RESEARCH

Martin Kowalczyk

The Support of Decision Processes with Business Intelligence and Analytics

Insights on the Roles of Ambidexterity, Information Processing and Advice

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With a preface by Prof. Dr. Peter Buxmann

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Foreword

The support of managerial decision making with Business Intelligence and Analytics (BI&A) has gained high priority in many businesses and the importance of this topic is recognized among practitioners and scholars alike. Prior related research in decision support and information systems mainly investigated the technological perspective of introducing and using such decision support systems. Thereby the decision process perspective of supporting managerial decisions with BI&A remained largely unexplored. Furthermore, extant research mainly focused on individual decision makers or groups of equal peers without considering the need for specialization and collaboration between decision makers and analytics experts (i.e. data scientists or analysts). Better understanding of the actual decision process perspective is highly relevant for the success of utilizing BI&A to effectively support decision making.

The research that Martin Kowalczyk conducted as part of his dissertation approaches the existing research needs by considering the organizational and individual perspectives of BI&A-supported decision processes. The organizational perspective focuses on investigating the processual aspects of decision making, including process phases, roles that are involved and how these interact. The individual perspective refers to decision making at the level of the individual, including cognitive efforts and behaviors involved in decision making. The purpose of this dissertation was to empirically investigate both perspectives and thereby to address the challenges of how to design and establish BI&A-supported decision processes that achieve improved decision quality.

This dissertation begins with presenting the results from a structured literature review, which contributes an integrative perspective on the current state-of-the-art in research. Building on this foundation, the dissertation first focuses on the organizational perspective and presents results from two studies that examine what constitutes successful BI&A-supported decision processes. Grounded in the organizational information processing theory, the first study investigates how different types of information processing mechanisms are composed within various decision processes. The results contribute to a better understanding of how information processing mechanisms should be incorporated in BI&A-supported decision processes. A second study on the organizational perspective identifies procedural characteristics (i.e. agility and rigor) that are relevant for the design of BI&A-supported decision processes. The focus of the dissertation then turns to the individual perspective, which is addressed by two further studies that investigate how analytics experts should frame and conduct BI&A support for decision makers in order to be effective in improving the quality of decision making. The first study on this perspective explores a comprehensive set of conflicting task requirements and identifies ambidextrous tactics that can address these conflicts. Grounded in these empirical findings, this dissertation contributes a theory of ambidexterity in decision support. The final study of this dissertation investigates the relevance of advice that analytics experts pro-

vide to decision makers. The presented results show how analytics experts' BI&A support affects decision makers' information processing behavior, their utilization of analytic advice and the resulting decision quality. Thereby this research contributes to a better understanding of how to shape the BI&A support that analytics experts provide to decision makers.

In his work, Martin Kowalczyk presents previously unexplored perspectives on the BI&A support of managerial decision processes. This research contributes to a better understanding of what constitutes successful BI&A-supported decision processes and how to establish effective BI&A support in decision scenarios that involve collaboration between specialized roles (i.e., analytics experts and decision makers). Thereby this work extends the theoretical foundations of decision support and information systems research and it offers various starting points for future investigations of BI&A support in decision processes. Therefore, I wish for broad diffusion of these research results in science and business practice.

Prof. Dr. Peter Buxmann

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Becoming a researcher at TU Darmstadt with the goal of exploring decision processes and particularly their support with business intelligence and analytics has been a great opportunity. During my time as researcher, at the Chair of Information Systems | Software Business & Information Management, I had the freedom and support to let my curiosity guide my research endeavors, which will remain an unforgettable experience. This allowed me to deeply investigate and elucidate the importance of ambidexterity, information processing and advice for the support of decision making with business intelligence and analytics. Looking back at this time I owe gratitude to many people without whom this would not have been possible.

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Martin Kowalczyk

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List of Acronyms

ACM	Association for Computing Machinery
AIS	Association for Information Systems
AISeL	AIS electronic Library
BA	Business Analytics
BI	Business Intelligence
BI&A	Business Intelligence and Analytics
CPM	Corporate Performance Management
CRM	Customer Relationship Management
DBMS	Database Management System
DM	Decision Maker
DSS	Decision Support System
DW	Data Warehouse
ECIS	European Conference on Information Systems
EIS	Executive Information System
ERP	Enterprise Resource Planning
ETL	Extract-Transform-Load
HSM	Heuristic–Systematic Model
IEEE	Institute of Electrical and Electronics Engineers
ICIS	International Conference on Information Systems
IS	Information System
JAS	Judge–Advisor System
MIS	Management Information System
MSS	Management Support System
OLAP	Online Analytical Processing
PDSS	Personal Decision Support System
PLS	Partial Least Squares
RG	Research Goal
RQ	Research Question
SEM	Structural Equation Modeling

1 Introduction

The general idea of improving managerial decision making through support with high quality information or facts is shared by the decision support specialty of information systems research (Arnott and Pervan, 2005, 2008, 2014), management research (e.g., Pfeffer and Sutton, 2006; Simon, 1960), and practitioners alike (e.g., Davenport et al., 2010; LaValle et al., 2011). The reason for this huge interest lies in research findings and practitioner reports that suggest that data-driven decision making results in better decisions and, as a consequence, in better organizational performance (Brynjolfsson et al., 2011; Davenport et al., 2010; LaValle et al., 2011).

