Extending the Understanding of Critical Success Factors for Implementing Business Intelligence Systems

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Extant studies suggest implementing a business intelligence (BI) system is a costly, resource-intensive and complex undertaking. Literature draws attention to the critical success factors (CSFs) for implementation of BI systems. Leveraging case studies of seven large organizations and blending them with Yeoh and Koronios's (2010) BI CSFs framework, our empirical study gives evidence to support this notion of CSFs and provides better contextual understanding of the CSFs in BI implementation domain. Cross-case analysis suggests that organizational factors play the most crucial role in determining the success of a BI system implementation. Hence, BI stakeholders should prioritize on the organizational dimension ahead of other factors. Our findings allow BI stakeholders to holistically understand the CSFs and the associated contextual issues that impact on implementation of BI systems.

Introduction

The successful implementation of information technology (IT) innovations remains both a theoretical and a managerial challenge. Many IT implementation projects have a high-risk profile (Harrington & Guimaraes, 2005; Kutsch, Denyer, Hall, & Lee-Kelley, 2013) and various IT innovations introduced by organizations are either rejected or underused by end users (Sharma & Yetton, 2003).

Business intelligence (BI) technologies have recently received considerable attention from both industry and acareceived (Chen, Chiang, & Storey, 2012). In a worldwide survey of IT spending (Gartner, 2013b), BI-related technologies (still) ranked among the top technology priorities of many chief information officers, with global BI software spending expected to grow by 7% over the previous year (Gartner, 2013a). Such enthusiasm can be attributed to the rising importance of BI systems, which have regularly been viewed as "a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions" (Wixom & Watson, 2010, p. 14). Yet implementing a BI system does not only entail the purchase of a combination of software and hardware; rather, it is a complex undertaking requiring appropriate infrastructure and resources over a lengthy period of time (Yeoh & Koronios, 2010). In fact, cases have previously been reported where large investments in various BI initiatives over lengthier periods resulted in little or no benefits for the organizations implementing them (Williams & Williams, 2007).

Despite the vibrant BI market and the complexities surrounding the implementation of BI systems, the critical success factors (CSFs) of BI system implementation initiatives remain poorly understood. A typical BI system implementation involves multifaceted technological, organizational, and process issues, sharing similar characteristics with other intelligence system (IS) infrastructural projects like enterprise resource planning (ERP) systems implementation (Popovič, Hackney, Coelho, & Jaklič, 2012). Still, most existing CSF studies have focused on identifying lists of CSFs and little contextual understanding is given to guide a project team tasked with implementing a BI system. Thus, this research aims to move towards a clearer understanding of the CSFs affecting the implementation of BI systems by advancing an earlier attempt in the field by Yeoh and Koronios (2010). More specifically, this study does not aim to identify a new set of CSFs but develops existing work and

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offers a better contextual understanding of the CSFs for implementing BI systems by leveraging case studies and blending them with the BI system success literature. In total, seven large organizations were examined and analyzed.

The remainder of this paper is structured as follows. In the following section we outline the success criteria for effective BI system implementations, followed by the CSFs for BI systems implementation success employed in this study. The Methods section describes the data collection and analysis method. It is then followed by research findings pertaining to the analyzed CSFs. In the Discussion, we highlight the research contributions and managerial implications of our findings. The paper concludes by outlining avenues for future research.

Criteria for Business Intelligence System Implementation Success

The IS success literature contains a plethora of studies considering various factors that determine the success or failure of an IS implementation. One of the most influential (DeLone & McLean, 1992, 2003) suggests treating IS success as a multifaceted construct, choosing several relevant measures based on the research objectives and the IS context under investigation, and considering possible relationships among the dimensions. Within the BI research milieu researchers have increasingly put forward specific criteria to assess the implementation success of a BI-related technology (e.g., Ang & Teo, 2000; Ariyachandra & Watson, 2010; Chen, Soliman, Mao, & Frolick, 2000; Hwang, Ku, Yen, & Cheng, 2004; Işik, Jones, & Sidorova, 2013; Popovič et al., 2012; Wixom & Watson, 2001). Nevertheless, it appears that there are no commonly agreed success criteria for implementing a BI system.

Drawing upon prior studies, our work takes a fresh approach to the assessment of BI system implementation success criteria so as to provide a better contextual understanding of the CSFs for implementing BI systems. We take two key success dimensions into account: process performance (i.e., how well the process of a BI system implementation went), and infrastructure performance (i.e., the quality of the system and its output) (Ariyachandra & Watson, 2010). A separate assessment of each dimension is required since these dimensions are not necessarily correlated. To illustrate, it is quite possible for an over-budget or beyond-schedule BI system implementation project to achieve a high-quality information output. Conversely, a within-budget and on-time project may still provide poor-quality reporting.

Process performance can be assessed in terms of time schedule and budgetary considerations (Ariyachandra & Watson, 2010). Time schedules consist of the period to implement the initial version of the system, whereas budget criteria call for the cost of developing and maintaining the system to be appropriate, or within reasonable limits (Ariyachandra & Watson, 2010).

Infrastructure performance has parallels with the three main dimensions of the IS success model (DeLone & McLean, 1992, 2003), namely, system quality, information quality, and system use. System quality reflects the performance characteristics of the information processing system itself, and is assessed through a system's flexibility, scalability, and ability to integrate data (DeLone & McLean, 1992, 2003; Popovič et al., 2012). Information quality refers to the accuracy, completeness, timeliness, relevance, consistency, and usefulness of information provided by the system (Işik et al., 2013; Popovič et al., 2012). System use is viewed as a "recipient's consumption of the output of an information system" (DeLone & McLean, 1992, p. 66).

Critical Success Factors for Implementing Business Intelligence Systems

To date, it appears that academic research on the CSFs of implementing BI systems is scarce (e.g., Dawson & Van Belle, 2013; Olszak & Ziemba, 2012; Sangar & AIahad, 2013). Existing research provides quite a limited breadth and depth of analysis with limited scope. Nonetheless, these works generally agree with and build upon the CSFs for implementing enterprise-level BI systems identified by Yeoh and Koronios (2010) (see Table 1). In our study, we employ the CSFs as qualitative measures to assess the success of implementing BI systems within our target organizations.

Methods

Research Framework

Building upon the IS success and CSFs literature, we develop a research framework that comprises the BI system implementation success criteria and the seven CSFs under the respective dimension of interest: organization, process, and technology. As illustrated in Figure 1, this research framework outlines how a set of CSFs contributes to successful implementation of a BI system. It postulates there is

TABLE 1. Critical success factors for implementing BI systems (Yeoh & Koronios, 2010).

