or her. Executive support systems can be implemented at the corporate or divisional level.

This definition is still a bit vague for research purposes. Even the name confers confusion about the attributes and applications of the concept; executive

information systems and executive decision support are two other terms commonly used. The shift in semantics reflects the broader conceptual reach that evolved over time. In the early 1980s, ESS was seen as an extension of a data-driven decision support system (DSS). Little attention was given to the underlying communication and coordination aspects of many executive tasks. Most corporations generate raw data via numerous transaction processing systems which were never designed to give information to executives. David Davis [1984] reports that 79% of the systems frequently used by managers are really transaction processing based and are not appropriate for the inquiry and analysis tasks really needed to support executives. An ESS bridges the corporate information gap (figure 1) by extracting and transforming the raw data from operational systems to the timely, concise information the executive needs. An ESS can give the executive an information synthesis linking internal and external data previously unconnected [Kador, 1989, pg. 1]. Only then may the executive merge these operational performance "facts" with his/her knowledge, judgement, and assumptions on which he/she bases

decisions and actions. A true ESS combines sophisticated analytic abilities of a DSS, personal productivity tools, and a communications and coordination capability.

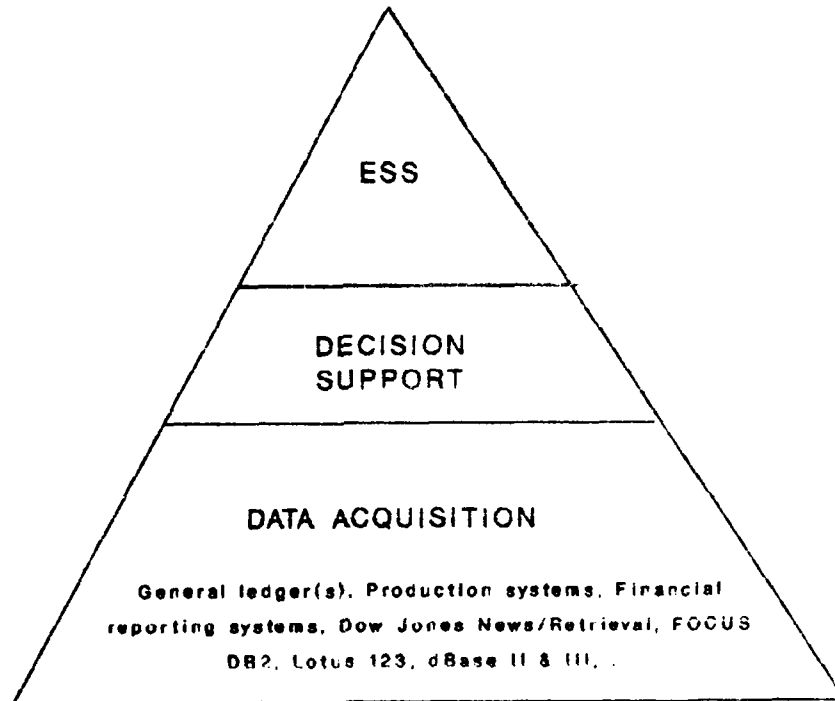


Figure 1

An ESS Bridges the Corporate Information Gap

Today, an ESS is considered different from lower level DSSs and/or office automation. An ESS differs from a DSS in its end use and end-user. ESSs are used by executives to improve managerial planning, monitoring, and analysis. DSSs are used by

operational (middle) management and tend to be more model and data analysis oriented [Pike, 1988, pg. 23]. An ESS differs in four major ways from traditional DSS and office support applications [Rockart and DeLong, 1988, pp. 17-25]. The first major difference is the broad range of applications included in an ESS. The executive's role and environment is so complex and ambiguous that additional applications are needed for the ESS to add value. Many internal and external "tidbits" of information may only be meaningful at the executive level. Also, the senior manager needs an "outgoing" communication capability to better lead the organization.

Software products custom designed for executive use is another difference. These products have a design philosophy reflecting different conceptions of the executive's tasks - tasks such as internal and external monitoring, limited analysis, and communications. For example, Comshare's Commander EIS gives information storage and retrieval via customized graphics, reports, and messages using automatically refreshed data with time and date stamping. Comshare's system promotes a prototyping

development methodology because of its software module reusability and compatibility with most existing software and database languages. The information gateway component of Comshare's Commander EIS makes integration of existing applications on the mainframe and PC possible.

A third factor setting ESSs apart from the traditional decision support and office automation systems is the additional complications arising during implementation. System and data timeliness, accuracy, and flexibility, are critical in an ESS. Political issues such as data ownership and other organizational and individual power and autonomy shifts add to the problems. Defining the information requirements is difficult and time-consuming to start, and the technical and political issues of getting access to multiple data sources can add more problems.

Finally, an ESS has the potential to affect the whole organization, not just an individual or department as the traditional decision support systems do. While an ESS was initially designed for one executive, the clear trend now is towards organizational systems, linking the top managers to

subordinates and peers. The development of an ESS requires a knowledge of what executives do; the least understood area of work activity.

The Nature of Executive Work

Henry Mintzberg views managerial work along two dimensions with the term manager broadly referring to foremen, middle managers, and chief executives as well. The first deals with certain sets of characteristics that have significant bearing on the manager's ability to administer a complex organization. The manager performs a great quantity of work at an unrelenting pace. His/her activity has no pattern and is characterized by brevity, variety, and fragmentation. The manager's environment is clearly one of stimulus-response - he/she deals with issues that are current, specific, and ad hoc. He/She prefers the "richness" of verbal media since these provide faster response, require less effort, and give greater flexibility. The manager figuratively appears as the neck of an hourglass and sifts information between his organization and the environment.

The second view describes the content of managerial work in terms of ten distinct roles or organized sets of behavior divided into three groups: interpersonal (figurehead, leader, and liaison), informational (monitor, disseminator, and spokesman), and decisional (entrepreneur, disturbance handler, resource allocator, and negotiator). The interpersonal roles stem directly from the manager's authority and status. The informational roles relate to the processing and handling of information/knowledge. As "nerve-center" the manager knows more about the total organization and its environment than any other member, so he/she is better able to decide on an appropriate course of action. As disseminator, the manager expresses factual information and value positions into organizational preferences to guide subordinate's decisions/actions. The decisional roles involves understanding complex decisions involving value trade-offs. The entrepreneur looks for opportunities and potential problems to initiate controlled change in his/her organization. As resource allocator, the manager relies upon "mental" models to guide their behavior.

Keen [1981, pg. 25] states, "most executive decision making is multifaceted, emotive, conservative, and only partially cognitive." Top managers must draw upon experience and judgement to deal with considerable uncertainty and ambiguity in decision making. Minzberg acknowledges the existence and importance of these mental models on executive activities. Cognitive modeling remains a mystery and designing an ESS to enrich this aspect of executive work is difficult.

Improving the manager's efficiency and effectiveness means better communication and access to information. Henry Minzberg states the manager faces a dilemma of delegation, i.e., access to critical information but lacking a formal means of disseminating it. The executive's time assumes a large opportunity cost and he/she faces the real danger of becoming an obstruction in the flow of decisions and information [Mintzberg, 1971, pp. 98-99].

Top managers recognize the value of IT to gain an edge. In today's volatile competitive environment, more timely and better quality data are needed to improve organizational planning and

control. A top manager must focus on the ambiguous and "human" tasks, which should take up most of their time. The primary benefits of IT use are time saved in dealing with the "hard" data and repetitive tasks, and better information for decision making. It's all linked, the executives mental model is communicated to the rest of the organization by the planning and control systems. These planning and control systems in turn enrich the executive's mental model; so it's an iterative and interactive process.

ESS Applications

Specific patterns of applications appear along two dimensions. One dimension pertains to the function(s) the manager performs, for example communications, performance monitoring and analysis. The other dimension embodies the managerial purpose for using the ESS, like office support, control, and helping conceptualize the mental model.

Along the functional dimension, communication and coordination is supported by access to electronic mail (EM) and conferencing. EM in particular has emerged as a salient feature among computer-based executive support. Status access gives the manager a

fixed set of reports to monitor organizational progress. Although currently a less common practice, the system may perform ad hoc querying of corporate and divisional databases for unstructured analysis and modeling. The pioneers use fourth generation tools such as FOCUS, NOMAD, or EXPRESS to access the database(s) which may link directly to a PC with additional spreadsheet support.

Managerial purpose accounts for the other pattern of key applications for ESS use. First, IT support of office functions improves the executives efficiency and effectiveness. Next, an ESS can improve the organization's planning and control processes. Lastly, use of an ESS can clarify the manager's mental model of the firm and its environment.

Office support (OS) applications gives efficiency gains to routine office tasks. In response to time, innovation, and change pressures, many executives are seeking IT's help to increase their efficiency in these day-to-day tasks. Office support is communications (EM, news, or word processing), data analysis (spreadsheets), and organizing tool (auto-filing and calendaring) based.

EM, the most significant OS application, helps senior executives communicate more efficiently by eliminating telephone tag, "information float", and time and place dependence within the organization. An ESS speeds decision making by presenting information in useful formats and disseminating it quickly. William Jeffrey, Senior VP at United Research, says, "sharing information and just trying to agree on facts takes 80% of a typical business meeting." Meetings are more productive with use of an ESS since the participants have the facts beforehand, time spent planning, solving problems, and making decisions can be 80% instead of 20%. Access to news, either happening within the company or around the world, helps simplify the information-scanning process. Computerized external news summaries such as Dow Jones News/Retrieval service or United Press International are usually more valuable than internal news. For executives with global operations, the ESS may select relevant readings from major world publications and trade reports. This "personal" newspaper includes only those articles screened against the executives preference profile [Gauthier, 1989, pg. 43]. Word processing may be

used for certain executive jobs (Eg. public relations) and where the corporate culture supports executive typing.

Like word processing, Rockart and DeLong [1988, pp. 85-88] found little executive use of spreadsheets. The most common use was for salary and bonus reviews (information too sensitive to delegate) and trend analysis. Finally, automatic filing and retrieval of notes, personal and business contacts, and letters, as well as his/her calendar help organize the senior executive's time. By nature, the impact of these OS tools on executives and the firm is limited. Levinson [1984, pg. 4] states, "these efficiency systems supporting tasks peripheral to the core needs of the business had low expectations of capabilities and benefits." The real payoff for ESS is the redesign and enhancement of the planning and control systems.

Management control - the efficient and effective use of resources to achieve organizational goals - involves planning to establish goals and a control system which collects and evaluates data to keep on track toward those goals. Rockart and DeLong

[1988, pp. 94-120] observed six ways how an ESS improved organizational planning and control.

(1) An ESS improves existing corporate and divisional reporting systems by speeding up reporting, increasing data integrity, and changing how data is collected and represented.

(2) It can reshape the content and structure of the management reporting system itself. The faster "metabolism" of business today requires weekly or even daily performance data to increase understanding of the marketplace(s).

(3) The planning and forecasting processes change as a result of improved control. Automation of some of the planning processes and standardization of meanings and formats make planning easier and more meaningful. Near real-time data and graphics displays easily allow the ESS to become future-oriented.

(4) An ESS gives the ability to do ad hoc analysis using information data bases (IDBs). A relational IDB, composed of data from both internal systems and external sources of text and data, in combination with a user-friendly access language gives ample flexibility for critical data

manipulation and report formatting. Ideally, the IDB will automatically extract data such that the necessary handshaking to host libraries, downloading, and processing is transparent to the user.

(5) The system enhances personal communication links by use of EM to tighten informal control and influence over subordinates.

(6) Program management is enhanced due to faster and more detailed access to status information. Executive overview increases visibility into operations and allows quicker corrective action, where necessary.

In the long run, the most significant effect of IT use by senior executives may be their improved vision or mental models of their business. A mental model is a cognitive construct describing a person's understanding of a segment of the managerial world [Rockart and DeLong, 1988, pg. 130]. Again, Rockart and DeLong [1988, pp. 135-150] observed six attributes of ESS important in enhancing mental models.

(1) An ESS improves access to external data which increase effectiveness of the executive's environmental scanning. Executives have a more

complete "conceptual map" and perceive information differently from subordinates - relevance is relative.

(2) It allows executives to explore new relationships by combining data from multiple sources.

(3) The system represents data in more meaningful formats (combined text, numbers, and graphics) which helps the managers understand their business by highlighting trends not observable in tabular form, and by exception reporting.

(4) An ESS gives in situ on-line analytic and modeling abilities to explore various scenarios to get a "feel" for certain cause-effect relationships.

(5) It gives the ability to surface and test those assumptions underlying the manager's mental model of the business. Assumptions are components of a mental image - an imperfect simplification of the business environment, based on limited inputs and mental processes - which guides the organization's actions [Rockart and DeLong, 1988, pg. 145].

(6) An ESS gives an executive access to corporate and/or external data "after hours". While off-hours thinking doesn't improve the mental model per se,

access to information supports some of the most reflective, and creative, thinking the executive does.

The ESS definition for this work goes as follows:

The routine use of a computer-based terminal (PC or workstation) and specific ESS software directly by, or expressly for, a member of the top levels in an organization for internal and external communications, and access to both internal and external data to monitor business performance, and give a better understanding of the environment on which to plan and act.

A Successful ESS

Defining and quantifying the benefits of ESS use is difficult due to their intangible and transient nature. The lack of metrics to assess value-added for such intangibles as better decision making, improved communications, and improved market position makes cost/benefit analysis very hard at best. The real pay-off is giving the executive quick access to reliable information that can be used in new combinations and may lead to new ways of thinking and better decisions. The difficulty in cost justifying an ESS keeps many IS departments from proposing such systems in the first place. Generally, the users pushing for the ESS have enough

clout, and the cost justification fades into the background [Moad, 1988, pg. 46].

Even though most firms do not measure the hard-dollar benefits, they do consider the costs involved. A University of Georgia's College of Business Administration study states "the average cost (1989 dollars) of developing an ESS is \$365K, and annual operating costs bring another \$208K to the party". Thus, an ESS is quite an expensive tool for all but large firms with deep pockets. Of the developing costs, the figures averaged \$128K for software, \$129K for hardware, \$90K for personnel, and \$18K for training. In the category of operating costs, the average annual numbers were \$117K for personnel, \$46K for software, \$29K for hardware, and \$16K for training [Ryan, 1989].

Economic justification is only part of the ESS's value equation. The executive's use the system and know the value of it. Rockart and DeLong [1988, pg. 38] give four criteria, from most to least valuable, for judging a successful ESS:

1. It changes or enhances the executives view of the business - i.e., it improves his/her mental model.

2. It gives the manager better planning and control abilities.
3. It leverages the manager's time, allowing the company to make better use of the executive's experience and expertise.
4. It educates the executive about the use and potential of IT.

Implementation Issues

Many commentators have drawn attention to implementation problems resulting in systems being technical successes but organizational failures. Implementation of an ESS is a special challenge due to the ambiguous nature of executive work, the uncertainty of the business environment, and the sensitivity of political issues stemming from real and perceived organizational power shifts. Implementation is also a dynamic process and so success is context sensitive with no "cookbook" answers. Despite this warning, Rockart and DeLong [1988, pp. 152-239] observed eight areas which appeared most important for successful ESS implementation.

(1) An ESS needs a committed and informed executive sponsor to champion its creation and use. He/she may drive the system into existence, then delegate use to others - it all depends on personality, technical bent, and management style. The executive sponsor must make the initial request for the system; stay on top of system development, give direction and feedback on the applications; and communicate commitment to all stakeholders. An ESS cuts across organizational boundaries, and to penetrate all areas, the executive sponsor is needed. This sponsor must comprehend the resources needed, organization impacts and any resulting resistance, and the need for an operating sponsor.

(2) An operating sponsor, a trusted subordinate of the executive sponsor, is usually put in charge of managing ESS development. He/she serves as a liaison between the executive users and ESS designers. This sponsor must communicate easily with both sets of stakeholders and help match business needs with technical capabilities. The operating sponsor could be a member of senior management or an IS manager with plenty of business sense and close working relationship with the top. He/she must mobilize the

necessary coalitions based on complex negotiations to garner support for the ESS and overcome organizational pluralism, social inertia, and counterimplementation [Keen, 1981]. The main responsibilities here involve; ensuring enough resources are allocated, determining the right requirements, prying data loose from organizational "factions", and protecting the design team from the top.

(3) The proper IS human resources are essential in the successful design and implementation of an ESS. Design teams combine the skills of executive and operating sponsors, as well as the IS group. The design team must have; enough people to finish the job, the right mix of skills commensurate with the sophistication of applications and amount of organizational boundary crossing, and enough business savvy to deal with top management. George Goldsmith, Human Interface Group President states, "talking to top executives and finding out more how they work, what they need and don't need, and how to make them more productive is a very different set of skills than most people in IS are used to. If an ESS doesn't deal with strategic issues and make life

easier for executives rather than giving them another task to learn, it won't get used" [Moad, 1988, pg. 44]. Ryan [1989] confirms this by asserting, "the ability to work well with executives was found to be the most necessary skill for a development team member."

Executives may turn to "fringe" groups - Eg. project teams, quick response teams, and information engineers - if they don't trust the MIS department. Fringe IS teams are best used on systems with a strong operating sponsor, the system has very narrow application to one executive, and with little organizational impact. As a rule, the system's chances for success are greater when developed by the main IS department and have a strong and committed operating sponsor. Jeffrey Turner [1985, pg. 58] found it was the culture and attitudes of the group participants that were the important factors and not the specifics of organizational alignment.

(4) As an innovation, ESS technology must fit the demands of the variable workstyles and business environments of the executive user(s). A big factor separating an ESS from all other management-oriented IT applications is the role management style plays in

the design, development, and use of the ESS. Compatibility, capacity, and response time drive the hardware decisions. Response time is a critical issue and must not compromise ease-of-use. Companies have been known to dismiss ESS packages because they could not deliver the desired screen in less than 30 seconds [Rinaldi and Jastrzembski, 1986, pg. 42].

