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The impact of business intelligence on organization's effectiveness: an empirical study

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# The impact of business intelligence on organization's effectiveness: an empirical study

Impact of  
business  
intelligence

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## Abstract

**Purpose** – The purpose of this study was to identify the influence of organizational strategy, structure, process and culture on organizational effectiveness and the possible mediating role of business intelligence (BI) systems among them.

**Design/methodology/approach** – Sample data for this study were collected from 225 organizational units in Bangladesh and analyzed using the partial least squares method, a statistical analysis technique based on the structural equation modeling.

**Findings** – The results revealed that organizational factors, such as organizational strategy, structure, process, and culture positively affect both BI systems' effectiveness and organizational effectiveness. Furthermore, BI systems' effectiveness partially mediates the impact of organizational strategy, structure, process and culture on organizational effectiveness.

**Originality/value** – BI systems are context-specific and can influence organizational effectiveness. Dearth in research on the influence of organizational factors to BI systems motivates this study to contribute in BI systems literature by proposing a theoretical model and investigating the mediating role of BI systems among various organizational factors and organizational effectiveness.

**Keywords** Organizational structure, Organizational culture, Organizational effectiveness, Organizational strategy, Business intelligence systems, Organizational process

**Paper type** Research paper

## Introduction

In today's changing business environment, business intelligence (BI) systems play critical role in organizations to support decision-making and improve organizational performance (Ramakrishnan *et al.*, 2012). These systems facilitate firms to store, retrieve and analyze large amounts of information about their operations and allow them to improve strategic and tactical decisions, and gain competitive advantage of the industry (Jones, 2005). Zeng *et al.* (2007) defined BI as "the process of collection, treatment and diffusion of information that has an objective, and the reduction of uncertainty in the making of all strategic decisions." It is a set of concepts, processes and methods to improve business decisions, which use information from multiple sources (i.e. internal as well as externally supplied by customers, partners or third parties) to understand business dynamics (Maria, 2005). Elbashir *et al.* (2008) used the term as business intelligence (BI) to refer to a group of systems for data analysis and reporting, which



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helps top-, middle- and lower-level managers to use relevant and timely information to make better decisions.

Over the past decades, BI has become increasingly important in both the business communities and the academia (Chen *et al.*, 2012). Many researchers found that BI systems yield real business benefits, and it is used by decision-makers throughout the firm for effective decision-making across a broad range of business activities (Chau and Xu, 2012; Ranjan, 2009; Sahay and Ranjan, 2008). It is the input to strategic and tactical decisions at senior management level, and it helps individuals to do their day-to-day jobs at lower management level (Negash, 2004). A recent study suggested that using a BI system is the way of improving business performance by providing actionable information for executive decision-makers to make better decisions (Cui *et al.*, 2007). It has been argued that BI is “both a process and a product”. The process is composed of methods that firms use to develop useful information and intelligence that can help to survive and succeed in the global economy. The product is information that will help firms to predict the behavior of their “customers, suppliers, competitors, products and services, markets, and the general business environment” with a degree of certainty (Wixom and Watson, 2010; Vedder *et al.*, 1999).

Recently, most research in BI emphasized the use of BI in organizations. The IBM Tech Trends Report based on a survey of over 4,000 information technology (IT) professionals from 93 countries and 25 industries, identified BI and business analytics as one of the four major technologies in organizations (IBM, 2011). In an annual survey of IT executives, BI topped the list of the most important applications and technology developments (Luftman and Ben-Zvi, 2010). *Businessweek* (2011) revealed that 97 per cent of firms with yearly turnover exceeding \$100 million were found to use some form of BI. Moreover, McKinsey Global Institute predicted that a 50 to 60 per cent gap between the supply and demand of persons with business analytical skill, as well as a shortfall of 1.5 million data-savvy managers with the know-how to analyze data to make effective decisions by 2018 (Manyika *et al.*, 2011).

In recent years, BI is continued to be a top priority for many firms, and the promises of BI are rapidly attracting many more champions (Evelson *et al.*, 2007). BI systems are broadly adopted or in process to be adopted in organizations today, supporting activities such as managerial decision-making, data analysis and business-performance measurement. Currently, many organizations have been investing billions of dollars to implement BI systems to accomplish the task (Anjariny and Zeki, 2011). BI has permeated various industries including banking, insurance, finance, retail, health care, telecommunications and manufacturing (Olszak and Ziemba, 2006). It has been applied to many areas that are related to the management processes and some of them have formed their own systems with specific characteristics (Li *et al.*, 2008).

