

How information-sharing values influence the use of information systems: An investigation in the business intelligence systems context

Aleš Popovič^{a,b}, Ray Hackney^{c,*}, Pedro Simões Coelho^b, Jurij Jaklič^{a,b}

^a University of Ljubljana, Faculty of Economics, Slovenia

^b Universidade NOVA, ISEGI, Portugal

^c Brunel University, Business School, UK

ARTICLE INFO

Article history:

Received 25 November 2013

Received in revised form 22 August 2014

Accepted 29 August 2014

Available online 18 September 2014

Keywords:

Business value of IT

Strategic IS management

Business intelligence systems

Information utilization

Information-sharing values

Structural equation modelling

ABSTRACT

Although the constituents of information systems (IS) success and their relationships have been well documented in the business value of information technology (IT) and strategic IS literature, our understanding of how information-sharing values affect the relationships among IS success dimensions is limited. In response, we conduct a quantitative study of 146 medium and large firms that have implemented a business intelligence system in their operations. Our results highlight that in the business intelligence systems context information-sharing values are not directly linked to IT-enabled information use, yet they act as significant moderators of information systems success dimensions relationships.

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Introduction

The potential of information systems (IS) to improve decision-making and advance organizational performance has been emphasized in the information technology (IT) business value literature for quite some time (Davern and Kauffman, 2000; Melville et al., 2004; Mithas et al., 2011; Nevo and Wade, 2011). In firm performance studies, IS have been found to support timely decisions, provide information that enhances comparative advantage, promote innovation, and offer a means to manage the uncertainty inherent in the business environment (Daft and Lengel, 1986; Dewett and Jones, 2001; Melville et al., 2004; Thong, 1999). High quality information, i.e. information that is relevant, reliable, accurate, and timely (Low and Mohr, 2001; Popovič et al., 2012; Wixom and Todd, 2005), enables improvements in decision quality and can, in turn, promote improvements in firm performance (Raghunathan, 1999). To leverage the benefits of high quality information, firms are therefore increasingly investing in IT and infusing different technologies into firms' processes.

In the IS and business intelligence (BI) literature business intelligence systems (BIS) are well recognized as contributing to decision-making, especially when firms operate in highly competitive environments (Popovič et al., 2012). BIS are most commonly identified as technological solutions holding quality information in well-designed data stores, connected with business-friendly tools that provide users – incumbents of executives, managers, business analysts and other roles within a firm

* Corresponding author.

E-mail addresses: ales.popovic@ef.uni-lj.si (A. Popovič), ray.hackney@brunel.ac.uk (R. Hackney), psc@isegi.unl.pt (P.S. Coelho), jurij.jaklic@ef.uni-lj.si (J. Jaklič).

utilizing BIS-enabled information for analytical decision making – with timely access to as well as effective analysis and insightful presentation of the information generated by enterprise-wide applications, enabling them to make the right decisions or take the right actions (Elbashir et al., 2008; Popovič et al., 2009). In investigating the business value of BIS, existing studies suggest BIS enable enhancements in firms' strategic planning and business processes, improvements in performance, and the building of competitive advantage (Negash and Gray, 2008; Popovič et al., 2012; Shanks et al., 2012) whereas time savings and better information for supporting decision-making are considered the main direct benefits of implementing BIS (Watson et al., 2002). BIS are typical complex IS and are rated among the top 10 strategic technologies (Gartner, 2012). They have also been identified as the most important key issue for CIOs (Luftman and Ben-Zvi, 2010). Firms devote significant resources and effort to implementing BIS to leverage their business value and enhance competitive advantage (Davenport et al., 2010; Negash and Gray, 2008).

Researchers increasingly claim that leveraging such performance benefits depends less on possessing the technology and more on the ability to best use the information in decision-making processes (Bosilj Vukšić et al., 2013; Davenport and Beers, 1995; Diamantopoulos and Souchon, 1999; Rindfleisch and Moorman, 2001). From a BIS perspective, a key form of information use is instrumental utilization, which refers to the range of organizational outcomes and impacts that are a direct result of the applications of information (Todd, 1999). Failing to utilize BIS-enabled information may lead to strategy blindness (Arvidsson et al., 2014) when a firm is unable to effectively exploit its available system capability (Arvidsson et al., 2014). Thus, BIS management activities that will increase the use and utilization of BIS need to become a part of the mainstream activities of executives (Galliers, 1991) in order to achieve a strategic impact. The successful implementation of the strategic change associated with system use is a critical challenge (Arvidsson et al., 2014), yet research addressing strategic BIS management issues, such as system adoption, its acceptance, and utilization for long-term success, is still scarce (Alhyasat and Al-Dalahmeh, 2013). The business value of IT/IS, IT/IS impacts on organizational and individual performance, IT/IS management, IT/IS implementation, and IT/IS adoption were identified in the past as key areas in the field of strategic IS research (Gable, 2010; Galliers et al., 2012). Recently, BI was identified as a promising research area in strategic IS milieu (Gable, 2010) and broader IS research (Chen et al., 2012). Although considered a topical area in the strategic IS field (Gable, 2010), to date only a handful of studies (e.g. Dinter, 2013; Işık et al., 2013) deal with “strategies for IS issues” in the BIS context. By emphasizing the role of employees' trust in information sharing and, consequently, its impact on effective BIS exploitation, this study fits into the strategic IS research agenda where works concerning trust-related issues have been encouraged (Gable, 2010). In addition, this study answers the call by Besson and Rowe (2012) to explore how the mechanisms of organizational transformation as certain behaviors, in our case varying levels of information sharing, result in the wider routinization of fact-based decision-making within organizations (i.e. the effective use of information).

