2000

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***Abstract*-A major Executive Support Systems (ESS) design problem is determining ESS requirements. We present the CESS method as a guide for ESS design - with a primary focus on ESS requirements determination and how requirements can be fulfilled using information and communication technologies. The method builds on Quinn and associates´ competing values model of organizational effectiveness and current ESS knowledge. CESS can guide ESS designers in designing ESS that support different managerial roles, i.e. the development of ESS that support managerial cognition and behavior.**

I. Introduction

Executive Information Systems (EIS) and Executive Support Systems (ESS) is a major Information Systems (IS) topic. As far as we know, EIS was first launched as the name of a specific computer-based information system [39]. Today, EIS and ESS are established as generic labels or categories of computer-based systems that are supposed to be used by, or at least to support, executives and top-managers. EIS and ESS are sometimes used interchangeably. However, ESS usually refers to a system with a broader set of capabilities than an EIS [49], for example, an ESS can include electronic communications, modeling capabilities and organizing tools. Throughout this paper we will primarily use ESS to denote both EIS and ESS - today the line between EIS and ESS is very blurred.

Studies suggest that a major problem in ESS design and development is requirements specification [58]. Studies also show that a legitimate need is a key to ESS success [9, 21, 58]. At the same time there has been a number of ESS failures. This paper addresses the issues and problems in ESS design in a novel way. In doing so we build on three postulates.

First, ESS is not a particular technology in a restricted sense, but primarily a perspective (vision) on executives and executive work, the role of information and communication technologies (ICT) and computer-based systems as executive support systems and how to realize this vision in practice. There is room for different perspectives on ESS and obviously also room for different ESS design approaches and methods. But as noted by Walls et al. [56] there exist little theoretical work that directly guides ESS design. The CESS is based on a well-established theory and model: the competing values model [47].

Second, it is a misconception to think of ESS as systems that just provide top-managers with information. Part of the problem lies in the use of the word information. ESS are systems that do more than provide information. ESS are systems that should support managerial cognition and behavior - providing information is only one of several means.

Third, effectiveness is a critical construct in Information Systems (IS) research and practice. Improved effectiveness is often claimed as a desired end for many computer-based information systems. CESS is based on the CVM, which has an effectiveness perspective.

The remainder of the paper is organized as follows. The next section discusses approaches for the design and development of ESS. This is followed by a presentation of the competing values model (CVM) and how the model can form the basis for an ESS design method. Section 4 presents CESS and how it can be used as a guide in ESS design. The final section presents conclusions and recommendations for further research.

II. Approaches for the Design and Development of ESS

There exist a large number of different methods and methodologies for the design and development of computer-based information systems [2] - Jayaratna [30] estimates that there are more than 1.000 ‘brand name’ methodologies worldwide. Fitzgerald [21] and Watson et al. [58] point out that there, for good reasons, are differences between traditional systems development methods and ESS development methods. After reviewing a number of IS development methods, Fitzgerald [20] suggests that new methods are needed and that they can be based on, for example, current management and organizational theories. This paper presents an ESS design method based on a current management theory and model.

An issue in the design and development of ESS is related to the relationships between designers, users, and other stakeholders. In general, the writings on IS development recommend that users should be involved in the design process. A problem often encountered in ESS development is that the users (top-managers) have very limited time for participating in the development process [19, 20, 38, 58]. A way out of this problem is to develop ESS design methods that are based on recent management models and theories. Such methods can support ESS designers in their design work and enhance communication with the users. Before presenting the underlying theory and model of CESS, we review some of the current ESS design and development methods.

In a study focusing on the ESS methods used by organizations in the US, Watson et al. [58] found that only two formal methods were used, namely: the critical success factors method (CSF) and the strategic business objectives (SBO) method.

The critical success factors (CSF) method can be used to identify executives´ information needs [48]. Critical success factors are "...the few key areas of activity in which favorable results are absolutely necessary for a particular manager to reach his goals" [4]. The CSF method was extended to include critical decisions and critical assumptions [27]. Critical decisions (CD) are the decisions or decision processes that directly affect the success or failure of the CSFs. Critical assumptions (CA) are the assumptions that lead a manager to believe that the CSFs are valid. An ESS should provide information and support related to the CSF, CD, and CA. Lu and Wu [35] presented the IDEAL method for ESS development. The method builds on CSF and critical success actions (CSA). CSA concern the decisions of actions, i.e. what to do if a particular CSF goes wrong.

Volonino & Watson [55] proposed a strategic business objectives (SBO) method. The SBO method derives executive information needs from an organization's objectives and the organization's critical business processes. SBO consists of six steps; the early ones being: identify an organization's strategic business objectives; identify business processes that are critical to the business objectives; prioritize strategic business objectives and critical business objectives; define information needed to support the critical business processes.

Walls et al. [56] proposed a theory for designing vigilant ESS. A vigilant ESS is an information system that helps "...an executive remain alertly watchful for weak signals and discontinuities in the organizational environment relevant to emerging strategic threats and opportunities." [56]. Walls et al. also described an information requirement determination method called the "Critical Attention Tracker".