However, in practice, ineffectiveness of BI is common in organizations, especially in the context of developing countries. Organizations are facing difficulties in implementing BI. Although BI has been already studied from technological perspectives, some organizations in developing countries still fail to achieve the success with BI applications (Jourdan *et al.*, 2008). This may be because the relationship between organizational factors such as organizational strategy, organizational structure, organizational process, organizational culture and BI systems has remained largely unexamined. It is essential to examine the relationship between organizational factors and BI systems' effectiveness because the primary objective of BI is to support

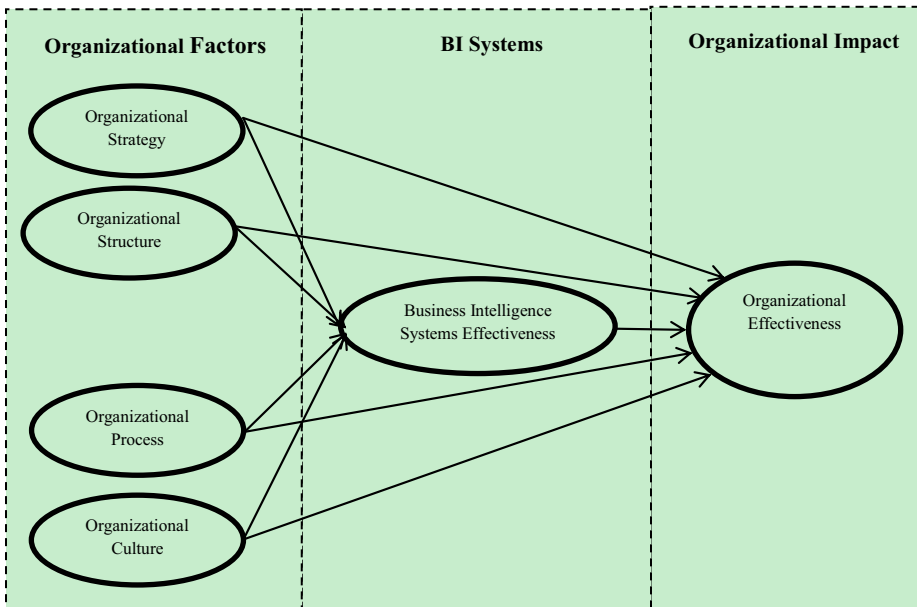
decision-making in organizations. It is also essential to examine the relationship between BI and organizational effectiveness. Therefore, this study attempts to address the following research questions:

- RQ1.* What is the relationship between organizational factors and BI systems effectiveness?
- RQ2.* What is the relationship between BI systems and organizational effectiveness?
- RQ3.* Does a BI system mediate the relationship between organizational factors and organizational effectiveness?

The rest of the paper is organized as follows. Theoretical framework is presented in Section 2. Section 3 explains the research methodology. The research findings are presented in Section 4, followed by discussion in Section 5. Implications are discussed in Section 6, while limitations and future direction are presented in Section 7. Finally, Section 8 concludes the paper.

**Theoretical framework**

The objective of this study is to investigate the impact of BI on organizational effectiveness. In the literature, the related studies suggest that the types of organizational factors in BI applications in an organizational setting are organizational strategy, organizational culture, organizational process and organizational structure. The theoretical model is presented in Figure 1. We will look at the theoretical model for each of the hypotheses in the following subsections.



**Figure 1.**  
Theoretical model

*BI and organizational effectiveness*

BI is one of the most widely searched terms and remains a topic of interest in both industrial and academic communities (Işık *et al.*, 2013). It is a set of technologies which collect and analyze the data to improve work-flows and organization decision-making (Herschel and Jones, 2005). It is the combination of collecting, cleaning and integrating data from different sources and presenting results that can improve business decisions-making (Akram, 2011). There is a large volume of published studies describing the role of BI on organizational effectiveness. Watson and Wixom (2007) found that BI includes the critical functions that help an organization improve both its performance and adaptation to change. To date, BI applications have focused on managing strategic and tactical business plans and initiatives. Organizations have been using BI to monitor, analyze, report and improve the performance of its business operations. BI helps organization to optimize business performance. It assists corporate managers and decision-makers to make accurate, timely and relevant decision in an organization and, thus, lead to the increases of productivity and profitability of an organization (Olaru, 2014). Turban *et al.* (2007) revealed that BI improves business organization's effectiveness. It gives an organization's suppliers, partners and employees the easy access to the information and the ability to analyze and share the information with others. Based on these arguments, it is hypothesized that:

*H1.* There is a positive relationship between business intelligence systems and organizational effectiveness.