Studies on the relationships between IS quality, information quality and their respective use have produced equivocal findings (e.g. Auster and Choo, 1993; Bokhari, 2005; Menon and Varadarajan, 1992; Todd and Benbasat, 1992). Scholars have therefore highlighted the role within firms of organizational factors that drive these relationships. One such increasingly considered organizational factor is information culture (Choo, 2013; Curry and Moore, 2003; Ginman, 1988). We understand information culture as a subset of the overall organizational culture *in which the value and utility of information in achieving operational and strategic success is recognized and where information forms the basis of organizational decision-making* (Curry and Moore, 2003). Information culture encompasses socially shared behaviors, norms, and values that define the importance, management, and utilization of information in a firm (Choo et al., 2008). To profile a firm's information culture, researchers emphasize various information behaviors and values, namely information integrity, information formality, information control, information sharing, information transparency, and proactiveness (Choo, 2013; Marchand et al., 2000). These behaviors and values are able to explain significant parts of the variance in information-use outcomes (Choo, 2013).

Existing studies indicate information sharing plays an instrumental role in BIS implementation and later in the realization of intended capabilities because BIS are inherently data-centric systems with a particular focus on data integration and sharing (Popovič et al., 2012) at either the departmental/process or enterprise level. The prevalent information-sharing values are believed to be inherently good (Gupta and Govindarajan, 2000) as they help reduce uncertainty (Galbraith, 1974) and may increase the motivation to use information (Hwang et al., 2013). Emphasis is therefore increasingly placed on the underlying mechanisms that link investments in IS, the quality of their information and the firm's information-sharing values to information use (Marchand et al., 2000). In contrast, the most common cause of resistance to information sharing is the fact that it may also lead to an increased sense of being under control (Crant, 2000).

Despite growing recognition of the value BIS utilization can bring to firms and the recent developments in the BIS discipline in both the academic and the business communities (Chen et al., 2012), our understanding of how information sharing influences BIS use and information use remains limited (Choo, 2013; Popovič et al., 2012). To address this gap, we conducted an empirical investigation using key informants, specifically decision-makers (i.e. incumbents of professions like managers, information analysts, strategists, and executives) in medium and large firms that use BIS to inform their decisions. We explored: *How do information-sharing values guide decision-makers' intended use of BIS-enabled information?*

We make two contributions to the BI and IT business value literature. First, we find that the greater the perceived quality of information provided through BIS, the greater the intended use of information in decision-making, while the improved BIS quality is not directly reflected in the increased use of information. Second, we recognize information-sharing values as a significant information-culture dimension shaping the BIS value relationships.

The remainder of this paper is organized as follows. We first set out the theoretical background of our research. More specifically, we examine existing studies on BIS, information use, and information-sharing literature. We then outline the

research approach followed in this study. We introduce the research model, hypotheses, outline the sources of data and explain our data analysis procedure. This is followed by our findings on the key characteristics of BIS quality and information quality, their influence on information use and on how information-sharing values transform these relationships. In the discussion section, we explore the theoretical contributions and practical implications of our findings. Finally, some inherent limitations and avenues for future research are given.

Theoretical background

To present the theoretical foundations for our work, we first distinguish BIS from other IS, link BIS quality and information quality to information use, introduce the concept of information-sharing values, and develop the rationale for information-sharing values that moderate the influence of BIS quality and information quality on information use.

Business intelligence systems

Following a lengthier period of substantial investments in setting up a technological foundation that supports business processes and strengthens the efficiency of operational structure, most firms have reached the point where the utilization of IT to support analytical decision-making is emerging as more vital than ever (Petrini and Pozzebon, 2009). Perceived as a response to the growing needs for access to relevant information (Popovič et al., 2012), BIS hold the potential to maximize information use (Watson et al., 2002), thereby creating competitive advantage (Davenport et al., 2010; Negash and Gray, 2008). From the perspective of organizational knowledge creation, and through a utilitarian view on IS, BIS distinguish themselves from prior IS: (1) through the authority to commence problem articulation and discussion; and (2) in data selection by addressing various information needs of decision-makers at different organizational levels (Ferrari, 2011; Shollo and Galliers, 2013). By integrating and processing raw data from available sources, BIS provide their users with information in various forms such as dynamic reports and dashboards (Wixom and Todd, 2005). Such BIS capabilities play a strategic role for firms where the decision-making process is considered a critical success factor, as it is by strategic management (Rossignoli et al., 2010).

Business intelligence systems quality

In the IS success literature, the role of system quality and its link to system and information use are well established (DeLone and McLean, 1992, 2003; Petter et al., 2008). With system quality we refer to the desirable characteristics of an IS, e.g. ease of use, system flexibility, system reliability, and response time (Petter et al., 2013).

In the BIS context, studies suggest a positive influence of BIS quality on BIS success (e.g. Wixom and Todd, 2005; Wixom and Watson, 2001). A high quality system can provide BIS users with an increase in decision-making productivity and alter the way people perform tasks (Wixom and Watson, 2001). A BIS importantly affects how decision-making for users is supported in the firm. When supplied with appropriate information-access capabilities, BIS users can perform decision-making tasks at various organizational levels faster and more systematically (Haley et al., 1999). Overall, BIS can modify the processes for providing users with access to information while decreasing the time and effort required to provide such access (Wixom and Watson, 2001).

Information quality and information use

While IS use has been widely documented as an important IS success dimension (Petter et al., 2013), there is an increasing need in the context of BIS to elucidate the distinction between the use of an IS for retrieving and analyzing information on one side, and on the other side effective use of IS-enabled information within business processes (Popovič et al., 2012) that aids improvements in firm performance.

