



An ambidextrous perspective on business intelligence and analytics support in decision processes: Insights from a multiple case study



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ABSTRACT

Providing data-centric decision support for organizational decision processes is a crucial but challenging task. Business intelligence and analytics (BI&A) equips analytics experts with the technological capabilities to support decision processes with reliable information and analytic insights, thus potentially raising the quality of managerial decision making. However, the very nature of organizational decision processes imposes conflicting task requirements regarding adaptability and rigor. This research proposes ambidexterity as a theoretical lens to investigate data-centric decision support. Based on an in-depth multiple case study of BI&A-supported decision processes, we identify and discuss tensions that arise from the conflicting task requirements and that pose a challenge for effective BI&A support. We also provide insights into tactics for managing these tensions and thus achieving ambidexterity. Additionally, we shed light on the relationship between ambidexterity and decision quality. Integrating the empirical findings from this research, we propose a theory of ambidexterity in decision support, which explains how such ambidexterity can be facilitated and how it affects decision outcomes. Finally, we discuss the study's implications for theory and practice.

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1. Introduction

Data-centric decision support is vital for managerial decision making in organizational decision processes. Business intelligence and analytics (BI&A) equips analytics experts (i.e., analysts or data scientists) with the technological capabilities to support decision processes with reliable information and analytic insights [1–4]. The added value of BI&A is based on increasing the utilization of “data-driven” decision making and thus improving decision quality and organizational performance [5–7]. However, realization of these benefits is not assured, and the very nature of organizational decision processes poses challenges for effective BI&A support.

First, the reality of organizational decision processes has often been characterized as nonroutine and ill-structured [8–11]. In these situations, ambiguity prevails and the right questions are not always obvious at the outset. Rather, questions and solution alternatives are developed as part of the decision process and are subject to change [8,10]. As a consequence, data processing and analytics requirements can change frequently [12]. To achieve effective decision support in such nonroutine processes, the analysts who are involved must be able to adjust to these changes and, as a consequence, must maintain a high degree of adaptability and flexibility in their procedures.

Second, effective decision support with BI&A requires analysts to have a high level of specialization in analytics, which is different from the domain knowledge of decision makers, and this leads to further

challenges [13]. Specifically, a high degree of analytics elaboration often makes it difficult for decision makers to assess the quality of the analytic advice they receive, due to their lack of analytics knowledge [12,13]. Findings from the cognitive sciences suggest that such knowledge gaps induce information asymmetries, and these can lead decision makers to neglect analysts' advice and to instead overly rely on their own assessment of the decision situation [14,15]. To mitigate this risk, analysts are supposed to provide transparency and alignment with decision makers regarding their procedures and goals in deriving the analytic advice [16,17]. This means that analysts have to ensure the rigor of their procedures in order to achieve coherence and traceability in the decision support that they provide.

In summary, analysts face decision process requirements that appear to be conflicting, or at least difficult to achieve simultaneously. Failure to meet these conflicting demands can thwart the potential benefits of BI&A support. However, despite their critical importance for the success of BI&A support, prior research has not considered these conflicting demands and their implications for managerial decision making. Therefore, in-depth research on this topic is required in order to gain a better understanding of the challenges that analysts face in supporting decision processes with BI&A. Organizational ambidexterity describes the capability of managing conflicting demands and as such provides a useful theoretical lens for our research [18,19]. We use a multiple case study approach to investigate BI&A support of managerial decision making and thus respond to the identified need for research on actual decision processes [20–22].

This paper makes several contributions. (1) We characterize and present previously unexplored tensions that pose a challenge for analysts' ability to provide effective BI&A support in organizational decision processes. (2) We provide insights into the tactics that analysts use to

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successfully manage those tensions, i.e., tactics that facilitate ambidexterity. (3) Through an investigation of decision processes with varying levels of ambidexterity, we provide initial evidence concerning the effects of ambidexterity by examining its impact on decision quality as well as its influence on decision makers' reliance on rationality and intuition in decision making. (4) Grounded in these empirical findings, we propose a theory of ambidexterity in decision support that addresses how this ambidexterity can be facilitated and how it affects decision outcomes. These contributions have great practical significance, as analysts need to be aware of the tensions and tactics in order to ensure the effectiveness and utilization of their BI&A support.

The remainder of this paper is structured as follows. In [Section 2](#), we discuss the theoretical background for BI&A, conceptions of decision making, and organizational ambidexterity. In [Section 3](#), we describe the details of our empirical study design and the data analysis procedure for our multiple case study research approach. In [Section 4](#), we present the results from the multiple case study. Finally, in [Section 5](#), we close with a discussion of the study's findings and limitations as well as possible directions for future research.

2. Theoretical background

This section provides an overview of BI&A and presents conceptions of decision making that have been developed in management and cognitive sciences. It also elaborates on the challenging requirements that organizational decision processes pose for realizing effective BI&A support and introduces conceptions of ambidexterity from management and information systems research.