*Organizational factors and BI systems*

The resourced-based view has been studied mostly to identify the relationship between organizational resources and its impact on value creation (Barney, 1991). A resource-based view explains how organizational resources that are rare, valuable and inimitable, generate sustainable competitive advantages for firms. Organizational resources cover a wide range of valuable assets controlled by the organization, including management skills, organizational strategy, culture, processes, structure, firm attributes, which enables the firm to utilize and ensure enhanced performance (Daft, 1983; Barney, 1991). Researchers have argued for the application of resource-based view of achieving firms' long-term success by measuring the strategic value of IT resources (Wade and Hulland, 2004). Furthermore, a fit among organizational resources depends on the best possible organizational design that is contingent upon numerous internal and external factors. Based on the contingency theory, previous studies further argued for the importance of fit among subsystems of the organization and the factors such as technology, people, information, strategy, culture, process and structure which ensures ultimate long-term firm performance (Tosi and Slocum, 1984). In other words, the organizational factors are viewed as non-IT resources, subsystems of a firm, and complementary to IT resources (Wiengarten *et al.*, 2013). In line with both resource-based view and contingency approaches, it is proposed that organizational factors, such as organizational strategy, structure, culture and process, impact BI systems' effectiveness that ultimately affects firm's effectiveness.

*Organizational strategy.* BI systems cannot work in isolation; instead, it takes organizational factors to make the organization effective with enhanced performance. The relationship between organizational strategy and BI systems utilization is crucial, thus demands keen attention of top managers. According to Daft (1995, p. 49):

[...] organizational strategy is a plan for interacting with the competitive environments to achieve organizational goals. Organizational performance largely depends on the sound strategy and its effective implementation.

This study followed Venkatraman's (1989) strategic orientation of business enterprise (STROBE) framework to analyze organizational strategy. Although the framework elucidates six dimensions to represent organizational strategy, we adopted the revised dimensions examined by Bergeron *et al.* (2004) where they validated four dimensions such as analysis, defensiveness, futurity and pro-activeness. Analysis refers to the capability of problem-solving through extensive searching with identification of root-causes and best potential results (Miller and Friesen, 1983). By taking conservative measures such as cost reduction and making organization efficient, the defensive behavior can be demonstrated through defensiveness dimension. Futurity dimension defines the simultaneous emphasis on decision-making by considering cost efficiency at present and in the future as well as strength in the long run. Pro-activeness demonstrates to be one step ahead to tap the opportunities such as business diversification with new industries, and continuous searching for market opportunities and exploitation of strengths to become pioneer. Once these four dimensions are incorporated, organizations are more likely to have strategic directions that lead to better performance.

The link between organizational strategy and BI systems' effectiveness is obvious. One of the major objectives of the BI systems application is to provide useful and timely information, so that top management can make valuable decision guiding organization to achieve success. A core alignment between business strategy and IT strategy is desirable for sound organizational performance. While high-performing firms ensure the strategic IT alignment (Chan *et al.*, 1997), researches reveal that low-performing firms are more likely to face paradoxical position, having poor alignment of business strategy and structure with IT strategy and structure (Bergeron *et al.*, 2004). Although some researchers have argued for strategic IT alignment that depends on the contextual factors such as industry, environmental uncertainty (Kearns and Lederer, 2004; Armstrong and Sambamurthy, 1999), knowledge sharing culture and prior information system (IS) success (Chan *et al.*, 2006); a growing body of researches have demonstrated the role of mediation between organizational strategy focusing on IT capabilities and organizational effectiveness (Bergeron *et al.*, 2001). With this line of argument, we posit that BI systems' effectiveness mediates the relationship between the organizational strategy and organizational effectiveness. Thus, we propose the following hypotheses:

- H2. Organizational strategy (analysis, defensiveness, futurity and proactiveness) will have a positive relationship with BI systems' effectiveness.
- H3. Organizational strategy (analysis, defensiveness, futurity and proactiveness) will have a positive relationship with organizational effectiveness.
- H4. BI systems' effectiveness mediates the relationship between organizational strategy and organizational effectiveness.

*Organizational structure.* Organizational structure is one of the important organizational factors that constitutes a congenial environment for BI systems' success. Organizational structure is defined as the pattern of relationships, authority and internal communication among members and tasks (Thompson, 1967). Structure is



consisted with some common variables such as centralization, formalization, vertical and horizontal differentiation, administrative intensity and professionalization (low complexity). In spite of these scales with different depth and breadth, the common goal of its application is to know the extent to which the administrative decision-making authority is dispersed to hierarchical roles and positions. Although the previous studies varied in measuring organizational structure, most of them emphasized centralization and decentralization as the important features to know how much organization is flexible regarding its tasks and activities. Centralization refers to the degree to which the authority for making a decision is controlled by the organization (Fry and Slocum, 1984). A high degree of authority is expected to execute the decision and implementation, on the other hand, decentralized authority is effective to have organizational innovation (Daft, 1978). A numerous study have suggested that decentralized structure ensures employee's satisfaction and motivation, flexibility in decision-making, prompt decision and execution, vertical communication, stability in external environmental changes and higher efficiency (Burns and Stalker, 1961; Schminke *et al.*, 2000; Daft, 1978).