The management, marketing and IS literatures ever more recognize the tie between information quality and information use (e.g. Citroen, 2011; Low and Mohr, 2001; Popovič et al., 2012). When considering information quality and system quality together, it is appropriate to consider information as the product of an IS and the IS as the information-processing system that produces the information (DeLone and McLean, 1992). Drawing on this reasoning, information quality can be viewed as the desirable characteristics of the IS outputs (e.g. relevance, accuracy, conciseness, completeness, understandability, currency, timeliness) (Petter et al., 2013). Moreover, we identify information use as taking information into account while making decisions (Diamantopoulos and Souchon, 1999).

In the view of Stvilia et al. (2007), for firms' "processes that depend on information, the quality of information is one of the key determinants of the quality of their decisions and actions". This view is shared by others, for example: Najjar (2002) connects information quality to service quality in the banking industry, Miller (2005) links information quality with a firm's market share, Rossin (2007) associates information quality with the performance characteristics of supply chains, whereas Vanden (2008) emphasizes the significance of information quality in determining option prices.

While it is broadly recognized that quality information plays a critical role in the success of firms (Choo, 1996; Daft and Lengel, 1986; Porter and Millar, 1985), any information acquired by decision-makers will have little impact on firm

performance if it is not actually utilized in the making of decisions (Davenport and Beers, 1995; Diamantopoulos and Souchon, 1999). Information use is a critical aspect of information processing since in this stage the acquired information is applied to strategic, tactical, and operational outcomes to impact firm performance (Citrin et al., 2007).

In the BIS context, the quality of information provided by the system and use of that information for decision-making are deemed some of the most important elements for achieving BIS success (Popovič et al., 2012).

Information-sharing values

Early research established that a highly developed information culture is positively associated with organizational practices, such as information utilization, that lead to a successful firm performance (Ginman, 1988). Information culture is manifested in the firm's values, norms, and practices that have an impact on how information is perceived, created, and used (Choo et al., 2008; Oliver, 2003). Identified as one of the three information capabilities that help predict firm performance, information behaviors and values have been previously used to characterize the information culture of a firm (Marchand et al., 2000; Oliver, 2008).

Within organizations, information sharing has been emphasized as an important driver of organizational performance (Yang and Maxwell, 2011). Augmented information sharing can lead to improved organizational efficiency, learning, innovation, flexibility, and understanding of organizational goals (Constant et al., 1994; Hatala and Lutta, 2009). Jarvenpaa and Staples (2000) suggest information sharing embeds the concept of volition that differentiates information sharing from involuntary information reporting. We understand information sharing as a voluntary act of making information available to others (Jarvenpaa and Staples, 2000).

Effective information sharing relies upon an organization's ability to employ an IT infrastructure in the vertical and horizontal distribution of information across the organization (Davis and Golobic, 2010). As technologies for information dissemination progress, decision-makers have more opportunities to share information (Constant et al., 1994). Although IT can provide the infrastructure for information exchange, the final sharing decisions rest with decision-makers, and seamless information sharing is by no means guaranteed within organizations (Barua and Ravindran, 1996).

Research model and hypotheses

Our research model is shown in Fig. 1. Although both system quality and information quality are generally important for information use (DeLone and McLean, 2003; Petter et al., 2008), researchers have suggested that their effects may vary significantly depending on the context (Petter et al., 2013; Wixom and Todd, 2005). Accordingly, we examine and theorize the relative impacts among the BIS success constructs, and develop our logic for information-sharing values moderating the influences among BIS success constructs.

BIS quality refers to users' perceptions about the desirable characteristics of the system (Petter et al., 2013) and measures its technical success (DeLone and McLean, 2003). Compared to information quality, system quality has received less formal attention in the IS literature (Nelson et al., 2005). Moreover, elements of system quality are often combined with dimensions closely related to service quality and ease of use (Nelson et al., 2005). Prior literature (DeLone and McLean, 1992; Wixom and Todd, 2005) presents system-quality-specific antecedents derived from the decomposition and integration of factors identified in the user satisfaction literature. Most of these factors reflect the more engineering-focused performance features of the systems being studied. Several authors contend that, either directly (e.g. DeLone and McLean, 1992, 2003) or through object-based attitudes (i.e. system satisfaction) and behavioral beliefs and attitudes (i.e. ease of use) (e.g. Wixom and Todd, 2005; Xu et al., 2013), IS quality is generally linked to information use. While earlier studies concerning various IS contexts provide

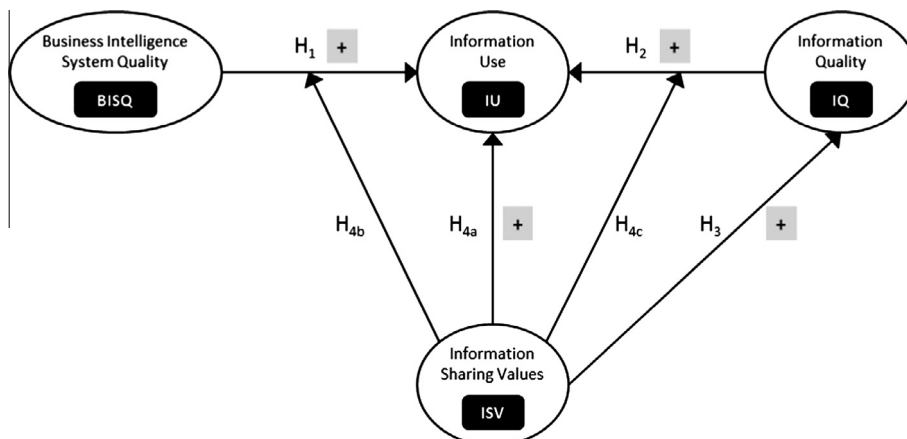


Fig. 1. Research model and hypotheses.

mixed support for this relationship, some recent conceptual and empirical studies within the BI milieu (e.g. Işık et al., 2013; Popovič et al., 2010; Shollo and Galliers, 2013) suggest a positive relationship between BIS quality and information use. Indeed, when users perceive that their information needs are attainable through existing BIS technical capabilities (e.g. BIS provides appropriate access to information, brings data from different business areas together, provides information in a timely manner, and works reliably) they would be willing to engage in information use behaviors that are conducive to performance outcomes, i.e. the acquired information from a system needs to be applied to the problem to impact performance (Citrin et al., 2007). We therefore propose:

Hypothesis 1 (H₁). Perceived BIS quality has a positive impact on BIS-enabled information use.

