



Towards business intelligence systems success: Effects of maturity and culture on analytical decision making

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ABSTRACT

The information systems (IS) literature has long emphasized the positive impact of information provided by business intelligence systems (BIS) on decision-making, particularly when organizations operate in highly competitive environments. Evaluating the effectiveness of BIS is vital to our understanding of the value and efficacy of management actions and investments. Yet, while IS success has been well-researched, our understanding of how BIS dimensions are interrelated and how they affect BIS use is limited. In response, we conduct a quantitative survey-based study to examine the relationships between maturity, information quality, analytical decision-making culture, and the use of information for decision-making as significant elements of the success of BIS. Statistical analysis of data collected from 181 medium and large organizations is combined with the use of descriptive statistics and structural equation modeling. Empirical results link BIS maturity to two segments of information quality, namely content and access quality. We therefore propose a model that contributes to understanding of the interrelationships between BIS success dimensions. Specifically, we find that BIS maturity has a stronger impact on information access quality. In addition, only information content quality is relevant for the use of information while the impact of the information access quality is non-significant. We find that an analytical decision-making culture necessarily improves the use of information but it may suppress the direct impact of the quality of the information content.

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1. Introduction

Evidently the most important research questions in the field of information technology (IT)/information systems (IS) in general involve measuring their business value [54], their success and identifying critical success factors [23]. In a decision-support context, business intelligence systems (BIS) have emerged as a technological solution offering data integration and analytical capabilities to provide stakeholders at various organizational levels with valuable information for their decision-making [76]. In contrast with operational systems, assessing the success of BIS is usually problematic since BIS are as rule enterprise-wide systems where most benefits are long-term, indirect and difficult to measure [69].

The term business intelligence (BI) can refer to various computerized methods and processes of turning data into information and then into knowledge [51], which is eventually used to enhance organizational decision-making [82]. We distinguish the terms BI and BIS and comprehend BIS (or the *business intelligence environment* [28]) as *quality information in well-designed data stores, coupled with business-friendly*

software tools that provide knowledge workers timely access, effective analysis and intuitive presentation of the right information, enabling them to take the right actions or make the right decisions. We further understand BI as the *ability of an organization or business to reason, plan, predict, solve problems, think abstractly, comprehend, innovate and learn in ways that increase organizational knowledge, inform decision processes, enable effective actions, and help to establish and achieve business goals* [80]. Accordingly, processes, technologies, tools, applications, data, databases, dashboards, scorecards and OLAP are all claimed to play a role in enabling the abilities that define BI [80]; however, they are only the means to BI – not the intelligence itself.

Much research has been done in the area of assessing IS success [8] with the McLean & DeLone multidimensional IS Success Model [22,23] being one of the most often used, cited and even criticized works. Categories such as desired characteristics of the IS which produces the information (i.e. system quality), the information product for desired characteristics (i.e. IQ), and the recipients' consumption of the information products (i.e. information use) have been referred to as common IS success dimensions [22]. The model emphasizes the understanding of the connections between the different dimensions of IS success. While value ("net benefits" in the McLean & DeLone success model) is the final success variable, use of the system is fundamental for certain "net benefits" to occur.

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While considerable evidence demonstrates the importance of BI and BIS for organizations, Wixom and Watson suggest the benefits of BIS have not been adequately researched and thus need further attention [84]. Ranjan [65] qualitatively explored the business justifications and requirements for incorporating BI in organizations. Elbashir et al. [27] researched the performance effects of BIS use at the business process and organizational levels. Asserting that the implementation of a BIS is a complex undertaking requiring considerable resources, Yeoh et al. [85] proposed a CSF framework consisting of factors and associated contextual elements crucial for BIS implementation. However, no study has provided an in-depth analysis of BIS success. Consequently, our study's main objective is to provide a comprehensive understanding of the interrelationships between BIS success dimensions, focusing on the variables affecting BIS use.

Different types of IS require specific success models [60] and users prefer different success measures depending on the type of system being evaluated, therefore we adapted the general IS success model to reflect the specifics of BIS. We pay special attention to: a) information quality (IQ); b) the use of information in business processes; and c) the factors affecting the level of use of information, provided by BIS, in business processes and thus the creation of business value. Although IQ is believed to be one of the most important characteristics that determine the degree to which available information is used in organizations, research offers mixed support for the relationship between IQ and its use [60]. IQ generally deals with two main aspects, namely the content of information and its accessibility [29] with different means of BIS impact on the two and with different sets of quality problems that potentially impact information use. Although some of these differences are implicitly recognized in previous IS studies [83], some of the IQ access characteristics have been attributed to antecedents of system quality and the relevance is often not explicitly considered as an IQ dimension. Based on the classification about IS effectiveness provided by Seddon et al. [70], the proposed adaption of the McLean & DeLone IS success model is derived from the managers'/owners' aspect, aiming to provide value for the organization and it focuses on a type of IT or IT application, in this case on a BIS.