Research has found a positive link between decentralized organizational structure and its alignment with firm's performance and innovation (Evans and Davis, 2005). It is obvious that decentralized structure increases the firm's performance. In a decentralized structure, effective decisions are taken and implemented promptly at the process level that in turn ensures firm's performance (Andersen and Segars, 2001). BI systems are seemed to be effective and affect firm's performance in decentralized structure, by which process-, customer- and suppliers-oriented information is communicated to top authority without any hurdle and delay. Therefore, the following hypotheses can be formulated:

- H5. Organizational structure (decentralization) will have a positive relationship with BI systems' effectiveness.
- H6. Organizational structure (decentralization) will have a positive relationship with organizational effectiveness.
- H7. BI systems' effectiveness mediates the relationship between organizational structure and organizational effectiveness.

*Organizational process.* Organizational process (management process) entails IT, marketing, manufacturing and supply chain management processes. Research reveals that the complementary between marketing and IT, manufacturing and supply chain management processes positively affects firm's performance (Bharadwaj *et al.*, 2007). Moreover, the integration of these complimentary effects and firm's IS capability mutually affect firm's operational performance and enhance organizational effectiveness (Bharadwaj *et al.*, 2007). Similarly, when organizational process (management process) is aligned with IT infrastructure, an organization may experience IT-based capabilities or competencies that lead to enhanced process performance and firm performance (Nevo and Wade, 2010). Furthermore, IT-process alignment builds a strong capability which brings firm's sustained competitive advantage (Wade and Hulland, 2004; Wiengarten *et al.*, 2013).

When information system is associated and incorporated with organizational processes, a synergistic effect is generally seen that enhances organizational capabilities. For instance, knowledge processes and management processes with

aligned information systems generate the organizational capabilities that determine organizational effectiveness (Radhakrishnan *et al.*, 2008). Most importantly, BI systems sometimes require to redesign specific organizational processes to adapt to IT infrastructure. An integrated customer and supplier processes help firms to process supplier- and customer-oriented information that increases firms' capability to exchange information quickly and firm's financial performance (Barua *et al.*, 2004). BI systems initiate and incorporate the firm's IT, customer, supplier, manufacturing capabilities to accentuate the operational procedures. The linkage between BI-enabled organizational processes and organizational effectiveness is depended on appropriate utilization of BI systems in the organization. Therefore, we assume that organizational process, consistent with BI systems, impacts firms' effectiveness through the effective BI systems, and it comes out the hypotheses below:

- H8. Organizational process (management process) will have a positive relationship with BI systems' effectiveness.
- H9. Organizational process (management process) will have a positive relationship with enhanced organizational effectiveness.
- H10. The association between organizational process (management process) and enhanced organizational effectiveness is mediated by the effectiveness of BI systems.

*Organizational culture.* Organizational culture is defined as "the pattern of shared values and beliefs that helps individuals understand organizational functioning and thus provides them with the norms for behavior in the organization" (Deshpande and Webster, 1989, p. 4). Schein (1985) emphasized on "shared assumptions" held by employees in an organization. While researchers are not in consensus on which dimension(s) represent(s) organizational culture, we follow the work of Denison and his colleagues (Denison, 1990; Denison and Mishra, 1995; Denison and Neale, 1996; Fey and Denison, 2003) who postulated four dimensions of organizational culture such as adaptability, consistency, involvement and mission. Adaptability refers to the extent to which an organization can cope with the external environment by changing behavior, structures and systems. Consistency is defined as the extent to which an organization has the ability to sustain a shared values, beliefs and norms among organizational employees. Involvement refers to the extent to which an organization allows its members to participate in decision-making. Mission refers to a clear and meaningful explanation of organizational purposes that is shared by all members in an organization.

Organizational culture is empirically related to organizational effectiveness, and conducive and solid organizational culture motivates employees to achieve organizational success. Moreover, organizational culture brings a sustained competitive advantage that is difficult to imitate. Information systems research has identified the positive relationship between firm's culture and organizational performance. Organizational culture does not impact organizational effectiveness directly, rather it needs people to be influenced and guided to achieve the organizational goals. In the milieu of organizational volatility, both structured and unstructured information lies within and beyond the boundary of the organization and such information exploration would be captured by the employees of organization. In an organization with strong and conducive organizational culture, members' capability to digest information from



unknown world is enhanced that leads to make constructive and effective decisions. Organizational culture (involvement, consistency, adaptability and mission) is related to organizational effectiveness such that involvement, consistency, adaptability and mission shape the organization in such a way it is likely to contribute to enhanced organizational effectiveness.