The above methods build in part on management and executive literature. They focus primarily on identifying information needs and especially monitoring information. Although, they can be useful, they have one major limitation. Since they to a large extent focus on information needs they are not complete in generating suggestions for use of ICT for supporting top-managers. We suggest that focus should be on managerial roles and an ESS design method should address how the roles can be supported by ICT.

The approach we took in developing CESS was to review some of the descriptive and prescriptive management and executive literature. The assumptions was that the review should point to areas in which ICT can logically aid top managers and executives and that it should be possible to develop an ESS design method based on the literature. Rockart and De Long [49] have recommended such an approach. The theory and model we will use build on the work of Robert Quinn and associates. The main reasons for using their work were that:

- They present a comprehensive framework/model of executive and top-management work and in their work there is a strong link between theory and empirical studies.
- They address the link between how managers perform their managerial roles and performance (effectiveness).
- Their framework/model can be used to understand how ICT can be used to support top-managers and executives.

The next section presents the competing values model (CVM).

III. The Competing Values Model and ESS Design

Organizational effectiveness is one of the foundations of management and organization theory, research, and practice [7, 34]. CVM was, in part, developed to clarify the effectiveness construct [42, 45, 46]. The CVM perceives organizations as paradoxical [5, 44], and it suggests that to achieve high performance requires an organization and its top-managers to simultaneously perform paradoxical and contradictory roles and capabilities [26]. The CVM of organizational effectiveness incorporates three fundamental paradoxes acknowledged in the literature: flexibility and spontaneity vs. stability and predictability (related to organizational structure); internal vs. external (related to organizational focus); and means vs. ends [42, 46].

Quinn and Rohrbaugh [46, 50] found that most measures of effectiveness reflect one of four organizational models: internal process model (IP), rational goal model (RG), open systems model (OS), or human relations model (HR). The four models provide competing views on the meaning of organizational effectiveness. The human relations model is characterized by a focus on internal flexibility to develop employee cohesion and morale. It stresses human resource development, participation, and empowerment. The internal process model is characterized by a focus on internal control and uses information management, information processing, and communication to develop stability and control. The rational goal model is characterized by a focus on external control and relies on planning and goal setting to gain productivity and accomplishment. The open systems model is characterized by a focus on external flexibility and relies on readiness and flexibility to gain growth, resource acquisition, and external support.

The CVM points out the simultaneous opposition in the criteria that organizational members use to judge effectiveness. An organization does not pursue a single set of criteria. Instead an organization pursues competing, or paradoxical, criteria simultaneously. Organizations are more or less good in pursuing the criteria, and, according to the CVM, organizations differ in their effectiveness [15].

Quinn [42, 47] translated the construct of effectiveness into managerial roles - two for each of the four organizational models. In the monitor role (IP) a manager collects and distributes information (mainly internal and quantitative information), checks performance using traditional measures, and provides a sense of stability and continuity. In the coordinator role (IP) a manager maintains structure and flow of the systems, schedules, organizes and coordinates activities (logistic issues), solve house keeping issues, and sees that standards, goals and objectives, and rules are met.

In the director role (RG) a manager clarifies expectations, goals and purposes through planning and goal setting, defines problems, establishes goals, generates and evaluates alternatives, generates rules and policies, and evaluates performances. In the producer role (RG) a manager emphasizes performance, motivates members to accomplish stated goals, gives feedback to members, and is engaged in and supports the action phase of decision making.

In the innovator role (OS) a manager interacts with the environment, monitors the external environment (environmental scanning), identifies important trends, is engaged in business and competitive intelligence, develops mental models, convinces others about what is necessary and desirable, facilitates change, and shares ”image and mental models.” In the broker role (OS) a manager obtains external resources, is engaged in external communication, tries to influence the environment, and maintains the unit’s external legitimacy through the development, scanning, and maintenance of a network of external contacts.

In the facilitator role (HR) a manager fosters collective efforts, tries to build cohesion and teamwork - building the ”trustful organization”, facilitates participation and group problem solving and decision making, pursues ”moral” commitment, and is engaged in conflict management. In the mentor role (HR) a manager is engaged in the development of employees by listening and being supportive, is engaged in the development of individual plans, and gives feedback for individual and team development.

After Quinn and Rohrbaugh´s initial studies, research on CVM has proceeded. This research shows that the CVM has utility as a general framework for organization and management research and practice. The CVM has also been used in the IS field - see, for example, Carlsson and Widmeyer [10], Sääksjärvi and Talvinen [53], Järvinen [31], and Carlsson and Leidner [8].

Research suggests that effective executives and managers are capable of balancing and performing contradictory and complex roles [25, 26]. Some studies have tried to explain why some executives are considered more successful than others are [42]. Research suggests that it is possible to link executive behavior to firm performance; for example, Hart and Quinn´s [26] study suggests that executives having the ability to play multiple and competing roles produce better firm performance, especially with respect to organizational growth and innovation (business performance) and organizational (stakeholder) effectiveness. Denison et al. [15], in a contingency-based study, empirically tested the CVM and the associated roles. They found support for the model and the roles, especially for managers that were considered high performing. Denison et al.’s study led them to define effective leadership as ”...the ability to perform the multiple roles and behaviors that circumscribe the requisite variety implied by an organizational or environmental context.”[15] - the notion of requisite variety is taken from Ashby [1].

