

How to design a proper 'executive information support system'

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HOW TO DESIGN A PROPER "EXECUTIVE INFORMATION SUPPORT SYSTEM"

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Abstract

"Executive Information Support" (EIS) systems are used more and more. But only analytic oriented executives find their EIS system indispensable for their daily work. So there is a gap between what non-analytic oriented executives need and what current EIS systems (can) give. This gap can only be bridged if we rethink the way an executive works instead of trying to prototype analytic oriented EIS systems to people who have a fully different working style. So, in designing an EIS, we have to go back to the basics of how different executives work.

This paper describes a method for tracing the full range of task and environmental aspects of the work of an executive as well as his or her working style. Using this method, it is possible to produce a structured description of the executive's tasks and procedures. Through this description, we have a solid basis for the development of a first prototype of a **personalized** EIS system. A case study design is proposed to learn more about the implications of working style, and task & environment on EIS system design.

Introduction

Managing a company is getting more and more complex. Competition is getting tougher because of the globalisation of markets. At the same time, many (top) executives are confronted with an increasing span of control, due to the flattening of the hierarchy in their company (Naisbitt 1982). Executives therefore need all the help they can get in managing their company.

An increasing number of executives find help in the use of an Executive Information Support (EIS) system (Rockart and Treacy 1982). Instead of having lots of non-read paper reports on their desk, they have a computer supported information and communication system that enables them to get a quicker and broader access to corporate data and external information. In the year 1988, both market leaders for EIS systems in the United States, Comshare and Thorn EMI, together have got 373 EIS systems operational (Main 1989). International Data Corporation, a firm for marketing research predicts that the market for EIS systems in the United States will grow approximately 40 percent each year. Many executives experience the use of an EIS system as a strategic advantage over the competition (Fersko Weiss 1985).

But there are also a lot of people who think that an EIS can hardly be of any use to an executive. For a discussion on this matter, see Rockart and DeLong (1988). They summarize the objections of several people to EIS systems as follows: the executive is someone whose interests are too focused, who doesn't have time to learn a new technology and who has too little to gain to be enticed into meaningful EIS system use. Rockart and DeLong however take a somewhat different point of view. According to them, EIS systems are a major support for a growing number of (mostly analytic oriented) executives but EIS systems are not, in the near future, appropriate for every executive. The differences between individual executives are well documented. They differ in cognitive style, orientation to detail, and working habits, as well as many other dimensions.

But if having an EIS system could mean a strategic advantage over your competitors than research has to be done in how far for instance non-analytic oriented managers can also be supported by an EIS system. This can be done by going back to what should be the roots of an EIS system design, namely how does a manager work. If we make a proper description of the work and environment of an executive, then it is possible to see in which areas of his or her work support can be given by an EIS system. With a very high probability, an EIS system designed in such a way will become a personalized system. This is very welcome because many researchers in the field argue that an EIS system should be a personalized system (e.g.: Watson et al. 1991; Friend 1986; El Sawy 1985). Making a description of the work and working style of an executive could also be useful for an executive who already uses an EIS system. Maybe we can find that there are some parts of his or her work that can be supported by an EIS system, but that just were never incorporated in the EIS system or prototype before.

In this paper we will divide a company into three logical components (figure 1). Because it was suggested that an EIS system should be a personalized system, we take the executive user and his or her personal working style as a starting point for the design of an EIS system. The executive however, is influenced by the task and environmental aspects of his work, which are in turn influenced by the executive. Both the executive and the task and environmental aspect of his work will be influenced by the coming of an EIS system. And as argued in this paper, they should also influence the design of an EIS system. So the components of this system that we call a company are constantly influencing each other. Therefore it is argued that an evolutionary design through

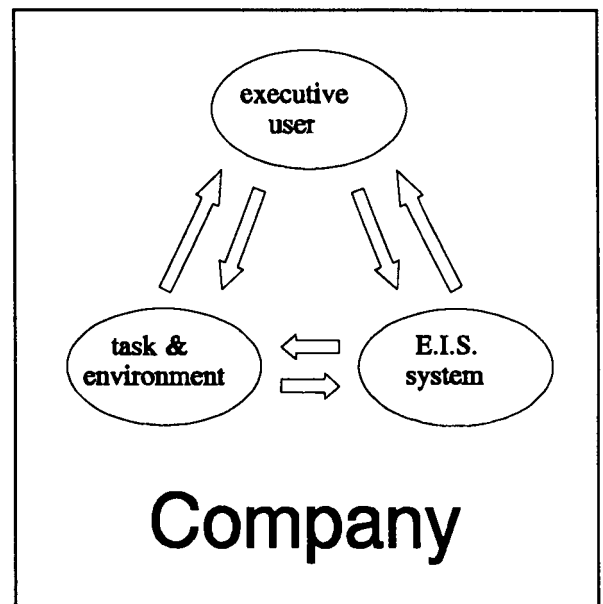


figure 1: The three major components in a company influencing each other in evolutionary EIS design.

prototyping is a correct approach but in order to make the first prototype as complete and as worthwhile as possible, we will have to make an in-depth study of the executive and his or her tasks and environment.