Dimension	Critical success factor (CSF)
Organization	Committed management support and sponsorship
	A clear vision and a well-established business case
Process	Business-centric championship and a balanced team composition
	Business-driven and iterative development approach
	User-oriented change management
Technology	Business-driven, scalable and flexible technical framework
	Sustainable data quality and integrity

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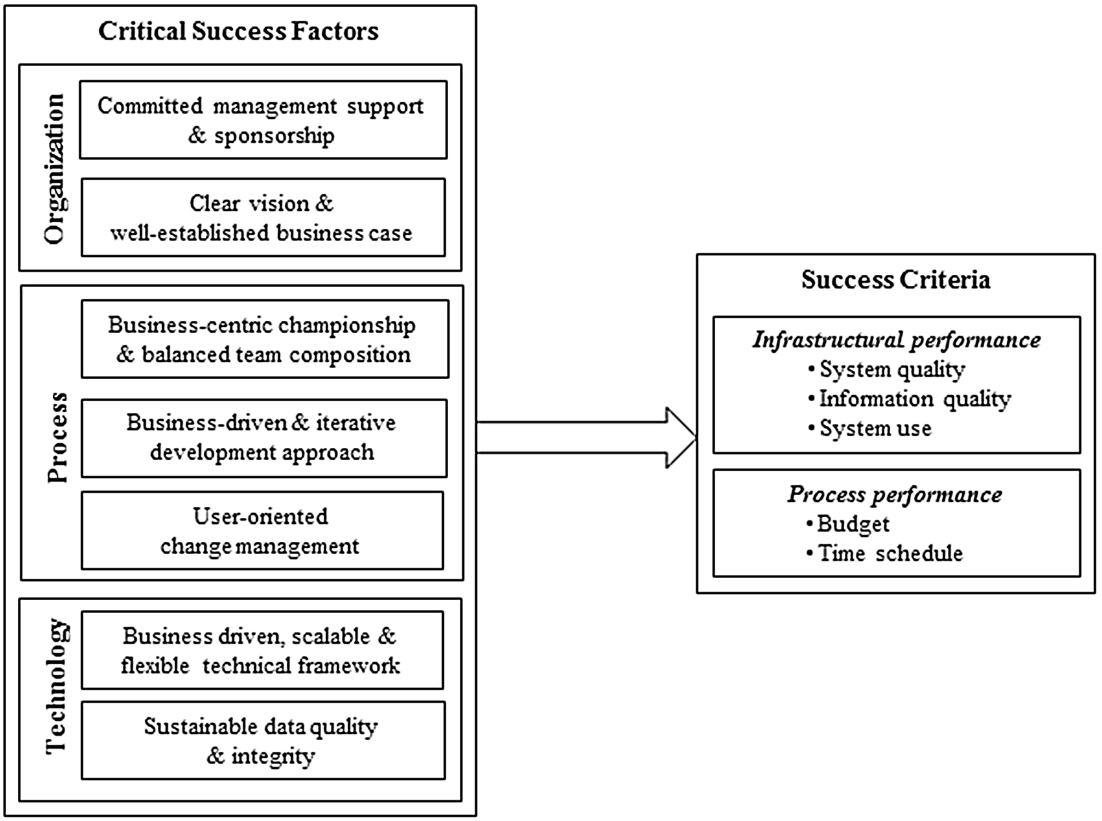

FIG. 1. Research framework.

a set of multidimensional CSFs that influences the success of implementing BI systems. This is assessed through infrastructure performance and process performance. In the proposed framework, fulfilling Yeoh and Koronios's (2010) CSFs is considered a requirement in order to ensure a successful BI system implementation.

Data Collection

Semistructured interviews were selected as the primary source of evidence to facilitate an examination of the organizations' experiences in relation to the CSFs identified in the literature. They were also chosen so as to provide a deeper understanding of the CSFs (Yin, 2014). Face-to-face interviews with BI stakeholders were conducted at scheduled times at their respective work sites. Each interview was carried out by one of the members of the research team; it was audiorecorded and lasted 1–2 hours. During the interviews, the researcher was provided with a variety of project-related documentation, such as project reports, business cases, planning documents, and training manuals. Additional documents such as organization structure charts, position descriptions, policy manuals, and annual reports were used to complement and substantiate evidence from other sources. In particular, the organization structure charts were used to better understand the interrelationships between different units such as IT and the business unit. All of this documentation provided further evidence to corroborate and augment the interview data, thus establishing triangulation for the case studies (Yin, 2014) and verifying data in the data analysis stage (Patton, 1990).

In selecting the number of cases, several studies recommend that case sampling is considered adequate when patterns have emerged, and the study is then deemed to have reached "theoretical saturation" (Eisenhardt, 1989). Nevertheless, several studies recommend four as the minimum number to achieve theoretical generalizability (e.g., Eisenhardt, 1989; Miles & Huberman, 1994; Yin, 2014) and not more than 15 cases to allow comfortable comprehension of "local dynamics" (Miles & Huberman, 1994). Seven cases were chosen for this study, which falls within the recommended range. They comprised a variety of large organizations in Australia. In order to maintain homogeneity and thus reduce the potential for confounding the effects of different industries, IT infrastructures, and information environments, it was decided that for the case-studies conducted for this research all organizations should come from the same industry. Thus, this enquiry focuses on engineering asset management organizations such as electricity, gas, water utilities, and railway companies (i.e., organizations with critical engineering infrastructure and engineering asset management business). The case sampling was therefore deemed to be rich in information and appropriate for

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TABLE 2. Case background.

Case	Type of organization	Annual revenue	No. of staff	Implementation success level
R1	Rail network access provider	M	M	Successful
R2	Passenger rail transport and rail freight provider	L	L	Successful
E1	Electric and gas utilities	L	M	Successful
S1	Shipbuilder and maintainer	M	M	Partially successful
W1	Drinking water, wastewater and storm water service utilities	L	M	Successful
W2	Water, sewage, recycled water utilities	M	M	Successful
W3	Bulk water supplier and water infrastructure provider	M	S	Unsuccessful

Note. The case descriptions have been disguised slightly to preserve the anonymity of the participants.
Small (S)=<USD $100 million, Medium (M)=USD $100 to $1000 million, Large (L) = >USD $1 billion.
Small = <1000 staff, Medium = 1000–5000 staff, Large = over 5000 staff.

theoretical replication. Overall, 26 interviews were carried out for all seven cases. The case background and implementation success level for each participating organization is presented in Table 2.