User needs - electronic mail or full-blown query/analysis ability - helps answer the make-buy dilemma. Software must be flexible to adapt quickly for prototyping and changing applications as the executive learns about the system. Also, some executives will learn command structures, but most rely on menus and prompts. Two branches of artificial intelligence, natural language interfaces and expert systems, have promise with application to ESSs. The most difficult trade-off with software design is security versus friendliness. The tailored application (customized) design philosophy is usually more effective than the "tool-box" approach. Comshare's Commander EIS and Pilot Executive Systems Command Center are two examples of very flexible commercial ESS software shells. The major difference is that Comshare's is a distributed system, meaning

each executive's PC works with data stored in its memory. By contrast, Pilot's "co-processing" system stays on-line with the mainframe [Main, 1989, pg. 78].

(5) An ESS is only as good as the data it makes available. A major issue in ESS development is access to quality internal and external data. Dock [1985, pp. 28-30] states "all five of the information properties of accuracy, timeliness, completeness, conciseness, and relevancy are crucial in order to have an effective ESS". Technical, political, and physical barriers in giving executives access to data needed can be a real roadblock to implementation. Keen [1981, pg. 26] reports the politics of data as the most prevalent cause of counterimplementation. Even if certain data are available, it is often fragmented, stored with incompatible codes and inconsistent definitions. In many firms today, needed data resides in flat files, hierarchical, or network databases. Installing an ESS can cause the rebuilding of the firm's data infrastructure - likely a costly and time-consuming affair. Creating common access to information, especially in a decentralized firm, strikes at the heart of political power and

corporate culture. The dual questions of who owns and who manages the data must be answered to ensure confidence in the data. One approach to maintain a sense of ownership and visibility is to include the name and phone number of the data supplier on the user interface screens. Data security will vary with experience, corporate culture, and being able to see through the thinly-veiled security concern as an excuse for a data ownership issue.

Data refreshment, adequacy, consolidation, and formatting is a "whole-nother-ballgame". Most ESS architectures use a dedicated information database (IDB) residing on a mainframe or minicomputer, with access provided by PCs. The key is getting the right information, not just the right information technology.

(6) The ESS must clearly solve or address specific business objectives or critical success factors (CSFs). CSFs will vary from company to company, and from executive to executive. The CSFs should drive the information requirements, not the other way around; however, this reflective process is rarely done. An ESS is not a paper-work clone; on the contrary, it must provide the right information

at the right time to management overwhelmed by paper reports. Digging numbers out of corporate data banks and massaging them with pencil and paper can take hours or even days of staff work - find where the information is, put it together, get everybody to agree on it, and send it back for necessary corrections [Nulty, 1984, pg. 40]. Bruce Hasenyager, MIS VP of Merrill Lynch, states "the system focuses on time series-oriented information to executives rather than repackaging in electronic form all the paper reports executives had previously received" [Moad, 1988, pg. 52]. Exception reporting is an integral part of the ESS; it should highlight variations from expected, planned levels of performance.

Prototyping is a common way of finding how IT can provide value to the executive. The ESS may teach the executive just what information and CSFs are important. A difficult task here is getting management to identify their needs due to the "soft" and one-time nature of the information. Delegating application decisions to subordinates almost always results in systems with mediocre impact since the subordinates lack the perspective only top management

can offer the designers. EIS Conference Report Newsletter publisher, Al Paller asserts, "its the sizzle that gets these (ESS) systems installed, but without a specific goal tied to it, the system won't get used or survive if the executive sponsor changes jobs or leaves the firm" [Moad, 1988, pg. 50].

(7) The designers and sponsors must anticipate and manage organizational resistance, i.e., social inertia and counterimplementation, resulting from changes in information flows, or power, from installing an ESS. Resistance stems from the interaction of the innovation and people; and may take the form of nonusage of the system, overt behavior, and/or withholding of information. Of course, the easiest way to counterimplement is to lay low and rely upon inertia based upon tactics of delay and tokenism. The motive behind this resistance could be from self-interest and power control, or it could be valid concern for the firm's interests that the innovation is inappropriate. Functional staff groups and some VPs certainly stand to lose their information-filtering roles to some extent. Increased visibility into line operations is a threat to the line manager's autonomy.

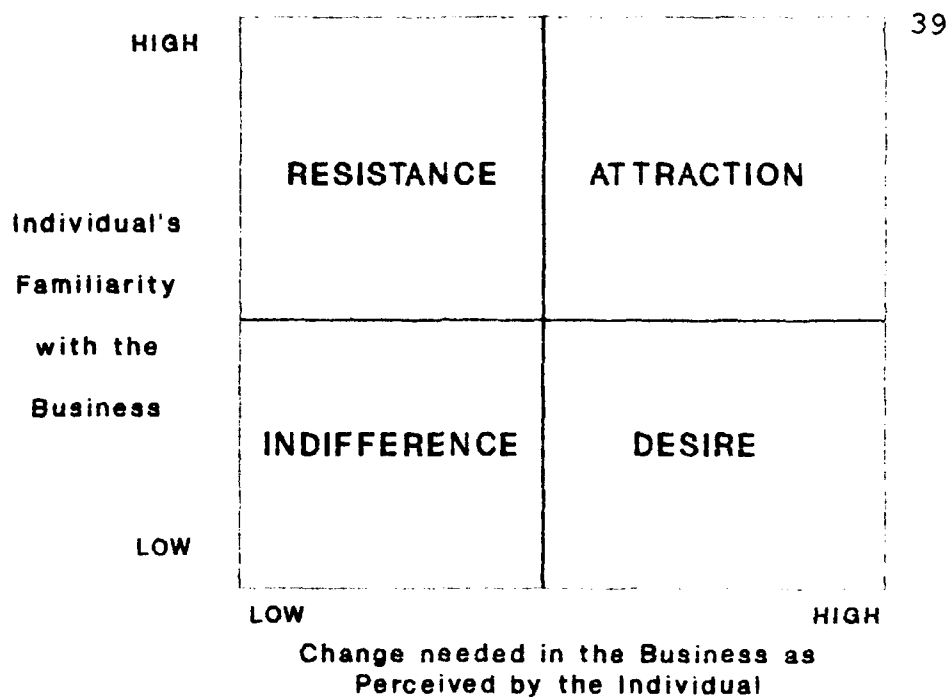


Figure 2

Assessing Attitudes Toward an ESS

Source: Rockart and DeLong, Executive Support Systems, (Homewood, Illinois: Dow-Jones Irwin, 1988), pg. 219.

Legitimate resistance results from logical perspectives, as opposed to emotional power reasons, of staff and line managers. Gary Gulden of the Index Group [Rockart and DeLong, 1988, pp. 218-219] developed a useful matrix for assessing manager's attitudes toward an ESS (figure 2). For example, an executive new on the job but perceiving that change is needed is likely to back an ESS. On the other hand, a manager who knows his/her role thoroughly and

who sees little change in the business environment is apt to question its utility. Often the subordinate line and staff see only the cost end of the ESS, while the top only see the benefits. Delayed benefits help cause inertia and inhibit acceptance of the system. Subordinates also fear executives will misinterpret the data because it's out of context. Non-adopters are not resisters if their decision has little impact on the system's value for others.

Resistance to ESS implementation is best managed by a combination of direct-power and participative approaches. The participative approach, through education, persuasion, and negotiation, is most effective in quelling uncertainty and fear plus making the system's value known. Keen calls this tactical approach "up-and-in" which relies on small groups with face-to-face involvement and participative management. Systems like an ESS may require a strategic approach to overcome inertia and counterimplementation. The strategic approach which embodies an incremental approach includes; more effort in the pre-design stages, hybrid skills in the systems staff, formal contracts among stakeholders, a policy planning or

steering committee, and a senior level "fixer" with authority and resources for negotiation [Keen, 1981].

Executive users must not use the information in a threatening way. In some cases, where management is seeking visibility into operations, direct political muscle may be the only way to overcome resistance. The more the system's purpose is to effect organizational change by altering information channels and flows, the greater the need for power and political tactics. In these cases, subordinate participation may not be encouraged in direct contradiction to conventional MIS wisdom [Rockart and DeLong, 1988, pg. 227]. A balance between the direct-power and participative approaches is context sensitive. Overpowering resisters, if carried too far, only serves to hurt morale and create a covert form of resistance. The participative approach could take too long and risk stagnating the project. So, the executive and operating sponsors are important in using their power or negotiating strengths to manage resistance.

(8) The ESS designers and sponsors must manage its evolution (growth of applications) and spread (increasing number of users). Again the interaction

of the technology, its users, and the organization is unique. The first thing to do is get some grasp of the system's goals and scope, i.e., is it designed on a "stand-alone" or organization-wide basis. Despite the cost savings of micro-based ESSs developed with hypertext products, host-based systems remain the preferred solution when large data bases are used which require frequent updating. As connectivity of the stand-alone PC systems improves so will their use as ESSs increase. The micro-based ESS market, for now, remains the province of consultants and small start-up firms [Davis, 1989].

Managing executive-user expectations is extremely crucial since their lack of IS experience and the prototyping nature of the ESS breeds many false perceptions. User support is most often in the form of one-on-one or coaching [Turner, 1985, pg. 68]. The "coaches" train and assist users in determining whether needed data are already available and whether any additional data can be obtained. They also teach access methods, and teach the executives to recognize analytic routines best fitted to different types of analysis [Rockart and Treacy, 1982, pg 86]. IS resources, people, data and

technology, must be forthcoming as more and more users come on-line. Early adopters diffuse the ESS concept by playing a key role in demonstrating the value of the innovation to their near-peers.

Impacts of ESS

The personal impacts of adopting an ESS involve the benefits derived from the applications affecting the executive's daily management processes. Time savings from the efficiency applications of office support certainly allow the executive to do the things he/she does best - managing and steering the organization. Better communications, coordination, and collaboration speeds decision making and may result in closer working relations with peers and subordinates, and eventually improved strategic advantage for the firm. The system may support understanding of the critical information needs and lead to a more robust understanding of the firm's competitive, and economic environment. The executive may manage more proactively by having better vision afforded by faster scanning of the environment, seeing trends, and validating assumptions making up his/her mental model.

Complete understanding of the broader impacts of ESS on organizations is speculative and conjectural. Evidence suggests - albeit anecdotal - that ESS are at least enabling certain changes in organizations. The organizational impact of an ESS is uncertain due to its innovative nature and the difficulty separating it from the other simultaneous changes usually taking place. An ESS does appear to support rational management objectives and/or political strategy to facilitate organizational change [Rockart and DeLong, 1988, pg. 240]. An ESS assists in the managerial objectives of decreasing staff levels, increasing spans of control, changing roles, influencing and understanding computer (IT) use, and affecting organizational change. Structural changes may or may not accompany ESS implementations.

Reduced staff and increased span of control flattens the organizational structure. Also, increased staff productivity will allow growth without adding more people. The electronic communication capabilities of an ESS increases the executives span of control by eliminating some middle-management information filters. Executive secretaries and staff analysts spend less time

collecting and processing information and more time analyzing and adding value to it. Their jobs are often enriched, as they are retrained to be designers and keepers of the new IDB. The support person can arrange for automatic, periodic, updates of the selected information and add it to the ESS menu [Kull, 1985, pg. 46]. David DeLong Observes, "a middle manager spends up to 80% of his/her time collecting, analyzing, and passing on information." The role of the middle manager may change, not diminish, as decisions are pushed down in the hierarchy and as upper management gets a clearer view of what is happening. An ESS lets subordinates make more important decisions [Main, 1989, pg. 80].

An important benefit of executives using IT seems to be the awareness of just what IT is capable of doing. The executives become opinion leaders in their own right as they learn the benefits of IT use. For IT to become a viable competitive weapon, senior management must understand how IT may impact the competitive environment and strategy of the business. The strategic role of IT and the CEO's perception of the utility of IT are believed to vary with industry and time [Jarvenpaa and Ives, 1988, pp. 4-5].

Jeffrey Turner [1985, pp. 61-62] reports once executives started using terminals, or at least had one on their desk, the use of computers by their subordinates increased significantly. In cases where top management was regularly monitoring performance data, the lower level managers demanded access to the system to see the data their bosses were seeing. One danger is that people may lose sight of reality. Frederick Ross, CEO of Raymark, observes, "Just because the numbers are printed out doesn't mean they are better than something scribbled on the back of an envelope" [Nulty, 1984, pg. 48]. The IS department also benefits by positioning itself as a vital, responsive, involved participant in the running of the corporation. An ESS tends to cut the organizational distance between IS and upper management.

An ESS may either change the business focus and/or shift power. Company or department-wide changes in business focus require an executive who envisions using the system to facilitate change from the start. Through encouragement of ESS use, the executive can shift attention to certain business details. Power shifts among departments, functional

groups, and individuals are another type of organizational change facilitated by use of an ESS. Departments usually gain influence by (re)claiming responsibility and gain independence by access to critical data. It seems the finance departments are the biggest winners and losers of power redistribution created by changed information flows. Also, these systems leverage the authority and psychological presence of senior management. The ESS sends a powerful message to subordinates that the boss is taking an interest in operational performance and he/she has the facts. High level visibility of performance data motivates the entire organization to perform well. Turner [1985, pg. 61] reported increased data visibility's only real change was timeliness, not content or scope. To allay such fear, some companies put a limit on how far the boss can "drill down" with his computer. At Xerox, he can't go below three levels; for example, division, major business unit, and U.S. sales are accessible, however sales for New England are not [Main, 1989, pg 80]. The result is a bias toward action and improved performance as the organization becomes focused on

the factors top management deems critical for success.

In some cases, it was reported the ESS was a catalyst in creating a closer working relationship between the executives and their subordinates [Turner, 1985, pp. 69-70]. Merrill Lynch's Hasenyager says, "Often, people get very supportive of the system. They want their work in front of the big bosses" [Moad, 1988, pg. 52]. The way this power is used is what really impacts the organization and varies from firm to firm, and executive to executive.

CHAPTER III

THE INNOVATION-DECISION PROCESS

LITERATURE REVIEW

The Innovation-decision Process

The innovation-decision process is central to the broader Diffusion of Innovations (DOI) theory. DOI theory defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system [Rogers, 1983, pg. 10]. Because it is new, there is considerable uncertainty as to how well an innovation solves an individual's or organization's felt need(s) or perceived problem(s). The innovation-decision process is an information seeking and processing activity in which the individual (organization) seeks to reduce uncertainty about the "new" alternative. Rogers posits a model (Figure 3) of the innovation-decision process which is usually a time-ordered sequence of five stages: knowledge, persuasion, decision, implementation, and confirmation. The communication lines depicted in

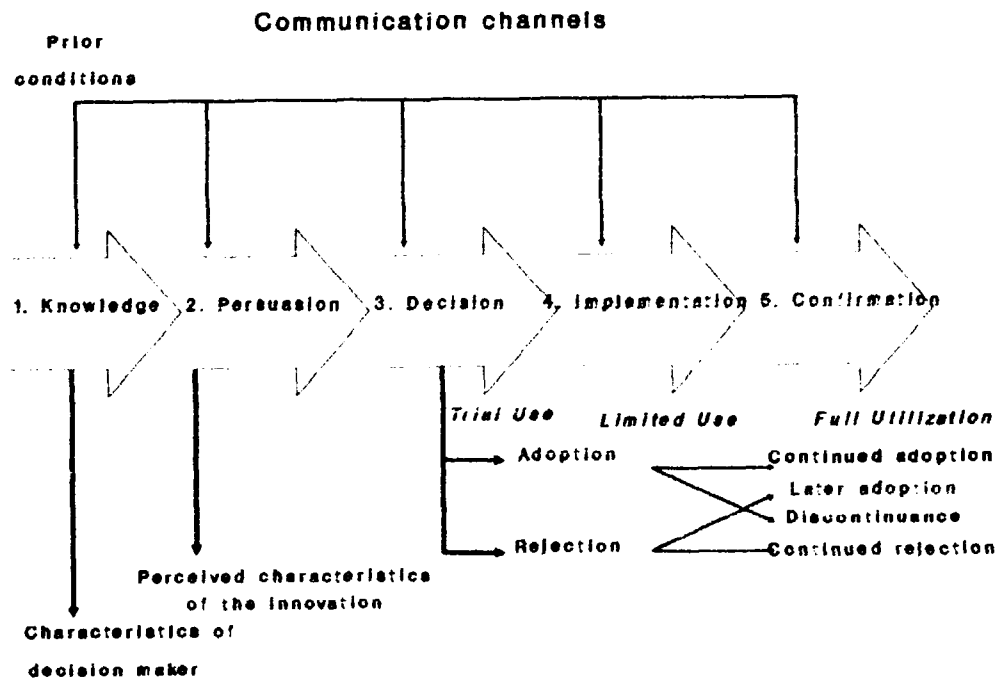


Figure 3
Stage Model of the Innovation Decision Process

Source: Everett M. Rogers, Diffusion of Innovations, Third Edition, (New York: Macmillan Publishing, 1983), pg. 165

figure 3 reflect the search loop or feedback of information throughout the stages serving to refine attitudes.

Knowledge Stage

The innovation-decision process begins when the potential adopter becomes aware of the

innovation and gains some understanding of how and why it works. The question is asked, what comes first the need or awareness of an innovation? Individuals tend to selectively expose themselves to messages about innovations which are needed; furthermore such exposure will have little effect unless the innovation is perceived as relevant and congruent with the individual's attitudes and beliefs. On the other hand, an individual may create a need based upon learning about an innovation. Here, the innovation may bridge the gap between one's desires and one's actualities. Zmud [1984, pg. 5] found that generally 'need-pull' innovations were found to have higher probabilities for commercial success than have 'technology-push' innovations.

Awareness-knowledge leads an individual to seek "how-to" and principles knowledge to further decrease uncertainty of the advantages and disadvantages of the innovation. How-to Knowledge is gained from information on how to use the innovation correctly, and possibly its fit with other components of a technology cluster. An inadequate level of how-to knowledge may lead to rejection or discontinuance. Principles knowledge involves information on the

underlying reasons why and how the innovation works. An innovation can usually be adopted without principles knowledge, although misuse during reinvention may occur and lead to discontinuance.

Early knowers of an innovation tend to have similar characteristics to pioneers: more education, higher social status, more exposure to mass media, more communicative, cosmopolite, more change agent contact, and more socially active. Of course, mere knowing is very different than using an idea. An individual's attitudes and beliefs, social norms, and the innovation relevancy all act to intervene at this point.