BI systems continuously focus on new information searching by utilizing all channels of data gathering, using information system mechanisms to synthesize and convert the data into useful information, monitoring all operational processes and tracking root-cause of the problems. BI systems' effectiveness leads to organizational effectiveness, conditioning the antecedent role of organizational culture. Because, shared perceptions, values, norms and beliefs held by organizational members provide a conducive and enduring environment, having free flow of information of suppliers and end customers among organizational hierarchies and different operational departments, such that the organization is benefited through prompt decision implementation, problem minimization and heightening performance. Therefore, the hypotheses are developed as follows:

- H11.* Organizational culture (involvement, consistency, adaptability and mission) will have a positive relationship with BI systems' effectiveness.
- H12.* Organizational culture (involvement, consistency, adaptability and mission) will have a positive relationship with enhanced organizational effectiveness.
- H13.* BI systems' effectiveness mediates the relationship between organizational culture and organizational effectiveness.

## **Research methodology**

### *Data collection*

A quantitative survey was designed and conducted in Bangladesh, one of the emerging countries in South Asia. This study targeted senior managers who took initiative to act out and enforce the BI systems, such as chief executing officers, managers of IT, managers of management information system (MIS), system analysts, human resources (HR) managers and business managers. These professionals were chosen as the respondents because they have vast knowledge of organizational characteristics, BI systems and its impact on firm's effectiveness.

We compiled a list of firms that had adopted BI systems from a prominent BI software vendor with an agreement of maintaining privacy. These firms have been utilizing technologies to advance business performance for at least 10 years in its respected sectors. A contact list, including mailing, email address and telephone number of each client was collected from the selected vendor. Strategic business units (SBUs) operating under a group of establishment were also emphasized similarly as with the parent organization.

A total of 587 managers in 363 organizations were selected based on the BI software adoption and the length of usage. Multiple respondents were selected from a large organization if the respondents hold managerial positions in IT, MIS and HR departments to reduce the bias. In a small organization, top managers such as chief executing officer and managers of MIS were chosen as information providers of BI systems and organizational factors.

All items were originally in English. Following the translation-back translation procedure (Brislin, 1980), the items were translated into Bengali. Two bilingual professors who taught MIS at university level in English and Bengali proficiencies were requested to check the translated items. With minor corrections, the revised items were sent to the five selected IT and MIS managers to match their understanding of the items. Some alterations were performed to get the final version of the translated items. Prior to the main survey, we conducted a pilot study of 23 selected managers to ascertain that the questionnaire items fit well to the research objectives. According to the results of this pilot study, the consistency was ensured and revision of the items was done to make sure the conciseness, understandability without redundancy of the items.

A structured questionnaire was prepared for targeted managers. Following the proposition of Dillman (2000), we sent a package including a cover letter, a questionnaire and reply-paid envelope to the recipients through the mail. Along with the mail, an email was sent to each respondent, including a cover letter and a questionnaire to make sure the convenience of giving responses. After four weeks of mailing out, an email was sent to respondents requesting to post back the filled questionnaire. The respondents who failed to respond were given both email and the paper package again after the expiry of another four weeks. Two weeks later, a final request was delivered to remaining recipients who did not respond to the survey. In line with the previous studies (Dillman, 2000; Chatterjee *et al.*, 2002), we found no significant difference between online and paper-based survey.

A total of 302 respondents from 168 organizations sent their responses. Among the respondents, 43 participants responded online. On an average, two managers of a single organization responded. Managers representing a SBU were asked to respond on behalf of either SBUs or their parent organizations.

After checking the responses, 14 questionnaires were found with considerable missing information (50 per cent or more) and, thus, were discarded from the survey. A usable sample of 288 respondents from 154 organizations was finally obtained. Seventy-one respondents provided information on behalf of their SBUs, which was used to match other informants from the same SBU. Sixty-three organizations were holding two or more informants. Therefore, the total sample of organizational unit became 225 by adding SBUs with the list of organizations.

Following the procedure described by Armstrong and Sambamurthy (1999), we averaged the multiple respondents of each organization on the main variables of the sample and conducted the correlation among the responses. We found a high average correlation (0.48;  $p < 0.05$ ) among the responses provided by respondents of each organization. Thus, the results provided support of the consistency between multiple respondents of each organization. On the other hand, a single informant from an organization was treated as the representative of the organization. Moreover, we found no significant difference between individual and average responses.

