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PREVIEW

**DEVELOPMENT OF AN EXECUTIVE SUPPORT SYSTEM
FROM A COGNITIVE PERSPECTIVE**

By

Qingjun Chen

A DISSERTATION

**Presented to the Faculty of
The Graduate College at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Doctor of Philosophy**

**Major: Interdepartmental Area of Business
(Management)**

Under the Supervision of Professor Sang M. Lee

Lincoln, Nebraska

July, 1995

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Development of An Executive Support System
From A Cognitive Perspective

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University of Nebraska, 1995

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Current business environments are becoming more turbulent, complex, and dynamic. It is a cognitively demanding task for today's business executives to process and conceptualize the multitude of conflicting environmental data.

Most executive information systems are designed from the view point of the behavioral aspect of executive work, that is, these systems are aimed to meet executives' information and communication needs. The cognitive aspect of executive support has been largely ignored in the executive support system research. This dissertation focuses on the cognitive aspect of executive work and proposes a three-mode conceptual model for building an executive support system in understanding dynamic business environments and strategic problems. This research argues that information system support to business executives may be delivered through three modes: retrospective, introspective, and prospective. In line with the three modes, case studies, cognitive mapping, and scenario

building are proposed to be the vehicles for realizing the three types of support.

The proposed conceptual model is validated through building a computer prototype system and conducting subsequent multiple case studies involving real world business executives. The prototype computer system, implemented using Visual Basic programming language, comprises three major subsystems: case memory, mapping assumptions, and scenario generator. The results of the case studies demonstrated that the system could be a valuable tool in augmenting an executive's own memory and reasoning processes.

The contribution of this research consists of: (1) proposing a new way of designing an executive support system; (2) proposing a conceptual model for executive support systems; and (3) implementing a computer prototype system that embodies the conceptual model.

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My special thanks are due to my mother for instilling in me the virtues of perseverance and compassion. This dissertation is dedicated to my wife, Di Ma, who sacrificed herself toward our common goal. Without her endless love and support, the completion of my study would not have been possible. My son, Long (Little Dragon), deserves accolades for his sacrifices.

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CHAPTER I

INTRODUCTION

1.1 Background

The Executive Information System (EIS) has become a buzzword among practitioners and academicians in the area of information systems and decision support systems. In a survey conducted by the Center for Information System Research (CISR) at MIT, it was found that about one-third of large U.S. corporations had EIS programs installed or were developing such programs. The study showed that more than half of EIS systems were used by people with such titles as CEO, CFO, and COO (Turban, 1993). Frolick (1994) cited a study that states that by 1994, 25% of the world executives would use EISs. Rockart and Delong (1988) predicted that 25% of senior executives will use EISs by the mid-1990s.

The original idea of EIS is a computerized system that provides executives with easy access to internal and external information that is relevant to their critical success factors (Rockart and Treacy, 1982). Such a system should be very easy to use and flexible enough for accommodating executives' changing need and focus. This early approach to EIS is heavily oriented toward the data analysis aspect of executive support. Later, EIS was renamed as Executive Support System (ESS) to include broad system supports for communication, office automation, and

word processing needs (Bullen and Bennett, 1983; Rockart and De Long, 1988). In the literature the terms EIS and ESS are used interchangeably.

The above mentioned data analysis, communication aspects of executive support have, more or less, been successfully implemented in today's many commercial systems. At the same time, both practitioners and researchers have started to realize that so-called executive information systems intended for top executive use also bring the meaningful answers to not-so-top managers. For example, an EIS provides valuable support for many line managers. Some begin to speak of EIS as "Everyone's" Information System (Frolick, 1994). This may imply that real decision support for top executives is of a different nature than that provided by most of today's EISs and DSSs.

A business executive plays a crucial role in an organization, especially in today's highly competitive and dynamic business environments. King (1985) argues that the most important role of the CEO is to create a vision for the organization's future and to lead the organization toward it. In a similar vein, Senge (1990) argues that the leaders' roles in a learning organization dramatically differ from that of the charismatic decision maker. Contrary to the traditional views of leaders, being the captains and the heroes, he believes that leaders in learning organizations are designers, teachers, and stewards. These roles require new skills: the abilities to

envision future state of business environments, the abilities to build shared vision, to bring to the surface and challenge prevailing mental models, and to foster a more systemic pattern of thinking.

Executive Information Systems or Executive Support Systems are directed at supporting these roles of executives. There are few empirical studies on how well current EISs or ESSs support these executive roles. But King (1985) pointed out that the current computerized support system does little to support the vision and leadership roles that is so critical to corporate success. Turban (1990) cites the following statement by Execucom System Corporation (Austin, TX) about current EISs:

Because EIS serves only the top executives, it does little to improve coordination and control except through the indirect effect of focusing attention throughout the organization on the executive's "critical success factors." The most severe shortcoming of an EIS, however, is that it only helps the executives understand where the organization is today --- it does very little to help them visualize where it can be in the future. It delivers information, but not intelligence. [pp. 367; emphasis added].