This study thus brings novel insights regarding the success of BIS and consequently identifies critical success factors of BIS implementation projects through considering specifics of BIS and the inclusion of different segments of IQ and an analytical decision-making culture in the model. We believe that this work contributes to understanding of the interrelationships between BIS success dimensions. From the aspect of IT development and BIS development, it can be expected that evaluation of such a model and interrelationships between its dimensions enables the understanding of problems and key success factors in implementation.

The structure of the paper is as follows. In the next section, the general IS success model is adapted to reflect the specifics of BIS that justify a separate study on BIS. The research model is then conceptualized. The second part of the paper presents the research design, methodology, and results. Finally, the results are discussed, including the implications for BIS theory and practice, while further possible research directions are outlined.

2. The business intelligence systems success dimensions

It is apparent that successful organizations do not focus solely on the speed and ways information is transmitted, and the amount of information they can process, but mostly on capturing the value of information along the information value chain [35]. A BIS, in its own right, adds value primarily at the beginning of the information value chain where, depending on the implemented technologies, it collects and structures the data transforming it into information.

The implementation of BIS can contribute to improved IQ in many ways, such as: faster access to information, easier querying and analysis, a higher level of interactivity, improved data consistency due to data integration processes and other related data management activities (e.g. data cleansing, unification of definitions of key business terms,

master data management). The term IQ encompasses traditional indicators of data quality, information relevance, and features related to information access [62]. To understand and analyze the benefits of BIS it is necessary to understand IQ as a broad concept which embraces all of the abovementioned aspects. We expect that addressing the content of information and its accessibility separately can provide better insights into the relationships between IQ and other dimensions of the BIS success model.

Nevertheless, the information that is thereby provided can only be viewed as potentially valuable. If organizations want such information to contribute to their success it must be used within business processes to improve decision-making, process execution or ultimately to fulfill consumer needs [62]. While the need for process orientation is widely recognized in approaches to operational IS development [44], BIS are still mostly understood as data-oriented systems as managerial tasks are less frequently organized by means of well-defined processes [5]. Many approaches do not allow us to associate data with processes [5], yet not relying on business process orientation can lead to BIS deficiencies as the operational process provides the context for data analysis and the interpretation of the analyses' results [5]. For example, in an enterprise where end-to-end operational business processes are not fully understood and managed, data integration is much more difficult if not impossible, and understanding of information needs for BIS is impeded. Understanding of business processes is required in order to find out the relevant indicators [36]. All of this has an impact on all dimensions of BIS success. A lower understanding of business processes, supporting IS, legacy systems, and even hardware infrastructure will be reflected in lower BIS maturity, IQ and, consequently, information use.

Although the improved IQ impacts the level of information use, limits may be expected on the quantity of information an organization can absorb [14] and the related dominant impact of organizational culture on decision-making [57], specifically the attitude to the use of information in decision-making processes. Therefore, we expect that particularly the analytical decision-making culture will affect how much organizations use quality information provided by BIS in their business processes (Fig. 1).

The analyzed BIS success model reflects some specifics of BIS compared to operational information systems. In contrast to operational systems, which focus on the fast and efficient processing of transactions, BIS provides quick access to information for analysis and reporting. They primarily support analytical decision-making [43] and are thus used in knowledge-intensive activities. Due to a more difficult process of identifying information needs as a result of less structured processes in knowledge-intensive activities, the BIS environment faces most challenges in assuring information content quality. It is thus useful to separate the two previously identified aspects of IQ when researching BIS success. Moreover, the use of BIS is in most cases optional. Researchers have previously identified the importance of voluntariness (vs. mandatory use) when studying IS usage behavior [78]. We can therefore expect a stronger impact of IQ and analytical culture on BIS's acceptance, use and consequently its success. Due to the use of BIS especially on strategic and

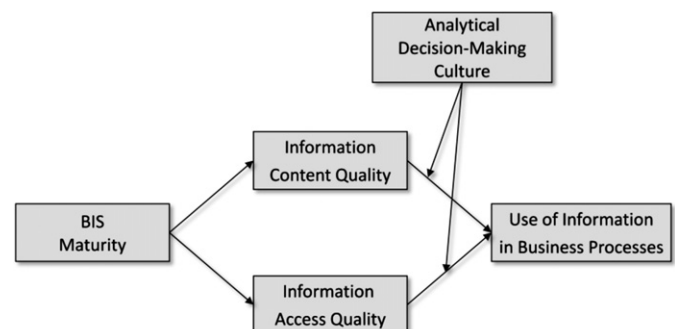


Fig. 1. The BIS success model.

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