The rest of this paper first discusses the logical components of figure 1 (EIS system, task & environment, and the executive user). After this, an in depth study of the work and environment of an executive is proposed. In evaluating several methods for task analysis for executives, we come to the conclusion that structured observation is an appropriate technique for studying the work and environment of an executive. Using this knowledge, a case study design is discussed that can be used to learn more about the implications of working style, and task & environment on EIS system design. The paper will end with a summary of the most important conclusions.

The EIS system (an operational definition)

The name Executive Information Support (EIS) system is introduced by Rockart and Treacy in 1982. Now, approximately ten years later there still is no agreement upon a standardized definition of an EIS system. There is however one definition that seems to gain popularity and that is the definition of an ESS (Executive Support System) by Rockart and DeLong (1988). They abandoned the usage of the name EIS system because they think that this name puts too much stress on the information part of the system, but the general ideas behind the original concepts are the same.

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

This definition of an ESS is a nice starting point for an operational definition of an EIS system because it doesn't emphasize functionality like many other EIS definitions (e.g. Preedy 1990, Turban & Schaeffer 1987). Rockart and DeLong built their ESS definition around the feature that distinguishes the system from many other concepts, namely the business functions of the class of users. The functionality of the system is left open. The system can now grow within this definition. However, some questions are left open, using this definition:

- Should we come up with a new acronym each time when system designers misuse an acronym for systems that do not meet the original concept?
No, because the name should not change as long as the concept remains the same.
- Should the group of users be as small as Rockart and DeLong indicate?
No, because there are many people whose work resembles closely to the work of the group of users defined by Rockart and DeLong.
- Should a definition of an EIS emphasize (routine) use of the system?
No, because a definition of an EIS should emphasize the fact that it is a support system.

In answering these questions around the ESS definition by Rockart and DeLong we come to the following operational definition of an EIS:

EIS: *An information/communication system that supports an executive with all the different tasks that his or her work consists of (planning, organizing, staffing, directing, coordinating, reporting, budgeting).*

Executive: *A manager with full responsibility for a (sub)organisation, with the (possible) support of a staff department.*

The problems surrounding a standardized definition of an EIS system show a striking similarity with the problems encountered in finding a proper definition for a Decision Support System (DSS). For a discussion on the definitional problems surrounding DSS, the reader is referred to Bots (1989).

Task and environment

Now that we know what we call an EIS, we can go on to the next balloon in figure 1: task & environment. First we will talk about the tasks of an executive because these have been generally accepted as being important in system design. Task analysis also is the first phase in making an ergonomic design. One of the early descriptions of the work of an executive was made by Gulick (cf. Mintzberg 1973). He described the work of an executive with the acronym POSDCORB (*Planning, Organizing, Staffing, Directing, COordinating, Reporting, Budgeting*). It is however questionable whether the work of an executive can be divided into these categories. For instance, an executive is not able to indicate when he spends time on each category. Mintzberg therefore described an executive as being an actor with ten roles in one play ("*figurehead, leader, liaison; monitor, disseminator, spokesman; entrepreneur, disturbance handler, resource allocator, negotiator*"). These ten roles provide categories into which the work of an executive can be divided during an observation study, but they do not provide guidelines for designing an information/communication system for an executive. For a discussion on the usability of different descriptions of managerial work, see also Carroll and Gillen (1987). Conclusion: There is no standardized way (yet) to describe the work of an executive in such a way that this description can be used as a solid base for guidelines concerning EIS system design.

An overview of environmental aspects of the work of an executive is given by Mintzberg (1973). He distinguishes: culture of the milieu; the nature of the industry; various dynamic factors such as competition, rate of change, and type of technology; and the characteristics about the company itself, including its age and size. There is only evidence for a few of these variables on how they influence the work of an executive. Mintzberg described the effects of size of the company and industry. Chief executives of larger companies for instance engage in more formal activities but are less concerned with the operating work of their organizations.