A context-based view of the notion of information quality suggests that *it needs to be defined relative to the user of the information, the task being completed, and the application being employed* (Nelson et al., 2005). Following this perspective, information quality refers to information characteristics to meet or exceed users' expectations, requirements or needs in completing a particular task (Nelson et al., 2005; Popovič et al., 2012). Existing IT/IS, marketing, and management literature suggest information quality has a positive influence on information use (e.g. DeLone and McLean, 2003; Low and Mohr, 2001; O'Reilly, 1982). Similarly, prior BIS studies have produced comparable results (e.g. Popovič et al., 2012; Yeoh et al., 2008). Thus, we put forward:

Hypothesis 2 (H₂). Perceived BIS-enabled information quality positively influences BIS-enabled information use.

According to Information Orientation theory (Marchand et al., 2000, 2001), information-sharing values represent one of the information capabilities that enhance an organization's information management practices. Previous research has linked an information-sharing culture to improvements in organizational information in market firms (O'Reilly, 1982), supply chain environments (Baihaqi and Sohal, 2012; Li and Lin, 2006), and public organizations (Svärd, 2014; Yang and Maxwell, 2011). Against this backdrop, we expect that information-sharing values influence the quality of BIS-enabled information. Since relevance and completeness are some of the most important information quality dimensions in the BIS context (Popovič et al., 2012), firms need to develop information capabilities to identify decision-makers' information needs and to ensure that information is available to them (Marchand et al., 2001). Yet, in many firms we witness "filtering mechanisms" that are based on values and behaviors and prevent decision-makers from establishing what information should be collected (Marchand et al., 2000), collectively resulting in poor information quality, i.e. irrelevant information available in BIS. Therefore, the current study hypothesizes that:

Hypothesis 3 (H₃). Information-sharing values have a positive effect on BIS-enabled information quality.

Information sharing is concerned with selecting and providing information to others. Hwang et al. (2013) assert that people have their own information-sharing values that will contribute to the overall motivation to use information for completing the required tasks. Moreover, it has been reported that a higher level of information-sharing values within a firm enhance individually held beliefs of information usefulness (Choo et al., 2008; Jarvenpaa and Staples, 2000) as well as the motivation to use an appropriate IS product to reduce uncertainty (Constant et al., 1994). Thus, we collectively hypothesize that:

Hypothesis 4a (H_{4a}). The level of information-sharing values positively impacts BIS-enabled information use.

Hypothesis 4b (H_{4b}). The level of information-sharing values influences the effect of BIS quality on information use.

Hypothesis 4c (H_{4c}). The level of information-sharing values influences the effect of BIS-enabled information quality on information use.

Research design

Data collection

The target population for this study was all medium- and large-sized firms operating in Slovenia, an EU country. The firms were selected from the official database published by the Agency for Public Legal Records and Related Services. The agency is the primary source of official public and other information on business entities and their subsidiaries which perform profitable or non-profitable activities. The final list provided 810 firms eligible for inclusion in the study. The data were collected using Web surveys that were addressed to employees most knowledgeable about BIS, its use, and the quality of BIS-enabled information for decision-making at the corporate level.

The questionnaire used in the survey queries the overall experience of the respondent with the quality and use of available information and BIS, and includes a set of questions regarding the constructs of our model: (1) perceived quality of BIS

(BISQ); (2) perceived information quality (IQ); (3) intention to use information provided by BIS (IU); and (4) respondents' tendency to share information (ISV). The remaining questions in the questionnaire are used to identify the participating firm (e.g. industry, number of employees, sales volume).

From the initial invitation, 123 completed Web surveys were received. To increase the response rate, follow-up reminders were sent out three weeks after the initial invitation which resulted in an additional 23 responses. In total, 146 responses from 146 firms were obtained, thus having one-to-one correspondence between a survey and a company. The final response rate was 18%.

The structure of respondents by industry type, average number of employees, and sales is presented in Table 1. The distribution of the respondents adequately represents the population of the country's medium- and large-sized firms.

Moreover, the level of development of a BIS (i.e. its maturity) within the surveyed firms according to different maturity dimensions linked to Data Sources and Analytical Capabilities is shown in Table 2. It can be observed that, while the levels of Data Warehouse/Data Marts use is relatively high, spreadsheets and separate databases are still frequently used as data sources in the BI environment. Accordingly, data integration and data consistency levels do not adequately follow the efforts to implement data warehousing. Not surprisingly, from the pool of BIS-enabled analytical capabilities, more advanced technologies (e.g. trend analysis, data mining, KPIs) are used to a smaller extent.

Operational measures

All constructs in the proposed model are based on reflective multi-item scales. Indicators of BISQ, IQ, and IU are adopted from the work of Wixom and Todd (2005) since they have been previously verified and considered in other IS (e.g. Barki et al., 2007) and BIS studies (e.g. Nelson et al., 2005; Popovič et al., 2012; Wixom and Watson, 2001). The measurement scale of ISV is adopted from the studies of Choo et al. (2008, 2006) and adapted to the context under study. All indicators are measured with a seven-point rating scale, with 1 representing the lowest level and 7 the highest. Table 3 presents a detailed list of the indicators used in the measurement model.