Based on the CVM and Denison et al.’s definition of effective leadership, we define an ESS to be effective to the extent that it is used by a manager in such a way as to support the manager in his different managerial roles, and support managerial cognition and behaviors that circumscribe the requisite variety implied by the organizational and environmental context. Our definition of effective ESS is based on a contingency view and postulates: 1) there is no best ESS, and 2) any ESS is not equally effective. The first postulate means that we can not say that a specific ESS, with certain capabilities and characteristics, is the best ESS in all situations. The second postulate means that in a specific situation all ESS are not equally effective. It is possible to differentiate between ESS in terms of their effectiveness.

Hence, the goal of CESS is to be a guide in ESS design and should lead to the development of ESS which when used will lead to increased effectiveness - according to the definition of an effective ESS.

IV. The CESS for Guiding ESS Design

Before presenting CESS a few things about the method have to be clarified. Watson et al.’s [58] study (see Section 2) showed that in most cases a number of different ”non-formal” methods and techniques were used along with formal methods in ESS development; ”non-formal” methods include, for example, discussions with support personnel, attending meetings in order to enhance the understanding of what information executives need - this mix of formal and non-formal methods was also noted by Fitzgerald [21]. Avison and Fitzgerald [2] and Fitzgerald [20] point out that the search for the ”grand” - and rigid - design methods might be over, and the best we can do in some cases is to develop methods that can be used as guides and to develop methods suitable for specific types of systems.

Based on the above, the CESS should primarily be perceived as a method for guiding ESS design and in most cases the method has to be supplemented with other formal and non-formal methods and techniques.

A. CESS

Our CVM-based ESS design method (CESS) is depicted in Fig. 1. The method starts with the choice of executive situation, scouting and entry phase. It includes how to set up

the ESS design project and finding sponsors and champions. The importance of this phase is stressed in the ESS literature and since there exist a good body of knowledge on these issues we will not address the phase here - the reader is commended to consult Watson et al. [58], Rockart & De Long [49], Fitzgerald [21], and Fitzgerald & Murphy [22] on these issues.

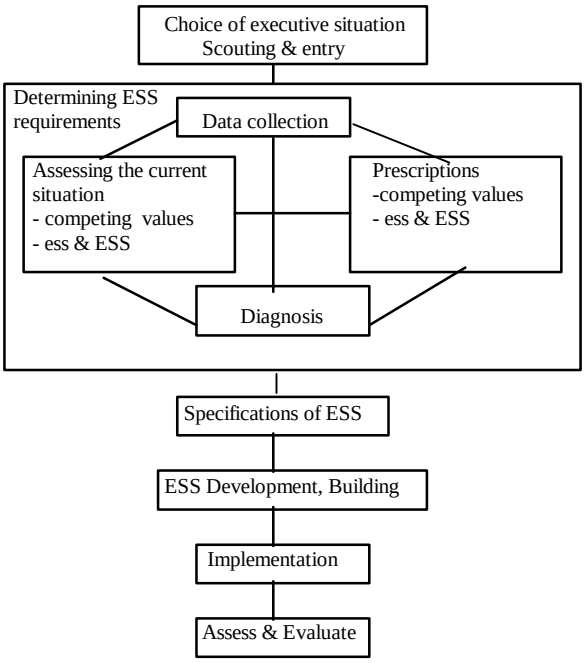

Fig. 1. The CESS method

The second phase (determining ESS requirements) consists of data collection, assessing the current situation, diagnosis, and prescriptions. The third phase includes the technical specification of the ESS, which is followed by the building phase. We, as well as other ESS writers, have found it useful to use prototypes and to develop ESS iteratively. The fifth phase (implementation) includes implementing the ESS, i.e. putting the ESS in the hands of the top-managers. It also includes education/training and especially for new users a hot-line (in some cases available on a 24 hours basis). The final phase is evaluation, which in most cases bring us back to the second phase. Although, the figure shows a straightforward process, there are in most cases iterations between the different phases.

In the next sections we focus on the second and third phase, since these are the strengths of CESS and also probably the most critical phases in ESS development [57, 58, 59].

B. Determining ESS requirements

This phase consists of four activities. The collection of data in order to assess the current situation, to be able to diagnose, and to prescribe desired changes.

Assessing the current situation

Assessing the current situation includes: 1) assessing the competing values and what managerial roles are performed (played), and 2) assessing the ess (non-computer based systems) used, and if a computer-based system (ESS) is used assessing the use of that.

In order to assess the current situation, different instruments developed and tested by Quinn and associates can be used [6, 42, 47]. By using the instrument it is possible to assess what different managers perceive as the effectiveness constructs, which roles they perceive as critical, and how much effort they are putting into the different roles. In using CESS, we have, for example, used the ”competing values leadership instrument: self-assessment” [42]. This instrument captures a manager’s perception of what roles he is playing and to what degree. We have also used the ”competing values leadership instrument: extended version” [42]. This instrument consists of 32 questions (behaviors) and a person completing the instrument has to, on a 7-point scale, respond to how frequently the person performs a specific behavior today and how often the behavior should be performed. The ”competing values organizational effectiveness instrument” [42] has also been used - this instrument measures perceptions of organizational performance. The results can be presented for individual managers or as a summary of individual managers’ perceptions.