The executive user

When we talk about the executive user in figure 1, we refer to the personal component that influences EIS design and task & environment. One way to describe this personal component is by the way of cognitive style. But in contrast to the field of Management Information Systems (MIS) and Decision Support Systems (DSS) (e.g. Macintosh, 1985), there has been little research in the field of EIS on the merits of incorporating the user's cognitive style in system design. This despite the fact that many researchers claim that an EIS system should be a personalized system (e.g.: Watson et al. 1991; Friend 1986; El Sawy 1985). But research on cognitive styles in relation to information system design has proven to be very troublesome. From a literature survey by Zmud (1979) it is concluded that cognitive behaviour is not only dependant upon individuals but also on task and environmental aspects. Furthermore Zmud states that too little attention has been paid to these task and environmental aspects. Therefore care should be taken in generalizing results from prior studies in this field. Huber (1983) is even more pessimistic about the usefulness of prior research on cognitive styles. He states the following:

- *The currently available literature on cognitive styles is an unsatisfactory basis for deriving operational guidelines for MIS and DSS designs.*
- *Further cognitive style research is unlikely to lead to operational guidelines for MIS and DSS designs.*

In discussing the matter Huber also states that an MIS or DSS has multiple users, each having his or her own cognitive style. Therefore Huber argues that the system should be flexible instead of idiosyncratic. But is it possible to create such a flexibility? And if so, doesn't this flexibility enlarge the complexity in using the system? It is very important to keep the complexity of an EIS system towards the user as low as possible in order to minimize the load on the executive. So an EIS system should have an idiosyncratic personalized front end for the user. The system should be flexible to the system designer. This flexibility allows the system designer to easily adjust the EIS-system to the personalized demands of the (new) user. Cognitive style however does not seem to be a very solid basis for guidelines on the design of a personalized front end to an EIS system. It is therefore that the concept of **working style** is introduced. The working style of a person is the observable component of his or her cognitive style. It is thought that a description of the working style of an executive together with a description of the task and environmental aspects of his or her work, can be a solid basis for an EIS system design.

Task analysis of the work of an executive

Now that we have discussed the three components of figure 1, it is time to search for a technique that can be used to describe each of the components. Because we are mainly interested in the building of a first prototype of an EIS system, an in depth study is proposed into the work of an executive, so we can get a grip on the two components: executive user and task & environment. An in depth study like this is called a case study (Yin 1984). A case study is habit-

ually being used for: exploration of a problem that is not yet fully understood, deepening of insight into a problem and the generation of grounded theory (Van der Zwaan 1990).

Glaser and Strauss (1967) introduced the concept of grounded¹ theory in their book "The discovery of Grounded Theory". The ideas of Glaser and Strauss are still valid despite the fact that their book is from 1967. This can be concluded from the recent literature on theory development based on case studies. Most of these articles refer to Glaser and Strauss (e.g. Yin 1984; Eisenhardt 1989). Glaser and Strauss gather their data through the use of what they call Theoretical Sampling. Following this concept the researcher jointly collects codes and analyzes his data. The process of data collection is controlled by the emerging theory. A researcher continues to gather data until Theoretical Saturation occurs. This happens when collecting more data doesn't enrich the formed theory any more.

Mintzberg (1979) also advocates the use of anecdotal material. In the following citation (page 587) Mintzberg argues that the gathering of anecdotal material, for instance by using the concept of theoretical sampling, is complementary to the systematic gathering of data:

For while systematic data create the foundation for our theories, it is the anecdotal data that enable us to do the building. Theory building seems to require rich description, the richness that comes from anecdote. We uncover all kinds of relationships in our hard data, but it is only through the use of this soft data that we are able to explain them

Therefore it is not surprising that the concept of structured observation, popularized by Mintzberg (1973), shows many similarities with the ideas behind unstructured observation. During structured observation, the executive is observed in his or her daily work and each activity is recorded systematically in a chronological order. Together with each activity, its goal is registered. Just like during unstructured observation, categories of activities are inferred from the gathered data. Mintzberg's research stimulated many other management researchers to use the technique of structured observation. It seems that many of the advantages of unstructured observation are also valid for structured observation, therefore we will elaborate a little bit more on the usability of this technique.

Martinko and Gardner (1985) identify several drawbacks on the use of structured observation in their survey on the use of this technique. Minor changes are proposed in order to minimize the effects of these drawbacks. Snyder and Glueck (1980) suggest an extension to the method that Mintzberg used. In their opinion, Mintzberg appears to look at managerial activities as if they are pieces of a jigsaw puzzle. He tries to describe what the puzzle looks like by measuring and counting the pieces. But a puzzle is not just a set of pieces that

¹ Grounded must be explained as based on empirical data contrary to theory based on philosophy.

fit together. One can only see the picture if each piece is connected with each other piece in the correct manner. This shortcoming can be overcome by asking the executive for the motives of his actions during the observation. Each time the executive engages into an activity, he is asked for his motives. Seemingly this type of research is very demanding to the executive, but in the study by Snyder and Glueck, executives rarely had to be asked for the what and why after the first day of the observation period. So the executives become accustomed to the presence of the researcher and his questions very quickly. The presence of the researcher also hardly influences the work that the executive does because much of the work is arranged in advance (e.g. basic events, meetings).

