



Business intelligence and organizational learning: An empirical investigation of value creation processes



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ABSTRACT

With the aim of bridging the gap between well-established research on information technology (IT) value creation and the emergent study of business intelligence (BI), this study develops and tests a model of BI value creation that is firmly anchored in both streams of research. The analysis draws on the resource-based view and on conceptualizations of organizational learning to hypothesize about the paths by which BI assets and BI capabilities create business value. The research model is first assessed in an exploratory analysis of data collected through interviews in three firms and then tested in a confirmatory analysis of data collected through a survey.

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1. Introduction

The business value of information technology (IT) has been demonstrated repeatedly in the past decades [13,36,83]. However, a major shortcoming of this field of research has been its disposition to study the business value of overarching IT concepts instead of the value gained by specific classes of information systems. The primary goal of those general IT studies has been to capture the organizational effects attributed to all IT assets and capabilities available to the organization. Those studies have been complemented by specific IT studies, aimed at understanding the business value of specific platforms and systems, such as electronic commerce [105] and enterprise resource planning (ERP) [62,66]. The contribution of the latter studies is based on the often implicit rationale that different technologies bring about different processes of value creation. Therefore, it is essential to understand the unique value creation mechanisms at play for each technology.

In terms of value creation, business intelligence (BI) appears to be among the most promising technologies in recent years, at least as reflected in the attitudes of IT executives [61]. However, despite this dramatic shift in investment patterns and value perceptions, little empirical research has addressed the value creation processes unique to BI systems (e.g., Refs. [33,124]). Although some efforts have been made to capture how BI generates business value, it is

safe to conclude that there is much to learn about the value creation processes induced by this dominant IT domain.

Against this backdrop, we seek to answer the following research question: What are the distinct mechanisms of value creation underlying the business value of BI? We argue in this paper that understanding the business value of BI requires the integration of *general* knowledge about the processes of IT value creation and *specific* knowledge about the features unique to BI deployment. We integrate the two by taking stock of well-established findings about IT value creation and adapting them to the context of BI value creation. In particular, general IT findings include the relationships observed in previous research among IT assets, IT capabilities, organizational resources, and business value [64,79,82,102], whereas specific BI adaptations involve the distinction between operational and strategic BI capabilities and the moderating role of organizational learning [74]. We demonstrate that organizational learning is an important theoretical lens for understanding how BI creates business value, especially given that BI systems are deployed to facilitate decision support, environmental adaptation, and organizational innovation. Specifically, the framework of exploration and exploitation in organizational learning [76] is applied because of the conceptual fit between the two types of BI capabilities (operational and strategic) and the two mechanisms of organizational learning (exploitation and exploration). In concert with the resource-based view (RBV) of the firm [8,122], these theoretical bases allow us to formulate a comprehensive research model of how the deployment of BI resources creates business value.

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In this paper, we adopt the process view prevalent in the literature on general IT business value [64,79,80,98], and we develop a research model that considers BI capabilities (operational and strategic) as mediating the effects of BI assets (BI infrastructure and BI team) on business value (operational and strategic). The research model also accounts for the moderating effects of exploration and exploitation on the relationships between assets and capabilities. The development of the research model is based on a comprehensive literature review, which shows that the diffusion of knowledge from the literature on IT value to that on BI value has been sporadic and inconsistent. A preliminary assessment of our research model relies on qualitative data collected in 11 interviews in three organizations. Subsequently, the model is tested with cross-sectional data collected from managers. Data analysis, using structural equation modeling (SEM), generally confirms the research model and shows that the lens of organizational learning and the distinction between operational and strategic BI capabilities are critical to understanding BI value creation.

The contribution of this study is attributed to our dual approach, which integrates insights gained from both general IT and specific BI research. The study therefore contributes to both streams of research. First, it contributes to BI research by providing a model of value creation specific to this domain, which, despite being a high-priority investment in many organizations, suffers from a lack of empirical grounding. BI research also suffers from insufficient theoretical development, and the present study demonstrates that organizational learning is a useful theoretical lens to further our understanding of BI value. Second, the study contributes to IT value research by showing that “opening the grey box of IS business value creation” [102,p. 149] may not be entirely possible unless value creation processes are grounded in a specific technological context. Finally, our dual approach is easily transferable to other technological domains, offering a promising avenue to advance research on domain-specific value creation processes.