The responses represented vast categories of industries in the sample (Table I). The dominant organizations in the sample are from manufacturing industry (54 per cent); this was followed by banking, insurance and financial industries (21 per cent), and then tourism industry (17 per cent). A least sample (8 per cent) is representing retail,

**Table I.**  
Breakdown of  
respondents

Descriptions	Frequency	Percentage (%)
<i>Gender</i>		
Male	187	83
Female	38	17
<i>Age</i>		
30-34	16	7
35-39	63	28
40-44	105	47
45-49	34	15
50+	7	3
<i>Industry</i>		
Manufacturing	122	54
Banking, insurance and financial	46	21
Tourism	39	17
Retail	18	8
<i>Position in organization</i>		
Business executives	108	48
IT executives	83	37
Both business and IT	34	15
<i>BI systems experience</i>		
2-4 years	41	18
5-7years	119	53
More than 7 years	65	29

wholesale and distribution industry. The average size of the firm is large with an average of 558 employees.

The respondents were dominated by males (83 per cent), while females represented very few (17 per cent) with an average age of 43 years old, and the average duration of relevant work experience was 13.4 years. Most respondents (48 per cent) were representing themselves as business executives, while 37 per cent were IT executives, with 15 per cent holding business and IT jobs simultaneously. Fifty-three per cent of the total respondents held experience on BI systems at least five years, while 29 per cent of informants had more than seven years of experience. Therefore, it represents that the informants have a vast experience on BI systems as well as organizational management. We conducted an ANOVA test ( $p < 0.05$ ) for testing non-response bias. All responses received within the first four weeks were treated as early responses and the rest as late responses. The results show that there are no significant differences between the two samples.

As this study undertook a survey based on self-report on all of the variables, the question of common method bias might arise. In line with the work of Konrad and Linnehan (1995) and Simonin (1997), we conducted Harman's one-factor test of all variables to measure the possible common method bias in our study. The result of principle component factor analysis revealed six factors with eigenvalues greater than 1.0, while these factors accounted for 70 per cent of the variance. Moreover, the first factor did not account for the majority of the variance (33 per cent). On the basis of these

findings, we can assume that the common method bias is not a concern in this study (Podsakoff and Organ, 1986).

#### *Measurement items*

We adopted the existing items used in previous studies for our research. Because of the length of items, we adjusted the items that match with this study. The construct, items and their sources are listed in Table II.

*Data analysis.* We used structural equation modeling (SEM) to analyze the data and test the hypothesized model. SEM is an important and effective statistical tool that integrates factor analysis (using a measurement model) and path analysis (using a structural model). SEM analyzes all hypothesized relationships simultaneously. Specifically, we conducted a confirmatory factor analysis (CFA) to assess the reliability and validity of the constructs and tested the structural fit of our theoretical model. We applied partial least squares (PLS) in version of Smart PLS 2.0 (Ringle *et al.*, 2005) to analyze the data collected. The following section presents the results of the measurement model estimation and elucidates the hypothesized results of the research model exposed in Figure 1.

## Results

#### *Measurement model evaluation*

We tested a measurement model at the item level to check whether scale items were adequate indicators of their underlying constructs. The measurement model revealed six latent constructs (i.e. organizational effectiveness, BI systems' effectiveness, organizational strategy, organizational structure, organizational process and organizational culture).

The internal consistency statistics were assessed by Cronbach's alpha and composite reliability (CR) (Dillon Goldstein's Rho), which were represented in Table III. Both the Cronbach's alpha and CR of all constructs were above the threshold of 0.7. Therefore, all the items used in this study were found reliable. We proceeded to test the construct validity by measuring average variance extracted (AVE), which measures the percentage of the variance captured by a construct by showing the ratio of the sum of the variance captured by the construct and measurement variance. Table III shows that the AVE of each construct was greater than a threshold of 0.5 (Yoo and Alavi, 2001).

Further, we tested the discriminant validity examining whether a construct better explains the variance of its own indicators than the variance of other constructs. The correlations estimated between every two constructs were from 0.14 to 0.61. Table IV illustrates that the square root of the AVE of each construct, representing in the diagonal positions, was higher than the entries in the corresponding rows and columns. Hence, the results support the discriminant validity of all constructs in the hypothesized model.

Finally, we tested the convergent validity using the factor and cross-loading of all indicator items in relation to their respective latent constructs. In Table V, cross-loadings of all items showed that the measurement items loaded highly on their respective constructs and did not load highly on other constructs. Moreover, the results revealed that all items loaded on their respected constructs with a factor between 0.65 and 0.91. Thus, we can affirm that these measurement items accurately represent distinct latent constructs.