The informants were drawn from different functional areas of their respective organizations and included BI project managers, project sponsors, project members (of IT and business fields), and key users. When examining the BI system implementation success criteria, namely, infrastructure performance and process performance, particular attention was paid to the selection of appropriate informants who are best positioned to rate success in those areas. Notwithstanding the fact that earlier BI success studies (e.g., Işik et al., 2013; Popovič et al., 2012) mainly employed BI system users as the sole key informants for their investigation, we expand the pool of informants to "technical" and "project-related" roles. As we focus on the CSFs influencing the implementation process of a BI system, and not the end-product itself, as was the case in prior studies, we deemed it appropriate to include additional informant roles. Blending the information from "technical" and "project-related" informants who possessed comprehensive information about the infrastructure (i.e., by referring to the administrative site of the BI systems and/or from internal feedback) with project members/sponsors from the business side who were directly involved in use of the BI systems (hence, they could supply the required information from the business-user perspective), provided the adequate reach and richness of the case information to meet our research objective. Table 3 summarizes the key informants' characteristics, namely, their position, project role, and function within the organization.

Analysis Method

A cross-case analysis approach was used in this study to better understand the findings (Miles & Huberman, 1994). In searching for patterns, we examined similarities and differences in relationships within the data. Varying the order in which case data are arrayed enables patterns to become more obvious (Stuart, McCutcheon, Handfield, McLachlin, & Samson, 2002). Moreover, this research did not produce quantitative data. In all cases, we were examining the presence or absence of a particular CSF (e.g., "Was data integrity in place?"), while at the same time ascertaining whether it had been fulfilled in a meaningful way.

When determining the suitability of each case for this enquiry we applied a set of success criteria of the research framework and categorized the cases as successful (S), partially successful (P), or unsuccessful (U) in their respective implementation projects. The extent of implementation success was examined against two key dimensions: infrastructure performance, which was viewed through the lens of system quality, information quality and system use, and process performance, which takes budgetary considerations and time-schedule measures into account. During the interviews, the participants were asked to rate the degree of success of their BI system implementation (Table 4). Adopting the same qualitative measures used by Poon and Wagner (2001) in their executive IS success study, a "Good" rating means that all informants agreed the measure was well-achieved. A measure rated as "Acceptable" refers to a somewhat satisfactory performance of the success measure, whereas a "Poor" rating indicates that the success measure was not well-achieved, as viewed by most informants.

The analysis of the triangulated results suggested five instances of notable success, one moderately successful case, and one failure. The five reported successful organizations depicted their respective BI systems as stable, flexible, scalable to include additional data sources, and responsive within anticipated times. Further, the information provided by the BI system was considered accurate, timely, complete, and relevant to most participants. In addition to the encouraging levels of end users' system use, the informants confirmed that their implementation processes were completed on time (or at least with an acceptable delay) and within budget (or with a reasonable spending excess).

In relation to the moderately successful case, it is noted that it was experiencing uncontrollable external factors in the implementation of its BI system. Moreover, the key application of its BI system was not identical to those of conventional commercial enterprises. Due to its unique form of business and the peculiar bonus system with its major defense client, it was more concerned with ensuring the

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TABLE 3. Summary of data sources.

Case	No. of informants	Position of informants	Project role	Function
R1	3*	IT manager	Project manager	IT
		Manager asset management	Project sponsor	Business
		Contractor/Consultant	Project member	IT/Business
R2	5*	Business decision support manager	Project member	Business
		Data warehouse manager	Project manager	IT
		Client services and delivery manager	Project member	IT
		Network access group general manager	Project sponsor	Business
		Finance performance manager	Key user	Business
E1	3*	System manager	Project manager	IT
		Business analyst team leader	Project member	Business
		Contractor/consultant	Project member	IT/Business
S1	4*	Senior business analyst	Project manager	Business/IT
		Logistic engineering manager	Project member	Business
		Integrated lifecycle group manager	Project member	Business
		Integrated lifecycle system manager	Project member	IT
W1	3*	Information manager	Project manager	IT
		Manager hydraulic systems services	Project member	Business/IT
		Business analyst	Project member/Key user	Business
W2	3*	Information service manager	Project manager	IT
		Data model architect	Project member	IT
		Asset management manager	Project sponsor	Business
W3	5	Business information system manager	Project manager	IT
		Business analyst	Key user	Business
		Asset management manager	Project sponsor	Business
		System manager	Project member	IT
		Operation and maintenance manager	Project sponsor	Business

Note. *The use of external consultants to do some major phases.

TABLE 4. Implementation success criteria for the seven cases.

Success measures	Case code	R1	R2	E1	S1	W1	W2	W3
Infrastructure performance								
1 System Quality		✓	✓	✓	✓	✓	✓	*N/A*
2 Information Quality		✓	✓	✓	✓	✓	✓	*N/A*
3 System use		✓	✓	✓	*A*	✓	✓	*N/A*
Process performance								
4 Budget		✓	✓	✓	✓	*A*	✓	*X*
5 Time schedule		✓	✓	✓	✓	✓	✓	*X*
	Overall	*S*	*S*	*S*	*P*	*S*	*S*	*U*

Note. ✓ = good, *A* = acceptable, *X* = poor, *S* = successful, *P* = partially successful, *U* = unsuccessful.

on-time delivery of assets and meeting quality and safety standards than reducing costs or staffing. However, its BI system had the benefit of enabling it to analyze and investigate the underlying business activities with ease. Auditable reporting could also be generated by the system to help the business meet its strict regulatory requirements.

Lastly, the firm that had experienced the failure of its BI system implementation had done so due to business issues in an early phase of its implementation process. The business needs and requirements for the BI system had not been clearly defined, and the firm continued to have silo information systems with multiple versions of the truth. The BI initiative was mainly driven by the IT department alone and viewed as a technological issue; as a result, management had to suspend the BI initiative prior to the BI systems being actually implemented. This instance of failure served as a useful contrasting case supporting comparative analysis in this research, especially in comparing the importance of organizational and process-related factors.

Background to Implementing the Business Intelligence Systems

Before analyzing the CSFs we first looked at the background and motivations for introducing the BI system to the participating organizations to better understand the relevance of the CSFs we later examined (see Table 5). Across all cases the informants noted that the need to facilitate performance management was one of the main drivers of the BI system's implementation. Among other reasons, the case data reveal an overall upgrade of enterprise-wide IS, the need for a "single version of the truth," mergers, and external requirements.

Findings

To compare the seven cases' levels of implementation success with the management of the CSFs, an evaluation of the seven CSFs was conducted through a cross-case analysis. For each case, the management of each individual CSF (i.e., how each CSF was addressed by the individual organization) is rated with a summary rating of ✓ (for a CSF that

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TABLE 5. Background to and motivations for implementing the BI systems.