Estimation

The structural model consists of four latent variables. It includes the constructs shown in Fig. 1, along with two latent variables that represent interactions between the original latent variables ($ISV \times BISQ$ and $ISV \times IQ$). Following the approach of Chin et al. (2003), interaction terms were modelled creating new constructs, having as indicators the products of the standardized indicators relative to the underlying constructs involved in the interaction.

The model was estimated using the partial least squares structural equation modelling (PLS-SEM) approach. This option is mainly motivated by the characteristics of the data and the properties of the model. In fact, PLS-SEM works efficiently with small sample sizes and complex models and practically makes no assumptions about the underlying data (Hair et al., 2012). What is more, the PLS-SEM approach has gained attention in the prime IS journals (Ringle et al., 2012). All data analyses were carried out using SmartPLS (Ringle et al., 2007) and SPSS.

Results

Descriptive analysis

The means and standard deviations of the original variables can be found in Table 4. In the collected data set the means vary between 4.89 for IU2 and 5.63 for ISV1. The highest means are found in the ISV indicators and the lowest in the IU construct. The means for most of the measures are around one scale point to the right of the center of the scale, suggesting a slightly left (negative) skewed distribution. Standard deviations vary between 1.277 for ISV3 and 1.607 for IU2. The IU indicators are those that globally show the highest standard deviations and the indicators of the ISV construct are those with the lowest variability.

Table 1

Structure of the respondents by industry type, number of employees, and sales volume.

Industry type		Number of employees		Sales volume	
Industry	Share (%)	Employees	Share (%)	Sales amount	Share (%)
Agriculture, hunting and forestry	3.1	50–99	18.11	Under €500,000	4.26
Manufacturing	40.6	100–199	29.73	€500,001 to €1 million	10.61
Electricity, gas and water supply	7.8	200–249	17.23	€1 million to €2 million	15.85
Construction	3.2	250–499	14.51	€2 million to €5 million	21.23
Wholesale and retail trade	21.7	500–999	13.26	€5 million to €10 million	20.67
Hotels and restaurants	5.6	1000 or more	7.16	€10 million to €20 million	14.53
Transport, storage and communication	9.1			Over €20 million	12.85
Financial intermediation	8.9				

Table 2
Respondents' business intelligence system maturity.

<i>Business Intelligence System Maturity Dimensions</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Distributions*</i>
<i>Data Sources</i>			
To what extent are Transactional System(s) used as data sources in your organization?	4.97	1.80	
To what extent are Spreadsheets and Databases used as data sources in your organization?	6.12	1.14	
To what extent are Data Warehouse(s), including Data Marts, used as data sources in your organization?	4.81	1.88	
Data are completely integrated, enabling real-time reporting and analysis	4.76	1.60	
Data in the sources are mutually consistent	5.01	1.51	
<i>Analytical Capabilities</i>			
To what extent are Paper Reports used in your organization?	4.89	1.75	
To what extent are Interactive Reports (Ad-hoc) used in your organization?	4.75	1.46	
To what extent is On-Line Analytical Processing (OLAP) used in your organization?	4.24	1.78	
To what extent are Analytical Applications, including Trend analysis and "What-if" scenarios used in your organization?	3.29	1.77	
To what extent is Data Mining used in your organization?	3.11	1.87	
To what extent are Dashboards, including Metrics, Key Performance Indicators (KPI), and Alerts, used in your organization?	3.50	1.91	

* Distributions of the responses from 1 (side furthest to the left) to 7 (side furthest to the right).

Table 3
Constructs and their indicators.

Construct	ID	Indicator
Information use (IU) (Wixom and Todd, 2005)	IU1	I intend to use information provided by BIS as a routine part of my job over the next year
	IU2	I intend to use information provided by BIS at every opportunity over the next year
	IU3	I plan to increase my use of information provided by BIS over the next year
Business intelligence system quality (BISQ) (Wixom and Todd, 2005)	BISQ1	In terms of system quality, I would rate BIS highly
	BISQ2	Overall, BIS is of high quality
	BISQ3	Overall, I would give the quality of BIS a high rating
Information quality (IQ) (Wixom and Todd, 2005)	IQ1	Overall, I would give the information from BIS high marks
	IQ2	Overall, I would give the information provided by BIS a high rating in terms of quality
	IQ3	In general, BIS provides me with high-quality information
Information sharing values (ISV) (Choo et al., 2006, 2008)	ISV1	I often exchange information with the people with whom I work regularly
	ISV2	I often exchange information with people outside of my regular work unit but within my organization
	ISV3	In my work unit, I am a person that people come to often for information

As ISV play an instrumental role in our research, we assessed whether there are significant variances between the participating firms from different industry types. The mean for ISV varies between 5.5 for Agriculture, hunting and forestry, and 6.2 for Financial intermediation. This result can easily be understood considering the nature of the businesses; never-

Table 4

Means, standard deviations, and standardized loadings of manifest variables.

Construct	Indicator	Mean	Std. dev.	Loading
IQ	IQ1	5.16	1.461	0.960*
	IQ2	5.08	1.527	0.977*
	IQ3	5.10	1.535	0.981*
IU	IU1	5.00	1.558	0.928*
	IU2	4.89	1.607	0.933*
	IU3	5.04	1.593	0.869*
BISQ	BISQ1	5.05	1.553	0.948*
	BISQ2	5.05	1.564	0.960*
	BISQ3	5.08	1.532	0.965*
ISV	ISV1	5.63	1.287	0.934*
	ISV2	5.44	1.297	0.931*
	ISV3	5.62	1.277	0.848*

Note:

* Significant at the <0.001 level (two-tailed test).

theless, these differences are relatively small and do not influence the results of our study where the role of ISV is explored and not the level of information sharing per se.