Construct	Item	Source
Organizational effectiveness (5)	OE1: Compared with key competitors, our company is more successful	Lee and Choi (2003)
	OE2: Compared with key competitors, our company has a greater market share	
	OE3: Compared with key competitors, our company is growing faster	
	OE4: Compared with key competitors, our company is more profitable	
	OE5: Compared with key competitors, our company is more innovative	
BI Systems effectiveness (10)	BI1: BIS improved coordination with business partners/suppliers	Elbashir <i>et al.</i> (2008)
	BI2: BIS reduced the cost of transactions with business partners/suppliers	
	BI3: BIS improved responsiveness to/from suppliers	
	BI4: BIS intelligence improved efficiency of internal processes	
	BI5: BIS increased staff productivity	
	BI6: BIS reduced the cost of effective decision-making	
	BI7: BIS reduced operational cost	
	BI8: BIS reduced customer return handling costs	
	BI9: BIS reduced marketing costs	
	BI10: BIS reduced time-to-market products/services	
Organizational strategy (12)	OS1: Emphasize effective coordination among different functional areas	Venkatraman (1989)
	OS2: Information systems provide support for decision making	
	OS3: Manpower planning and performance appraisal of senior managers	
	OS4: Use of cost control systems for monitoring performance	
	OS5: Use of production management techniques	
	OS6: Emphasis on product quality through the use of quality circles	
	OS7: We emphasize basic research to provide us with future competitive edge	
	OS8: Forecasting key indicators of operations	
	OS9: "What-if" analysis of critical issues	
	OS10: Constantly seeking new opportunities related to the present operations	
	OS11: Constantly on the lookout for businesses that can be acquired	
	OS12: Operations in larger stages of life cycle are strategically eliminated	

(continued)

**Table II.**  
Measurement items

Construct	Item	Source
Organizational structure (5)	ORS1: Any major decision that I don't require this company's approval ORS2: In my dealings with this company, no single matter has to be referred to anyone higher up for a final answer ORS3: My dealings with this company are subject to a lot of rules and procedures stating how various aspects of my job are to be done (R) ORS4: I don't have to ask company representatives before I do anything in my business ORS5: I can take very little action on my own until this company or its representatives approve it (R)	Ferrell and Skinner (1988)
Organizational process (5)	OP1: Project management rules and procedures formalized via documents such as contract books, sign-off forms, and such OP2: Formal project management rules and procedures actually followed OP3: Formal progress reviews held (sometimes also called design, gate, phase or stage reviews) OP4: Technology enabled organizational processes to perform well OP5: Strategic planning process actually encourages information sharing and cross-functional cooperation	Tatikonda and Montoya-Weiss (2001)
Organizational culture (8)	OC1: Most people in this company have input into the decisions that affect them OC2: Cooperation and collaboration across functional roles is actively encouraged OC3: There is a high level of agreement about the way that we do things in this company OC4: Our approach to doing business is very consistent and predictable OC5: Customers' comments and recommendations often lead to changes in this organization OC6: This organization is very responsive and changes easily OC7: This company has a long-term purpose and direction OC8: There is a shared vision of what this organization will be like in the future	Denison and Mishra (1995)

Table II.

*Structural model assessment.* The structural model is examined by incorporating the estimation of the path coefficients and the variance explained  $R^2$  values. Specifically, we measured all the relationships of the hypothesized model by describing unmediating and mediating relationships separately. Moreover, bootstrapping (5,000 resamples) generates coefficient and  $t$ -statistics.

*Unmediated model.* Table VI describes the unmediated structural model with the variance explained ( $R^2$ ) and the path coefficients of all the constructs. We found that of BI systems' effectiveness. Moreover, BI systems' effectiveness significantly affects



Constructs	AVE	Composite reliability	Cronbach's alpha
BIS	0.6519	0.9493	0.9406
OE	0.5723	0.8693	0.8120
OC	0.7946	0.9687	0.9631
OP	0.7302	0.9312	0.9078
OS	0.6732	0.9611	0.9559
OST	0.6889	0.9170	0.8876

**Table III.**  
The measurement model

**Notes:** AVE = average variance extracted; BIS = business intelligence systems; OE = organizational effectiveness; OC = organizational culture; OP = organizational process; OS = organizational strategy; OST = organizational structure

Constructs	BIS	OE	OC	OP	OS	OST
BIS	<i>0.8074</i>					
OE	0.6067	<i>0.7565</i>				
OC	0.3492	0.4224	<i>0.8914</i>			
OP	0.4296	0.4531	0.2439	<i>0.8545</i>		
OS	0.4622	0.5797	0.2884	0.3293	<i>0.8205</i>	
OST	0.2775	0.3048	0.1483	0.2507	0.1569	<i>0.8300</i>