Persuasion Stage

The process continues with the individual forming either a favorable or unfavorable attitude or "feeling" toward the innovation. At this stage, a general perception of the innovation is developed by taking into consideration such attributes as relative advantage, compatibility, and complexity. In forming an attitude toward the innovation, the individual may conceptualize and imagine using the new idea in his/her present and/or future situation. Peer

opinion and other social reinforcement is very important at this stage due to the uncertainty involved with the innovation's expected consequences. The potential adopter seeks innovation-evaluation information to reduce the uncertainty. Near-peers (homophileous) subjective opinions are very convincing. This stage results in either a favorable or unfavorable attitude toward the innovation which does not always directly lead to an adoption or rejection decision.

Decision Stage

At this stage, the individual (organization) engages in activities leading to the choice to adopt or reject the innovation. Trialability of the innovation (if possible) helps reduce perceived uncertainty even further. Sometimes the trial of a new idea by a peer will sometimes substitute for their own trial - trial by proxy. The decision to reject is just as logical and likely. Rejection could occur at any stage; forgetting the awareness during the knowledge stage, or discontinuing after the decision to adopt during the confirmation phase. In some cases where there is strong influence

(sociocultural, collective peer pressure, or authoritative) and the decision stage may precede the persuasion stage.

Implementation Stage

Implementation involves an overt behavioral change in the adopter as the innovation is put into use. Problems can and usually arise at this point as reality sets in and uncertainty about expected consequences still exist. In an organization, problems of implementation are likely to be more serious as the innovation may threaten the traditional organizational structure - people's perceived roles and power. Counterimplementation may signal that the costs of changing a system in equilibrium are perceived as greater than the likely benefits [Moore, 1987, pg. 27]. More people are involved in the innovation decision and are often different from the implementors, and operators. Implementation may continue for a long period of time, however a point is reached marking the end of this stage when the innovation loses its distinctive quality and becomes an "institutionalized" part of the adopter's daily operation.

For certain innovations and adopters, reinvention - the degree a user changes or modifies an innovation - occurs at the implementation stage. Reinvention moderates the "black or white" choices to the potential adopter - where modification or selective rejection of certain features of the innovation are also options. Implementation problems may drive reinvention in order to improve the fit with individual and organizational needs. An innovation flexible enough (like an ESS) to adapt to the adopter is less likely to be discontinued. Reinvention is more likely to occur if the innovation; is complex, has many applications, has a wide user audience, is not understood (ignorance), or allows local pride of ownership. A change agent may also influence its clients to modify an innovation. Thus, potential adopters play an active role in the adoption and diffusion process by reinventing to give the idea new meaning as applied to their context. In other words, the actual "form" of adoption may be different than intended.

Confirmation Stage.

At this stage, the adopter looks for reinforcement for past decisions(s), but he/she may reverse this decision if exposed to messages against the innovation, at any time. The individual strives to avoid an uncomfortable state of cognitive dissonance or reduce it if it occurs. If the individual gets information that he/she should not have adopted, then this dissonance may be reduced by discontinuing the innovation. Conversely, if he/she originally decided to reject the innovation and later heard pro-innovation messages, then the individual could abate dissonance by adopting. Of course, individuals avoid becoming dissonant in the first place and seek only information supporting their decision (action) - selective exposure.

Discontinuance is the decision to reject an innovation after its been adopted. Replacement and disenchantment are the two types of discontinuance. A replacement discontinuance occurs when a better idea comes along - often one with more relative advantage. A disenchantment discontinuance happens as a result of dissatisfaction with the innovation's

performance. Later adopters tend to discontinue an innovation more than earlier adopters [Rogers, 1983, pg. 188]. Discontinuance hints that the innovation was really never routinized into the adopter's way of life during implementation. The perceived attributes, relative advantage and compatibility are negatively related to discontinuance - just opposite the rate of adoption.

In the IT context, confirmation is better understood as part of the utilization process [Brancheau and Wetherbe, 1989, pg. 7]. The innovation-decision process, assuming adoption, then becomes, knowledge, persuasion, acquisition, trial use, limited use, and full utilization. Confirmation occurs throughout the stages of use. Trial and limited use reflect stages of implementation, spread and evolution of the IT. Rejection could occur prior to or during trial use. Discontinuance is a reversal of the utilization process.

Communication Channels.

Different communication sources and channels play varying roles during the stages of the innovation-decision process. The mass media has more

affect at the knowledge stage while interpersonal channels play are more effective at persuading. In cases where the innovation is radically new or esoteric, cosmopolite interpersonal channels perform the role of mass media for garnering awareness. Due to their wide network, pioneers often act as "gatekeepers" and launch diffusion by bringing new ideas into the organization [Brancheau and Wetherbe, 1988, pg. 5]. Logically, mass media is relatively more important for earlier than late adopters since very few, if any, interpersonal channels carry the innovation information at this time. Although, Brancheau and Wetherbe [1988, pg. 9] report in the context of end-user computing, mass media were not as important as expected since interpersonal channels dominated all stages of adoption decision making. Also, the earlier adopters are more adventuresome and independent, hence mass media may be enough to move them to adopt. They simply do not need strong interpersonal influence and social approval. Using a communication channel inappropriate to a particular stage in the decision process generally results in later adoption of the idea.

The Innovation-decision Period

The innovation-decision period is how long it takes to pass through the innovation-decision process. The rate of awareness-knowledge of an innovation is faster than its rate of adoption [Rogers, 1983, pg. 203]. This implies two things which vary with both individuals and the innovation itself: time to first awareness-knowledge, and time to adopt once the knowledge is gained. Innovations with certain characteristics are more adoptable, i.e., those less complex, more trialable, more advantageous, and more compatible with potential adopter experience and values. The main difference in time to adoption resides in the individual.

Earlier adopters have a shorter innovation-decision period than later adopters for both reasons above [Rogers, 1983, pg. 205]. First, early innovators have characteristics which make them learn about new ideas sooner than their peers. Secondly, the first to adopt (innovators, pioneers) need less time to move from knowledge to decision since they are more open toward new ideas and less resistant to change. In the IT context, these individuals may

also have greater need for the innovation. Also, more technically accurate sources with greater credibility are involved early in the diffusion game. The earlier adopters also seem to possess certain personality traits to better deal with ambiguity and conceptualize abstract ideas to fit the situation. Later adopters can merely observe existing applications, hence do not require these mental abilities.

Types of Innovation-decisions

Innovations may be adopted or rejected by individual members of a social system or by the entire social system either by a collective or authority decision. An individual-optional innovation decision is made by an individual independent of the decisions made by others in the social system. Interpersonal networks and system norms have strong influence on the decision. A collective innovation decision is made by a "group" consensus - sometimes called the buying group. Individual freedom of choice varies depending on the nature of the system and innovation. An authority innovation decision is made by one or select few whom

have power, status, or a particular expertise. The rest of the social system have little say and must implement the decision. Some individuals will feel forced or threatened to use an innovation against their will and experience an adaption of cognitive dissonance coined innovation dissonance. To overcome innovation dissonance, the individual could either alter his/her attitude toward the innovation or attempt to alter the required behavior by circumventing organizational dictates [Moore, 1987, pg. 221]. Examples of resistance to imposed technological innovations exist throughout history since French workers threw their wooden shoes or "sabots" into machinery to wreck, or "sabotage", it. Counterimplementation is likely to occur when a technology is perceived as threatening ,as an ESS might be perceived in some situations. A contingent innovation decision is a sequential combination of any of the three types above. Very often either a collective or individual-optional decision follows an authority type of decision in an organizational setting. An example being where a purchasing agent acts as the authority to buy a number of personal computers and it is up to each manager to decide

whether he/she wants one or not (an individual-optional decision).

Attributes of Innovations and Rate of Adoption

Innovations possess certain qualities which affect their rate of adoption throughout a social system. The receiver's perception, repeat perception, of the attributes of the innovation, that effect their adoption. Rogers [1983, pg. 211] proposes the five most important attributes of an innovation as relative advantage, compatibility, complexity, trialability, and observability.

Relative advantage is the degree an innovation is perceived to be better than another idea or current alternatives. Price reflects market value as perceived by the manufacturer and the cost is that value as viewed by the adopter. Economic advantages such as reduced costs and/or increased profits certainly rank high during innovation evaluation. Adopting an innovation may allow one to gain social status especially if the innovation is very visible. A high-tech or modern image may offer a strong incentive to adopt an ESS. Relative advantage is mainly what peers and change agents

communicate to reduce the potential adopter's uncertainty about the innovation. So, the more advantage an innovation offers relative to alternatives, the faster the rate of adoption.

Compatibility is how an innovation is perceived as consistent with sociocultural values and beliefs, past experience, and needs. The present state of affairs is the benchmark upon which new ideas are assessed, thus the rate of adoption of an innovation is situational and is affected by the idea it supersedes. An idea too similar to the existing one wouldn't be perceived as an innovation and appear to offer no advantage and would very likely not be adopted. Similarly, an innovation too "new" or incompatible would just as likely not be adopted. Previous experience in the innovation's domain leads to increased ability to recognize its potential advantages [Moore, 1987, pg. 227]. As use of the system matures, experienced users become less fearful of the consequences of using the innovation. Therefore, it appears that incremental improvements perhaps leading to a series of innovations is in order for diffusion to take place. The compatibility of an innovation must also consider the felt needs of

the adopter. As mentioned earlier, the innovation may create that need; and reinvention may make the idea more compatible. The more compatible the innovation is perceived or less uncertain usually the faster the rate of adoption.

Complexity is the degree the innovation is perceived as difficult to understand and use. Generally, the more complex an innovation, the slower the rate of adoption and the harder to implement. Again, those with experience in the innovation's domain perceive it as not being as complex.

Trialability is the degree of trial use the innovation allows which reduces its risk and uncertainty for the potential adopter. Early adopters rank trialability higher because they have no peer experience to tap. Related to trialability is reversibility, the ability to reverse one's decision, and divisibility, the ability to break down a larger innovation into smaller components which could be adopted on a piecemeal basis. All these concepts serve to reduce risk and allow the adopter to return to a pre-innovation condition. The use of a specific innovation, like an ESS, by others or use of a similar technology creates inferential beliefs

by projecting others to oneself [Moore, 1987, pg. 229]. Trialability is positively related to rate of adoption.

Observability is how easily the results of innovation use are visible to others. The presence of tangible or measurable results reduces uncertainty and presents a stronger case for innovation adoption. Some ideas are "soft" or conceptual, hence harder to see and are slower to diffuse. Frequent visibility is also a factor affecting the rate of adoption. Generally, the more observable the results of an innovation, as perceived by the members of the social system, the more rapid the rate of adoption.

The Rate of Adoption

The rate of adoption is generally measured as the number of individuals who adopt an innovation in a specified time period (where adoption is considered a binary event). Traditional innovation diffusion theory suggests that within a social system, the number of adopters per period of time roughly follows a bell-shaped curve. On a cumulative basis, the same data plots a S-shaped curve [Brancheau and Wetherbe, 1989, pg. 5]. The Brancheau and Wetherbe [1989, pp.

13-14] study supports extension of theory to include IT contexts. Infrastructure constraints and technology change affect the pattern of adopter distribution and account for secondary take-off points and protracted "dips" in the curve.

Rogers [1983, pg. 233] proposes a paradigm for the rate of adoption which includes the attributes just discussed, the type of innovation decision, the communication channel, the social system, and the amount of change-agent influence. An individual-optional decision is usually adopted quicker than one adopted by an organization. The communication channel should match idea complexity to facilitate diffusion - i.e., mass media works best with less complex ideas. Communication network interconnectedness and social system (organizational) norms strongly influence the rate of adoption. These subjective norms may overwhelm one's own attitude towards adopting the innovation. The social system creates a kind of peer pressure or "diffusion effect" as more and more members adopt. Norms change as the new idea is incorporated into the system. An innovation information and peer influence (especially opinion leader near-peers) threshold seems to occur -

at 10% to 25% of the population - commonly called the "take-off" point. Lastly, change agents promotions and incentives have indirect and differing effect on the rate of diffusion.

Organizational Influence on Adoption

Organizations change much more slowly than technology, especially IT. Innovation invariably requires reallocation of (usually scarce) organizational resources. An organization is a stable hierarchical system which works together to achieve common goals. Each individual has a prescribed role or "office" with certain duties for organizational tasks. Despite the static appearance of an organization, innovation is occurring all the time, continuously shaping its structure and individual behavior. All formal organizations have various kinds of informal norms, communication networks, and practices. These prevailing norms put emphasis on interpersonal/internal communication. Most reward systems indirectly compensate those who pay attention to these channels [Brancheau and Wetherbe, 1989, pg. 21]. Organizational

"innovativeness" is affected by size and structural characteristics.

The size of an organization has a mixed influence on innovativeness with small sized private firms just, if not more, inventive as larger ones [Rogers, 1983, pg. 359]. The problem with size is; it is easy to measure but it only approximates the real underlying variables like slack resources, structure, and total resources. Structural attributes - centralization, complexity, formalization, and openness - as well as certain individual qualities affect organizational innovativeness. Figure 4 segregates these variables into three sets of characteristics: individual (leader), internal structure, and external factors. The internal characteristics need further explanation.

Centralization reflects how much power is concentrated into the hands of a few individuals. Usually, the more centralized, the less innovative the organization tends to be. However, once the decision to adopt is made, the centralization may

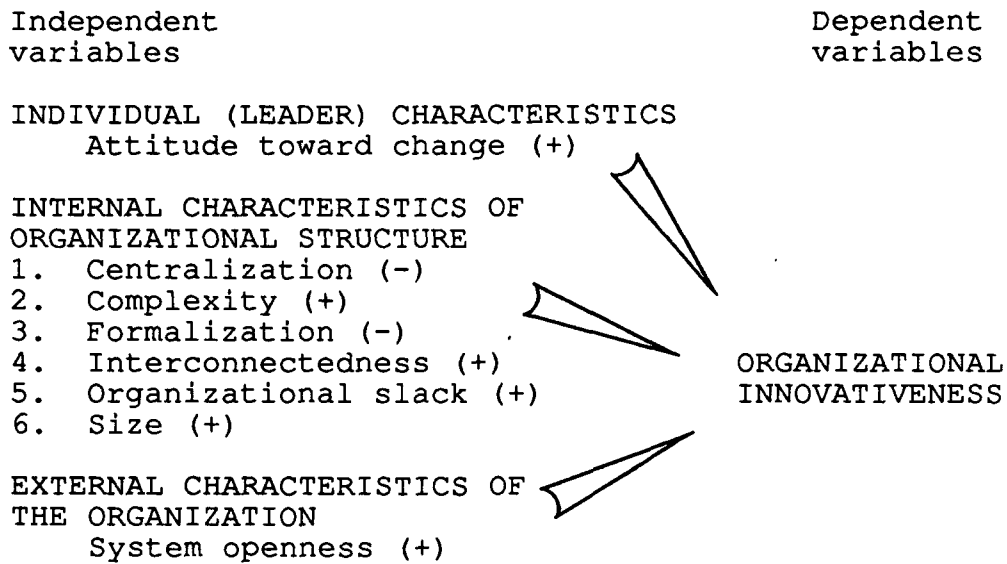


Figure 4
Variables related to organizational innovativeness

Source: Everett M. Rogers, Diffusion of Innovations, Third Edition, (New York: Macmillan Publishing Co., 1983), pg. 377.

facilitate implementation. Complexity (professionalism) measures the member's level of knowledge and expertise, usually measured by the range of occupational specialties and formal training. Formalization is the degree the organization enforces its members to follow rules and procedures in performing their roles. It tends to stifle innovative thinking, but encourages implementation. Interconnectedness is how close the members are tied in communication networks.

Information systems are often intended as coupling devices to coordinate planning and improve management control. This density of communication patterns within the organization differ from the context in which the original diffusion research was applied [Brancheau and Wetherbe, 1989, pg. 26]. The more complex and less interconnected the organization, the more social inertia is allowed to exist and the higher the frequency of innovation failure [Keen, 1981, pg. 25]. Most case studies of complex decisions suggest that firms are far more pluralistic (not very interconnected) than we think and do not create a favorable climate for innovation [Keen, 1981, pg. 27]. Organizational slack refers to how much uncommitted resources are available.

The internal variables above are only tendencies and have rather low correlation with organizational innovativeness. The opposite effects during initiation and implementation tend to cancel out the variable's influence. Low formalization, high complexity, and low centralization aid innovation initiation, but also make implementation more difficult.

Innovation Process in Organizations

Innovation behaviors often commence when organizational members recognize either a need for change (usually triggered by the emergence of performance or social gaps i.e., a problem or opportunity appears) or a new technology (one that promises to enhance organizational performance [Zmud, 1984, pg. 728]. Rogers [1983, pg. 363] proposes an organizational innovation process consisting of five stages: agenda-setting, matching, redefining, clarifying, and routinizing. The first two stages - initiation - involve the information gathering, assessing, and conceptualizing leading to the decision to adopt. The later three stages - implementation - involve all the decisions and actions needed to put the innovation into use. Usually, these five stages progress as listed, however overlap, backtracking, and skipping are entirely possible.

Agenda-setting is always going on in an organization and could be considered opportunistic technology scanning by individuals in order to solve perceived performance problems. As with the

individual innovation-decision process, this process is usually innovation-driven, not problem-initiated [Rogers, 1983, pp. 365-67]. Matching is a conceptual feasibility test in fitting the idea to the problem which includes consideration of potential problems during implementation. A mismatch here may conclude with the decision to reject the innovation.

Redefining is really reinvention of the innovation to fit the organization's need and structure better.

Organizational structure is just as likely to change and may involve creation of a new unit responsible for the innovation. Clarifying occurs when the idea is put to wider use (assimilated) in the organization as new applications evolve and greater understanding takes place. Too ambitious assimilation can lead to disaster as misunderstandings or unwanted side effects (consequences) occur. Routinizing happens when the innovation is linked to core organizational processes and put to regular use. During "routinizing", the focus shifts from the business crisis (if it was the initial driver) to a combination of monitoring business health and looking toward the future. Discontinuance of the innovation may occur at this stage. Levinson [1984, pg. 4]

reports, "those ESSs not routinized were not linked to any core business function."