Case	
R1	*Due to a new arrangement, the company has acquired a competitor company and is now overseeing a much wider area of the rail network. *The BI system success story of the acquired company has inspired the executives to expand the BI system initiative to an enterprise-wide scale. *In order to facilitate "one-stop" planning, reporting and business analysis, the company adopted a BI system with great enthusiasm.
R2	*The company has been using a BI system for more than a decade, initially for its various silo functional needs, such as safety reporting, network access, maintenance and operation. *To better facilitate overall business performance, the organization has recently been restructured accordingly, and the silos BI systems are undergoing amalgamation.
E1	*A BI system was implemented for the advanced analysis, planning and risk management of the vast electricity network. *Due to market deregulation, legislative compliance and auditing requirements, a BI system was adopted and widely supported by all stakeholders. *Conformance and compliance are more critical for the BI system than cost savings.
S1	*A BI system was implemented as part of its ERP package. The key use of the system is for business reporting, analysis of asset lifecycle performance and supply chain management. *Due to its unique business nature, the BI tool was not meant to cut the operating costs or for competitive advantage, but to meet the strict compliance requirements and bonus system.
W1	*The BI initiative was mandated due to the "multiple versions of the truth" and time-consuming work in managing and analyzing information related to water quality, hydraulics monitoring operations and the telemetry system. *The entire system was implemented in two major stages. *The project also involved major upgrades of existing operational systems.
W2	*As part of a larger BI initiative, the BI system was implemented for GIS-related advanced analysis, planning and management of the utilities network. *Due to legislative compliance and auditing requirements, a BI system was adopted successfully and widely supported by all staff and external stakeholders. *For the BI system, a "single version of the truth" is critical for auditing purposes.
W3	*The BI initiative was mainly driven by the manager of the business information system who is a technology enthusiast. *He has been promoting the advantages of a BI system, and organized a number of interactive sessions with BI vendors. *However, the BI effort was not supported by business stakeholders as they clearly failed to identify their BI needs and requirements.

TABLE 6. Committed management support and sponsorship.

Case	
R1 ✓	*There was consistent support from the executives, especially through their involvement in the steering committee, and direct endorsement from the CEO. *Their endorsement of the BIS commanded respect and interest among others. *Sponsorship and budget described as generous
R2 ✓	*The initial BIS development was strongly supported by functional managers. *Now the silos BIS have gained the attention of top executives. *As a result, it involved some degree of organizational restructuring (i.e. an amalgamated BIS is in progress for its major network access and maintenance divisions). *Budget described as adequate *Existence of a high-level steering committee
E1 ✓	*Top management support was strong, MD is crucially aware * Sponsorship and budget described as generous *Top-down commitment was shown in defining the process of business needs and report requirements *Existence of a high-level steering committee
S1 *P*	*Initially, the executives focused more on the benefits of ERP than the BIS. *However, the BIS was gaining momentum as in supporting auditable business reporting and complying with the needs of its key client and strict regulation. *Budget described as adequate
W1 ✓	*Top management support was strong; the BI system was initiated by the CIO. *The CIO appointed a specific project manager to lead and co-ordinate the project. *The project manager was empowered at board project level and reported directly to the CIO. *Sponsorship and budget described as generous *Existence of a high-level steering committee
W2 ✓	*Top management, both the CEO and CIO, fully supported the BI initiative. *The project manager reported directly to the CIO and were empowered at the broad project level. * Sponsorship and budget described as adequate
W3 *X*	*Top management was not convinced about the usefulness of a BIS for the business. *The executives instead supported its ERP modules expansion projects.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

was fully addressed), P (for a CSF that was partially addressed), or X (for a CSF that was ignored). The ratings are supported by factual data from field research with each organization. That is, referring to Yeoh and Koronios's (2010) definition of each CSF, we determined whether a particular CSF was present and fulfilled in a meaningful way for each case organization. When all elements of a CSF were present, the CSF was rated as "Fully addressed." However, when only some elements were present, the CSF was judged as "Partially addressed." The following subsections analyze and discuss the results of each of the seven CSFs as they relate to the case studies. Rather than giving an account of the experiences of all case organizations relative to each CSF, this section discusses critical factors with salient data from various cases in order to explain the underlying research issues.

Committed Management Support and Sponsorship

We begin our analysis of the CSFs for BI system implementation with an examination of committed management support and sponsorship (Table 6). Within our case

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organizations management support was detected in the form of business executives' direct involvement in the project steering committee and providing overall direction and support to the BI initiative. The typical membership of steering committees included the CIO, general managers, functional managers (who are also data owners), IT/IS managers, and project manager(s). Hence, senior managers together with the committees could determine a strategic BI governance direction and ensure that the process for establishing and maintaining the BI-business alignment would be ongoing. This assertion was best demonstrated in cases R1, E1, and W1, where the steering committee was responsible for system acceptance, signing-off deliverables at the relevant milestones, and recommending continuation to the next development phase. Further, the involvement of senior business executives in steering committees addresses the project prioritization and cross-departmental scope definition issues, and assures the appropriate allocation of relevant resources for such a complex undertaking. Having such a project steering committee composed of a group of senior managers boosted the implementation process, leading to a standardized, business-aligned BI system.

As for business-side sponsorship, business executives of the successful cases were also committed to fully sponsoring and resourcing the implementation process. The requisite operating resources included financial commitment, adequate staffing, and the allocation of sufficient time to get the job done. This can be seen in the instance of failure (W3), as exemplified by its project manager:

> Last year, while the company was considering implementing a BI infrastructure, a vendor walked in and asked what was wanted. Management did not know what BI systems or their capabilities were, or what kinds of report they could generate. . . . I am not a qualified engineer so I cannot say if the system is capable of providing what the engineers want . . . (for the implementation of a technology) we consider the total cost of ownership. The actual implementation may be cheaper, but when we consider costs incurred in learning new technology and costs relating to the adoption of technology you have to make a decision on the total cost of ownership and not just the initial implementation cost.

As a result, the BI initiative in case W3 was curtailed due to a lack of commitment and sponsorship from the business stakeholders who were strongly focused on the cost.

A Clear Vision and a Well-Established Business Case

The results of our study indicate the five most successful cases (R1, R2, E1, W1, and W2) formally aligned their business cases for introducing a BI system with their corporate business vision (Table 7). The project teams focused on their current business requirements while also including expected directions and organizational growth in their project decisions. Aligning the business case with the organizational vision requires that a strategic vision exists in the first place. In the unsuccessful case of W3, an organizational vision to integrate BI did not exist, while in the partially successful case (S1) the BI initiative was not primarily constituted at the organizational and strategic level, but mainly driven by its key defense client. This situation prevents implementation projects from being strategically aligned to core business needs and neglects the corresponding development of a solid business case. In these two instances, the project teams concentrated on either technology or their client's requirement and, in so doing, they overlooked their strategic and core business requirements. Nonetheless, for S1 the implementation project was completed and the BI system was still in use, largely to meet the stringent safety standards and regulatory reporting requirements of its defense client. In W3, the company neglected to define how the adoption of a BI system would accomplish its main business goal, which contributed to the early termination of the project. In fact, the BI team had attempted to include all possible scenarios when defining the project's benefits, yet the various business units had failed to specify their particular need for the BI system. In the end, this nebulous scenario blurred the motivation for, and vision of, the proposed new

TABLE 7. A clear vision and a well-established business case.