Measurement of reliability and validity

We first examine the reliability and validity measures for the model constructs (Table 5). All Cronbach's Alphas exceed the 0.7 threshold (Nunnally, 1978) and are usually higher than 0.9. Without exception, the latent variable composite reliabilities (Fornell and Larcker, 1981) are higher than 0.90, showing the high internal consistency of the indicators measuring each construct and thus confirming construct reliability. The average variance extracted (AVE, Fornell and Larcker, 1981) is also always higher than 0.80, indicating that the variance captured by each latent variable is significantly larger than the variance due to measurement error, and thus demonstrating unidimensionality and the high convergent validity of the constructs. The reliability and convergent validity of the measurement model was also confirmed by computing standardized loadings for indicators (Table 4) and Bootstrap *t*-statistics for their significance (Anderson and Gerbing, 1988). All standardized loadings exceed the 0.7 threshold and were found, without exception, significant at the 1 percent significance level, thus confirming the high convergent validity of the measurement model.

Discriminant validity is assessed by determining whether each latent variable shares more variance with its own measurement variables or with other constructs (Chin, 1998; Fornell and Larcker, 1981). In this vein, we compared the square root of the AVE for each construct with the correlations with all other constructs in the model (Table 6). A correlation between constructs exceeding the square roots of their AVE indicates that they may not be sufficiently discriminable. We can observe that the square roots of AVE (shown in boldface in the main diagonal of both matrices) are always higher than the absolute correlations between constructs. We conclude that all the constructs show evidence of acceptable validity.

Model estimation results

Table 7 shows the explanatory power (through determination coefficient R^2) of the equations explaining the endogenous constructs: information use (IU) and information quality (IQ). It can be seen that the proposed model reveals relevant explanatory power for information use (0.43) and a slightly smaller explanatory power for information quality (0.21). Further, Table 7 presents the estimates of the path coefficients of the proposed model and the respective significances. The effect sizes for evaluating the predictive importance of each determinant (original constructs and interaction terms) may also be found in Table 7 (origins of the effects in rows and destinations in columns).

Table 5
Reliability and validity measures.

Construct	Cronbach's Alpha	Composite reliability	Average variance extracted
IQ	0.9719	0.9816	0.9469
IU	0.8972	0.9358	0.8295
BISQ	0.9545	0.9706	0.9166
ISV	0.8905	0.9314	0.8192

Table 6
Correlations between the latent variables and square roots of average variance extracted.

	IQ	IU	BISQ	ISV
IQ	0.9731	0.6224	0.5843	0.4532
IU		0.9108	0.4069	0.3982
BISQ			0.9574	0.3385
ISV				0.9051

Note: Numbers shown in bold denote the square root of the average variance extracted.

Table 7
Structural model results and effects sizes (f^2).

Criterion	Predictors	R ²	Path coefficient	f ²
<i>Path coefficients</i>				
IU	BISQ	0.43	0.079	0.01
	IQ		0.493**	0.29
	ISV		0.094	0.06
	ISV × BISQ		0.054	0.00
	ISV × IQ		−0.191*	0.03
IQ	ISV	0.21	0.452**	0.27

Notes:

* Significant at the 0.05 level (one-tailed test).

** Significant at the 0.01 level (one-tailed test).

The effect of BIS quality (BISQ) on information use was not found to be significant. Therefore, there is insufficient evidence to support BIS quality having a direct influence on information use, and thereby hypothesis H₁ is not confirmed. Please see the next section for a discussion of this result.

On the contrary, the effect of information quality (IQ) on information use was found significant (0.493; $p < .01$), thus confirming hypothesis H₂. The effect shows a large effect size, confirming suitable predictive relevance.

The effect of information sharing values (ISV) over information quality was also found to be large and significant (0.452; $p < .01$), thus supporting H₃.

Finally, we found partial support for the set of hypotheses H_{4a} through H_{4c}. The direct effect of information-sharing values on information use was found to be non-significant. Therefore, there is not sufficient evidence to support information sharing directly influencing information use (H_{4a} was not confirmed). The interaction effect ISV × IQ was found significant ($p < .05$), therefore supporting the moderating effect of information-sharing values on the IQ–IU relationship as stated in hypothesis H_{4c}. In addition, its effect size is still relevant (0.03). This path coefficient is negative (−0.19), revealing that the effect of information quality on information use will be attenuated for those organizations that have a high information-sharing culture. On the other hand, the interaction effect ISV × BISQ was not found to be significant, thus not supporting hypothesis H_{4b}. This result is attributed to the fact that BIS quality itself was not found to be a significant direct predictor of information use. Together, these results support the pure moderating role of information-sharing values for the IQ–IU relationship. We consequently conclude that the quality requirements expressed in the IQ construct will be less important for inducing BIS-enabled information use within those organizations that have strong information-sharing values. The consequences of this assessment will be discussed in the next section.

Discussion

The current IT business value literature often considers information processing and use capabilities, namely IT practices, information management practices, and information values, separately. However, these capabilities work together in interaction and synergies across different capabilities have to be exploited to enable effective information utilization. While the link from information values, and information sharing specifically, to information management practices has previously been recognized (Marchand et al., 2000), present studies have not yet delved deeper into the related details. By answering the research question “*how do information-sharing values guide decision-makers’ intended use of BIS-enabled information?*”, our findings reveal important insights that boost understanding of the influence of information-sharing values on IS success relationships in the context of BIS success. These findings can, in turn, be generalized not only empirically, but several theoretical conclusions about the underlying mechanisms that cause the impact of information sharing on the relationships among IS success dimensions can be drawn from the data analysis using a mode of inference, namely retroduction within the critical realism philosophical perspective (Tsang, 2014).