Consequences of the Innovation

Consequences impact the confirmation/ routinizing stage of the innovation-decision process. Invention and diffusion are but means to an ultimate end: the consequences of adoption. Every innovation produces some social and economic reaction as it moves through the social system. Rogers [1983, pp. 380-391] classifies consequences into three dimensions: desirable v. undesirable, direct v. indirect, and anticipated v. unanticipated.

Desirable and undesirable consequences are the functional and dysfunctional effects, respectively, of an innovation to the adopter. An innovation tends to impact all members of a social system whether they have adopted or not. An idea may be functional for the system but dysfunctional for certain individuals and vice versa. An innovation may be more functional for some individuals than others and may in fact occur at the expense of others. A point returned to shortly when equality is discussed. The first adopters frequently get

economic and social gains called windfall profits - a reward for risk taking. Desirable and undesirable consequences go hand-in-hand and it is very difficult or impossible to separate the two.

Direct consequences are the changes to the adopter which occur in immediate response to use of the innovation. Indirect consequences occur as kind of a "ripple-effect" as a result of the direct consequences. Beneficial direct consequences may lead to problems down the road which are difficult to manage and plan for.

Anticipated consequences are those intended changes and results of using the innovation. Unanticipated consequences are unintended changes perceived by the members of the social system and reflect lack of understanding of how the innovation functions and of the internal and external forces operating in the social system. The undesirable, indirect, and unanticipated consequences usually go together, as do the desirable, direct, and anticipated consequences.

Diffusion tends to widen socioeconomic gaps, hence lessen equality in a social system. Early adopters have favorable attitudes toward new ideas

and the means to adopt innovations and gain windfall profits. Change agents concentrate efforts on the early adopters hoping to tap the "opinion leaders". So the rich get richer. In essence then, the adoption of innovations tends to widen the socioeconomic gap between earlier and later adopters. Finally, the system social structure has some effect on equality of an innovation's consequences. An already unequal social system will probable grow more unequal as the innovation is introduced. In the IT context, this means that those having organizational power and adopting a new IT will most likely get more information, hence power.

CHAPTER IV

RESEARCH METHODOLOGY

An empirical approach was taken to explore the critical success factors involved in the innovation-decision process with respect to executive support systems (ESS). This work falls in the realm of purposeful, systematic generation of assertions from a collection of qualitative field data. Every scientific research model makes some simplifying assumptions about complex reality. This research on executive support systems in the context of the innovation-decision model is no different. The nature of the analysis is to first and foremost select those companies which have adopted an ESS. Therefore, a pro-innovation bias exists and is admitted upfront. By definition, a pro-innovation bias implies the innovation should be diffused and adopted by all members of the social system, that it should diffuse rapidly with no rejection or reinvention - in other words, an ESS is a great idea. It also makes it a lot easier to answer my research questions in a company that uses an ESS. The time

has come for information technology (IT) to diffuse into the executive suite, therefore ESSs are an interesting IT to study.

This pro-innovation bias is overcome somewhat by looking at an emerging technology while the diffusion process is underway. This investigation is part of a more robust longitudinal study of diffusion and organizational assimilation of a variety of IT innovations. Process research is data gathering and analysis seeking to determine the time-order sequence of events. The longitudinal study is one way of doing process research. This study of the ESS decision process tends to be more qualitative in nature - a case study approach - necessary to reflect the "process" nature of the study. Process research is more important when looking at organizational behavior.

A weakness in doing surveys is the dependence on recall data gathered during semistructured interviews and on questionnaires. ESS is recent and is a salient innovation (pro-innovation bias again) in the minds of executives. The survey audience by nature tends to be above average in education and memory. Follow-on researchers studying ESS will

benefit from "stirring the memory ashes" and the resulting data will better reflect the time dimension. Hopefully, getting a few views of the ESS adoption decision in each organization will serve as a validity check on the data. Recall problems also manifest blurring of causal relationships especially questions concerning impacts - where responses are usually value-laden and based on subjective judgements.

Research Context

The organizations involved in the research were large businesses in manufacturing and services. The information technology studied was the executive support system (ESS). The user segment was primarily a member of the top tiers of the corporate or divisional structure. Studying an emerging technology means not looking at the entire innovation decision cycle. Since ESSs are new, recall problems were not a serious problem. An ESS has many of the same characteristics as other end user technologies, like database management or spreadsheet software, it is reasonable to expect some similarities with previous IT diffusion studies. An ESS supports a

variety of tasks, it is relatively easy-to-use, and unless mandated, does not require group adoption.

Since an ESS is really a cluster of technologies, each with its own range of features, no attempt was made to standardize the form of adoption across firms. Indeed, reinvention was expected to improve the technology's fit to the various work styles and functions of this select and highly autonomous group of end-users. Finally, the lack of control over specific job task may present a limitation, since relative advantage is related to the job task.

Data Collection

Data were collected through semi-structured interviews with key systems developers and users. A self-administered questionnaire was used in cases where the user did not allow an interview. The two survey instruments, the questionnaire and semi-structured interview guide are at appendices A and B, respectively. A telephone was used to canvass firms, get the initial interview, and follow-up, where needed. A cover letter and executive summary

(appendices C and D, respectively) was sent to each participating developer before any interview.

Interviews were conducted during the period of November 1989 through January 1990. The interviews normally lasted one hour or less (an important promise from the interviewees perspective). The interviews were semi-structured in that the guide was used to direct the interview; individual questions were mainly open-ended. Some folks more openly addressed the semi-projective questions regarding impacts than others. The results of data collection at the first firm were quickly used to tailor the survey instruments used during the rest of the study. Initial interviews served to identify additional individuals who had more direct, functional responsibility for ESS-related activities in the organization.

The key developer contact in each firm helped distribute the user questionnaires to a small cross-section of users. The user survey requested background information on personal characteristics, communication behavior, and perceived benefits from ESS use. Upon completion of the interviews in a firm, field notes were prepared which also served as

the start of a case write-up. Returned questionnaires and any follow-ups completed each firm with all pertinent qualitative data summarized into the case write-ups in chapter V. A summary of use and impacts, as reported in the survey, is at table 1 in chapter V.

Upon completion of all cases, the entire set was examined and analyzed to reveal common observations, and concepts; and reasonable descriptions of them. The concepts are reconciled with existing concepts from the innovation-decision model. This approach seemed like the most adequate and efficient way to obtain the type of information required and contend with the difficulties of an empirical, hence subjective, situation. Interpretation of the results is fully discussed in chapter VI.

CHAPTER V

CASES AND SURVEY RESULTS

The following cases chronicle the events occurring during ESS introduction and use at eight firms, as best understood by the author. The information was gathered from personal interviews, questionnaires, and other published materials.

Adolph Coors Brewing Co.

Coors Brewing company is a \$1.35 billion (1988 sales) firm primarily engaged in brewing beer. In 1987, the VP-Logistics requested IS to give them some kind of automated support system to give the executives responsible for manufacturing operational information. The VP-IS, Mike Hattery, thought, "it was time to better utilize PCs." The task fell to the end user computing (EUC) group to assess the project. Tom Ross, manager of EUC, was familiar with the EIS concept and started an initial evaluation of a large number of products. Mr. Ross was very informative and persuasive on the concept of ESS. Pilot Executive Systems Command Center was evaluated

for one month using live production data. Primarily for cost reasons, Mike Hattery decided the EUC group working in cooperation with business analysts would develop a system in-house. The corporate culture didn't support the effort and skepticism was everywhere. Mr. Bill Lewkow, Sr. Business Analyst on the project reports, "the benefits were too intangible to support the usual project analysis, but we did have the three VPs (IS, Logistics, and Maintenance) behind it."

The designed EIS (no nickname) uses a VAX 8600 configured with IBM XT PCs emulating terminals via a Higgins Novell network. A Builder's Easel report generator, screen painter, and graphics package - from Interactive Images Inc. - coupled with a menu-driven user interface navigated by mouse, keyboard, or touch screen, makes the system easy to use. Personal productivity tools include Symphony wordprocessing, relational database, spreadsheet applications; and calendaring, auto-filing, and rolodex utilities. The manufacturing executives worked with the VP-IS to determine requirements. Data were customized to fit the particular interests of each executive. For example, the VP-Logistics

gets shipping and order information; the VP-Maintenance gets overtime and equipment status; and the VP-IS gets mainframe performance capacity and utilization data. The daily operations report goes to all three. In June 1989, after a six month prototyping period, the manufacturing LAN, called MANLAN, reached 50 users in manufacturing, another 50 in IS, and 20 in marketing. The central EIS still serves only four top executives in manufacturing. Training takes the form of a half to full hour coaching session with someone from EUC. Both the VP-Logistics and VP-IS log-on to the EIS and MANLAN via passwords from home.

Mr. Lewkow says, "this limited manufacturing EIS is in the initial stage of adoption. Just like MANLAN has diffused, we envision going company-wide with the EIS too." Larry Durmitt, Sr.

Programmer/analyst says, "we're using the ESS as merely a report delivery system right now."

Expansion of the EIS into the next logical area, finance, is on hold for a number of reasons. First, funding has been halted until further notice.

Secondly, the business analyst's attention was diverted to recent merger and acquisition activity

with Strohs Brewery. Thirdly, Mr. Lewkow explained, "the finance system is so complex, we (EUC group) 'hit the wall' early in the game; we tried our best to sell it, but without much enthusiasm from financial management, we simply went on to other projects." Finally, response time is fairly long and the system needs some performance "tweaking" before expanding it. Most counterimplementation has been either refusal to use or endorse it. "We (IS) have always experienced a large communication gap with sales and marketing; its very hard to manage their expectations," avers Lewkow.

The MANLAN increases productivity by coordinating meetings ahead of time, keeping the executives calendars on-line, and sharing memos in a timely manner. MANLAN supports voice mail which is a well received feature of the system. People are dependent on the system more than they will admit, since they keep their schedules on it. It saves a lot of shoe leather and administrative delays are minimized. "The secretaries would type a report, proof, correct, retype, and send out, all this meant at least a two day information float", says Lewkow. The jury is still out on the better decision issue

because there simply are too many issues involved. Mr. Lewkow feels, "procrastination is still with us." The system is reported to encourage more teamwork if the managers are inclined that way to begin with. "While EIS at Coors hasn't been used strategically yet, we anticipate using it to help profile the retail and customer marketplace in the near future", says Lewkow. The biggest winners so far in change of power or influence appear to be the IS group. "We in IS have slightly more prestige and visibility, they (executives) seem to have a better understanding of the technology and we have more insight into management thought processes", claims Lewkow.

The MANLAN has allowed some attrition to take place. "Three secretaries now do the job of four", says Terry Scheck, another business analyst within IS. The secretaries do more of an administrative assistant role; for example, they now do budget variance investigations. Lower management is handled by less clerical support than before MANLAN. In 1984, Coors Brewing had some 20 PCs, now there are over 700 in use. Mr. Lewkow laments, "utilization of these machines has remained low, the systems are

misused, and there are still thousands of islands of information out there."

Mr. Lewkow uses the EIS/MANLAN system about 10 hours a week, primarily to communicate and coordinate. He stresses, "its the small things that add up, if the user is expecting a revelation, you'd better educate him/her right quick." He feels the system will really blossom as the value of information is recognized and some problems are worked out. Mr. Scheck uses the system about 2 hours per week and echoes the concerns that "the EIS has real potential and isn't being used for the important benefits that would lead to better decisions and planning." Both men see a corporate integration of the 10 or 11 different computer systems as necessary before the EIS diffuses and real potential realized from usage.

CONOCO, Inc.

CONOCO Inc. is an \$18.8 Billion (1988 revenue) firm engaged in all aspects of the oil and gas industry. In late 1983, then President of Petroleum division, C.S. "Dino" Nicandros, read a HBR article entitled "The CEO goes On-line" by Rockart

and Treacy (see reference section). Mr. Nicandros had always sensed a general malaise with the "slow management process floating on a sea of paper." The article created an awareness of "why not apply technology to give better, quicker, and more succinct information." The IS department started an initial development using the corporate mainframe. In June of 1984, Mr. Lloyd Belcher was brought in to head an EIS development team composed of seven application/systems analysts and three programmers. Since CONOCO is considered an aggressive leader in the petroleum industry, a novel system like an EIS was a "natural move".

An assessment of the newly commercial ESS products from both Pilot Executive Systems and Comshare Inc. lead to a decision to build a system in-house. Mr. Belcher relates, "the systems (commercial) were too generic . . . couldn't be tailored well enough to our environment." A consultant with savvy on such systems was initially retained to get the project off the ground. A prototype based on a corporate mainframe environment (due to work previously started) was introduced to a "handful" of executives in June of 1985. The EIS

"crashed" and didn't receive attention because according to Belcher; "the mainframe was the wrong platform, wasn't responsive enough; initially was developed without getting the real needs of the users; and data were not made available." Also, activity was low because "the boring monthly financials didn't lead to frequent updating and response time of 45 seconds is anathema to any EIS."

Mr. Nicandros, now CEO, "kept the faith" and continued backing the project, even as no cost/benefit analysis was ever done. Skepticism was evident and the VP-International Production was concerned about providing data for political reasons. Counterimplementation took the form of lack of participation. Mr. Belcher states, "its a myth that an executive has the time to pry into numbers and look to punish a subordinate . . . his/her itinerary wouldn't allow it." The EIS team wanted to exploit the PC as the platform and development proceeded this time based on suggestions by consultants - Rockart was one of them - to begin from a CSF perspective. Belcher explained, "we had to find out what the critical information needs were from each executive." CONOCO CSFs include "exploratory activity, monitoring

production (throughput per refinery), and market conditions."

In summer 1986, the EIS (no nickname) was back in the executive suite based on the EIS team developed COMPAQ PC network on a LAN. The LAN offers electronic mail and both company and external news. An easy to use, point and shoot, menu interface written in Turbo Pascal integrates all supporting applications (Eg. LOTUS macros and Paradox RDMS). Response time now averages three seconds and the user may use a mouse or keyboard. The platforms are standard; however, screens and data take on the personality of the user. Data are refreshed daily by functional analysts. Special function keys, called hot keys, are customized for each executive. For example, by pressing F3 the VP-Production can get information on crude oil processing by area (North Sea, Texas, etc.). The VP-Marketing doesn't need exploratory data so his screen repertoire differs. Mr. Belcher states, "the EIS at CONOCO is both a prototype and mature system; its a 'living' system, you cannot stop enhancing an EIS." Industry news such as American Petroleum Institute (API) and Dow Jones Stock Quotes are used to a limited extent. If

one were to ask 10 executives which application was most important, you'd get 10 different answers.

The original EIS now has over 100 users and has spawned the creation of a middle management system coined the CONOCO Information System (CIS). The CIS offers limited functionality and less sensitive information than its predecessor. Some 1000 users corporate-wide use the CIS and demand is growing, while the number of users on the original EIS is staying around 100. A definite amount of clout is associated with being on the original EIS. Lloyd Belcher claims, "the success of both systems rests on their intuitive use and performance." Training to a new user involves 30 minutes of coaching. Mr. Belcher avers, "if an EIS requires training it will fail." He goes on to sum up a successful EIS in three words, "performance, performance, performance." While no directive has been issued to use either system, folks are enticed to use it. According to Mr. Belcher, "if you can't answer a question on data the boss is seeing, what prevents the boss from 'drilling' deeper." Users must log-on via a series of passwords. The senior

executives can read/write the EIS from home with CONOCO supplied COMPAQ and IBM PS-2 PCs.

The executives at CONOCO are seasoned professionals who have been around the petroleum industry a long time. "The EIS perhaps presents information quicker and in a different way . . . the 'ureka, I found it' discovery is truly a myth", according to Belcher. The system allows the management team to share more information and quickly. For example, the oil prices graph is shared and discussed daily over the LAN. This sharing and meeting of the minds allows a synergy of understanding of the business environment. The CONOCO economics department publishes a weekly report on worldwide petroleum and political conditions, called PetroFlash, on the LAN which is purported to foster improved strategic business understanding. The lively discussions occurring during the EIS development on CSFs helped the executives focus and thrash out the real needs of the business. Data is now shared and open.

The industry has dictated an organizational flattening since the early 1980s. The EIS was a timely innovation in that it certainly facilitated a

leaner organization. The functional analysts now updates the system(s) as part of their job. While conjecture, executives now seem to have more time to contemplate and make decisions due to the quick delivery of information. Mr. Belcher states, "you give an executive more time during the day, he will do more of what he's paid to do, and that is direct the company." The real benefit is computer use has grown from only a few managers in the early 1980s to over 1000 now. The creation of a very visible EIS team and its placement in the Corporate Planning and Analysis Department sends a signal that information and its supporting technology has a valuable role in the future of the firm.

Next, Mr. Belcher would like to see the system move into the boardroom to function in a more facilitative and authoritative manner in setting corporate policy and goals. Mr. Belcher averages 30 hours a week use between both systems and particularly enjoys the personnel news and company bulletins.

Grumman Corp.

Grumman Corp. is a \$3.7 billion (1988 sales) firm engaged in the design and production of: military and commercial aircraft, space systems, and related components and subassemblies; special vehicles including aluminum truck bodies and emergency vehicles; and others including EDP services, yachts, hydrofoil boats, control cabs for off-shore petroleum exploration, and solar hot water systems. In the mid 1980s, senior management voiced concern about getting information on-line. CEO, John O'Brien, also felt a general discontent and voiced, "we are a technology company, lets bring our management process into the 80s . . . to stay competitive." Early in 1987, the marketing department requested a system to do competitive industry analysis. Barbara Mencher, IC Manager, explains, "they (marketing) didn't want to go through traditional data processing channels." Marketing was very vague and left it up to end user computing (EUC) to build it. Grumman Data Systems president, Bob Myers, issued a directive charging the information resources group (Grumman's version of an emerging

technologies group) to examine possible technical solutions and end user computing (EUC) with implementation. Myers had been looking for a system that would make Data Systems Division's Business Operations more readily accountable and financial in nature. An evaluation committee composed of a management matrix group provided oversight. The goal was to do away with much of the paper used in tracking operations.

