Senior Executive Information Behaviors and Decision Support: A Research Agenda

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Abstract. Business intelligence (BI) is currently the top technology priority of chief information officers (CIOs) and is a major growth area of business IT. BI systems are the IT-based systems that have the greatest impact on organizational strategy. Unfortunately, BI projects are subject to high failure rates and those that are implemented suffer from a utilization problem where only 10 to 20% of intended users actually use the systems. Most decision support systems (DSS) and BI research and practice treats managers as a homogenous group, but management research reports differences between senior executives and other levels of management, and individual differences between managers. This is a significantly more complex development environment than that assumed by current DSS and BI research. There are no specialist methods for analyzing the decision support requirements of senior executives. This paper discusses the rationale and design of a research project that uses a design-science strategy that aims to develop and test such a method. The method will be based on a sound understanding of senior executive information behaviors.

Keywords. Business intelligence, senior executives, information behaviors, decision support requirements, methodology, design science.

1. Introduction

Business intelligence (BI) is at the forefront of the use of IT to support management decision-making. Surveys by industry analyst Gartner report that BI has been the top technology priority for the last four years and that this ranking is likely to remain for some time [1, 2, 3]. The decisions made by senior executives using BI support are the most important IT-supported decisions in organizations, so important that they can “make or break” the organization.

Analyses of decision support systems (DSS) research have found that research on BI development and implementation seriously lags industry practice [4]. This means that there are few BI methods and predictive models that have been subject to rigorous

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1 This paper is based on a seminar held at the School of Information Systems, Curtin University of Technology, 16 July 2009.
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scientific development and evaluation. There is a strong need for such models and methods as the trade press has reported high BI project failure rates [5, 6]. Despite this, industry marketing material and sales workshops continue to make strong claims for the importance of BI and the success of vendor-supported projects. While BI vendors are making a strong pitch for the development of organization wide systems that are used by all levels of management, and even operational staff, their sales presentations continue to focus on strategic decision scenarios that are the responsibility of senior executives.

What is clear from industry presentations is that vendors and consultants do not have a clear understanding of the nature of senior executive work. This is also likely to be true of IT departments in organizations. They also do not have a method for determining senior executive decision support needs and use generic IS methods that were created for operational information systems (IS). The lack of a specialist method for specifying senior executive decision support requirements is accompanied with a lack of understanding of senior executive information behaviors. These behaviors include acquiring information, processing information, and using information. Senior executives operate in work environments and undertake decision tasks that are significantly different to those faced by other managers and operational workers in an organization. This means that they are likely to have significantly different information behaviors and significantly different decision support needs.

This paper presents a research project that aims to investigate the nature of senior executive information behaviors. Based on this understanding, the project will develop a method for specifying the decision support requirements of senior executives. The method should lead to significantly better decision support from BI systems. This paper is structured as follows: first, the research problem is discussed in more detail. The research design for the project that will target the problem is then presented. Finally, the project is assessed against the guidelines for IS design science proposed by Hevner, Mark, Park, and Ram [7].

2. The Research Problem

This section provides a discussion of the background of the research problem. It begins with an overview of research on senior executives and then discusses how DSS and BI research and practice has viewed senior executives. The section then addresses information behaviors theory and the BI utilization problem. The various strands of this discussion are then merged to provide a statement of the research problem.

2.1. The Nature of Senior Executives

The target population of this research project is senior executives, the most senior managers in an organization. In management research senior executives have also been called top managers, upper echelons, and managerial elites. Pettigrew [8] defined managerial elites as “position holders who carry labels such as Chairman, President, Chief Executive Officer, Managing Director, or inside or outside Director.” Hambrick, Finkelstein, and Mooney defined executive positions as including chief executive officers (CEOs), chief operating officers (COOs), and divisional presidents [9]. Senior executives have also been defined as “CEOs and their direct reports” [10, 11, 12], “vice presidents and above” [13, 14, 15], and “the top two tiers of an organization” [16, 17].
Management research has for some time understood that the work of senior executives is significantly different to that of other managers. The two seminal pieces of research in this area are Mintzberg [18] and Kotter [19]. Both Mintzberg and Kotter used intensive case studies of managerial work. In particular, they used diary studies of senior managers where researchers observed virtually every minute of executives’ work over significant periods, sometimes months. Mintzberg found that senior managers’ activities are characterized by brevity, fragmentation, and variety, a difficult environment for DSS development. He also identified ten interpersonal, decisional, and informational roles that senior managers undertake. Kotter developed a model of senior executive work based on setting agendas on major issues over various time horizons, developing a large network of people both internal and external to the organization, and then using the network to implement the agendas.