Frolick (1994) also stated that many earlier EISs failed because executives often felt their thinking could not be supported by computers, and that information provided by the EISs was too limited. Based on his consulting experience, Crockett (1992) thinks that one of the problems of current EISs is their lack of support for executives to find solutions to their problems. He cites that many CEOs complain that they know more about their companies' problems than they want to know --- what they need are solutions. As Rockart and De Long (1988) observed, in recent years, a deep understanding of the roles of senior executives, together with increased empirical evidence of the use of EIS, has underscored the fact that the data-driven, analysis-oriented perspective of EIS is far from sufficient and much more should be involved.

There is a need for information system researchers to rethink the way in which computerized systems can better serve top executives' needs. This conclusion is supported by the following observations: (1) Today's business executives face a highly dynamic and competitive business environments, which is very different from the one a decade ago. Their requirements for information system support are different due to the new challenges they are facing. Traditional behavior-oriented IS support should be augmented by cognitively-oriented support. This is the major motivation of this dissertation. Further discussion on the cognitive approach will follow in the next section. (2)

Advances in computing hardware and software technologies have broadened the avenues for IS support to top executives. For example, the multimedia technology (an integration of video, audio, and text technologies) will have a fundamental impact on executive support (Frolick, 1993; Minch, 1990).

(3) New findings in management, information systems, cognitive science, and executive studies provide new insights in executive support.

1.2 EIS Paradigm Shift

The field of Decision Support Systems is currently undergoing a "paradigm shift." A paradigm shift is a radical change in a field's approach to its subject matter, its methods and its interpretation of findings (Kuhn 1962). This shift seems to be the change from a behavioral perspective to a cognitive perspective (Yadav and Khazanchi, 1992; Carlson and Ram, 1990; Ramaprasad, 1987; Zmud, 1986; Young, 1983).

DSS/EIS research traditionally has focused on the IS support for the behavioral aspects of decision making as well as extensions of the analytical capabilities of decision makers. With the paradigm shift, the research is also shifting toward providing support for the cognitive aspects of decision making. This change is especially significant for top executive support because cognitive orientation or a mental model of an executive plays a very important role in his or her understanding of business

environments and ill-structured problems. Some scholars argue that the primary difference between top executives and middle managers is in their cognitive approaches to work (Rockart and De Long, 1988, pp. 50).

The cognitive approach to system design focuses on the process by which executives understand, interpret, store, and retrieve information. A "mental model" is an important concept in understanding the cognitive process. Roughly speaking, "mental models" are deeply ingrained assumptions, beliefs, generalizations, or even pictures or images that influence the way people understand the world and how they react to external stimulus (Senge, 1990). A formal treatment of mental models will be given in Chapter II.

When an executive must make an unstructured decision, he or she generally uses his or her "hunch" or "intuition" to make a judgment. Such a judgment is based on his or her mental models although he or she may not be consciously aware of the existence of such mental models or the effects they have on the judgment. In fact, some researchers have reported that,

...beliefs are ... a powerful constraint on the options the executives will consider and the decisions they make ... these beliefs can be so powerful a constraint that top management may miss opportunities presented by actual or potential changes in the

objective constraints. [Donaldson and Lorsch, 1983, pp. 10].

Thus, it seems reasonable that an attempt to aid executives from the cognitive perspective should be one of the primary objectives of providing information system supports to executives.

1.3 Problem Statement

Business executives play influential roles in determining the future directions and strategic orientation of an organization (Chaganti *et al.*, 1987). It is the executives' role to be aware of things, to make sense of things, and to translate these interpretations of the firm's internal and external environments into meaning, e.g., mission, strategy, and action, for organizational participants (Daft and Weick, 1984). Such a role becomes even more important in today's highly competitive global economy.

Therefore, an executive's ability to understand the business environments and to recognize important events, trends, and their relationships are crucial to an organization's success. Research has shown that an executive's understanding of business environment highly depends on his or her mental models of the world (Mintzberg, 1973; Daft and Weick, 1984; Ford and Hegarty, 1984; Huff, 1990). Executives' decision-making is heavily influenced by

the assumptions and beliefs that (s)he holds about the world around him or her.

The real world is changing rapidly while one's mental model of the real world may stay relatively stable. This discrepancy between mental models and reality creates blindspots which prevent executives from seeing the major shifts in the marketplace. Such blindspots have caused many giant corporations, such as IBM and Sears, to fall (Gilad, 1994).

Traditional Executive Support System research has been primarily concerned with the behavioral aspect of executive work and has largely ignored the cognitive aspect of executive support. This research is an investigation into the cognitive aspects of providing IS support to executives for a better understanding of the complex business environment. In other words, this research attempts to resolve issues that impinge upon the design of an executive support system which can provide the requisite capabilities to support an executive's "thought process" (Zmud, 1986). Thus, the dissertation addresses four research issues:

- (1) What cognitive limitations might distort an executive's objective understanding of business environment?
- (2) What type of executive "thought" support might overcome these limitations?
- (3) Can a conceptual model be developed that incorporates a cognitive perspective of executive support?
- (4) Can a prototype computer model be built to provide this