In part, due to the problem of involving users (top-managers) in the design process, we have developed a supplementary way to identify the requirements for managerial behavior and cognition. Following the definitions of effective management and effective ESS, requirements for managerial behavior and cognition can be ”derived” from an organization’s external and organizational context. Carlsson and Leidner [8[present three contextual characteristics that can be used to identify requirements for managerial behavior and cognition: organizational environment, organizational strategy, and organizational structure. They use the following characteristics: 1) for the external environment: turbulence, competitiveness, and complexity - adapted from Huber et al. [29], 2) for the strategy: prospectors, defenders, analyzers, and reactors strategy - adapted from Miles and Snow [37], and 3) for the organizational context: centralization of decision making, standardization of procedures, specialization of functions, and interdependence of organizational units and processes - adapted from Huber et al. [29]. The model presented by Carlsson and Leidner has been used to identify the requirements for managerial variety.

The purpose of assessing ess and ESS use is to assess how ess (non-computer-based systems) and ESS are used by the top-managers. Using the CVM we can identify four ideal ess/ESS subtypes. For ESS we have named them ESS-IP, ESS-RG, ESS-OS, and ESS-HR (Fig. 2). A specific ESS is a combination of the four subtypes and has to a larger or smaller extent characteristics of the four subsystems. Here it

is crucial get perceived use and usefulness in relation to effectiveness constructs and managerial roles - this can be supplemented by logging actual use of the ESS.

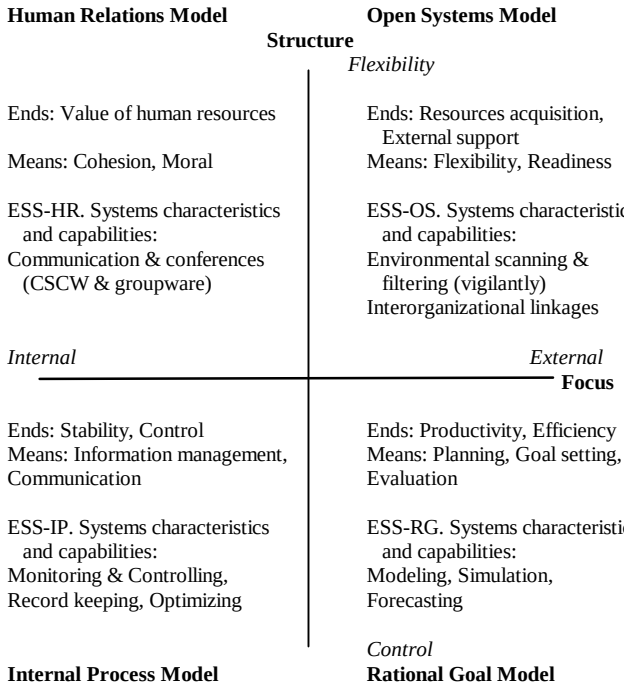

Fig. 2. Competing values model and systems characteristics and capabilities

The first subtype (ESS-IP) supports the internal process model and the associated managerial roles; it has an internal and control emphasis. The ends for ESS-IP are stability and control. Most functional and cross-functional quantitative CBIS can be used as ESS-IP. Traditional accounting information systems and production systems are good examples of systems used for supporting the IP-model. In most cases the ESS-IP can be built ”on top of” transaction-based CBIS (operational systems). Studies suggest that many ESS are built on top of existing internal CBIS [58] and most of these are closely associated with the IP model. From an executive’s point of view the performance objective of ESS-IP is to provide user-friendly support for control and monitoring processes.

The second subtype (ESS-RG) has an external and control emphasis. ESS-RG should support a manager in handling semi-structured problems. Examples of ESS-RG capabilities and features are what can be found in ”traditional” Decision Support Systems (DSS), i.e. support for goal setting, forecasting, simulations, and sensitivity analyses. Although many DSS have an individual focus, DSS can also be group-oriented (GDSS) and support executive teams in strategic planning processes.

The third subtype (ESS-OS) has an external focus and an emphasis on structural flexibility. ESS-OS supports an executive in identifying problems and possibilities by support for environmental scanning, issue tracking, and issue probing. Environmental scanning can be quantitative or qualitative oriented and can include: industry and economic trends, legislative issues, competitor activities, new product and process development, patents, mergers and acquisitions, alliances, national and international events.

The ESS-HR subsystem helps an organization and its executives in the development of the human capital of the organization. ESS-HR capabilities and features of importance are similar to what can be found in Computer Supported Cooperative Work (CSCW) systems and groupware. ICT, like e-mail, voice mail, and videoconferencing can be used in ESS-HR to overcome distance and time.