Case	
R1	*There is a clear business vision for the BI system adoption.
✓	*A link from the BI system to business objectives is defined.
	*The current BI initiative spans all functional boundaries of asset management.
	*The business case was highly endorsed by top management and supported by all relevant stakeholders.
R2	*Initially, the business vision was more functionally oriented, but
✓	recently an enterprise-wide business vision has been in place.
	*The recent amalgamated BI initiative was a vision of top management. The actual business case is still in the preparation stage.
E1	*The current BI initiative spans all functional boundaries of asset
✓	management.
	*The business case was highly endorsed by top management and supported by all relevant stakeholders, and particularly welcomed by business analysts and general users.
S1	*There was some degree of business vision in place, but the
P	business case was mainly driven by its key customer who is still very influential.
	*The company was initially seen as a purpose-built contractor of the customer (who still is a big shareholder of the company).
W1	*There is a clear business vision for the BI system adoption.
✓	*A strong case from the BI system to business objectives is established.
	*The detailed BI case was fully supported by business function managers and general users.
W2	*There is a clear business vision for the BI system adoption.
✓	*Grounded on legislative compliance and auditing requirements, the system was adopted successfully and widely supported by all staff, contractors and external stakeholders.
W3 *X*	*There is no clear business vision from the senior management.
	*The business case was driven by technology and thus received little support from the business side.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

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system. Based on these findings, it is implied that formally aligning a business case in support of a BI system with the business' strategic vision greatly enhances the likelihood of a successful BI system implementation.

Business-Centric Championship and a Balanced Team Composition

For the process dimension of business-centric championship and a balanced team composition, the case data suggest that the champion played a major role in the development of BI systems (Table 8). Their leadership and strong business acumen gave the project more of a business than a technical focus, except for the unsuccessful W3. In fact, based on the face-to-face interviews, most champions (i.e., project managers) seemed to have an in-depth understanding of the business as well as sufficient technological knowledge. Yet the particular approaches they adopted could produce different outcomes. For example, in W3 the champion had stressed the technological features but overlooked the compelling business needs. Apparently, he did not identify the core business requirements and instead invited BI vendors to "sell" the advantages to management while emphasizing the technological perspectives. A BI initiative usually spans many functional units and requires resources and data from those groups. In the successful cases of R1, R2, and W1, the role of the champions involved managing the political and organizational issues that arose during the course of the project. In R1, the champion was faced with the challenge of convincing management and various functional groups of the strategic value of integrating the BI system of the parent company with that of the acquired firm. The champion in R2 was engaged in the political issue of how the operation data would interact with the maintenance data and other data, currently and in the future.

Managing a large-scale BI initiative goes beyond typical IT project management. The BI teams were also responsible for fostering an enterprise-wide culture of collaboration for implementing the new BI system because committed support is required from across the organization. The successful cases demonstrated that commitment has to come not just from management but also from a competent BI team with appropriate business and technical skills. This enables the high-level design to be driven by business personnel and ensures that core business needs are a driver of the logical data architecture. Besides that, all of the businesses in this study reported that the use of external consultants had greatly enhanced the success of the system implementation (Table 8). Cases R1, E1, S1, and W1 had their BI systems technically implemented by external contractors, and cases R2 and W2 sought some limited assistance from external contractors. This chiefly occurred because internal staff had minimal ability to design the system architecture (especially for the integration of source systems) and limited time to master the complex ETL and data modeling tools. Indeed, the use of experienced external

TABLE 8. Business-centric championship and a balanced team composition.

Case	
R1 ✓	*The team consists of the IT manager (champion) and several IS staff in partnership with external consultants. *Particularly, the champion played a successful role as a "coordinator" among executives, business stakeholders and key users. *However, the actual construction of the system was developed by external consultants and contractors with the assistance of some internal IS staff. *Ongoing incremental development was carried out by the internal team.
R2 ✓	*Owing to legacy, the two main silo BIS are championed respectively by two individual project managers. However, a "middleman" was recently appointed to coordinate silo BI systems integration issues from a business perspective. *All systems were developed in-house and maintained by a large team and contractors. *The team comprises both BIS experts and business personnel. *Although the IT department alone comprises more than 50 competent IS employees, the challenges of silo BIS integration was due to the business issues.
E1 ✓	*The BI initiative was championed by a designated system manager, who was also a senior electrical engineer with strong business acumen. *The system was mainly developed by external contractors assisted by a team of internal IS staff. *For ongoing development, a team of internal IS staff in partnership with external contractors acted upon the request of key users during a regular review and, occasionally, upon an ad hoc request.
S1 *P*	*Initially, the manager of the business information system acted as the champion, but the actual implementation was contracted out to external consultants and the IT vendor. *After the system was in operation, a business analyst was assigned to the role of system owner to oversee the maintenance task. Nonetheless, his role is more like a coordinator between users and the service provider.
W1 ✓	*The BI initiative was championed by a designated information manager who has been working with the CIO for a long time. *The system was mainly developed by external contractors assisted by a team of internal IS staff. *For ongoing development, a team of internal BIS staff in partnership with external contractors acted upon the request of key users during a regular review and, occasionally, upon an ad hoc request.
W2 ✓	*The BI initiative was championed by a designated system manager who comes from the firm's asset management division. *The system was initially developed by external contractors and assisted by a team of internal IS staff. *For ongoing maintenance, a team of internal BIS staff acted upon the request of key users during a regular review and, occasionally, upon an ad hoc request.
W3 *X*	*The BI initiative was championed by the manager of the business information system, a technology enthusiast. *The BI team comprises IT personnel only with minimal participation from the business side.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

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consultants is so significant that theoretical replication occurred, as evidenced by the successful cases and even the partially successful case. The failure of W3 may, in part, be attributed to the decision to avoid using experienced external consultants. This left the project champion and his internal team, which possessed little experience in implementing BI systems, with a complex task within an already complicated water utilities company. The importance of experienced consultants, especially in the early phase of the project, should be considered for those companies that are planning to implement BI systems to avoid costly and unnecessary pitfalls. Overall, our finding suggests that a balanced BI team should include a quality external consultant, a dedicated champion who possesses adequate business knowledge, and an internal project team that consists of both business and technical personnel.