Following Mintzberg [18] and Kotter [19], research on senior executives has tended to focus on the nature, role, and processes of the top management team (TMT). Pettigrew [8] and Carpenter, Gelatkanycz, and Sanders [17] provide reviews of this work. Two of the major themes of TMT research are that the organization is a reflection of its senior managers and that the characteristics of the TMT matter more than that of the senior executives considered individually [20]. While most TMT research has focused on strategy formulation, Roberto [21] found that TMTs also perform critical monitoring and control functions, functions that can be supported by DSS and BI. He found that “team” is not a stable construct and that the membership of groups of senior executives that address various strategic issues in an organization can be volatile; also a difficult decision support environment. Katzenbach [22] argued that the TMT is not really a team at all and that most senior executives do not work collectively as a TMT. Noburn [23] in investigating the nature of TMTs found that the characteristics of CEOs are significantly different to other members of the TMT. As an alternative to the TMT model Arendt, Priem, and Ndofor [24] proposed the CEO-Adviser model of senior executive behavior that views the CEO as the ultimate strategic decision maker but someone who uses an extensive network of advisers to arrive at a decision. A consistent critique of senior executive research has been that few studies actually directly engage members of the TMT in data collection. Unlike the early studies of Mintzberg and Kotter, they tend to rely on archival and demographic data for their studies [8, 25].

2.2. DSS, BI and Senior Executives

Most, if not all, DSS and BI research assumes that managers are significantly different to operational workers. This understanding of managerial users can be traced to Keen’s specification of the nature of the DSS development environment [26]. Keen argued that for DSS:

1. Users don’t know what they want and analysts do not understand what users need,
2. The analyst and user cannot provide functional specifications,
3. Users’ concept of the task will be shaped by the DSS,
4. Users have the autonomy to tackle the tasks in a variety of ways.

This is a radically different environment to large-scale operational systems. The personal DSS approach to cope with this development environment is to use a rapid, evolutionary development approach [27]. The analyst builds a DSS and exposes the manager to the system. The use of the DSS helps both the manager and analyst explore
the information needs of the manager and make changes to the functionality of the DSS. While this approach of using multiple versions of a system to develop requirements works effectively for a small-scale personal DSS, it is more difficult to use with large-scale BI systems.

While DSS and BI research (and practice) acknowledges that managers are fundamentally different to operational staff, it unfortunately assumes that managers are a relatively homogenous group of workers; it ignores much of the management research discussed above. In adopting this homogeneity position DSS and BI researchers and professionals assume that managers have similar general patterns of decision-making and have similar patterns of information demands and behaviors. Further, there is an assumption that information demands and decision-making tasks are related to a particular managerial position or role and that BI should support a position and not a particular individual. This ignores individual differences in decision-making and the way that jobs are performed. These individual differences are likely to increase in importance the higher the position is in the organizational hierarchy. The author’s experiences with senior executives as DSS users in two design-science projects show that senior executives are significantly different users to lower level managers and operational staff [27, 28].

2.3. Information Behaviors

In attempting to understand the information behaviors of senior executives (how they acquire, process, and use information) there are number of theories that could be of assistance. One set of theories has addressed media or information channel selection. Various models have been developed including the influential media richness theory (sometimes called information richness theory) that is founded on economic or rational decision making principles [29, 30]. This theory has been strongly challenged by Markus [31] and Ngwenyama and Lee [32]. The latter study used critical social theory to reframe the phenomenon as communication richness.

Another set of theories has addressed how managers search for, and acquire, relevant information. This set can be termed environment scanning research and concerns how CEOs with limited cognitive resources scan their volatile and complex environments for relevant information [33, 34]. This research is unusual in management in that it has principally focused on CEO behaviors rather than managers in general. One useful construct for DSS and BI from environment scanning research is information specificity [35]. Information specificity occurs when the value of information is restricted to its use and/or acquisition by specific individuals or is restricted in its use and/or acquisition during specific time periods. For example, it may be that some information can only be acquired by senior executives themselves, while other information acquisition may be delegated. Some information may only be acquired at a particular time.

An appropriate theory for understanding senior executive information processing is cognitive bias theory. It is currently the dominant theory in behavioral decision-making [36, 37]. Cognitive biases are cognitions or mental behaviors that prejudice decision quality in a significant number of decisions for a significant number of people. The adverse effects of cognitive biases are strongest for difficult and novel decision tasks – precisely the decision environment of senior executives. Overcoming or reducing the negative effect of these biases can significantly improve executive
decision performance [38]. Bias theory is well known and accepted in management research [39, 40, 41] and has been used in research on DSS development [28, 42].