The above has been used in developing in a number of instruments that can be used to assess ess and ESS use - the instruments are ideal instruments that have to be adapted to a specific context. The instruments - 16-32 questions and 5/7-point scale - are used to have individuals to assess how frequently they use ess/ESS for performing specific behaviors (managerial roles) and the person’s perceived value of the support (the ess/ESS). We have also in some cases asked the respondents to answer questions about an ideal situation.

Using the instruments and other in-formal methods and techniques it is possible to assess the current use of ess and ESS and the perceived usefulness.

Diagnosis and desired changes (prescriptions)

A good fit between the current situation and the desired situation (i.e. the managers see no need for a change and the support they receive is good) means that there is no need for a new ESS. But, it is still possible to discuss the design of an ESS, but the primary purpose of the ESS would be to improve the efficiency - the ESS will primarily reinforce and improve the current state (ESS as a personal tool).

If there is a misfit between the current situation and the desired situation or there is a misfit between current support and desired support, then there is a possibility to develop an ESS. In this case the ESS will be used as a means (tool) for focusing organizational attention and learning as well as a means for organizational change (9, 58, 54].

The result of the diagnosis phase will be recommendation concerning how the competing values should be changed and how an ESS should support the different managerial roles in the future. The result will be used in the next phase.

C. Specification of ESS

The output of phase two is desired changes. In the Specification of ESS phase these will be transformed into ESS specifications. That is, taking the requirements and specify ESS characteristics and capabilities. This will later on lead to the development of an ESS and hopefully when the managers use it will lead to that the desired changes are fulfilled.

We now discuss how ESS can support the different managerial roles by looking at ESS capabilities and ESS

information content. Although we propose how ESS can support different managerial roles it is not an ESS's capabilities and information characteristics that will determine the system's effectiveness, but how the capabilities are actually used by managers in their different roles. It should also be noted that new ICT that can be used for ESS will constantly hit the market and technologies will continue to change and evolve rapidly.[a]

To discuss the usefulness of ICT for ESS we use an ICT typology. There are several different ways to classify ICT (23, 24, 28]. Here we adapt the classification presented by George et al. [24]. They describe seven different ICT. There are no clear boarders between the different types of technologies and a specific ESS has features from more than one type of ICT.

The first type is communication technologies, which is ICT used to foster and support team, organization, and inter-organizational communication. The second type is coordination technologies, which is used to coordinate resources, projects, people, and facilities; for example to ensure that there is a synchronization of tasks and activities both horizontally and vertically. The third type is filtering technologies, which are used to filter and summarize information. The fourth type is decision making technologies and techniques. This type is used to improve the effectiveness and efficiency of decision making processes. The fifth type is monitoring technologies, which is used to monitor the status of organizational activities and processes, industry trends, etc. The sixth type is data/knowledge representation technologies, which is used to represent and store data, text, images, animations, sound, and video. The seventh type is processing and presentation technologies which is ICT used to process data and present information. Fig. 3 suggests the extent to which each of the seven ICT can be useful in building the different ESS subsystems.

ESS subsystem / Model: / **Building components** / ESS Type:	Internal process ESS-IP	Rational Goal ESS-RG	Open Systems ESS-OS	Human Relations ESS-HR
Communication	**	**	**	***
Coordination	***	**	*	***
Filtering	***	**	***	*
Decision making	**	***	*	**
Monitoring	***	**	***	**
Data/knowledge representation	**	***	**	*
Processing & presentation	**	***	**	**

Key requirement: *** Somewhat useful: ** Little use: *

Fig. 3. ICT technologies for the four ESS subsystems.

For ESS-IP the key capabilities are: 1) monitoring the status of organizational activities and processes, 2) filtering and summarizing critical information, and 3) support for coordination of resources, projects, people, and facilities.

Monitoring support can be provided by using "standard" ESS software to build ESS for status access and exception reporting and enhanced with structured or free wheeling drill down capabilities. ESS can also include the use of data warehouses, multidimensional databases, and OLAP (On Line Analytical Processing) which, for example, can give a manager the ability to slice and dice a multidimensional database (datacube). The Web browser is becoming an almost universal interface. The browser can be used to integrate an ESS with the organization's intranets. An increasing number of ESS software packages are developed to be Web-ready. This means that OLAP on data from a data warehouse or a multidimensional database can be directly accessed via the organization's intranet. In general, these changed and new capabilities make it possible to use traditional internal control systems more actively and in an ad hoc manner.

Filtering support can be provided by using technologies for filtering and summarizing information from internal information sources. If an organization uses a data warehouse or data marts filtering can be done in the "extract, transfer, load" process and in the "analysis and presentation" process. In order to enhance this software agents and push technology can be used.

Coordination support, for example, to ensure that there is a synchronization of tasks and activities both horizontally and vertically, can be provided by project management tools, electronic calendars, and workflow management systems. It is possible to use information generated in a workflow management system to assess the workflow.