2.1. Data-centric decision support with business intelligence and analytics

BI&A, which has its origins in data-centric approaches such as data warehousing, comprises a number of data collection, integration, and analytics technologies [1,20,23]. BI&A systems aim to improve data processing in order to increase the quality of the information that is available for decision making [1,24]. In this regard, BI&A encompasses a number of basic analytics capabilities, such as online analytical processing, ad hoc queries, and descriptive statistics, as well as advanced analytics capabilities for data mining, prediction, and optimization [1,3,20,23].

With an increasing level of analytics capabilities, the utilization of BI&A for delivering data-centric decision support becomes a specialized task, which requires analytics experts – for instance, data scientists or analysts – to support managerial decision makers [3,13]. Hence, analytic advances induce a knowledge gap between analysts, who specialize in analytics, and decision makers, who have domain-specific knowledge [13]. Due to their lack of analytics knowledge, decision makers have to rely on analysts in the context of BI&A-supported decision processes. At the same time, analysts depend on the domain-specific knowledge of decision makers for developing relevant analytic insights and advice. As a consequence, effective BI&A support requires collaboration between analysts and decision makers [13,22].

Prior research on decision support has mainly assumed decision contexts in which decisions are made by either isolated, individual decision makers or groups of equal, undifferentiated decision makers [21,25]. The implications of specialization, collaboration, and an uneven distribution of decision-making power between decision makers and analysts has not been adequately considered in the literature, despite being highly relevant in practice [12,13,22]. Our research investigates such decision-making setups from the underexplored perspective of analysts, focusing on the challenges that arise for effective utilization of BI&A in organizational decision processes.

2.2. Conceptions of decision making in management and cognitive sciences

Insights from management and cognitive sciences provide the foundation for a better understanding of the challenges for effective BI&A

support of organizational decision processes. In both research areas, interrelated conceptions have been developed that distinguish between more rational and more intuitive modes of information processing and decision making [26–28]. Whereas management research distinguishes between rationality and intuition as two main properties that can characterize decision processes [29–32], cognitive sciences investigate associated cognitive processes under the designation “dual-process theories” [33–35]. We will focus on relations between the two domains and discuss their implications for decision processes.

Although there are variations among dual-process theories, they all distinguish between cognitive processes that are fast, automatic, effortless, and associative and those that are slow, controlled, effortful, and deductive [34,35]. A widely adopted practice in the cognitive sciences designates these two modes of processing as “System 1” and “System 2” [35,36]. System 1 and System 2 are viewed as working concurrently. System 1 is assumed to quickly propose intuitive answers to decision problems, while System 2 is supposed to control the quality of these proposals [35]. However, this is not always the case, as the rational reasoning associated with System 2 requires considerable cognitive effort, and such effort is considered to be limited by human cognitive capacity. Rather, individuals tend to use heuristics or mental shortcuts as adjuncts to System 1 in order to reduce the effort involved in processing difficult tasks. These heuristics have been found to lead to different kinds of systematic errors and to result in biased decision making [37].

In this context, intuition is regarded as decision making that retains a hypothesized proposal from System 1 without control by System 2 [35]. Hence, intuitive judgment is based on System 1 processing and arrives at decisions through informal reasoning without the use of analytical methods or deliberative calculation [38]. In contrast, rational decision making relates to System 2 processing and includes the acquisition of information through conscious reasoning and deliberative analytical thought [39]. In sum, dual-process theories offer cognitive explanations for an interaction between intuition and rational analysis in managerial decision making [28].

In management research, the rationality of decision processes has been investigated both theoretically and empirically [8,29,40,41]. Rationality has been characterized as systematic information gathering and reliance on analysis for the purpose of decision making [29,40,42,43]. Existing evidence about the relationship between rationality and the quality of decision outcomes mainly supports a positive relationship [42, 9,11]. Nevertheless, the presumption that only rationality should be considered in decision making research has been called into question [8,31].

Intuition has been proposed as providing an alternative approach to managerial decision making, particularly for decisions involving ambiguous or uncertain situations. These situations are characterized as having excessive cognitive processing requirements, entailing that decision makers might not be able to utilize rational processes [30,32,39,44]. Intuition has been defined as an interplay between knowing and sensing, which allows understanding to be attained without explicit analytical inferences [28,39,44]. Very few studies have investigated the direct relationship between intuition and decision outcomes, and those that have done so provide an inconclusive picture. Intuition has been found to have a positive effect on decision outcomes in unstable decision environments and a negative effect in stable decision environments [30]. Furthermore, intuition has been found to significantly increase the occurrence of major unexpected, negative decision outcomes [45]. In consequence, intuition is seen as a “troublesome decision tool” [44], and most authors caution that sole reliance on intuition creates a risk in the decision making process [9,32,45,46]. Based on these findings, some researchers suggest the possibility of interactions between intuition and rationality as components of decision making [39,44,47].

The implications of interactions between intuition and rationality in the context of BI&A-supported decision processes remain unexplored, and our understanding of their effects on decision outcomes is limited. From the analyst's perspective, the goal is to deliver analytic insights

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