Recent advances in the information infrastructure for Business Intelligence and Analytics (BI&A) have provided the technological foundation for collecting and analyzing unprecedented volumes and types of data. BI&A provides technological capabilities for data collection, integration, and analysis with the purpose of improving the quality of the information that is available to support decision making (Chaudhuri et al., 2011; Chen et al., 2012; Watson, 2010). Based on these technological advances, support of managerial decision making with BI&A has gained high priority in many businesses and has given new prominence to data-driven decision making, which is increasingly considered a competitive advantage (Davenport et al., 2010; McAfee and Brynjolfsson, 2012; Wixom and Watson, 2010).

While the supply of high-quality information through BI&A creates the potential for improving managerial decision making, this information must be used effectively in decision processes in order to live up to this potential (Pfeffer and Sutton, 2006; Sharma et al., 2014). Unfortunately, it seems that much of the potential remains untapped, as the BI&A systems that are introduced are subject to high failure rates and particularly suffer from not being utilized by decision makers (Arnott, 2010; Shah and Capellá, 2012). Hence, leveraging the benefits of BI&A depends not only on establishing a high-quality information infrastructure, but also on the organizational context and characteristics of the decision processes for which BI&A is deployed (Davenport, 2010; Popovič et al., 2012, 2014; Ross et al., 2013).

In this regard, while the technological evolution of BI&A has tremendously improved technological capabilities for supplying high-quality information and analytic business insights for the purpose of decision support, it has also induced the need for more specialized data-processing and analytic skills. These skills are required for effectively utilizing and analyzing data that is available to organizations through their internal and external data sources. This need for specialization has rendered the role of analytics experts (i.e., data scientists or analysts) increasingly important for decision support. These specialists have the required analytics expertise for utilizing BI&A to deliver analytic decision support to decision makers

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(Davenport et al., 2010; Davenport and Patil, 2012). Analytics experts support managerial decision making with respect to business decisions (e.g., competitive strategies, mergers and acquisitions, and managing product and service portfolios) by structuring decision problems, searching for relevant data, developing alternative solutions based on data patterns and analytic insights, and finally providing analytic advice to decision makers (Davenport and Patil, 2012).

Considering analytics experts' role as mediators between information and decision makers' use of that information, the success of BI&A support depends not only on the introduction of BI&A technology, but also on the presence of analytics experts and their collaboration with decision makers in the context of organizational decision processes. Thus, the constitution of a decision process – in terms of the phases, steps, mechanisms, and roles that are involved – is bound to have major implications for the effectiveness of BI&A support. Literature reviews on the use and effects of BI&A have identified a major need for research about decision processes and actual decision making in the context of BI&A (Arnott and Pervan, 2014; Kowalczyk et al., 2013; Shollo and Kautz, 2010). Similarly, a recent call for research indicates the need for further investigations from the decision process perspective, including behavioral and organizational aspects, in order to achieve a better understanding of how organizations can improve the quality of decision outcomes and thus create value from the utilization of BI&A (Sharma et al., 2014).

This thesis addresses these calls for research by investigating BI&A support in the context of organizational decision processes. The research presented herein elucidates several issues related to organizational and individual perspectives on BI&A-supported decision making by utilizing a mix of qualitative and quantitative research approaches. The following sections describe the research problem in more detail, provide an overview of the research background, define explicit research goals and questions, and outline the structure of this thesis.

1.1 Scientific Relevance and Problem Characterization

Although data-based decision support systems (DSSs) and BI&A in particular involve the support of decision making, research in this area has been found to have a rather limited grounding in relevant theories of decision making from reference disciplines (Arnott and Pervan, 2005, 2008, 2014). In particular, the traditional research perspective has been mainly oriented toward technology, with a focus on how data is transformed into high-quality information that can be supplied to decision makers as input for their decision making (Lycett, 2013; Shollo and Kautz, 2010). This perspective has been criticized for not considering the organizational and social contexts of decision support, which involve interactions between the people who are involved in decision processes. These interactions should have a major impact