This paper proceeds as follows: the next section provides the theoretical background, which leads to the development of the research model. The third section describes the research methodology used to test the research model, and the fourth section describes the data analysis and results. Finally, the concluding section discusses the key findings, contributions, limitations, and directions for future research.

2. Theoretical background and research model

The theoretical analysis begins with a short introduction of research on the business value of BI systems. We then present three consistent observations about the business value of IT; we also demonstrate, through a structured literature review, that the implications of these observations on the business value of BI have yet to be fully studied. This theoretical background is the foundation upon which the research model is constructed in the rest of this section.

2.1. BI systems

BI is as an overarching term for decision support systems that are based on the integration and analysis of organizational data resources toward improving business decision making. The term BI is widely used to describe a variety of different applications of information analysis that enable informed decision making based on wider knowledge [120]. In this work, the term “BI systems” is used to describe the technical artifacts that provide BI functionality to users. BI systems aim at improving the quality of information used in the decision-making process as a consequence of

simplification of storage, identification, and analysis of information [81]. They offer a comprehensive view of the entire organization, permit the analysis of business activities from multiple perspectives, and enable rapid reactions to changes in the business environment [78].

Some studies have emphasized the organizational impacts of BI, suggesting that the introduction of BI systems into an organization implies not only technological enhancement but also a revolutionary way of performing and managing business activities and decision-making processes. Davenport [24] highlights the transition toward a culture of fact-based decision making that is associated with the use of business analytics and the adoption of BI systems. Watson and Wixom [120] describe the benefits of BI systems, including cost and time savings, improved information and business processes, better decisions, and superior strategic performance, on a continuum that ranges from local impacts on specific business processes to global impacts on the entire organization. In an empirical study of 85 firms, Lee et al. [68] show a positive impact of BI systems on supplier operations, market segmentation, and sales activities, but no impact on financial performance. These findings are consistent with those of other empirical studies (e.g., Ref. [33]).

2.2. What we know about IT value creation

A large body of research has converged on the notion of a fundamental mechanism of IT value creation, according to which business value is the product of capabilities that are generated through the interaction between IT assets and organizational resources [64,79,82,102]. Specifically, this fundamental mechanism represents the integration of three consistent findings: (i) causal relationships exist between IT assets, IT capabilities, and business value; (ii) IT capabilities are created through the interaction between IT assets and organizational resources; and (iii) business value can be categorized as either operational or strategic. Next, we discuss these three consistent observations.

First, the RBV has often been adopted to describe the effect of IT assets on IT capabilities and the effect of IT capabilities on business value. The RBV maintains that the heterogeneity and immobility of firm resources result in superior performance, and that firms may be strategically differentiated based on firm resources that are valuable, rare, imperfectly imitable, and non-substitutable [8]. This view incorporates an important distinction between two types of firm resources: assets and capabilities [116]. Assets are defined as anything tangible or intangible that the firm can use in its processes, whereas capabilities are repeatable patterns of actions in the use of assets [101]. While assets are the basic units of analysis, a capability is the capacity for a group of assets to cooperatively perform an organizational activity [49]. Therefore, firm assets are the basic building blocks of firm capabilities, which represent integrated and coordinated arrangements of assets [2,108]. The notion that asset availability determines a firm’s ability to develop capabilities suggests a cause-and-effect relationship between firm assets and capabilities [94]. Furthermore, because capabilities are considerably more heterogeneous and immobile than assets, they represent the primary source of strategic value. Such value may be manifested in overall firm performance or in the effectiveness of specific business processes [96]. In line with these RBV conceptualizations, IT capabilities, defined as “combinations of IT-based assets and routines that support business conduct in value-adding ways” [100,p. 108], have been considered as the foundation of IT business value [13,14,35,36,63].

Second, research has confirmed that IT capabilities are created by the interaction between IT assets and organizational resources. This research has often drawn upon contingency theory, explicitly or implicitly, to underpin the importance of organizational

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