TABLE 9. Business-driven and iterative development approach.

Case	
R1 ✓	*The project scope was clearly defined, covering almost the whole enterprise. *A top-down approach for setting report requirements *An incremental delivery approach was adopted over a number of phases to deliver quick wins. *The project started in an area that was most easily impacted. *The team learnt from the BIS experience of the acquired company, and practiced it in the parent company.
R2 ✓	*The project scope is clearly defined by functional area, but not meant to be enterprise-wide. *For the second-phase integrated BIS, an incremental delivery approach was adopted with the initial focus on business integration issues. *Technical solutions will be introduced later according to the business problems identified.
E1 ✓	*The project scope was clearly defined for the engineering side of the business. *An incremental delivery approach was adopted to deliver quick wins. *The reporting requirement was set via a top-down approach, but bottom-up implementation was widely practiced.
S1 *P*	*The project scope was limited to those involved in asset management and integrated the lifecycle support area. *A top-down approach was adopted as the company had little choice regarding the system vendor.
W1 ✓	*The project scope was clearly defined, covering all the asset and water-related functions, except the customer side. *An incremental delivery approach was adopted over a number of phases to deliver quick wins. *The project started in the most critical areas of improvement instead of "easy" areas.
W2 *P*	*The project scope was limited to those involved in the spatial information and asset management areas. *Reporting and analytical requirements were planned at enterprise-wide level. *The BIS was implemented in a one-off fashion as it covers a well-defined business subject area.
W3 *X*	*The project scope is clearly defined. *The project started in several areas at once, a "big-bang" approach. *The team faced communication issues with the business stakeholders.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

Business-Driven and Iterative Development Approach

Regarding the business-driven and iterative development approach, all of the cases put considerable effort into managing their implementation projects, but the scale and scope of their respective projects also had a significant impact on the outcome (Table 9). This was particularly apparent in W1, where the large scale, great cost, and complex legacy systems and data integrity issues obliged its BI team to break the project up into several key areas in terms of business functions, information types, and underlying technology. Using an incremental delivery ("iterative") approach, the team divided the project into several major phases that would be introduced over 3 years. The business-centric project scoping established a solid foundation to determine the associated time frame and related resources. In addition, the team prepared project documentation that specified the expected milestones, the responsibilities of the respective business units, and the target dates for completion. Hence, all business parties were kept informed of the proposed changes and kept involved, and the project team could focus on the prioritized business areas without becoming trapped in one complex "big bang" project implementation. This phased approach is well understood because the complexity and duration of such a large BI system implementation project can quickly become overwhelming and out of control. The iterative development approach helped ensure that the project tasks were not lost in the frequently chaotic project environments, especially where some team members remained responsible for their regular duties. Therefore, it would seem that a business-driven and iterative development approach positively supports the success of a BI system implementation.

User-Oriented Change Management

With regard to user-oriented change management (Table 10), it appears that the majority of business users from most cases did not object to the system implementation initiative because many were already familiar with the analytical and management reporting tools and could easily foresee the potential benefits of a standardized, enterprise-wide BI system. In fact, the key business users who were interviewed expressed enthusiastic interest in their new BI system applications, showing the researcher how it has helped improve their work by delivering timely and consistent information and saving significant time in resolving conflicting data. Hence, based on the experiences of the successful companies, it is evident that neither an education nor a "marketing" campaign is needed to win the support of informed, knowledgeable business users who are already aware of the benefits that can come from a BI system. Namely, there is no need to "preach to the converted." Further, the case studies show that key business users'

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TABLE 10. User-oriented change management.

Case	
R1 ✓	*The project manager consulted the CEO and top management individually before making the final case. *Key business stakeholders and users were involved in the project throughout the implementation process. *Consistent support was in place.
R2 ✓	*The users were familiar with and dependent on the BIS, and generally welcomed the integrated BIS effort. *Education was not an issue. *When any new requirement arose from respective functional units, the unit manager was called in as the local champion. *Consistent support is in place.
E1 ✓	*Key business analysts/users were involved from the outset. *Regular workshops were conducted with the user group. *Consistent support was in place.
S1 *X*	*Users were not consulted but instead asked to use the system, especially in meeting the compliance requirement set by its key customer. *Consistent support is in place.
W1 *P*	*Only staff at managerial levels was consulted, who also make up the steering committee of the project. *Users were not consulted but encouraged to use the system as the manual methods and systems are being gradually phased out. *Consistent support is in place.
W2 ✓	*Key business stakeholders, especially the asset management and maintenance division, were involved in the project throughout the implementation process. *General users were consulted on the choice of interface. *Consistent support was in place.
W3 *X*	*Business stakeholders and key users were not involved in the early phase. *The business side was asked to suggest its BI needs rather than being based on genuine, evolving business requirements.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

interactive involvement throughout the various phases of the project is critical to implementation success. Evidence from the cross-case analysis suggests that greater user participation can contribute to better appreciation of their needs. As demonstrated in cases R1, R2, E1, W1, and W2, regular workshops and meetings between business users and project teams are an efficient way to achieve this objective. One interviewee pointed out that a workshop also facilitates an efficient communication platform where business stakeholders of different functional groups can discuss a particular issue from multiple angles at the same time.

Most case-study interviewees stated that, although the training provided to the general users helped with the adoption of the new system, constant support after the system was implemented was even more critical. According to key users from the successful organizations, training using generic data rather than their own data was of little value because ad hoc reports and analytics queries are generated "on the fly." Moreover, the key users had adequate knowledge of the application tools that were considered to be "intuitive," and most were experienced with the functions of BI systems. This specific finding indicates that a lack of rigorous training did not seem to result in any significant disadvantages with regard to user-oriented change management. It appears that providing consistent maintenance support upon request can better aid the business users than standard training sessions. As a result, committed and consistent support from the BI team is influential for system use, particularly during the period when the new system is being adopted. This finding is in line with the evolutionary development requirements of a BI system, as opposed to routine maintenance for classical operational systems. In summary, findings about user-oriented change management suggest that interactive user participation throughout the implementation cycle can help meet their critical information needs and format requirements. In addition, business users will better appreciate the BI applications if formal and constant maintenance support is in place throughout the adaptive system lifecycle.