Top-managers in organizations living in increasingly turbulent environment are likely to increase their use of internal real-time information [3, 18]. Traditional ESS are often based on financial data, but many organizations are rethinking their performance measures [16]. There is a shift from treating financial figures as the foundation for performance measurement to treating them as one among a broader set of measures [32]. Performance measures related to quality, customers, learning and growing, and even intellectual capital are increasingly used by companies. Balanced Scorecard (BSC) software has been launched by a number of companies and BSC will probably be a standard feature of ESS software and Enterprise Systems (ES). ES can in part fulfill new information requirements.[b] Alternatively, ES make it possible to in a simple way pipeline data from the enterprise system to, for example, a data warehouse that are

[a] See Power and Kaparthi [41] for a recent review of the changing technological context of DSS and ESS or visit the DSS-page at URL http://dssresources.com

[b] An enterprise system - also referred to as enterprise resource planning (ERP) - enables an organization to integrate the data used throughout its entire organization. Some ES have rudimentary tools for developing ESS. It should be noted that an ES in part imposes its own information logic on a company [13].

used by an ESS.[c] In many cases this trend requires an organization's top-managers to become more actively involved in information ecology [11, 14].

For the ESS-RG three capabilities are key: 1) support for improving the effectiveness and efficiency of decision making processes, 2) data/knowledge representation, and 3) processing and presenting numerical data, text, images, animation, sound, and video. Capabilities found in traditional DSS and GDSS (Group DSS) can be used for generating and evaluating more alternatives, do simulations and quantitative analyses. Many of an executive's decisions are single shot decisions where, for example, decision analysis tools can be used to get consistent decisions. Decision making technologies could also be used to support team meetings. GDSS, if properly supported by group process techniques [17], can be useful as ESS [58]. GDSS can have tools for: electronic brainstorming, idea organization, voting, stakeholder identification and analyses [40].

For the ESS-OS two capabilities are key: 1) filtering and, 2) monitoring. Filtering techniques can be used to facilitate electronic communication applying artificial intelligence techniques to sort, distribute, prioritize, and automatically respond to electronic messages [52]. There is also monitoring and filtering techniques to be used for environmental scanning. These techniques include, for example, the use of intelligent agents and push technology for scanning the internet. An example of this is Comshare´s robot-based detect and alert system called NewsAlert that monitors internal and external data sources and delivers alerts to the desktops of managers and executives in the form of a personalized electronic newspaper [52].

For the ESS-HR two capabilities are key: 1) communication for fostering and supporting individuals and teams, and 2) coordination. Coordination technologies, like project management tools and calendars, can be used to manage and organize the execution of decisions and processes. A major purpose of ESS-HR is to help an executive communicate information that will motivate and allow organizational members to be creative within defined limits of freedom [51]. Communication technologies can be used to communicate: 1) basic values, purposes, and direction for organizational members, and 2) codes of business conduct and operational guidelines. For these purposes ICT like e-mail, videoconferencing, electronic documents, and multimedia can be useful. Although the media richness theory [12] suggests that technologies like e-mail is a lean media (compared to face-to-face), recent research suggests that lean media can be used in rich ways if an organization encourages and supports rich use [36].

The output of this phase will be a specification of what should be built.

[c] Although it from a technical perspective might be simple to pipeline the data, designing an adequate data infrastructure for a data warehouse is far from a simple task [33].

D. Some remarks and some tips

The CESS has been developed using a current management and executive theory and model and current ESS knowledge. It has in varying degrees been used in real applications, in executive programs, and it has been used in quasi-experimental lab studies. Over the years the method has been enhanced.

We have in the design process used ESS exemplars. Exemplars are descriptions of how different types of ESS can be used to support different managerial roles. The focus in the exemplars is on use and impacts of use and less on technical aspects. The use of exemplars seems to be useful.

We have used Decision Explorer (from Banxia) and GroupSystems (from Ventana) in the second phase. Decision Explorer has been used to identify and present "misfits" and to present and discuss remedies. GroupSystems has been used in lab studies to work through the first three phases, with an emphasis on the second and third phase. Both ways to use computer-based support seem to enhance the process and they both seem to be worthwhile to further explore.

Research suggests that there are changes in the criteria of effectiveness over an organizational life cycle [43]. Another emphasis change can be found with regard to management level [42]. Implications of these findings are that the importance and criticality of effectiveness criteria and managerial roles will vary over time as well as between managerial levels. This knowledge can (and should) be used when design an ESS.

V. CONCLUSION, DISCUSSION, AND FURTHER RESEARCH

The CESS method has been presented as a new guide for ESS design and development. The content of the method builds on Quinn and associates' competing values model and current ESS knowledge. The process of the method builds on prescriptions found in most ESS writings, for example, regarding the relationship between the ESS designers and the users (top-managers), the importance of having sponsors and champions, the iterative process, and the use of prototypes and exemplars.

Future research on CESS will include the development of better instruments and better support for the second and third phase (this includes the development of computer-based support). Future research will also include empirical studies addressing the relationship between ESS use and support for managerial cognition and behavior and how this is linked to individual and organizational performance. The result can improve our ability to design ESS and prescribe how ESS can be used to improve individual and organizational effectiveness.

REFERENCES

[1] W.R. Ashby *Design for a Brain*. New York: Wiley, 1952.

[2] D. Avison and G. Fitzgerald "Information systems development," in *Rethinking Management Information Systems*, W.L. Currie and B. Galliers, Eds. Oxford: Oxford University Press, 1999, pp. 250-278.