Early in 1987, assessment of commercially available systems was started. Pilot Executive Systems Command Center and an ISCO graphics package were evaluated on paper. Since there was time pressure and the firm was already using and satisfied with a Comshare DSS package called System W, a contingent purchase agreement was made with Comshare for their Commander EIS. A six month evaluation period coupled with training by Comshare followed. No formal cost/benefit breakdown was done due to the "potential intangible benefits and the fact the CEO wanted it." Grumman has purchased 75 systems from Comshare at \$1500 each, to this add in an unestimated cost in manpower. The Comshare Commander EIS also fit better with the firm's IBM 3090 VM/VMS and plans

for a distributed network using NEC multisynchronous monitors and IBM PCs.

In December 1987, the Strategic Information Resource Planning system's (SIRP) first modules were being used. Requirements were garnered from the functional areas via systems analysts within the IR group and relayed to EUC technical specialists. The data providers felt already overworked and were initially reluctant to comply. High level corporate interest and directive along with selling by EUC dispelled concerns rather quickly. For example, Data Systems Business Operations felt they "could do it (run their own tasks) themselves." Ms. Rose Panerelli, a Technical Specialist within the EUC group felt, "it was really a ruse for fear of loss of power." By July 1988, most of SIRP functional modules were in place. Almost simultaneously, another corporate-wide EIS called Industry Information system (INFO) came into use. Ms. Panerelli explained, "the systems are constantly evolving, data are customized per executive, and modules are released all the time." The systems have user crossover but not really much information crossover. SIRP is used by 25-30 executives and

emphasizes strategic indicators, financial data, and competitive analysis. INFO's audience of roughly 50 users supports marketing by identifying customer/product opportunities and is further tailored to each of the ten business unit presidents and executives.

Comshare Inc. initially offered a two day in-house training session to the system developers. The executives take advantage of a very intuitive system and get 30 minute coaching (one-on-one) from a technical specialist. Ms. Panarelli avows, "its not technical training at all, its really what data are available." Data are refreshed nightly and at other scheduled updates by automatic downloads to the PC. The executives simply leave their machine on when he/she is done for the day. Of course, a manual call for any update can occur at any time. The systems display an icon screen which is easily manipulated by mouse. One complaint concerned the static nature of Comshare's reporting and annotation feature called Briefing Book. Ms. Panarelli complains, "you can't really slice and dice the data as wanted." Mr. J. Lewis Putt, Manager of Strategic Financial Planning, echoes the concern, "I was responsible for requirements development, but had no involvement in

selecting the rather disappointing software platform." "There is a subtle yet certain pressure to use the systems . . . expect more of a formal mandate in near future", avouched Ms. Panarelli. Grumman plans to expand applications to include off-site vendor and government information. Ms. Panarelli expects the systems to grow to a total of 150 users this year and level off.

The salient benefits include more timely and available data, better communication, and improved understanding of the business environment. Ms. Mencher comments, "I think it's really an eye-opener for the executive to get information in a timely manner." The systems take information formerly compiled once a year and sitting on a shelf and now collect it monthly in a value-added, easy to comprehend, manner. Furthermore, "the information is less redundant and grants sharing and comparing of the numbers", asserts Ms. Panarelli. SIRP is a visual means to track performance indicators and help define CSFs. Bob Myers was heard saying, "meetings are more productive; we now spend our time discussing instead of rehashing information." The system really has reduced telephone tag. Both systems allow the

executives to view monthly financial information before meetings so they won't be hearing about them for the first time. Standardized reporting formats now lets the CEO conduct monthly reviews in a line by line manner on-line. Briefing Book allows looking at operational performance reports in a context meaningful to a particular executive. The VP-Long Range Planning explains, "adding value to the data is important and that perception depends on the executive." Ms. Mencher states, "the managers can no longer wait until the night before to put their budget together . . . they really have to put their houses in order." Ms. Panarelli says, "INFO is the 'lifeblood' of the marketing directors." No revenue enhancing benefits were recorded; however, while hard to quantify, the goal is to reduce expenses.

Ms. Panarelli believes the systems facilitate "doing more with less" and have allowed attrition in the management ranks to occur. The information providers and some secretaries seem to have more enriched jobs. Ms. Panarelli reports, "EUC enjoys increased visibility and influence, and enhanced credibility . . . we're now taken more seriously." Although, a technical firm, Grumman now has many more

executive PC users than early 1980s. Mr. Putt identifies another benefit, "EIS have promoted better data integrity across a multi-divisional organization."

The EUC group would like to see a more open architecture replace the "static" Briefing Book. In other words, the group would like more integration of Grumman's internal systems to present information in more flexible ways. Ms. Panarelli, herself not a user, sees faster data reporting and electronic mail as the key features of the systems. She also states, "a sophisticated text and data analysis tool would have real potential for an EIS." Mr. Putt envisions, "more benefits as the system matures if we can figure out a cost-effective way of using it."

Guaranty National Corp.

Guaranty National Corporation is a \$144 million (1988 sales) holding company engaged in writing non-standard automobile (private passenger and commercial) insurance risks and general liability insurance, including malpractice and general property insurance. In August 1988, Mr. Steven Wille was hired as the newly created VP-Corporate IS. The Sr.

VP-Personal Lines and EIS co-developer, Jim Shallert, expressed a general discontent "with the slow and static way they got the performance picture." Mr. Shallert, who uses the system 15 hours per week, reports learning about ESS via trade literature and vendors and has been "sold" on the concept since. One of the conditions of Mr. Wille's employment was that he develop an automated system that would give a "browsing" ability to the data which was felt "had to lead to better business decisions." Mr. Wille reports a general frustration with IS support to executives throughout his professional career.

I've always been frustrated with traditional IS support to the executives. I took it upon myself to learn this emerging concept of ESS by reading, consulting vendors, and picking the brains of others in the IS profession. I was working for another firm (not identified) where the powers to be were not open to the concept of ESS. I was really stifled, so when the job opportunity at GNI presented itself, I jumped at it.

Concerned with cost, but with no cost/benefit analysis, Mr. Wille, a self-proclaimed expert programmer, decided to build a system centered on the TeraData relational database machine. TeraData provided training and a six month trial period. Still within August, an initial prototype was given

to a "core" of executives. A PC LAN supports a 3Com E-mail network along with an Enable integrated office automation package. The Enable system offers personal productivity aids like wordprocessing, spreadsheet, and modeling applications. All software was tried before actual purchase and of course had to be tailored to the needs of GNI. Mr. Wille "encouraged adversity" during requirements collection and prototyping. The goal was to standardize the financial reporting, so very little tailoring per user was done. Data elements were prioritized in top-down fashion which resulted in a three tier classification of applications on the network. A series of user passwords and read/write privileges are enforced.

Although a piecemeal EIS (no nickname), learning and use is very easy. The workstation interface is entirely menu driven. Data is automatically refreshed by the TeraData system with the Honeywell corporate mainframe. Training was actually an afterthought, Mr. Wille says, "coaching, a booklet, an on-line tutorial, coffee-break classes, and a user group cover the whole training issue." Dan Haug, VP-Planning and Administration and a self-

proclaimed computer novice, says, "I used the on-line tutorial and now use the system about 10 hours per week for the whole gamut of applications." No controversy during implementation arose with total acceptance; although Mr. Wille admits, "a few don't use it (the EIS) to its full potential." Today a total of 83 users are on the network, but Mr. Wille said, "we just received more workstations and will have 130 users in the next few months." The highest level tier, only used by the six top executives, is used for strategy and planning decision support. Most folks use TeraData for direct access to corporate data and Enable for wordprocessing, budgeting, and graphics. "We have no secretaries, clerks, or word processing people, all of us (executives) do our own typing and meeting preparations, including preparing overhead graphs, a real plus", relates Wille. No one is forced to use the EIS, in fact Mr. Wille reports, "the subordinates push their bosses to see their work on the system."

GNI now see trends they didn't see before and a lot faster. "We spotted an unprofitable pocket within the personal auto sector, and responded quickly with a change in rates", avowed Wille. Mr.

Shallert echoes the need for the system by saying, "the executives here started buying PC based personal productivity tools out of our own pocket before Wille and the EIS came along." Improved decisions and a better understanding of the marketplace are reported because the EIS allows one to view data from different angles. "TeraData lets you test assumptions before settling on a course of action", reports Wille. The executives feel they are more effective and their jobs are more fun.

The EIS plays a key role in the strategic direction of GNI because of the way information is delivered. "The efficiency of decisions due to the rapid, concise, and graphic way the data is presented allows more time for contemplation by the executives", states Wille. In a sense, GNI now runs a looser ship, allowing more individual creativity, because the EIS lets management do things they couldn't do before. Mr. Wille tells, "we do our 5-year plan on a color three dimensional spreadsheet which is easy to conceptualize, and the graphics make a terrific presentation."

Mr. Wille reports he uses the systems "all the time." He would like to see an evolution toward

divergence, allowing more ways of doing things and individual creativity. "The real benefits for us is it drives down clerical costs, and improves executive decision making. The EIS is efficient because people think about something once, type it, print it and/or send it for immediate action", stresses Wille.

LASC - Georgia

Lockheed Aeronautical Systems Company (LASC) - Georgia is a company of the \$10.6 billion (1988 sales) Lockheed Corp. Lockheed Corp. researches, develops, and produces: strategic fleet ballistic missiles, space satellite systems and payloads, tactical defense and communication systems; high performance and airlift aircraft; advanced marine systems and ships; and information services including software. In late 1975, Bob Ormsby was the President of LASC - Georgia. Mr. Ormsby, an engineer and "techie" himself, was "playing around" with one of the first color graphics terminals in the electrical engineering R&D lab. The graphics terminal, developed by another LASC scientist - whom shortly went on to start Intelligent Systems Corp. (ISC) - was used to monitor and control various laboratory

chemical processes. Mr. Ormsby stated, "why can't we adapt this (system) to give executive information . . . there is no reason we can't automate the sea of paper that constantly inundates the executive suite." Ormsby kept the idea of some kind of "EIS" alive initiating meetings and dialog with traditional IS, engineering, and other executives. Interestingly, actual development of the "EIS" was not started until early 1978 because of the rapid proliferation in information technology. As the EIS developer, Mr. George Houdeshel reflected, "we didn't want to settle on a system while cheaper and faster hardware was coming out almost daily."

In March of 1978, Mr. Ormsby asked an engineering manager, Mr. Houdeshel, to head a matrix group to develop an EIS in-house. The eight person group composed of five information analysts with differing functional expertise and two programmers were charged by Ormsby to "develop a system to give me the information to run the company." The MIDS team also had the IS Department's cooperation by executive mandate, as Ormsby made IS report via a dotted-line on the organizational chart to Houdeshel. In six months, the president was on-line with a

working prototype; a prototype which became the heart of the Management Information and Decision System (MIDS).

Based upon the electronics R&D lab demonstrations, ISC was approached to provide the platform for MIDS. At this time ISC sold the graphics terminal only for processing applications and were talked into management applications by Ormsby and the MIDS team. No formal cost/benefit analysis was even attempted since "Ormsby asked for it and the benefits were very intangible." LASC's advanced technologies group (ATG) acted as a gatekeeper of integrating technologies, and Ormsby's unswerving dedication to getting the system, "greased" acquisition. Initially, data were extracted from the host DEC VAX 1134 and refreshed at the terminals by a floppy swapping "sneaker brigade". Later, a VAX 1170/80 host provided data directly to the VAX emulated terminals. The information analysts updated the data manually and transmitted to the executives daily. The only hardware modification was that the graphic terminals on/off switch had to move to the front of the machine to fit in the executives credenzas. Today, the environment involves an IBM

3090 with IBM PS-2 model 50s serving as workstations. Data is refreshed automatically by communication links in 5 - 10 % of the applications. System security involves a "double" matrix of password and terminal identification. There are no home users yet.

The MIDS team took a proactive role during development by offering numerous "suggestions" as they gathered requirements from various levels of management. The prototype was shown to each executive with the "good" features spreading as they were identified. By March of 1979, the system was used by some 30 executives. All software and screens were developed by the MIDS team. In 1980, another 10 users came on-line. Steady growth continued throughout the 1980s as the number of "core" system users seems to have leveled off at today's 110. The system now has around 800 screens with 70 - 100 of them updated daily and 350 replaced annually. Mr. Houdeshel credits the success of the system to the development mindset to "marry the technology to the needs of the business". A middle management MIDS subsystem giving summary information and intra-divisional vertical data is in the making.

MIDS is very easy to use with a menu-driven user interface designed to accommodate the executive's work style in mind. A maximum of four keystrokes to navigate the screens is adhered to because "executive work is a sporadic and flexible process". The user can peruse subject matter by menu, get a chronological listing of news and industry events, or get specific information by key word index by typing the first three letters. A very intuitive system, 15 - 20 minutes of one-on-one coaching with each executive by a MIDS staff member is all that's needed to get him/her up and running with basic MIDS features. The MIDS team is on call if an executive wants to learn more. "The executives quickly saw the 'value-added' and the initial reluctance disappeared . . . using the system became a status symbol", according to Houdeshel. While no official mandate of use was made, indirectly an executive was forced to use it to see what his/her boss was seeing. For example, the COO phones the VP-Manufacturing and asks what the numbers on screen P38 mean, he/she better have an answer. Houdeshel relates the story of the VP-Operations who said "stick it in the corner" five years ago, moves on to

corporate, and comes back as president and now is one of the system's best advocates and users. "He saw value in quickly catching up on operations via MIDS instead of calling on the current VP-Operations . . . he felt more in control, this way", says Houdeshel.

Data are tailored top-down to each executive user's interest and level. For example, the COO and CFO get screens displaying sales by line of business while a business unit VP gets the information on his/her contribution to the whole. The COO gets indexes on weighted quality, while the VP-Manufacturing gets quality by shop and specific engineering data. Program managers get specifics on their own program's costs and schedules. Mr. Houdeshel reports, "the most important value of this system is to give quick and accurate 'what-is' information in a format that gives each executive a single point of focus instead of pouring over a mountain of paper." Another widely used and effective feature, Electronic mail (EM), is offered via a user transparent VAX/IBM crosstalk interface to the IBM PROFS system. On-line industry and DOD news is used by a small group of executives.

Each executive perceives their own value-added by using MIDS. The VP-Finance has stated, "I save 20% office time." The current President, Ken Cannestra, claims, "I call fewer meetings and those meetings I do attend are shorter and focused." While no one would admit dependence on it, the president does keep his daily schedule and sequence of events on it. Mr. Houdeshel feels it allows better quality decisions by correlating relevant information. For example, "the COO can merge turnover rates from the human relations screen with rejection rates from the quality screen to examine relationships." The system saves time by reducing "paper tigers". A paper tiger creates all sorts of excitement and action for no reason. Again, Mr. Houdeshel described a recent paper tiger:

A payment of \$28 million was expected from Saudi Arabia. The courier sent to pick it up was snowed in at LaGuardia and allowed the accounting period to lapse. Finance showed a large cash flow problem due to the missed interest. MIDS automatically transferred the funds to the Lockheed account. The exception and annotation ability of MIDS alerted the executives to what was happening and prevented a ripple effect of overreactions.

It's the unexpected and non-CSF benefits that sometimes really payoff. During a layover, a South

Carolina Senator stopped by and asked "why isn't Lockheed doing more business with SC." The COO called up the MIDS screen tracking business by geographic region and clearly showed the senator just how much LASC did do with SC. While not considered a CSF, MIDS tracks environmental hazards, OSHA and EPA regulations and rulings, and LASC's plans and actions on related issues. Mr. Houdeshel states, "falling down in this area can become a CSF real quick."

While conjectural, it appears MIDS has helped give the LASC executives better insight into what their marketplace is like and what information they really need to assess performance. The VP-Marketing can now see worldwide conditions on-line and overlay this information into the planning process. The Lockheed DOD representative in Washington feeds information on defense acquisitions and budgets to the executives. No documentation attests to increased revenue by MIDS although again the marketing department feels they could better match customer prospects with product offerings. Decreased paper costs is the only hint on decreased expenses due to MIDS. No net change in power or political influence was reported.

The MIDS system is credited with facilitating organizational change. The "tailored" information, via standardized reports and plans, allows management with less staff, especially the upper middle echelon (director and division level). MIDS cuts out duplication of data especially in differing contexts. The position of information analyst was created to support MIDS. Mr. Houdeshel goes on to say, "MIDS has even influenced the curriculum at Georgia State University Business School to tailor coursework in MIS toward the needs of an information analyst." The speed of "what-is" analysis lets problems be known a lot earlier than before. Executives are now "tuned-in" to the value of information with PCs omnipresent in the executive suite. Finally, MIDS has given IS visibility and changed its image from reactive to proactive. The Division IS manager is now the VP-Modernization, and is driving a revamp of corporate-wide IS integration.

As ESS technology matures, Mr. Houdeshel states, "I'd like to see the computer go into the background with video and audio technology coming to the foreground. Natural language processing and expert system technology should evolve to allow audio

annotations and parameter setting to track CSFs."

Mr. Houdeshel himself uses MIDS about 20 hours a week to monitor usage and read company news. The success of MIDS is echoed in that all four presidents since 1979 have used and highly endorsed it.

MAPCO Inc.