Business-Driven, Scalable, and Flexible Technical Framework

Turning now to technological issues (Table 11), the successes of R1, R2, E1, W1, and W2 and the partial success of S1 confirm the importance of a business-driven, scalable, and flexible technical framework. In these cases, the technical frameworks were designed and standardized centrally by the BI competency team and driven by core business needs. The required source systems were stable and compatible with the BI system implementations, despite some data integrity issues across diverse back-end systems. In addition, their respective high-level system architectural designs were deemed flexible, scalable, and extensible across other functional areas, meeting dynamic management reporting and analytical requirements while making provision for possible future applications. Moreover, prototypes using real corporate data proved to be helpful in obtaining the acceptance of business stakeholders. According to most interviewees, prototypes facilitate better communication among staff of different functions, especially in showing them the benefits, advantages, and values an individual unit may contribute to the overall organization. The case studies reveal that those organizations which have implemented ERP infrastructure and/or integrated asset management systems are more likely to achieve success, as shown by cases R1, R2, E1, and S1. Consistent with the interviewees, this is mainly because existing integrated information infrastructures (such as ERP) had provided an adequate foundation for a large-scale BI system implementation. Moreover, the senior management and key business stakeholders of these enterprises were more aware of the benefits of BI applications and adopted the systems quite readily. This was particularly true for R1 and S2, where an integrated BI solution (together with an ERP system) had been planned and included at the outset of the project. Therefore, they managed to optimize the large investment in the enterprise-wide information infrastructure while ensuring the greater effectiveness of

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TABLE 11. Business-driven, scalable, and flexible technical framework.

Case	
R1 ✓	*The ERP implementation laid a solid infrastructural foundation for the BIS. *The data model was flexible, scalable, and extensible across all functional areas. *The technical framework was standardized centrally and driven by business needs. *The compatibility of various analytical, reporting and mining tools with the ERP was validated at the outset.
R2 *P*	*The silo BIS and ERP implementation had provided an adequate infrastructural foundation for the integrated BIS. *Although the data model of silo BIS was adequate and extensible, it was not meant for an integrated BIS. *Integrating those silo BIS posed compatibility issues due to the different IT vendors. *The team was working on the broader data model and technical framework to integrate the silo BIS.
E1 ✓	*The implementation of an integrated asset management system provides a good infrastructural foundation for the BIS. *The data model is flexible, scalable, and extensible across all asset management domains. *There was a standardized, scalable, and extensible technical framework to accommodate both advanced analytics and mining requirements.
S1 ✓	*The ERP implementation laid a good infrastructure foundation for the BIS. *Although the data model was flexible, scalable, and extensible, it was limited to certain functional areas only. *There was a standardized technical framework, but with limited extensibility. *There was no compatibility issue with the various analytical and reporting tools as those tools are strategic partners of its ERP system.
W1 ✓	*The strategic technical framework was standardized centrally and driven by business needs. *Acknowledging the lack of existing enterprise-wide IS architecture such as an ERP foundation, the framework was planned from a strategic and an organizational perspective. *The data model is flexible, scalable, and extensible at the enterprise-wide level, incorporating possible future applications.
W2 ✓	*The technical framework was standardized centrally and driven by core business needs. *The domain model covers all areas (including pipes and facilities) of water, wastewater, and recycled water. *The data model is flexible, scalable, and extensible across all those asset-related areas.
W3 *P*	*The ERP implementation and various silo systems provide a somewhat stable foundation for the BIS infrastructure. *The data model is flexible and extensible but meant for functional needs. *The technical framework is extensible to accommodate BI requirements. *There are compatibility issues with various IS applications.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed.

operational, reporting and analytical processing. By way of contrast, the failure of W3 was in some measure the result of incompatible legacy IS applications and siloed ERP modules, which deterred executives and functional managers from looking further into BI applications. This observation also applies to the case of R2, which faced a similar problem in the early phase of its BI applications. Integrating the siloed BI applications from individual functional units had posed complex technical issues to the centralized project team. Such challenges included functional-focused data models, incompatible vendor tools, and multiple versions of the truth. It can be seen, then, that organizations which adopt a business-focused view in planning their adaptive BI systems are more likely to succeed with their BI initiatives.

Sustainable Data Quality and Integrity

Lastly, with regard to the CSF of sustainable data quality and integrity, the case studies show that most organizations were committed to achieving and maintaining a high level of data quality and integrity, albeit with various degrees of priority (Table 12). Businesses R1, E1, S1, and W2 clearly stressed the importance of this specific factor. Their efforts to establish common business definitions and measures were evidenced by data dictionary frameworks, corporate glossaries, business-centric dimensional and metadata models, data quality working groups, data governance committees, corporate coding policies, and corporate data models. In doing so, business domain experts were actively involved in validating and verifying quality attributes to address the issues of multiple versions of the truth. Moreover, a range of regular workshops with business decision-support personnel, user reference groups and high-level steering committees was convened to solve the problems arising from business issues. Further, most cases indicated that business users were proactive in reporting data quality issues. While all interviewees reaffirmed the importance of high-quality data derived from source systems, in some instances corporate transactional systems were reverse-engineered and aligned to facilitate a common hierarchy for management reporting and communication. It is noted that the project team in W2 acted as the data custodian for data quality issues that arose within the company. According to the project champion of W2, the sources and repercussions of data quality problems can best be demonstrated and resolved through their "neutral" role. This is because the organization of the cross-functional BI team and the characteristics of the information generated by BI systems make them a suitable unit (and one without internal contradictions) for assuming the role of data custodian for the enterprise. Sustainable data quality and integrity ensures a single version of the truth and thus the quality of information provided by BI systems. This finding also reinforces the significance of cross-system analysis and business-side participation in overcoming data quality problems inherent in siloed functional units.

Overall, the findings with regard to the CSFs represent best practices of firms that have successfully implemented BI systems and provide insights for BI stakeholders that can increase the chances of implementation success. The contextual understanding of CSFs is intimately related to the arena of actual BI systems implementation because it is

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TABLE 12. Sustainable data quality and integrity.