Using the extension suggested by Snyder and Glueck during structured observation, allows you to get a description of the work of an executive on a higher level of abstraction. It can be concluded that with the lessons learned from the past, that the Method of structured observation is an appropriate method for mapping the tasks and working style of an executive. So at this point a choice has to be made between the method of structured observation (Mintzberg 1973) or the method of unstructured observation (Glaser & Strauss 1976). The choice is made in favour of the structured observation approach for three reasons:

- Structured observation is a popular technique in management research.
- Studies using this technique can easily be compared.
- The only observations that are recorded during unstructured observations are the ones that seem interesting at the time of observation. One could imagine however that events that are not recorded can become very important later on. In structured observation, every action is recorded.

Some people like to bring even more structure in research on mapping the executive's tasks. Mintzberg (1973) mentions five other techniques:

1. Secondary sources: Archival work on magazines, reports, television etc.
2. Interviews and Questionnaire: Ask the executive himself what he does by way of interviews or questionnaires.
3. Critical incident and sequence of episodes: Search for Critical incidents through the use of observation or interviews. Critical Incidents indicate those places where effectiveness can be improved.
4. Diary: While doing his job, the executive himself records details of each activity on a precoded pad.
5. Activity sampling: The executive is observed for a few minutes at random time intervals and briefly interviewed every two hours.

But none of these methods can record all of the executive's goals and activities as well as his or her working style. Therefore and because of the already mentioned reasons above, the technique of structured observation is chosen. The structured observation technique will be used with the extension as suggested by Snyder and Glueck (1980, see discussion above). Using this technique, it is possible to produce a structured description of the executive's tasks and procedures. Through this description, we have a solid basis for the development of a first prototype of a **personalized EIS system**.

A Case study design

In order to learn something more general about how the components executive user and task & environment influence EIS system design, the choice was made to study three executives with the same function (three case studies). The choice for the same function was made in order to be able to study the differences and similarities between the working styles of the executives without having to cope with different tasks as an interfering variable. The choice for three case studies is made from a pragmatic point of view. The researcher only has four years for the whole project and the availability of executives is limited. There are no theoretical objections against three case studies.

According to Eisenhardt (1989), there is no ideal number of case studies for generating a valid theory. Pragmatically she mentions that the number should be somewhere between ten and four. With fewer than four cases, it is often difficult to generate theory with much complexity. With more than ten cases, it quickly becomes difficult to cope with the complexity and volume of the data. But the lower limit is questionable because Yin (1984) describes several single case studies that generated rather complex theories. The upper limit is also questionable because each case study may only be compared with another case study on the general level (contrary to data level; Yin, 1984). Therefore it can be said that the number of case studies can be chosen quite arbitrary.

Using the proposed framework we can come to three structured descriptions of the executive's tasks and procedures. In these descriptions we can include the individual working styles of the executives. Further research, for instance action research², will have to identify if our ideas about the usability of such a description for a personalized EIS system design can generate general guidelines.

Conclusions

- Many executives experience the use of an EIS system as a strategic advantage over the competition (Fersko Weiss 1985).
- Research has to be done in how far for instance non-analytic oriented managers can also benefit from an EIS system.
- An evolutionary design through prototyping is a correct approach but in order to make the first prototype as complete and as worthwhile as possible, we will have to make an in-depth study of the executive and his or her tasks and environment.

² In Action Research, the researcher affects the situation he is researching. His role is to actively associate himself with the practical outcome of the research in addition to generating theory on the matter.

- In answering questions around the popular ESS definition by Rockart and DeLong (1988) we come to the following operational definition of an EIS:

EIS: *An information / communication system that supports an executive with all the different tasks that his or her work consists of (planning, organizing, staffing, directing, coordinating, reporting, budgeting).*

Executive: *A manager with full responsibility for a (sub)organisation, with the (possible) support of a staff department.*

- There is no standardized way (yet) to describe the work of an executive in such a way that this description can be used as a solid base for guidelines concerning EIS system design.
- It is very important to keep the complexity of an EIS system towards the user as low as possible in order to minimize the load on the executive. So an EIS system should have an idiosyncratic personalized front end for the user. The system should be flexible to the system designer.
- Cognitive style does not seem to be a very solid basis for guidelines on the design of a personalized front end to an EIS system. It is therefore that the concept of **working style** is introduced. The working style of a person is the observable component of his or her cognitive style.
- Structured observation is an appropriate method for recording the executive's goals and activities as well as his or her working style.
- Using the structured observation technique, it is possible to produce a structured description of the executive's tasks and procedures. Through this description, we have a solid basis for the development of a first prototype of a **personalized** EIS system.
- Further research will have to identify if our ideas about the usability of such a description for a personalized EIS system design can generate general guidelines.

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