2.4. The BI Utilization Problem

BI usage rates have been low in the managerial ranks of organizations. This situation has been politely termed the “BI utilization problem” in industry workshops. The folklore of the BI industry is that 20% of users actually consume BI technologies, what has been called the 20/80 usage rule. However, industry research reports that the real usage level is actually much lower, approaching 11% [43].

There are a number of possible reasons for the BI utilization problem in organizations. Much of the problem could be a result of BI developers and IT departments not understanding the nature of senior executives and senior managers. Another reason for the low managerial uptake of BI is the view or philosophy of decision making inherent in most, if not all, BI tools. BI tools stress rational decision-making and quantitative analysis. Indeed, the recent sales pitches by vendors have been dominated by the provision of complex analytics. Unfortunately for this sales strategy, judgment not analysis is the dominant form of decision making for senior managers [41, 44]. Industry research supports this view and indicates that managers do not place much reliance on analytics in strategic decision-making [45].

2.5. The Research Problem

We are now in a position to combine the various streams of the discussion above. BI is the top technology priority of CIOs and is a major growth area of business IT. Vendors continue to focus on strategic decision processes in sales campaigns and IT departments are keen to engage senior managers in their organizations with BI projects. BI systems that support senior executives are arguably the IT-based systems that have the greatest impact on organizational strategy. Unfortunately, BI projects are subject to high failure rates and those that are implemented suffer from a utilization problem where only 10 to 20% of intended users actually use the systems. BI vendors and consultants do not have a sound understanding of senior executive work and decision-making and there has been relatively little research on managers and BI. Most DSS and BI research and practice treats managers as a homogenous group. One result of this situation is that we don’t have a coherent idea of the information behaviors of senior executives and can’t clearly articulate how they acquire, process, and use information for strategic decision-making. Senior executives work in an uncertain and stressful environment. The information they need is not always available from traditional information sources including operational IT systems, and may not be able to be provided by subordinates. Unfortunately, we have no methods for analyzing the decision support requirements of senior executives. Any effective method needs to be based on a sound theoretical understanding of senior executive information behaviors and must recognize the differences between senior executives and other levels of management and individual differences between executives.
3. Research Agenda

The goal of this research is to develop and test a methodology for understanding and specifying the decision support requirements of senior executives. This methodology will be based on a sound understanding of senior executive information behaviors. Such a methodology should lead to more effective BI systems and more effective strategic decision-making in organizations.

The research uses a design-science strategy [7, 46]. Design-science research creates and evaluates IT artifacts that are intended to solve identified organisational problems. March and Smith [47] defined four classes of IT design artifacts:

- **Constructs** – concepts that form the research domain’s vocabulary;
- **Models** – a set of propositions or statements expressing relationships among constructs;
- **Methods** – a set of steps used to perform a task;
- **Instantiations** – realized information systems.

This project involves a series of build-evaluate cycles [47] to arrive at a series of rigorously tested design artifacts. The overall project design is shown in Figure 1. As shown in the Figure, the project will progress through three major stages. Each stage is expected to take one to 1.5 years to complete.

![Figure 1. Overall Research Design.](image-url)
All three stages of this project involve the direct involvement of senior executives both in the laboratory and the field. As mentioned above, the major constraint on researching senior executives is access to participants: CEOs, presidents, chief finance officers (CFOs), COOs, vice-presidents, and directors. Another pragmatic constraint is that if research access to senior executive participants is possible, executives normally do not want to be studied by junior researchers and students, they want to interact with experienced senior researchers.

3.1. Stage 1 Research Design

The aim of the first stage of the project is to develop a framework for understanding senior executive information behaviors. This framework is a model artifact in the sense of March and Smith [47]. The research design for Stage 1 is shown in Figure 2.

The information behaviors framework will be informed \textit{inter alia} by the theory discussed in Section 2. The framework will also be informed by a single case study in a large complex organization. Four senior executives from a suitable organization, a
multinational corporation with many billions of dollars of annual revenue, have agreed to participate in the research.