Case	
R1	*A master data management approach was adopted.
✓	*A data dictionary framework was in place. It included a data governance committee, corporate coding policy, corporate glossary, and data dictionary.
	*A corporate data model has been developed, which includes candidate information entities and subject areas and baselines.
	*In doing so, workshops, interviews, and questionnaires were conducted; corporate systems were reverse-engineered.
	*Transaction systems were aligned to facilitate a common hierarchy for management reporting and communication.
R2	*A functionally-based data dictionary framework was in place,
P	and includes a corporate glossary and data dictionary.
	*To address multiple versions of the truth, the newly appointed integrated BIS champion and the business decision support personnel were preparing a core asset information oriented framework.
	*These silo BIS are reverse-engineered to achieve data integrity.
	*A high-level steering committee and data governance workshops were in place.
E1	*A data dictionary framework was in place.
✓	*A data quality working group, corporate glossary, and data dictionary were in place.
	*There were regular data-related workshops with the key users.
	*Users were pro-active in reporting any data quality issues, and actions were taken promptly.
	*A data cleansing tool was applied.
S1	*The quality of data was adequate as most of the glossary and
✓	measures had been fully supplied by its key customer.
	*The role of the data steward was well defined as being the functional steward.
	*Within the system, there was an automated data quality "watchdog" mechanism to track operational data quality issues.
	*The data provider will be alerted and asked to solve the issues.
W1	*Initially, the quality of data was adequate at the unit level, but
P	not at the cross-functional level because each unit developed its own measurement and definition.
	*Now the BIS project manager is streamlining the data quality efforts via a centralized approach.
	*There were regular data governance workshops with the functional managers.
	*A data cleansing tool was applied.
W2	*The quality of data is extremely high with a single truth.
✓	*A master data management approach was adopted.
	*A data quality working group, corporate glossary and data dictionary were in place.
	*The BIS team also acted as a watchdog for data quality issues.
	*There were regular data quality workshops with the key users.
	*Users were pro-active in reporting any data quality issues, and actions were taken promptly.
W3 *P*	*A functional-based data dictionary framework is in place.
	*A visualization tool and pictures of assets were incorporated as part of data quality and validation efforts.
	*The data inconsistency was usually validated by long-experienced personnel.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed.

derived from real-world, BI-based organizations. The CSFs are readily understandable by BI practitioners and considerably generalizable to a range of organizations. Moreover, the qualitative findings from the case studies serve as a basis to allow BI practitioners to better understand and manage what is typically a complex BI systems implementation.

Discussion

Implementing a BI system is a costly, resource-intensive, and complex undertaking. This research uses a multiple case-study method to understand how large organizations address the CSFs of BI system implementation. The evidence from the case studies generally confirmed the applicability of Yeoh and Koronios's (2010) set of multidimensional CSFs. It appears that there is a macro-level pattern for interpreting the CSFs related to such infrastructure-based projects. The research demonstrates that some of the conventional CSFs in the existing IS literature also influence the implementation of BI systems, thus affirming the existence of a common set of CSFs for IS implementation. However, the contextual elements of the CSFs for BI systems are found to be considerably different from those associated with the implementation of other systems. Therefore, the conventional CSFs cannot be applied to BI systems without giving careful thought to the relevant contextual issues. In addition, there is a new understanding of factors associated with the technological dimension due to the technical challenges that vary with the nature of the particular infrastructural system.

More significantly, the cross-case analysis reveals that organizational factors were the most critical in dictating implementation success. Due to the nature of an enterprise-level BI system that is cross-functional and business-driven, the research findings indicated that those enterprises which had a clear vision and a well-established business case, and committed management support and sponsorship from the business side, were more likely to be successful in implementation. The five successful cases clearly demonstrated that addressing the organizational CSFs was the cornerstone on which they successfully based the implementation of their BI systems. Conversely, the unsuccessful case failed because it focused primarily on the technology and neglected the core requirements of its organization.

Having a clearly defined set of CSFs is important, yet it is even more critical to address the CSFs in the right sequential order. The triangulated data derived from the case studies show that by placing organizational needs ahead of other issues an enterprise has a greater likelihood of achieving a useful business intelligence system.

We contribute to the business value of IT literature by unpacking how CSFs impact success in implementing BI systems. We supplement the existing body of knowledge on CSFs for implementing BI systems by progressing beyond simplistic views that emphasize the "what" factors and looks at the "why" and "how" of organizations' BI system implementations. In addition, the research framework of this study offers a qualitative measurement instrument for organizations to assess their BI system initiatives. Moreover, this study contributes to the IS research stream by broadening our understanding of why there are differences between

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conventional online transaction processing (OLTP)-based systems and large-scale online analytical processing (OLAP)-based systems, like BI systems. More specifically, it calls attention to the need to not only consider technical issues but also take account of organizational and process dimensions when exploring BI system CSFs.

Our results also highlight important managerial implications. To begin with, large and complex organizations, such as those characterized by the case organizations, that are planning to implement enterprise-wide BI systems now have a tool for assessing and understanding those CSFs that contribute to the likelihood of BI implementation success. More precisely, the proposed CSF framework groups the factors under organizational, process, and technological milieu as different means and ways that should be employed in order to facilitate their development to secure success in BI system implementation. For managers, it will help them determine those factors to which they should give continuous scrutiny. Next, for senior management, the CSFs findings can certainly assist them by optimizing their scarce resources in those critical areas that will improve the implementation process. They can concentrate on monitoring, controlling, and supporting only those critical areas that importantly contribute to success. Moreover, leaders can play a pivotal role by championing the development of key areas, offering ongoing training and support, and by revising the reward schemes used to motivate and engage staff in this process. The findings with regard to the CSFs represent best practices of firms that have successfully implemented BI systems.

This study sheds new light on the CSFs associated with implementing BI systems in organizations. Conversely, there are still some limitations and unanswered questions that offer avenues for further research. This study focused primarily on participants and companies that had experience with commonly used products such as SAS Institute, IBM Cognos, Oracle, Microsoft, and SAP Business Objects. There may have been some bias in responses not shared by individuals familiar with other products. However, Gartner Research emphasizes that the mentioned vendors and products account for the majority of the market (Schlegel et al., 2013), and the distribution and use of these products is considered well represented in this study.

Our case study design also limits our ability to generalize the results to a wider population of firms. The selected cases are mainly engineering asset management organizations. As such, the results of this research may not necessarily apply to organizations outside the studied context. We thus recommend that scholars replicate and extend this study to broader contexts. For instance, in our study six of the seven organizations had successfully (or partially successfully) implemented BI systems. Future research should study whether and how the proposed CSFs perform in less successful implementation environments. A stronger focus on studying cases of failure would also add valuable insights. In addition, a longitudinal design would be desirable to further examine the dynamics of the relationships outlined in our conceptual framework. One might also claim that firm size and the industry sector of the organizations could have influenced our results. We therefore recommend that future studies control for firm size and industry sector to account for BI system implementation success differences attributable to interindustry or country differences (Hendricks & Singhal, 2001). For differences attributable to organizational resources, future research should extend our work and examine how other elements, such as organization structure, people and their skills, and routines interact to enable the successful implementation of BI systems within organizations.

Conclusion

Understanding CSFs is a key for successful implementation of a BI system. This study examined the organization, process, and technology factors impacting BI systems implementation in seven large organizations. The empirical findings from the case studies concluded that the CSFs do indeed have a direct, positive and significant influence on the BI systems implementation. That is, the CSFs are essential prerequisites for BI implementation success. Moreover, the case studies also reveal the significance of addressing and prioritizing organizational CSFs.

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