[3] L.J. Bourgeois and K.M. Eisenhardt "Strategic decision processes in high velocity environments: four cases in the microcomputer industry," *Management Science*, vol. 34, pp. 816-835, 1988.

[4] C.B. Bullen and J.F. Rockart "A primer on critical success factors," CISR Working Paper #69, Center for Information Systems Research, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA, 1981.

[5] K.S. Cameron "Effectiveness as paradox: consensus and conflict in conceptions of organizational effectiveness," *Management Science*, vol. 32, pp. 539-553, 1986.

[6] K.S. Cameron and R.E. Quinn *Diagnosing and changing organizational culture*. Reading, MA: Addison-Wesley Longman, 1998.

[7] K.S. Cameron and D.A. Whetten, Eds., *Organizational effectiveness: a comparison of multiple models*. San Diego, CA: Academic Press.

[8] S.A. Carlsson and D.E. Leidner "Appraising executive support systems: a competing values based approach," *Proceedings of the 5th European Conference on the Evaluation of Information Technology*, Reading, UK, pp. 11-24, 1998.

[9] S.A. Carlsson and D.E. Leidner "Impacts of ESS use on managerial behavior and cognition," working paper, Informatics, Lund University, 2000.

[10] S.A. Carlsson and G.R. Widmeyer "Conceptualization of executive support systems: a competing values approach," *Journal of Decision Support*, vol. 3, pp. 339-358, 1994.

[11] R. Cooper and R.S. Kaplan "The promise - and peril - of integrated cost systems," *Harvard Business Review*, vol. 76(4), pp. 109-119, 1998.

[12] R.L. Daft and R.H. Lengel "Organizational information requirements, media richness, and structural design," *Management Science*, vol. 32, 554-571, 1986.

[13] T.H. Davenport "Putting the enterprise into the enterprise system," *Harvard Business Review*, vol. 76(4), pp. 121-131, 1998.

[14] T.H. Davenport with L. Prusak *Information Ecology*. Oxford: Oxford University Press, 1997.

[15] D.R. Denison, R. Hooijberg, and R.E. Quinn "Paradox and performance: toward a theory of behavioral complexity in managerial leadership," *Organization Science*, vol. 6, pp. 524-540, 1995.

[16] R.G. Eccles "The performance measurement manifesto," *Harvard Business Review*, vol. 69(1), pp. 131-137, 1991.

[17] C. Eden and F. Ackermann *Making Strategy: The Journey of Strategic Management*. London: Sage, 1998.

[18] K.M. Eisenhardt and L.J. Bourgeois "Charting strategic Decisions in the microcomputer industry: profile of an industry star," in *Managing Complexity in High Technology Organizations*, Von Glinow and Mohrman, Eds., New York: Oxford University Press, pp. 74-89, 1990.

[19] B. Fitzgerald "Executive information systems without executives," in *Matching Technology with Organizational Needs, Proceedings of the Third Conference of the UK Academy for Information Systems*, D. Avison and D. Edgar-Nevill, Eds., Lincoln University, UK, McGraw-Hill, pp. 298-310, 1998.

[20] B. Fitzgerald "Systems development methodologies: the problem of tenses," *Information Technology & People*, forthcoming.

[21] G. Fitzgerald "Approaches to the development of executive information systems and the contrast with traditional systems development," in *Human, Organizational, and Social Dimensions of Information Systems Development*, D. Avison, J.E. Kendall, and J.I. DeGross, Eds., Amsterdam, North-Holland, pp. 339-351, 1993.

[22] B. Fitzgerald and C. Murphy "Executive information systems: separating fact from fallacy," *Journal of Information Technology*, vol. 9, pp. 288-296, 1994.

[23] J.F. George "The conceptualization and development of organizational decision support systems," *Journal of Management Information Systems*, vol. 8(3), pp. 109-125, 1991-92.

[24] J.F. George, J.F. Nunamaker, Jr., and J.S. Valacich "ODSS: information technology for organizational change," *Decision Support Systems*, vol. 8, pp. 307-315, 1992.

[25] S. Hart and C. Banbury "How strategy-making processes can make a difference," *Strategic Management Journal*, vol. 15(4), pp. 251-269, 1994.

[26] S.L. Hart and R.E. Quinn "Roles executives play: CEOs, behavioral complexity, and firm performance," *Human Relations*, vol. 46, pp. 543-574, 1993.

[27] J.C. Henderson, J.F. Rockart, and J.G. Sifonis "Integrating management support systems into strategic information systems planning," *Journal of Management Information Systems*, vol. 4(1), 5-24, 1987.

[28] C. Holtham "Improving the performance of workgroups through information technology," Working Paper, City University Business School, London, 1992.

[29] G.P. Huber, K.M. Sutcliffe, C.C. Miller, and W.H. Glick "Understanding and predicting organizational change," in *Organizational Change and Redesign*, G.P. Huber and W.H. Glick, Eds., New York, Oxford University Press, pp. 215-265, 1993.

[30] N. Jayaratna *Understanding and Evaluating Methodologies*. London: McGraw-Hill, 1994.