MAPCO Inc. is a \$1.8 billion (1988 sales) business engaged via separate subsidiaries and affiliates in the production, trading, and marketing of natural gas liquids, fertilizers, coal, and refined petroleum products; and the transportation by pipeline of natural gas liquids and anhydrous ammonia. In 1988, the CEO from Phillips Petroleum spoke to the MAPCO CEO about his EIS - a Comshare Commander EIS shell. At the same time, accounting had tried to build their own system in-house to provide summary financial information to the CFO, Skip Dickerson, and COO, Bob Howe. The system ran afoul by providing wrong and too much data. Bob Howe asked, "can't we develop a companywide system, one not so specific." Phil Baxter, the VP-IS, was told to start investigating a system for MAPCO. John Framell, Director IS, was fairly familiar with the

various commercially available EIS shells and so was charged with assessing them. Mr. Framell credits trade literature and vendor information, stemming back to the early 1980s, for his knowledge on ESS. He adds, "most persuasive was self education and interest in ESS." The IS department at MAPCO was considered quite proactive already and jumped at the chance to develop such a system. Phil Baxter is very influential within the firm and had both the CFO's and COO's commitment on the project. Pilot Executive Systems Command Center, Execucom Executive Edge, and Comshare Commander EIS were examined. Of the three, Comshare had coordinated demonstrations at three nearby firms, Phillips Petroleum, Frito-Lay, and Burlington-Northern Railway. "The Commander EIS distributed architecture and better graphics were strong selling points", said Mr. David Gilbert, Manager of EIS. With no cost/benefit analysis and the system not budgeted for, money was quickly found and an order placed with Comshare in March 1989. The CFO and COO both knew the value of information for improving business decisions and competitive posture.

In April 1989, a CPA from internal auditing, David Gilbert, was reassigned to manage the EIS team. All total, five new positions were created, Mr. Gilbert's and four special systems analysts, to implement the acquired system. Since MAPCO was segmented into five business units, the team would roll out the EIS (no nickname) segment-by-segment, corresponding to each business unit. A cross-functional group of project advisors for each segment was used to assist the executives in identifying requirements. The project team (EIS and advisors) would go out and interview all VPs in each segment. By June 1989, the \$500 million Gas Products Division (segment 1) had a quite functional prototype with some 40 users. Gas Products President, Charles McConnell, championed the system and now uses it three hours a week mainly for fast reporting and decision support. Controller, Randall Doyle, uses the system two hours a week and reports, "I was familiar with the EIS concept from a MBA course which included SAS applications . . . I appreciate the value of information." Merrill Dierker, VP-Marketing claims, "a vendor of EIS was quite persuasive back in

1986, but the EIS group taught me how to use our system."

In September, the \$1 billion Petroleum Division (segment 2) had some 45 users. Petroleum Division Controller, R.V. Threadgill, Jr., reports, "I learned about ESS from a vendor and a company meeting, none of which were very persuasive." Transportation (segment 3) and Coal (segment 4) are scheduled for release in February and June 1990, respectively. The corporate group, called segment 5, already has limited functionality. Mr. Gilbert stresses, "each segment is by no means finished, we expect each to evolve in applications and grow somewhat in number of users." As applications go, MAPCO is purchasing 45 more System W modeling modules. Passwords, data access limitations, and lock-codes provide adequate security. Only the VP-IS and the CFO have home access via portable IBM PS-2 model 70s.

Generally, the system shell only required customizing the data per segment. Data refreshment is automatic by clock (about 4 AM) and takes about 15 minutes. The user only has to leave his/her PC on when they leave work for the day. Comshare provided

training in-house for developers and some interested users. Most of the executives get a short coaching session from the EIS team. Mr. Gilbert says, "the system is extremely easy to use and performs much better than expected." The interface is menu driven by mouse with displays in color graphics. "The strongest features of the EIS are the operating statistics, 'what-is' data, ad hoc data retrieval and manipulation report generator feature called Execu-view, and the customized status reporting and annotation feature called Briefing Book", reports Gilbert. Newswire, the Commander EIS interface to Dow Jones Stock Quotes is used by only 2-3 executives. Some folks feel the system was pushed on them and indirectly forced to use it when a superior also uses it. In a slight twist of events, Mr. Gilbert tells, "the COO calls the president or CEO up and says lets discuss the data on screen XYZ." At first, some data ownership and filtering took place but was a short lived fear due to much communication and assurance from the executive sponsors. Mr. Doyle states, "pride of ownership (information) can disrupt the harmony and effectiveness of EIS."

The EIS gives more timely and concise information which is important because now the executive can see trends on a monthly performance screen and correct problems sooner. Mr. Gilbert says, "it saves a lot of calls to accounting and IS for reports since Execu-view can slice and dice the data the way the executive wants to see it." In fact, segment 5 will do away with paper divisional profit and loss statements. The Petroleum Division upon examining the per store profit contribution screen decided to divest in some service stations and invest in the more profitable truck stores.

Communications and coordination has improved by allowing executives to look at the same numbers in standardized - menu driven reports over the LAN. Mr. Framell asserts, "communication at all levels has improved . . . data integrity was definitely established." Each business unit still has autonomy in controlling the amount of detail in their report. During analysis and design, more teamwork was engendered due to the cross-functional matrix group interaction. Also, the COO called meetings for each segment's VPs to focus their CSFs. External industry news, like Infoweb, as well as "what is" performance

data allows the executive to compare charts and better characterize the competitive environment. Mr. Gilbert saw no real power struggle but did say, "the Controller's (Division not identified) lack of participation has resulted in the Planning and Budget Group's emerging influence."

The EIS is leading a transformation in innovative thinking at MAPCO. The real benefit has been the re-examination and focus on CSFs and documented tracking on each. One near term strategic use of the EIS is to monitor weather forecasts. Mr. Gilbert gives the following explanation:

The weather drives the demand and supply, hence price, of propane. During the recent cold spell (December 1989), the price of propane went from \$0.35/gallon to \$1.25/gallon in two weeks. We didn't prepare, ran out of propane, and lost a lot of revenue.

The EIS, while not designed with the express purpose of shaving jobs, is credited with expanding the "sphere of influence" of one position and allowing one person to do the job of two. "A gas production field manager's job was combined into that of the division manager, resulting in recalling the field manager to the Tulsa office when the Division manager retired", recalls Gilbert. A real benefit is

the level of interest and use of computers now by the executives. One of the COO's new years resolution was to learn Harvard graphics on his PC. IS is now seen as more proactive and contributing to the corporate mission. Interestingly, in fall of 1988, the highest level in IS was changed from director to a vice president.

Mr. Gilbert uses the EIS about 16 hours a week mainly to monitor the system, and manage his staff. He feels the major benefits are its ability to focus and filter information to the executives and reduce the volumes of paper data, and concentrate on the true CSFs. He would like to see the system do more dynamic ad hoc modeling and really become a competitive weapon. He reports executives average about eight hours of use per week. Mr. Threadgill sums up the value as using the systems as, "it gives more awareness of real world complexity, gives more strategic focus, and results in less repeat questions and thus more opportunity to begin at the last jumping off place." Mr. Doyle sees future value in AI to do more of the initial filtering, doing the statistical analysis, and reporting correlation of data.

Oscar Mayer Foods Corp.

Oscar Mayer Foods Corp. is a \$2.0 billion (1988 sales) firm involved via numerous subsidiaries in the production and marketing of a variety of food products, including red meats, turkey, Claussen Pickles, and Louis Rich luncheon meats. In 1987, the CFO, Bob Lowe, spoke with a management consultant on "how to bring in some automated tools to give competitive advantage to a firm operating in a stodgy industry." At the time, Oscar Mayer had a relatively new and young, tight-knit management team, who were enthusiastic and receptive to information technology. In August 1987, the Client Support Group (CSG) of the IS Department was tagged to assess the ESS technology. Mr. Gary Barber, Sr. Manager of the CSG, was already familiar with the concept of ESS through vendor relations, professional meetings, trade literature, and consultants since June 1985. Mr. Barber recalls, "one autumn day in 87, Bob Lowe returned from a Comshare user conference in Chicago and it was mandated we go with Comshare Commander EIS, and fast." The other major commercial

contender, Pilot Executive Systems never gained any rapport with the Oscar Mayer buying group.

By the end of 1987, \$60,000 was spent on Comshare software shells and additional hardware, plus an undisclosed amount on manpower. While each executive and analyst(s) specified requirements, a classic prototyping development delivered a functional workstation for Ron Kelly, Sr. VP-Operations based on production data. A month later, in March 1988, 13 users were on the network with access to information on volume and profitability, weekly PL statements, daily commodities, and daily operations (production). The economics and marketing departments have special keys representing the daily commodities reports. The EIS system, called EISy, also transparently crosses over to the IBM PROFS system, an electronic mail and collaboration system. Mr. Barber explains, "our system is in the limited use stage of adoption, what I mean is it's routinely used for what's on it so far, we foresee much growth and evolution coming, and consider ourselves as still acquiring." Oscar Mayer plans to expand the system to include the senior financial and marketing managers (director level). The next application

involves tying the "what is" information to our long-term profitability planning", tells Barber. So far, Oscar mayer has spent \$120,000 on EISy's hardware and software, and four man-years in development.

EISy is a typical Comshare-based system. Data are refreshed automatically from the corporate IBM 3090 to a distributed PC (IBM PS-2 model 70) network via a LAN. While the Comshare report generator, Execu-view, isn't used much; the other features are, especially Briefing Book. An application (screen) is easy to build using any data in the corporate mainframe. The executive simply points at an icon representing the wanted information with a mouse or keyboard. "EISy is so intuitive, a one-on-one three to fifteen minute coaching session is generally more than adequate for training", says Barber. Ironically, the only short-lived counterimplementation came from the finance area. "Data were withheld by the financial folks who felt they would lose personal contact with the executives by electronic delivery . . . power has shifted from finance to IS", accounts Barber.

EISy has certainly displaced some paper reporting at Oscar Mayer. "Operations information

lagged by a few days and was in tabular form . . . now with EISy, the VP-Operations gets yesterdays production by product line in a standardized graphic format", vaunts Barber. Reporting is tailored to the higher level needs versus merely summarizing it for middle management. The executive now sees the numbers faster along with "hidden" trends, and aids quicker corrective action. While already a small close cadre, the executive team does use PROFS EM to browse and annotate notes. Mr. Barber extols, "our executives now better understand the competitive environment and make higher quality decisions, thus improving executive productivity." Mr. Barber went on to say, "we now have a better handle on variations in the commodity market."

The fate of middle management "data handlers" at Oscar Mayer seems in jeopardy, although some of the data handlers have become information analysts. EISy has created more computer use, since the executives now have a PC in their offices. The Sr. VP-Strategy and Planning, who learned and does his own Harvard graphics for presentations says, "life is easier on me, since executives live in meetings."

The CSG has more visibility, but no real enhanced image has come to IS because of EISy.

Mr. Barber only uses EISy when checking its performance. He sees faster and accessible performance "what-is" data, and trends as being the most important applications right now. He would like EISy to provide ad hoc query and analysis so it can be used for what it was bought for, competitive advantage. Finally, Mr. Barber foresees EISy facilitating a flatter organization at Oscar Mayer.

Wausau Insurance Co.

Wausau Insurance Co. is a \$1 billion (1988 premium billings) firm engaged in writing business, property, casualty and life insurance. In early 1988, the CEO, Leon Weinberger, announced, "we must rely on automation to help us solve our business problems." The Integrated Office Systems (IOS) Group was tagged with assessing available technology and get the project off the ground fast. Jim Patz, Manager of the IOS group, reported reading about ESS in the trade literature. The IBM sales representative who spoke with Mr. Patz about compatible ESS shells and was quite "high" on the

Comshare Commander EIS offering. Initially, the CEO wanted to improve "process turn-around time" on financial reporting (P/L, expenses, by-location, and line-of-business). The CFO became the self-designated chair of the EIS project steering committee. The steering committee was composed of the chair, Mr. Patz as manager, four financial managers, and two data processing analyst types.

By the end of 1988, all but the Comshare and Pilot Executive systems remained, out of some 14 vendors under initial consideration. Comshare came out and did a very professional and convincing presentation, along with a demonstration and 60 day trial period. Pilot refused to even come out for the presentation. A private management consulting firm was also retained and according to Mr. Patz was quite influential in recommending the ESS as a solution. The data processing department placed an order with Comshare in January of 1989. No cost/benefit assessment was undertaken based on the "subjective" nature of the benefit side and the CEO's prominence in the project. Mr. Patz estimated initial cost, which was an important consideration, at \$250,000 for the software and labor. The system platform is that

of a typical Comshare Commander EIS environment; a corporate IBM 3090 mainframe, an IBM PC LAN, and 386-based IBM PCs. The system includes almost full Comshare functionality: System W, a modeling DSS; Execu-view, the ad hoc data query and analysis report generator; and Briefing Book, an interactive EM interface for status reporting and annotations. Electronic mail and an array of personal productivity applications and utilities also reside on the network (Eg. Calendaring, phone book, and WordPerfect). A series of passwords give a measure of security. Only the CEO and the Exec. VP-Operations access the system from home.

The project group gathered critical information needs from the executive community. The list of data elements was then prioritized in top-down fashion, more detail was added as the system evolved. The original idea behind the Wausau EIS was to standardize and summarize the financial data, so the data were not customized per executive. Data are refreshed automatically overnight or upon a manual call during the day. A short 60 day prototyping period delivered a basic "what-is" income statement and balance sheet in early 1989. By March of 1989,

corporate-wide use began with 15 executives and seven data providers. Mr. Patz says, "Wausau is clearly in the limited use stage of adoption, the project team is now expanding the configuration to include the personnel executives and the screens and data to support them."

The EIS was generally well received with only a few folks reluctant to use it. One Sr. VP-Commercial Insurance complained, "I really don't have time to learn it." The CEO made the statement, "I will introduce the executive staff to technology one way or another." Shortly thereafter, in coordination with the CFO, all paper financial reports were taken away. The message was strong, "if you'd like to participate in knowing our performance you'll have to use the terminal." The executive only has to point (mouse or keyboard) at an icon, the system prompts him/her to "drill down" through each screen of increasing detail. Comshare and the IOS group did an initial two hour group training session. New users and those wanting special instructions get one-on-one coaching by an IOS member. Mr. Patz sees the system expanding to include some 30 director and VP level

users across the organization sometime within the year.

The EIS gives rapid access to "what-is" financial information and displays it graphically. Mr. Patz envisions most of the written reports eventually going away and will accomplish the original goal of redirecting the firm toward automating the management process. The revision cycle on reports is less than half the time it was last year. Mr. Patz explained:

It took over two days for a report to reach the executives. An analyst would work on a report, the criteria and assumptions would change which resulted in re-doing the report. More shoe leather was wasted on coordination, re-typing, and re-coordination. Now with the direct communication via the LAN, its annotation capability, and integrated Lotus spreadsheets, the communication is direct with the information transmitted the same day.

Some meetings and most of the telephone tag are eliminated. Mr. Patz claims, "teamwork has been enhanced because the system expands the teams." Mr. Patz avows, "if the EIS allows the executives to make even a few better decisions, Wausau will yield big dividends."

Output from the EIS is used in strategic planning. The financial analysts jobs have changed

in they are now responsible for organizing the data behind the newly standardized reports. Much of the routine tasks of running down data and number crunching are done automatically. Mr. Patz feels, "the system has opened some opportunities for recognition and potential advancement." The secretaries now are the keepers of the executives calendars, and work on word processing and electronic mail. The CEO's mandate to start taking advantage of technology is evidenced by PCs in his staff's offices. The finance area has worked much closer with the data processing department. Senior management is beginning to realize the value of information and its attendant technology.

In summary, Mr. Patz feels, "the critical issues when introducing an EIS are to stress the benefits of quick access to information, real information, and educate the executive on just how valuable that information is." While Mr. Patz does not use the system himself, he sees real value in more timely information allowing better decisions for both near term control and strategic planning.

TABLE 1

SUMMARY OF QUESTIONNAIRE RESULTS

LEGEND

A Coors	D GNI	G Oscar Mayer
B CONOCO	E LASC	H Wausau
C Grumman	F MAPCO	

	A	B	C	D	E	F	G	H
<u>Application Area</u>								
Office Support								
E Mail	x	x	x	x	x	x	x	x
Word Proc.	x	x	x	x		x		x
Auto-file	x							
Spreadsheet	x	x		x		x		x
Calendar	x	x	x			IP		x
Rolodex	x	x				IP		x
Planning and Control								
Faster Reports	x	x	x	x	x	x	x	x
Ad hoc Q&A		x	x	x	x	x		x
Prgm mgmt.				x	x	x		
DSS			x	x	x	x		
Enhanced Mental Model								
External News		x	IP			x	x	
Industry Info		x	x		x	x		
Stocks		x			x	x		
Company News	x	x			x	x		
"What is" data			x	x	x	x	x	x
Modeling			x	x		x		x
Trends				x	x	x	x	x
Off-hours Acc.	x	x		x	x	x		x

- Notes: (1) x means used as reported by at least one respondent.
 (2) Boldface denotes most important reported by at least one respondent.
 (3) IP = in progress

TABLE 1 Continued

	A	B	C	D	E	F	G	H	$\bar{X}$
<u>Personal Impacts</u>									
More timely data	3.3	4.0	4.5	5.0	5.0	4.0	4.0	5.0	4.35
Can do new tasks	2.5	5.0	3.5	4.7	4.0	4.8	4.0	3.0	3.94
Better Decisions	3.0	4.0	3.5	4.5	5.0	3.8	3.0	5.0	3.98
More Comm/Coord.	4.7	4.0	4.0	3.7	5.0	4.2	4.0	4.0	4.20
More teamwork	3.7	3.0	3.5	2.2	5.0	3.6	3.0	3.0	3.38
More Job Sat.	3.0	3.0	3.5	4.2	3.0	4.4	3.0	1.0	3.14
Bus. Environs	2.2	5.0	3.5	3.7	5.0	4.8	4.0	1.0	3.65
Career potent.	2.7	5.0	2.5	4.7	5.0	4.0	1.0	1.0	3.24
More power	2.2	1.0	2.5	3.2	5.0	3.4	3.0	3.0	2.91
More visibility	2.7	3.0	3.0	3.5	5.0	3.7	3.0	3.0	3.36
Average:	3.00	3.70	3.40	3.94	4.70	4.07	3.20	2.90	3.62

	A	B	C	D	E	F	G	H	$\bar{X}$
<u>Organizational Impacts</u>									
Strat. Advantage	2.3	3.0	4.5	4.7	4.0	4.0	2.0	4.0	3.56
Leaner structure	3.0	3.0	4.0	3.5	4.0	3.7	4.0	3.0	3.53
Workroles Chged.	4.0	4.0	4.0	4.0	3.0	4.2	2.0	3.0	3.53
IT usage up	4.5	5.0	4.0	4.5	5.0	4.2	2.0	4.0	4.15
Cut Costs	2.5	3.0	2.0	3.2	3.0	2.7	2.0	2.0	2.55
Role of IS up	3.0	1.0	3.0	2.5	4.0	4.0	2.0	3.0	2.81
Average:	3.22	3.17	3.83	3.98	3.83	3.80	2.33	3.17	3.36

Rating Scale: Strongly Disagree 1 2 Not Sure 3 4 Strongly Agree 5

	A	B	C	D	E	F	G	H	$\bar{X}$
<u>Dependence</u>									
avg. rating	3.3	7.0	3.5	5.8	7.0	3.5	1.0	6.0	4.64

Rating scale: Job not affected 1 2 3 4 5 6 7 Impossible without

CHAPTER VI

INTERPRETATION

This chapter presents and discusses the concepts or "common threads" of thoughts and actions - a fortiori, the eight case studies and survey results listed in chapter V - which were felt to lead to the successful introduction and use (adoption) of an executive support system (ESS). A chronological record of "events" are examined in the context of the innovation-decision framework set forth in chapter III. Due to the varied and everchanging nature of the technology involved, and context sensitive utilization, a descriptive analysis follows.