It has previously been emphasized that the extent of BIS-enabled information use in decision-making depends largely on the quality of BIS-enabled information (i.e. the higher the quality of the information, the greater the extent of its use by

decision-makers when making decisions); however, the influence of BIS quality on BIS-enabled information use was found to be insignificant (Popovič et al., 2012). Our results confirm prior findings; while BIS-enabled information quality positively contributes to decision-makers' intentions to use BIS-enabled information (H_2 is confirmed), BIS quality does not have a significant direct relationship with BIS-enabled information use (H_1 is not supported). A possible reason for this is that BIS quality features, such as reliability, accessibility, flexibility, ability to integrate data, and speed of the system, are only distantly related to the use of BIS-enabled information. As BIS-enabled information quality appears influential in shaping decision-makers' intentions to use BIS-enabled information, firms should focus their efforts and resources on developing and refining mechanisms for improving the content quality of BIS-enabled information, namely information relevance, completeness, currency, accuracy, and format (Wixom and Todd, 2005).

Considering a broader view of IT-enabled information use for decision-making, the literature suggests that intra-organizational factors such as information-sharing values (Choo et al., 2006, 2008; Hwang et al., 2013; Yang and Maxwell, 2011) also play an instrumental role in shaping decision-makers' intentions to use IT-enabled information, as well as the need for higher quality information. Against this backdrop, and coupled with mixed theoretical support, our study adds value to the understanding of BIS success by providing empirical support about how information-sharing values guide decision-makers' intended use of BIS-enabled information for decision-making.

The implications stemming from our findings are twofold. To begin with, in contrast with prior research on the influence of information sharing on IT-enabled information use, we found no direct relationship between information-sharing values and information use in the BIS context (H_{4a} is not supported). Decision-makers' increased readiness to share information among them will not readily translate into increased BIS-enabled information use because information-sharing activities enable decision-makers to find alternative ways to access the information that is not available from BIS. In this sense, BIS-enabled information can be viewed as a "constant"; decision-makers will use such information independently of their tendency to share information. Thus, we can expect that other mechanisms exist through which information-sharing values influence BIS-enabled information use.

Second, quality information was found to be importantly intertwined with information sharing and use. In fact, when a decision-maker is responsible for the decision outcome, he or she demands high quality information to support the decision. Thus, higher levels of information-sharing values act as a catalyst for improving BIS-enabled information quality since decision-makers expect information sharing will add to the fulfillment of their information needs. Within an organizational environment that includes a stronger tendency to share information, we can anticipate a greater readiness for BIS implementation projects. These projects are, in their essence, integrative and add to the cleansing, editing, and unifying of data that yield higher quality information. As the level of intra-organizational information sharing increases, we can anticipate an increase in the success of BIS projects as the ability to integrate data improves, data inconsistencies are reduced prior to starting projects, decision-makers' needs for addressing enterprise-wide business issues are better understood beforehand, and risks in decision-making are alleviated. In this sense, via BIS implementation projects information-sharing values add to the information quality, namely information relevance, completeness, currency, accuracy, and format. Indirectly, as emphasized earlier, this improves BIS-enabled information use.

The scarce prior studies that investigate the concurrent impact of information-sharing values and information quality on IT-enabled use (e.g. Jarvenpaa and Staples, 2000) suggest somewhat different, and even opposite, results. While their study proposes a direct positive impact of information-sharing values coupled with the concurrent impact of both information-sharing values and information quality on the use of collaborative electronic media, our findings suggest that, in the BIS context, increased levels of information-sharing values suppress the requirements decision-makers pose upon the quality of BIS-enabled information. These conflicting results can be partially attributed to different conceptualizations of the dependent variable. More precisely, the use of collaborative electronic media in Jarvenpaa and Staples' (2000) study can only serve as a proxy for information use. In addition, the different results can to some extent be credited to the different nature of the systems under study. One of the main differences lies in the breadth of information sharing, where Jarvenpaa and Staples' (2000) measurement instrument gives a much greater emphasis to external sharing, which can be an important difference since information sharing traditionally tended to occur more within rather than across functions. Generally, information sharing is considerably context-dependent, as discussed by Jarvenpaa and Staples (2000). It thus appears that, in BIS settings, decision-makers are, to some extent, willing to sacrifice the demand for high quality BIS-enabled information. Firms that can successfully improve information sharing among decision-makers can thus achieve benefits in the form of investing fewer resources to improve the content quality of BIS-enabled information, which can be a costly endeavor. To improving their information sharing firms can, for instance, begin by considering their organizational structure and organizational culture since these have previously been shown to have a broad impact on activities performed within firms, as well as on the characteristics of shared information, reward and incentive systems for motivating decision-makers to share information, trust, and the social identification of decision-makers with the firm (Yang and Maxwell, 2011). Collectively, the above have been shown to influence decision-makers' beliefs regarding intra-organizational information sharing (Yang and Maxwell, 2011).

From the perspective of the strategic management of BIS, firms can thus choose two paths to alleviate the risk when making decisions (Arvidsson et al., 2014). Given that information-sharing values were found to be significant in shaping the influences on system use and IU, managers should recognize that these behavioral characteristics and values should not be underestimated. On a more practical note, firms can on one side focus their efforts on improving the quality of BIS-enabled information that would ultimately lead to information use and, consequently, to the effective exploitation of available system capabilities. In this case, information-sharing values can importantly contribute to the results of these efforts. On the

other side, lower investments in improving the quality of BIS-enabled information can, to some extent, be substituted with a more mature information culture, specifically with increased levels of information-sharing values. Because information sharing is generally considered a desirable behavior within firms (Constant et al., 1994), it might be perceived by employees as an adequate alternative to seeking quality information for their decisions. Specifically, employees might believe that higher levels of information-sharing values intrinsically include “good” information being shared and therefore give less emphasis on information quality over information use. Managers who want their employees to leverage information use should focus on clarifying and distinguishing the importance of the information-sharing process from information quality itself.