[31] P. Järvinen "On cultures and information technology applications in organizations," in *An Ethical Global Information Society*, J. Berlcur and D. Whitehouse, Eds., London: Chapman & Hall, pp. 203-214, 1997.

[32] R.S. Kaplan and D.P. Norton *The Balanced Scorecard*. Boston, MA: Harvard Business School Press, 1996.

[33] C.E. Koh and H.J. Watson "Data management in executive information systems," *Information & Management*, vol. 33(6), pp. 301-312, 1998.

[34] A.Y. Lewin and J.W. Minton "Determining organizational effectiveness: another look, and an agenda for research," *Management Science*, vol. 32, pp. 514-538, 1986.

[35] H.-P. Lu and C.-F. Wu "The IDEAL method for guiding ESS development," *Information Systems Management*, vol. 15(5): pp. 56-65, 1998.

[36] M.L. Markus "Electronic mail as the medium of managerial choice," *Organization Science*, vol. 5, pp. 502-527, 1994.

[37] R.E. Miles and C.C. *Snow Organizational Strategy, Structure, and Process*. New York: McGraw-Hill, 1978.

[38] J. Nandhakumar and M. Jones "Designing in the dark: the changing user-developer relationship in information systems development," *Proceedings of the Eighteenth International Conference on Information Systems*, Atlanta, GA, December 15-17, pp. 75–87, 1997.

[39] D.R. Nash "Building EIS, a utility for decisions," *Data Base*, vol. 8(3), pp. 43-45, 1977.

[40] J.F. Nunamaker, A.R. Dennis, J.S. Valacich, D.R. Vogel, and J.F. George "Electronic meeting systems to support group work," *Communications of the ACM*, vol. 34(7), pp. 40-61, 1991.

[41] D.J. Power and S. Kaparthi "The changing technological context of decision support systems," in *Context Sensitive Decision Support Systems*, D. Berkeley, G. Widmeyer, P. Brezillon, V. Rajkovic, Eds., London: Chapman & Hall, pp. 41-54, 1998.

[42] R.E. Quinn *Beyond Rational Management: Mastering the Paradoxes and Competing Demands of High Performance*. San Francisco, CA: Jossey-Bass, 1988.

[43] R.E. Quinn and K.S. Cameron "Organizational life cycles and shifting criteria and effectiveness," *Management Science*, vol. 9(1), pp. 33-51, 1983.

[44] R.E. Quinn and K.S. Cameron, Eds., *Paradox and Transformation: Toward a Theory of Change in Organization and Management*. Cambridge, UK: Ballinger, 1988.

[45] R.E. Quinn and J. Rohrbaugh "A competing values approach to organizational effectiveness," *Public Productivity Review*, vol. V(2), pp. 122-140, 1981.

[46] R.E. Quinn and J. Rohrbaugh "A spatial model of effectiveness criteria: towards a competing values approach to organizational analysis," *Management Science*, vol. 29, pp. 363-377, 1983.

[47] R.E. Quinn, S.R. Faerman, M.P. Thompson, and M.R. McGrath *Becoming a Master Manager*. Second edition, New York: John Wiley & Sons, 1996.

[48] J.F. Rockart "Chief executives define their own data needs," *Harvard Business Review*, vol. 57(2), pp. 81-93, 1979.

[49] J.F. Rockart and D.W. De Long *Executive Support Systems: The Emergence of Top Management Computer Use*. Homewood, IL: Dow Jones-Irwin, 1988.

[50] J. Rohrbaugh "Operationalizing the competing values approach," *Public Productivity Review*, vol. V(2), pp. 141-159, 1981.

[51] R. Simons *Levers of Control*. Harvard Business School Press, Boston, MA, 1995.

[52] R.H. Sprague, Jr., and H.J. Watson *Decision Support for Management*. Upper Saddle River, NJ: Prentice-Hall, 1996.

[53] M.M.T. Sääksjärvi and J.M. Talvinen "Evaluation of organizational effectiveness of marketing information systems-the critical role of respondents," *Proceedings of the 4th European Conference on Information Systems*, pp. 435-450, 1996.

[54] B. Vandenbosch "An empirical analysis of the association between the use of executive support systems and perceived organizational competiveness," *Accounting, Organizations and Society*, vol. 24, pp. 77-92, 1999.

[55] L. Volonino and H.J. Watson "The strategic business objectives method for guiding executive information systems development," *Journal of Management Information Systems*, vol. 7(3), pp. 27-39, 1990-91.

[56] J.G. Walls, G.R. Widmeyer, and O.A. El Sawy "Building an information system design theory for vigilant EIS," *Information Systems Research*, vol. 3(1), pp. 36-59, 1992.

[57] H.J. Watson and M. Frolick "Determining information requirements for an EIS," *MIS Quarterly*, vol. 17(3), pp. 255-269, 1993.

[58] H.J. Watson, G. Houdeshel, and R.K. Rainer, Jr. *Building Executive Information Systems and Other Decision Support Applications*. New York: Wiley, 1997.

[59] J.C. Wetherbe "Executive information requirements: getting it right," MIS Quarterly, vol. 15(1), pp. 51-65, 1991.