Awareness-knowledge

First and foremost, it looks like there is a bit of confusion on just what technologies an ESS includes. The developers identified aspects of all three spheres of ESS applications; office support, planning and control, and to a slightly lesser extent, improved mental models. The users, on the other hand, claimed a wide range of technologies and

applications. Some identified office support, including electronic mail as a different system altogether. Even within the same firm, differing definitions were identified.

Universally, the underlying need was termed as a general discontent with management activity coupled with at least a vague awareness of computer technology. Five of the eight developers stated serendipity as the ESS driver, where fortuitous knowledge of a business issue and ESS technology occurred at the same time. This "middle out" approach goes along well with the "learn as we go" flexible technology aimed at intangible benefits. The EIS development teams help the executives flesh out and clarify CSFs and real strategic information needs over time. In only two firms was some form of organized technological assessment effort evident. The other three firm's developers claimed awareness and excitement about ESS technology as the driver for their ESS. A technological window of opportunity seems to span this "performance gap" between technology and management processes. The users tended to claim technology as the driver most often with issue(s) or serendipity splitting the remainder.

As expected, in the real pioneering firms, one visionary executive was credited with introducing the concept of applying existing computer technology to their management processes. Throughout the 1980s, a few pioneering individuals took it upon themselves to learn about ESS and spread the word within their own companies. Most developers proceeded from their own interest and knowledge gained before the request came to develop a system. The developers claim self-involvement in the development process or vendor as their source of both how-to and principles knowledge. The developers also sought information from consultants due to ESS' complex technology. As the idea emerged, and commercially available systems became viable (mid 80s), knowledge diffused via vendors and trade literature to the developers. Seven of the eight firms reported the vendor as a source of initial information; all of these adopted 1985 or later. Many executive users claim they already knew about ESS from vendors and literature before IS got involved. Some users started using the system within three to six months of learning about the concept. A few of the executive sponsors developed awareness by talking with managers in other

firms and meetings. Some concepts of ESS are starting to filter into MBA coursework as well. The users didn't need or want principles knowledge. While trade literature had some value during this stage; the interpersonal channels of communication were most frequently noted for developing awareness by developers and users alike.

Persuasion

In all cases, a high degree of peer influence and social reinforcement of ESS use was evident. Indeed, use of the system became almost mandatory to effectively participate in the social setting. Very persuasive were in-house vendor presentations, talking with other executives, and/or inspection of an ESS product at other nearby firms. In one case, the executive sponsor saw a demonstration at a trade show, came back and specified the purchased product. The IS developers interest developed subtly over time as a result of professional awareness and interest (intellectual capital) or as a result of desire by an executive. The sponsor(s) knew the value of information and sought technology to support them, thus had a favorable attitude to begin with. Many

users (non-gatekeepers) became persuaded well after the decision and some even post trial use. In both the awareness and persuasion stages the number of sources cited as influential tended to become more numerous the later the adoption. Interpersonal channels and trusted sources of information prevailed during this stage.

Decision (Acquisition)

A steering committee took the form of a specially created development team combined with functional experts, and chaired by either a high level executive sponsor (Eg. CFO., Exec. VP) or a VP level IS professional. The development team (various names) had a great deal of authority for acquisition, a clear mission tied closely to the functional areas, and a fairly high organizational profile.

Assessment of alternatives usually involved only a small selection of products, with much of the evaluation done on paper. The firms that purchased a commercial product reported a fairly short evaluation period which ranged from zero to six months. In most cases only the chosen solution was evaluated. Very often evaluation and trial use were done

simultaneously. Each firm had its own agenda and utility match-up based upon their perceived needs. Paper reduction, competitive advantage, and faster reporting were cited as initial reasons for looking into an ESS. The roles of the buying group often overlapped as the one champion had plenty of clout to influence, decide, and use. The gatekeeper(s) tended to be the executive sponsor(s), although technology scanning was usually delegated to developers. All the cases reported high level executive sponsorship and interest; most often an operational sponsor was recognized. This highly visible advocacy and commitment was deemed necessary for success, especially during implementation. None of the systems sprang from a grass-roots or pure IS effort. The best sponsors understood the value of information and were knowledgeable, enthusiastic, and tolerant of developing IT. A divisional champion was helpful in getting the specific business focus inculcated into the ESS. None of the firms reported any cost/benefit structure or budget planning being done. The buying group found the money and personnel from somewhere within the organization.

Four firms elected to build their system and four purchased Comshare Commander EIS. The specific development environment helps with the make-buy decision. Those electing to build their own system did so because there were no commercial products available yet, dissatisfaction with what was available, or cost. Those building reported slightly more favorable personal impacts. No difference in organizational impacts were observed for those building or buying. Those mentioning competitive advantage as the drawing card to ESS tended to purchase, while those looking to change the management process or reduce paper, built. Insufficient resources proved to slow or kill ESS implementation in one case. Either way, high performance and functionality was a necessary, but not sufficient condition to guarantee success. The "real deal" is to fit the technology to the business practices and constraints of the organization. Once awareness of using IT to support management processes is gained, focus must shift from technology to the executive needs which had better be in sharp correlation to the firm's CSFs. The ESS must not become an end in itself.

The attributes of ESS come into play during decision. Economic advantage didn't appear very important in that no cost/benefit analysis was done on any of the systems. Furthermore, the firms tended to downplay the importance of costs. Access to the "core" ESS was perceived to confer status as admitted by a few firms. In most of the firms a valued goal was to increase overall computer use and bring their management processes in line with their high-tech or industry leader image. The promise of strategic advantage and better decisions appear a valid goal but one hard to measure and plan for. Most firms are just beginning to reap these intangible, but valuable benefits.

Compatibility was initially low but improved with time because of the modular nature of these systems. One key is to start off small and give some functionality and familiarity to the executive; this also keeps up their interest. Despite a general awareness, executives are not very familiar or comfortable within the computer domain. The ESS must fit into and support existing executive processes or it won't get used. It seems due to the ambiguous nature of their work, executives possess the

necessary personality traits which play in favor of fast adoption.

Trialability is enhanced due to the divisible nature of ESS technology. Perceived risk is minimized because the executive could always go back to original information sources regardless of his/her degree of adoption. Dependence starts off small and at a rate each user feels comfortable with. The firms reported a slight dependence (see table 1) on the ESS, primarily for scheduling and reporting.

Complexity is very low from the user's perspective. The systems were easy to learn and use; the complex technology is transparent to the user. An ESS has to be very intuitive and if a lot of user education is needed, the system will fail. Although training activity and resources varied and were fairly uniformly distributed, most firms reported a brief (15-30 minute) coaching session as enough.

The speculative and subtle benefits make observability low. The few results from using the ESS are highly leveraged and do become visible. The system has great "hero" potential as its utility is realized. The systems were perceived as more

observable from data providing subordinates as reporting cycles shortened.

Trial use

As mentioned, ESS evaluation (assuming adoption as the cases do here) and trial use overlapped. In every case, prototyping was the chosen development methodology. Six months was the reported maximum time to first functional deliverables. Not only does this approach give the users some functionality quick, allow the developing team to more accurately determine the real user and development resource needs, and reuse software modules; it also reduces uncertainty, risk, and fear by allowing incremental learning to take place. In many cases the terms "prototype" and the actual ESS were synonymous. The executives learned, and are learning, what they really need the system to do. The executives know their jobs and industry already; they had to learn what IT could do for them. By involving the executives as beta users and allowing them to conceptualize their needs, they helped the developers understand their thought and work environment. The focus is oriented to learning about

the match-up of technology and executive management processes, and how to apply it. The most successful firms started, or restarted, from a CSF perspective, and grew closer tied to them later in the use stages. These systems supported firms reporting a higher incidence of desired impacts and tended to become "routinized" into the business. This means starting with what is most important to the executives, mainly the financial and marketing information. Those starting from a later stage in operations, like production, did not get as many benefits. Finally, the successful firms recognized that the CSFs were moving targets and the technology had to be flexible enough to chase them.

In all cases a special team was formed to develop and manage the introduction of the ESS. Most effective were teams not only dedicated but also those who became permanently assigned to the ESS. When the development team "went away" onto other projects after implementation, the ESS tended to flounder. Despite advances in AI and claims by some vendors, the "human" link is still necessary to the vitality of the ESS. The special team had to learn the management thought processes of their user

constituency. These people must work closely with the users to constantly change the system to support their dynamic needs. Thus a trade-off exists with executive analysis time and system effectiveness. The team in most cases worked in cooperation and coordination with main IS primarily to get at the data. The development team must transition to a support team and not go onto other projects.

In every case, the users were heavily involved in an information audit. Indeed, many valuable benefits came out of this need identification and refining process. The meetings, cross-matrix groups, and oversight committees forced the executive(s) to think, focus, and air their CSFs. Each executive must drive and specify the requirements.

Prototyping plays in favor of adoption in terms of the attributes of the innovation itself. Relative advantage is discovered as many began seeing the system as a necessity to augment their management processes. The ESS offered a greatly superior option to traditional paper-based methods. Compatibility is enhanced by giving experience in the ESS domain and

allowing the users to marry their management processes to it.

The same incremental learning experience serves to reduce complexity. A user orientation was limited to a 15 - 30 minute one-on-one coaching session. If an ESS needs "training" it will fail! Ease-of-use doesn't stop with the mouse or infrared remote driven icon interface leading to bit-mapped high resolution color graphic displays (EGA minimum). Screen navigation must consider the sporadic executive thought processes by going from a summary/exception item to a specific reason faster than the user could determine from a print-out.

The technology is by no means trivial and a complete audit of the firm's existing and available hardware, software, and communications resources is necessary. Whether built or bought, the system must interface with a large number of applications and platforms. Response time is critical; the successful systems had response times averaging three seconds, and certainly less than 15 for any ad hoc data query. Most firms reported either having data integrity beforehand or was a side benefit of adopting an ESS. From a developers point of view, the commercial

products and components of built products offer 4GL or CASE-like tools required to support the application flexibility and prototyping development methodology of ESS.

By definition, prototyping is trialability and observability at its finest. The piecemeal approach allows reversibility and divisibility and serves to allow the adopter to return to their pre-ESS state and reduce risk. Observability is mixed with the ESS. Due to the level of user, early results are very observable; and keeps project interest high.

Surprisingly, very little resistance to ESS was reported. Counterimplementation took the form of non-participation, and data protection and filtering. Most successful among managing fearful perceptions was a selling and informative tact by both the executive sponsors and the developers. The perception by the data providers that the boss was going to snoop into "nitpicky" operational detail is really a myth. Those respondents close to the top reported the typical executive's agenda is too busy to allow such action.

While no formal mandate was ever issued in any of the firms in this study, almost unanimously it became a necessity to use the ESS to effectively carry out their job. In two of the cases, the most direct form of mandate was taking the paper reports away. As an executive, the system was a symbol of progressive management technique and as reported in a few cases, a status symbol. The management teams were fairly interconnected and created a climate favorable for innovation. The density of communication patterns within the executive suite didn't allow social inertia to hide very long. Mandate or peer pressure tended to speed the adoption process.

The respondents reported very little, if any, net change in power or influence within the organization. The ESS creates an information sharing environment where most users sense a mutual growing of power. The value of this "sharing" cannot be overstated, this may be where better decision making and strategic understanding takes place. The real disrupters of an ESS are pride of ownership and "islands" of information. Throughout, it appeared the IS function, especially the EIS development team,

were the real beneficiaries of increased clout. Enhanced career potential, power, visibility, and job enjoyment all rated low as motivators for adopting an ESS. Although rated mediocre, teamwork is increased due to the initial development effort and sharing of information or expanding the teams. A little evidence points to increased organizational prominence of those units using the system more, but the jury is still out.

Limited use

True, as most literature on ESS states, the system must fit the management style and processes of the user, but the cases suggest managers do change their style somewhat to take advantage of the ESS. A few of the executives reported becoming somewhat dependant on their ESS for keeping their agendas. The systems tend to smooth out the "feast or famine" of traditional standard reporting. Standard reporting is intended for a general audience. The executives didn't see any of the numbers until all were ready and then it came all at once. The executive gets accustomed to the more practical

electronic delivery of information needed for reuse and recall.

The most common application areas reported were E-mail and faster reporting of "what is" information. Most salient personal impacts were more timely data, ability to do new tasks, better decisions, and more communication and coordination. Increased IT use and improved strategic posture were the most agreed upon organizational impacts. All respondents disagreed or at best were unsure the ESS decreased expenses, with some quite disappointed in this regard. Access to external and industry news was used to a very limited extent and tended to be industry sensitive. If used at all, only the top few accessed the system from their homes. If ten executives were asked what their most important application is, you would get ten different answers.

The fast delivery of "what is" information allows each executive to take corrective action sooner, if needed. An important benefit is the system gives "value-added" information and allows a single point of focus. Ad hoc query and analysis letting one to correlate and view the data from different angles is good only if the user sees the

relevancy and doesn't let procrastination override. Personal impacts were more positive than organization impacts. Generally, those firms reporting more favorable personal impacts filtered down to improved organization impacts, and as expected rated higher in dependence as well. Those firms more successful had more functionality; it did not matter whether the firm built or bought their system. An interesting phenomenon of "upchain" pressure to use the system began, as subordinates started calling attention to certain "facts" to their bosses. Non-usage took the form of limited usage or "shallow functionality".

ESS technology is transferred to another group at the same time as experimentation and learning is going on in one group, and before consequences (impacts) of use are fully understood. A segment-by-segment or module-by-module roll-out worked quite well for most firms and allowed mutual developer and user learning to take place.

Reinvention was evident by the customized screens and data access, each geared toward a particular level, functional area, and/or business unit. This gives them a path of least resistance and risk exposure. The software module building approach

is needed to give maximum flexibility to a user with changing and ambiguous management processes. The two firms specifying standardization of reporting as being of key importance, still tailored the data in a top-down prioritized fashion and used it in multiple tiers.

The two words summing up a successful ESS during the growth stages (limited and full use) are performance and flexibility. Early results keyed on efficiency improvements. These "successful" applications were necessary to reduce anxiety associated with the forthcoming changes to management processes. The systems are beginning to be "routinized" or linked to core business functions. The efficiency gains led to increased effectiveness because the executive had a little more time in which to contemplate. It was often mentioned, the system has incredible merit, but no revenue enhancement or cost reduction could yet be directly credited to adoption of the ESS. The key is to emphasize the benefits of quick access to information, real information, and its value to the firm. If couched within a starting CSF perspective, the long range

strategic and organizational shifts in focus will naturally occur.

Full Utilization

While many respondents claimed full utilization of their ESS, the message was that an ESS never reaches the static stage typical of a full production system. Many specified the system went directly from prototype to use and still consider it a prototype. An ESS is an "alive" system and must constantly chase a moving target of requirements. During this stage, the mutual learning period continues between the users and developers. Long term planning is almost non-existent as those in practice are still trying to perceive the intangible impacts and benefits.

The ESS is the great "facilitator" and partner at this stage. All the firms either implicitly or explicitly expressed a goal or expected benefits of strategic advantage. While a few successes are reported, it seems planning and use of the ESS for that purpose is haphazard. The EIS development team works closely with their executive constituents and was felt necessary to support the

strategic focus as the technology becomes more familiar. The applications having real potential for increased revenues and profits and facilitating decision making are just now beginning to be realized. Most credited the ESS as facilitating organizational change already dictated by market and industry conditions. The middle management "data handling and filtering" functions appeared most in jeopardy. These same individuals though became "partners" to the executives as information analysts and enjoyed a better chance for promotion.

Typical of organizations approaching this stage of use was the creation of a "spin-off" middle management ESS. In three firms, the middle management support system grew fast with larger reach but narrower scope. These systems supported summary and intra-divisional information. The "core" systems growth had pretty much flattened out, but evolution of applications was expected as integration, IT advancements, and the mutual learning process matures and leads to a future focus. The more future oriented firms reported having systems supporting a fuller palette of management activities. These systems also shifted away from pure DSS.

Desirable, yet unanticipated consequences were reported which reflect that mutual learning process, and not a lack of understanding as viewed by Rogers. Although the most salient impacts so far appear to reside in efficiency improvements, all respondents acknowledged the technology and systems as new and expected them to yield strategic and cost benefits (effectiveness) soon. Roger's confirmation stage appears to be going on in parallel to use.

TABLE 2**SYNOPSIS OF FINDINGS**Awareness

- Image problems.
- Fortuitous "match-up" of technology and business need.
- Developer professionalism.
- Interpersonal communication channel prevalent.

Persuasion

- Users must "value" information.
- Peer pressure.
- Demonstrations and trusted sources very influential.
- Interpersonal communication channel dominance.

Decision (acquisition)

- A committed and tolerant "champion".
- Limited evaluation period.
- No cost/benefit structures.
- Tied to business needs (CSFs).
- Attributes - a mixed bag.

Table 2 ContinuedTrial Use

- Prototype!
- Allow for mutual learning.
- Users drive requirements.
- Dedicated and continuous development team.
- No "training"!
- Little resistance.