Iivari [48] argues that design-science concepts and artifacts should be tested in the laboratory before undertaking expensive and time-consuming fieldwork. Such a strategy also increases the likelihood of the fieldwork yielding high quality results. In this project the laboratory approach that will be used is a series of focus groups. Three focus groups will be conducted, one with senior executives, one with middle level managers, and one with BI analysts. Middle level manager and BI analyst focus groups have been included in the design as these groups are responsible for providing senior executives with information. The participants will be provided with a draft of the Senior Executive Information Behaviors Framework. They will be asked for their opinions on the framework in a laboratory with observational facilities. The sessions will be video and audio recorded for analysis. Participants will be able to verify and request changes to the recordings.

The focus group and case study components of Stage 1 constitute observational design science evaluation [7, Table 2].

3.2. Stage 2 Research Design

Stage 2 of the project involves two processes that, together, will yield the primary design artifact of the research – a method for specifying the decision support requirements of senior executives. The design of Stage 2 is shown in Figure 3.

![Figure 3. Stage 2 Research Design.](image)

The first process is shown on the left hand side of Figure 3, it involves the validation of the senior executive information behaviors framework that was the output of Stage 1. The evaluation and validation of the framework will involve intensive case studies of senior executives. The case studies will be non-participatory observations of how the executives acquire, process, and use information. Each case study will observe
a single executive. These case studies will be similar in some ways to the diary studies of Mintzberg and Kotter. The executives that comprise the case will be chosen to reflect organization size, market sector, and personal seniority in a manner similar to that recently used by Mintzberg [49]. The framework will be changed at appropriate times during, and after, each case to reflect the insights obtained in the case. The number of cases will be determined using a theoretical saturation logic [46]. Under this strategy cases will be conducted until no major change to the framework is indicated by the case analysis. It is hoped that three or four cases will be sufficient. Kotter’s seminal study used six cases [19]. The outcome of this part of Stage 2 will be a rigorously evaluated information behaviors framework.

The second process of Stage 2 will combine the validated framework with DSS development theory [27, 28] to create a method for specifying the decision support requirements or needs of senior executives. While Figure 3 portrays this method development process in an orderly and linear fashion, it will most likely occur in parallel with the validation of the information behaviors framework.

3.3. Stage 3 Research Design

The final stage of the project involves the field-testing of the project’s primary design artifact – a method for specifying the decision support requirements of senior executives. The method will be evaluated using participatory case studies. Like Stage 2, the number of cases will be determined using a theoretical saturation logic. The cases will involve using the method in real BI development projects. The first participatory case study will involve the project researchers in specifying senior executive decision support requirements. A key aspect of at least one subsequent case will be to train business analysts who were not part of the research team to use the method and then work with them on the development project. A small panel of senior BI professionals will be used to evaluate the effectiveness of the use of the method in each case from an industry perspective.

4. Concluding Assessment

This paper has provided a discussion of the rationale and design of a three-stage research project that aims to address the BI utilization and failure problems by developing a rigorously validated method for specifying the decision support requirements of senior executives. Hevner et al. [7] specified a set of guidelines for the assessment of IS design-science research that have been widely accepted. The final part of this paper is to assess the project against the Hevner et al. guidelines. This analysis is presented in Table 1. The first column of the table identifies the seven guidelines. The second column provides a description of the guidelines in Hevner et al.’s words, and the third column assesses the project on each guideline. This assessment shows that the project has the potential to yield high quality design science outcomes.

<table>
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<tr>
<th>Criterion</th>
<th>Description</th>
<th>The Senior Executive Information Behaviors and Decision Support Project</th>
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Table 1. Assessment of the Project using the Hevner, March, Park, and Ram Guidelines.
Design as an Artifact
Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
The project will produce model, method, and instantiation artifacts. The principal artifact will be the senior executive DSS requirements method.

Problem Relevance
The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
The project addresses a research problem that is of significant strategic importance for organizations. It addresses the current top CIO technology priority.

Design Evaluation
The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Each stage of the project involves the rigorous evaluation of the project artifacts through focus groups, case studies, and expert panels. The project design also allows for the iterative improvement of the artifacts.

Research Contributions
Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
The primary contribution will be the DSS requirements method. The project will also make a contribution to the understanding of the role of multi-method research in IS design science.

Research Rigor
Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Particular attention has been paid in the research design in using an appropriate method for each part of the project. The main methods are literature analysis, focus groups, observational and intensive case studies, and participatory case studies.

Design as a Search Process
The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Each stage of the project involves iterations of theory building and artifact development. The degree of iteration will be determined using the principle of theoretical saturation.

Communication of Research
Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.
Papers from the project will be written for both high quality IS journals and professional management journals. The results will be presented at academic conferences and industry workshops.

References


P.G.W. Keen, Decision support systems: A research perspective, *The Data Base for Advances in Information Systems* 12, 12-25.