While information sharing (Jarvenpaa and Staples, 2000) is a voluntary act, in many circumstances we are asked, encouraged, or urged to share (Marchand et al., 2001). There is a host of ways to share information, such as through IS, meetings, or through conversation (Marchand et al., 2001). Historically, informal sharing mostly took place through, for example, unscheduled meetings and after-work social events, but is now also mediated through IT such as online forums, blogs and wikis (Davison et al., 2013). Formal IS, such as BIS, have well-defined management systems and structures, with explicit instructions that help guide information exchange processes among employees (Schwaer et al., 2012). Interactive IT applications that facilitate informal information sharing (Davison et al., 2013) differ from formal ones in that they are not directly laid down and governed by management (Schwaer et al., 2012). Employee participation is voluntary and trust plays a key role in deciding whether to use informal information-sharing channels.

While at first sight information sharing appears to be a straightforward activity, its understanding becomes more complex when we take the potential barriers to sharing information into consideration. Understanding the barriers to information sharing, and blending them with the results of our study, informs us about the ways BIS can be effectively exploited. These preconditions for sharing information consist of the existence of common language and shared meanings among decision-makers within a firm, a prior relationship among decision-makers, the perceived level of trust among decision-makers sharing information, and a shared purpose or ownership of results (Marchand et al., 2000, 2001). If a common language and meanings among decision-makers exist, it will be easier to establish an integrated BIS. With it, firms acquire a broader view of their business activities and performance, i.e. better quality information in terms of its relevance and comprehensiveness. Yet, higher levels of information-sharing values increase sensitivity about business issues due to a lack of common language and shared meanings, further encouraging the development of a dictionary of implicit or explicit common business terms. Next, prior research viewed quality information as a means to reduce an employee's perception of vulnerability when making decisions (Thomas et al., 2009). We advance this existing understanding by asserting that, if firms succeed in establishing proper levels of trust among decision-makers, people will share and use information – even though not of the highest quality – to reduce risk as they will have confidence in the appropriate interpretation of that information and its use. Existing research posits that trust is a necessary condition for information sharing (Wang and Noe, 2010) and plays an important role in various organizational strategies involving IS (Kanawattanachai and Yoo, 2002; Lankton et al., 2014). Trust is particularly important within the BIS milieu since BIS primarily provide information regarding firm performance; in fact, BIS come with the implicit promise about providing quality information. Thus, trust aid making quicker and more effective decisions as decision-makers do not need to check out whether the available information is valuable. Decision-makers' willingness to trust the performance information will create a climate of transparency in which people willingly uncover failures, mistakes, and errors. This will, in turn, inspire decision-makers to sense information and seek information proactively, and consequently better comprehend their information needs when developing BIS. Previous works have shown the importance of information-sharing values for information proactiveness, information sensing, and processing (Marchand et al., 2000). Accordingly, the trust-building process can be important for warranting decision-makers to continue using strategic IS (Lankton et al., 2014). Finally, when the understanding of a common purpose is established, specifically when a BIS is built around the concept of business performance management where links among BIS users, decision-makers, and strategic goals are clearly defined, decision-makers will perceive information of a higher quality as it will assist them in their contribution to the strategic goals, the global optimization of their activities, and reduced risk. At the same time, the presence of shared purpose reinforces information sharing regardless of the quality of the BIS.

Despite its contributions to theory and practice, our study has limitations and also opens opportunities for future research. Our conclusions regarding the relative impacts of information-sharing values on IS success relationships are limited to a single country. Although the effects were controlled by employing a theoretically unrelated control variable, and performing common method bias tests, caution should still be exercised when generalizing the findings to other user, technological, and organizational contexts. For example, future research may investigate the validity of our research model across different user groups, e.g., early adopters and late adopters. Moreover, the prevailing type of organizational culture might be another concern with regard to generalizing our results. As such, we encourage future studies to examine the proposed research model and hypotheses in different settings.

Further, we theorize information-sharing values as independently impacting IS success dimensions and relationships, yet certain organizational conditions, e.g. worker empowerment, team orientation, orientation toward creating change, the firm's strategic direction, goals and objectives (Srite and Karahanna, 2006), might significantly facilitate or hinder the way information-sharing values affect the relationships of the IS success dimensions. Future research might also explore how improved IS success dimensions influence information-sharing values. In addition, future research could investigate the dynamics of information-sharing values over time. For example, researchers might employ a longitudinal research design to examine the process through which and the reasons why information-sharing values have a greater impact on a certain

type of IS. Overall, we recommend that researchers carefully select the contextual characteristics, including specific types of IS, to theorize the pertinent influences of information-sharing values on the dimensions and relationships of IS success.

Conclusion

Information use is the key for managers operating amidst highly competitive environments. This study explored whether and how information-sharing values influence information use. Drawing on the business value of IT, user satisfaction, technology acceptance, and information culture literature facilitated the development of research hypotheses and a conceptual framework that explicates these relationships in the BIS context. We conducted an empirical study among medium and large firms to test the research model and hypotheses.

We found that BIS quality has no significant influence on the intention to use BIS-enabled information. Further, we confirmed that information quality is the key driver of information use and found that information-sharing values negatively affect this relationship. While information-sharing values have no direct impact on BIS-enabled information use, they directly improve the quality of BIS-enabled information.

This study represents a significant advance in our theoretical understanding of the role of information-sharing values in increasing the use of BIS-enabled information. The results also provide instrumental insights for managers to foster an information culture, specifically information sharing, to leverage the implemented IS to more effectively extract their value potential. We hope that this work inspires future attempts to elaborate on our findings.

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