Limited Use

- Subtle mandate.
- Valuable applications vary with personal perceptions.
- "What is" and electronic mail most used applications.
- Electronic delivery of information important.
- Small net change in power evident.
- Continue mutual learning.

Full Utilization

- An "alive" system.
- Haphazard planning.
- Facilitates organizational change.
- Creation of middle management "spin-off" systems.
- More functionality lends to better future orientation.
- Desirable, yet unanticipated consequences pay off.

CHAPTER VII

SUMMARY AND CONCLUSION

Summary

This research identified some of the key personal and related management issues relating to the successful adoption of an executive support system (ESS). Every executive already has some form of an information infrastructure, whether it takes the form of a series of telephone calls, memos, reports, requests or briefings from executive assistants and analysts, or a terminal. So, ESS is not a new process, it is an improvement to an existing one. A clustered IT, the ESS is not only an innovation in its own right, it is particularly an interesting one because its use is aimed at a powerful, sophisticated, yet fairly computer illiterate group.

Executives are more aware of the capabilities of new IT and the volumes of existing corporate data. ESS developers and users rely primarily on interpersonal channels and trusted sources of communication for learning and especially when

forming a positive attitude toward ESS. The top must see the value of information, be open and enthusiastic to emerging IT, and visibly advocate its use. The executive users must drive the needs and actively participate in the requisite prototyping approach to development.

A dedicated development team with both technical and management expertise must shift to a support role and stay with the growing system. Implementation may proceed smoothly if data providers are kept in the loop and assured by the executive sponsors that the sharing of information need not threaten anyone and will improve overall organizational effectiveness. Whether built or purchased, an ESS starting off supporting the business needs (CSFs) has the best chance for success. The technology is very advanced, but must not get in the way of performance. The executives will accept nothing less than an easy to use system; if much training is involved, the ESS will fail.

In the words of Peter Drucker, "that which is measured improves". An ESS can start small and give immediate efficiency returns. Giving an executive more time leads to more contemplation, better

decisions, and an effective shift of focus toward the future. The "sharing" of information throughout the executive suite allows a synergistic improvement in understanding the marketplace. As the match-up of technology and the management processes is appreciated, the long range effectiveness goals will come to fruition even faster.

It's the little things adding up over time that really pay-off; the tremendous revelation is a myth. So far, the personal impacts outweigh the organizational ones. Each user can grow with the system as time and interest allows, but all will feel a certain peer pressure to use it. An ESS so far has been a great facilitator of organizational change. The ESS is a "living" system and must continue to evolve toward better supporting the everchanging needs of its special users. Each system is unique to the industry, firm, and executive it supports.

These descriptive cases identify many generalizations that firms have learned the painful lessons from their EDP past. ESS appears to be on another, perhaps flatter, S-shaped curve beyond the early 1970s S-shaped stage model by Gibson and Nolan. Identifying those natural forces and actions useful

during the adoption process may help management anticipate and resolve problems before they begin.

The future of ESS

Executive support systems, the concept, is just now emerging from the pioneer/early adopter stage. Uncertainty of using this new IT, as with all innovations, with its incipient frustration and difficulties is being overcome with real, new, benefits being discovered daily. ESS will remain a tool for senior managers and their organizations to perform their jobs, but it's not for everyone.

Executive style, perception of the usefulness of IT, and organizational culture will effect the use, impact, and effectiveness of ESS for years to come. Office support, communications, and planning and control functions will continue as main uses of ESS for the near term. The ability to communicate and exert the proper control and influence at senior levels are organizational imperatives.

The real pay-off involves increased understanding of the business environment; clarifying the mental model. As executives learn and put faith into an ESS, they will make quicker decisions to act

and take advantage of fleeting opportunity. Dramatic increases in the intensity of competition, shortened production and market cycles for new products and services, and the vast tome of available information make the ESS an essential partner in the executive suite. Organizational prophets portend that those organizations that do not manage the transition from an industrial orientation to an information orientation will very likely suffer extinction [Straub, 1989, pg. 1338]. Finally, as with most innovations providing relative advantage, diffusion is inevitable.

In general, the respondents agree, ESS will benefit in the 1990s as IT becomes more integrated and sophisticated. Artificial intelligence definitely has a place with natural language processing and expert "front-ends" set up with parameters to automatically filter and correlate data make use easier and more effective. The computer will go more into the background as video and audio technology improves. Database machines give even faster ad hoc query and analysis of information.

Hindsight and Limitations

A real constraint in this study was the limited number of firms which time made available for study. Certainly, no statistical treatment or prescriptive argument is possible with eight firms. More respondents in each firm would give a "reality check" on many of the subjective and speculative results. This study used firms who have adopted an ESS. The pro-innovation bias led the results, by design, and did not allow examination of discontinuance or rejection. The level of target user group presented problems in getting in-depth and more interviews. People are reluctant to speak about their specific long range strategic plans and impacts. Due to multi-faceted events occurring over time, direct causal relationships could not be fixed to adoption of the ESS. The study had no control over "position" of the user and its impact on relative influence on adoption.

Research Opportunities

Future research should look into both peripheral issues to this paper and that involving a global view to general IT adoption and organizational

assimilation. Clearly, the research proffered here could be repeated in order to view the unfolding diffusion of ESS. Comparison with studies on other emerging ITs may then offer generalized insights into managing the increasingly complex information revolution; as well as allow better technological forecasting and assessment.

As the technology matures, this research could be expanded to include more or different firms, use a different adoption framework - such as Fishbein's and Ajzen's theory of reasoned action, or key on specific issues. One possibility is to examine the affect of an ESS on subordinate's behavior - any "technostress" - and organizational change. Whose job is enriched, whose is enlarged, and whose is deskilled or deleted? Does the ESS drive a flattening of the organizational structure and what are the mechanisms involved? Does use of an ESS create more teamwork or loose federations of warring prima donnas, each armed with all the puzzle pieces?

Using the ESS to improve strategic planning and posture deserves a closer examination. Research could focus on comparing different industries. Does

the role of IS and status of its managers change as ESS use becomes more tied to a firms plans and actions?

Future research could focus on personal characteristics - the five adopter categories, effects of peers, superiors and subordinates, and organizational culture perceived norms as related to innovativeness. Is innovativeness a stable trait or do members - including organizations - of the social system change as circumstance dictates? Innovation dissonance or discontinuance of an ESS is not well integrated into the theory. So as the technology matures, examine firms who have not adopted or who have and discontinued, and why? Finally, since members of different social systems interact, what are the effects of these overlapping, dependent, channels of communication on the diffusion process? Only a longitudinal study could track progress and form of ESS adoption throughout the diffusion cycle.

Conclusion

In conclusion, the innovation-decision theoretical framework is useful for understanding some of the forces underlying the adoption of an

emerging technology like the ESS. The concepts which emerged from the collected data shed light on those management issues which lead to the positive adoption of an ESS. AN ESS supports the entire enterprise by letting executives look inward to get a better perspective outward.

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APPENDIX A

USER QUESTIONNAIRE

EXECUTIVE SUPPORT SYSTEMS (ESS) ADOPTION USER SURVEY

Firm _____ Date _____

Name _____

Title _____

System (if named?) _____

When did you start working your present job (Month/year)? _____

Did you inherit the ESS from your predecessor? Y N

In talking with others, we have found most go through a similar series of stages, like those listed below, when learning about and using a new technology like ESS. We assume you already are beyond the awareness, persuasion, and acquisition stages.

Please estimate your own level of use of ESS by circling the number of the stage best describing your current situation.

1 Initial Use (You're just starting to use it. May include trial use to confirm your decision to adopt.)

2 Limited Use (You're using it for some routine applications.)

3 Full Use (You're using the ESS to its full potential.)

KNOWLEDGE AND PERSUASION

From where did you first learn (L) about ESS? Circle as many as appropriate. Circle the ONE which was most persuasive (P)?

Vendor	L	P	Co-worker	L	P
Trade literature	L	P	Boardmember	L	P
Meeting	L	P	IS department	L	P
Consultant	L	P	Friend	L	P
other	L	P			

When was that (month/year)? best guess _____

ACQUISITION/DEVELOPMENT

Please rate the influence you had in each of the following factors in the adoption process. Circle the appropriate number.

	No influence				Final say
Buying the ESS	1	2	3	4	5
Defining requirements	1	2	3	4	5
Selecting a specific product	1	2	3	4	5
Determining the first application	1	2	3	4	5

Please rate your level of agreement with each of the following statements. Circle the appropriate number.

	strongly disagree		not sure		strongly agree
It was the CEO's idea all along	1	2	3	4	5
It was changed to better fit our/my needs	1	2	3	4	5
It was customized to my management processes	1	2	3	4	5
A particular executive "championed" the idea	1	2	3	4	5

Please circle the number of the following statements which best describes your firm's situation.

1 Issue driven: A definite business problem caused us to look for a technology like ESS as a solution.

2 Technology driven: Knowledge of ESS technology caused us to look for applications or opportunities to use it.

3 Serendipity: Both knowledge of a business issue and ESS technology seemed to occur at roughly the same time.

UTILIZATION

When did you start using the ESS (month/year)? _____

On average, how many hours a week do you use the ESS? _____

What application(s) do you, or secretary, use your ESS for now? Check all applicable items. Circle most important check marks.

Office Support

- | | |
|---|--------------------------------------|
| ☐ Electronic mail | ☐ Spreadsheet |
| ☐ Word processing | ☐ Calendaring |
| ☐ Automatic-filing | ☐ Rolodex |

Planning and Control

- | | |
|--|---|
| ☐ Standard reports | ☐ Program management |
| ☐ Ad hoc query & analysis | ☐ Communications |
| ☐ Faster reporting | ☐ Decision support |

Enhanced Mental Model

- | | |
|---|---|
| External data sources | Internal data sources |
| ☐ News services | ☐ Company news |
| ☐ Trade & Industry | ☐ Performance data |
| ☐ Stock Quotes | |

- | | |
|---|--|
| ☐ Off-hours access | ☐ Modeling/analytic |
| ☐ Trends | ☐ Other _____ |

How familiar are you with computers/software? Circle.
novice 1 2 3 4 5 6 7 expert programmer

How did you learn to use the ESS?

Self taught _____ IS dept coach (one-on-one)
 _____ Booklet _____ vendor
 _____ on-line tutorial _____ formal group training
 _____ other _____

In your work, how dependent are you on the ESS? Circle.

Job not affected 1 2 3 4 5 6 7 impossible without

Please rate your level of agreement with the following statements about use of the ESS. Circle the appropriate number.

	strongly disagree	1	2	3	4	5	strongly agree
Easy to use							
Does what I expected it to do		1		2		3	4 5
Will grow in number of users		1		2		3	4 5
Will grow in number of applications		1		2		3	4 5
Counterimplementation was evident		1		2		3	4 5
I'm forced to use it		1		2		3	4 5

BENEFITS AND IMPACTS

Please rate your level of agreement on the specific personal benefits and impacts from using the ESS. Also rate the importance of each factor to you as high, medium, or low (H, M, L) Circle the appropriate number.

	strongly disagree	1	2	3	4	5	strongly agree	importance		
								H	M	L
Data more timely		1		2		3	4 5			
Can do tasks not previously done		1		2		3	4 5	H	M	L
Better quality decisions		1		2		3	4 5	H	M	L
Better communications and coordination		1		2		3	4 5	H	M	L
More teamwork		1		2		3	4 5	H	M	L
Job more satisfying		1		2		3	4 5	H	M	L
Clearer understanding of our business environment		1		2		3	4 5	H	M	L

Please continue rating the personal impacts of FSS use. Circle importance as high (H), medium (M), or low (L).

	strongly disagree		not sure		strongly agree	importance			
Enhances my career potential	1	2	3	4	5		H	M	L
Use increased my power or influence	1	2	3	4	5		H	M	L
Increased visibility	1	2	3	4	5		H	M	L

Your ESS use may impact the organization. Now rate the organization-wide impacts. Again, please rate how important each factor is to the effectiveness of your organization as H, M, or L. Circle your choice.

	strongly disagree		not sure		strongly agree	importance			
Better strategic planning and posture	1	2	3	4	5		H	M	L
Allows a leaner or flatter organization	1	2	3	4	5		H	M	L
Has redefined some work roles	1	2	3	4	5		H	M	L
Has created more computer use overall	1	2	3	4	5		H	M	L
Reduced expenses	1	2	3	4	5		H	M	L
IS department plays more strategic role	1	2	3	4	5		H	M	L

Any other major personal or organizational impacts/benefits?

Overall, do you envision more benefits and/or impacts coming as the technology matures? Care to speculate?

Would you like a summary of this project's results? Y N

Thank you for your time and cooperation. A self-addressed stamped envelope is enclosed for your convenience.

Please return to:
 Emerging Technologies Project
 Graduate School of Business Administration
 University of Colorado - Boulder 80309-0419
 Researcher: Vern E. Hasenstein (303) 651-2597
 Director: Dr. James C. Brancheau (303) 492-5830

APPENDIX B

INTERVIEW GUIDE

ESS: AN INNOVATION-DECISION PERSPECTIVE

ADOPTION INTERVIEW GUIDE

Date	_____	Mode	T	P
Firm	_____	System	_____	
Name	_____	Title	_____	

Background

Primary responsibilities?

How will others know if you are successful?

Describe most important tasks.

Knowledge-awareness

Where did you first learn about ESS?

When was that?

Did a particular business problem start the hunt for an ESS?

Persuasion

Who or what persuaded you that ESS was the solution?

Any corporate culture influence?

Any controversy or negative influences?

Acquisition (decision to adopt)

What were the important benefits to go ahead with an ESS?

When did you acquire?

Who made up the buying group?

Gatekeeper (information controller)

Influencer (information supplier)

Decider (informal, power, decision swayer)

Buyer (formal, purchasing agent)

Was any formal cost/benefit analysis done? Estimated Cost?

Did you buy a commercial shell, develop in-house, or combo?

How many different products considered?

Name of purchased/used components?

Was there a demo or trial before purchase?

If purchased, was modification necessary?

Was there a steering committee for this system?
Were you a part of it?

Was a prototyping approach to development used?

Did you specify what the systems needs to do - requirements?

Utilization

When did you start using the system?

How many users?

What stage are you in (initial, limited, or full production)?

Who taught you how to use it? Coaching involved?

What do you use the ESS for and the most important application?

Does the ESS do what you expected?

Is it easy to use?

Do you think the system will grow? Applications? Users?

Are you forced to use it by a superior?
Do you wish you didn't have to use it?

Did you sense any counterimplementation efforts?
What were they?

Benefits and Impacts

What does the system do to support you?

How would you have done these tasks without the ESS?
Could you have?

Are you dependent on it?

Specific personal benefits and impacts:
Tasks take less time? What do you do with time saved?
Better quality decisions?

Better communication, coordination, and collaboration?

Closer working relationships? Teamwork?

Job is more satisfying (challenging)?

Clearer understanding of business environment?

Better understanding of what I need to know?

Enhances my career potential? Rewards?

Any change in power or influence?

Security a problem?

Any measurable financial benefits? Revenue, expenses ...

Your ESS-based actions impact the organization.

Any **organization-wide** impacts?

Better strategic planning and posture?

Leaner/flatter organization?

Any redefined work roles?

More computer use overall?

Tighter ship?

Closer relationship with the IS department?

Overall, do you see more benefits and/or impacts coming as the technology matures? Care to speculate?

Thanks so much for your cooperation. May I call again for any further clarification.

APPENDIX C

COVER LETTER

Mr. David Gilbert
MAPCO INC.
1717 S. Boulder Ave.
Tulsa, OK 74121-1628

Dec 19, 1989

Dear Mr. Gilbert,

I'm with the Emerging Technologies Group at the University of Colorado at Boulder. As discussed, over the telephone, your firm has adopted a relatively new information technology (IT) - the executive support system (ESS). Aside from various claims made by vendors, the information systems profession has little information about the best way to transfer a "new" IT, like an ESS, to the corporate setting. Your participation will help us understand the important factors for the most successful introduction and effective use of an ESS. We define an ESS as:

The routine use of a computer-based terminal (PC or workstation) and specific ESS software directly by, or expressly for, a member of the top levels in an organization for internal and external communications, personal productivity, access to both internal and external data to monitor business performance and its environment, and give a better understanding on which to control, plan and act.

We'd prefer a personal interview, but due to time and place constraints we ask you take 15-20 minutes to complete and return the attached questionnaire. You may refuse to answer any question and withdraw from the study at any time. Your responses are held in strictest confidence. Your participation is completely voluntary, and cooperation is greatly appreciated.

Thanks,

- S -

Vern E. Hasenstein
Researcher (MS Candidate)

Emerging Technologies Group
Graduate School of Business Administration
University of Colorado
Boulder, CO 80309-0419
Research Director: Dr. James C. Brancheau

APPENDIX D

EXECUTIVE SUMMARY

RESEARCH PROJECT

EXECUTIVE SUPPORT SYSTEMS: INTRODUCTION AND USE

EXECUTIVE SUMMARY

Overview

Compares the experiences of users, and examines the factors which supported the successful introduction, spread, and evolution of executive support systems (ESS).

Objective

To identify factors leading to the acquisition and use (adoption) of an ESS. This study seeks to gain the insight needed by managers to more effectively introduce and manage the use of new information technology, specifically an ESS.

Research Context

A number of firms, both service and manufacturing, which are using an ESS are included in the research sample.

Data Collection

Data are collected via semi-structured interviews and self-administered questionnaire from November 1989 to January 1990.

Participant Time Requirement

Key information systems "developers", and executive users, are asked to give a *maximum* of one hour for the interview. Those not available for the interview are asked to complete and return a questionnaire; which requires 15 to 20 minutes to fill out.

Confidentiality

All survey information given by the firm's employees is held in strictest confidence. Details will not be disclosed to anyone outside the research group at the University of Colorado, unless expressly permitted. Participants may refuse to answer any questions for any reason and withdraw from the study at any time. Participation is voluntary, and your cooperation is graciously appreciated.

Participant Benefits

Firms sharing their experience with ESS help develop an understanding of the "right" way to introduce and manage its use. Participants will receive a summary of findings and thus compare their own experience with others.

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(303) 651-2597 (H)