**Table IV.**  
Correlation matrix and square root of the AVE

**Notes:** BIS = business intelligence systems; OE = organizational effectiveness; OC = organizational culture; OP = organizational process; OS = organizational strategy; OST = organizational structure. The principal diagonal of the correlation matrix represents the square root of the average variance extracted (AVE) per construct

organizational effectiveness ( $\beta = 0.6180$ ,  $t$ -statistic = 7.6298,  $p < 0.001$ ). Thus, organizational strategy ( $\beta = 0.4177$ ;  $t$ -statistic = 4.8076;  $p < 0.01$ ), organizational structure ( $\beta = 0.1559$ ;  $t$ -statistic = 2.4963;  $p < 0.01$ ), organizational process ( $\beta = 0.2217$ ;  $t$ -statistic = 3.0731;  $p < 0.01$ ) and organizational culture ( $\beta = 0.2171$ ;  $t$ -statistic = 3.1436;  $p < 0.01$ ), positively affected organizational effectiveness. Thus, the results support the *H3*, *H6*, *H9* and *H12*. The  $R^2$  for BI systems' effectiveness was 0.351, indicating that the variation in the organizational factors explained 35.1 per cent of the total variance the results support the *H1*. The  $R^2$  for organizational effectiveness was 0.486, indicating that the variation in the organizational factors explained 48.6 per cent of the total variance of organizational effectiveness.

*Mediated model.* Table VII describes the mediated structural model with the variance explained ( $R^2$ ) and the path coefficients of all the constructs. Consistent with the unmediated model, we found that organizational strategy ( $\beta = 0.3019$ ,  $t$ -statistic = 4.2661,  $p < 0.01$ ), organizational structure ( $\beta = 0.1394$ ;  $t$ -statistic = 2.1952;  $p < 0.01$ ), organizational process ( $\beta = 0.2537$ ;  $t$ -statistic = 3.6772;  $p < 0.01$ ) and organizational culture ( $\beta = 0.1800$ ;  $t$ -statistic = 3.1603;  $p < 0.01$ ) had a positive and significant impact on BI systems' effectiveness. Thus, the results support the *H2*, *H5*, *H8* and *H11*. It is noteworthy that after controlling BI systems' effectiveness, organizational strategy ( $\beta = 0.3702$ ;  $t$ -statistic = 4.2571;  $p < 0.01$ ), organizational structure ( $\beta = 0.1354$ ;  $t$ -statistic = 2.1815;  $p < 0.01$ ), organizational process ( $\beta = 0.1422$ ;  $t$ -statistic = 2.2164;

Items	Constructs	BIS	OC	OE	OP	OS	OST
BIS1		<i>0.8151</i>	0.2857	0.5373	0.3699	0.4400	0.2973
BIS2		<i>0.8246</i>	0.3309	0.4768	0.3192	0.3547	0.2415
BIS3		<i>0.8168</i>	0.3646	0.4479	0.3475	0.2928	0.1594
BIS4		<i>0.7863</i>	0.2732	0.4263	0.3004	0.3416	0.2649
BIS5		<i>0.7981</i>	0.3270	0.4882	0.3719	0.3686	0.2744
BIS6		<i>0.8528</i>	0.2839	0.5689	0.3700	0.4172	0.1984
BIS7		<i>0.7737</i>	0.2391	0.5013	0.3433	0.4002	0.1692
BIS8		<i>0.7960</i>	0.2260	0.4995	0.3715	0.3545	0.2407
BIS9		<i>0.7893</i>	0.2031	0.4514	0.3286	0.3468	0.1782
BIS10		<i>0.8187</i>	0.2844	0.4676	0.3357	0.3777	0.1883
OC1		0.3355	<i>0.8877</i>	0.3617	0.2032	0.2314	0.1664
OC2		0.3188	<i>0.9112</i>	0.3866	0.2041	0.2591	0.0888
OC3		0.2771	<i>0.8832</i>	0.3623	0.1960	0.2223	0.1287
OC4		0.2671	<i>0.8728</i>	0.3594	0.1810	0.2364	0.1417
OC5		0.3198	<i>0.9022</i>	0.3794	0.1843	0.2691	0.1500
OC6		0.3177	<i>0.9061</i>	0.4053	0.2479	0.3011	0.1028
OC7		0.2938	<i>0.8938</i>	0.3735	0.2799	0.2848	0.1547
OC8		0.3445	<i>0.8737</i>	0.3832	0.2391	0.2507	0.1306
OE1		0.4712	0.2963	<i>0.7397</i>	0.3476	0.4289	0.2184
OE2		0.4520	0.3148	<i>0.7715</i>	0.3774	0.4559	0.2551
OE3		0.4661	0.3567	<i>0.7837</i>	0.3372	0.4565	0.2920
OE4		0.5325	0.3422	<i>0.8227</i>	0.3700	0.4805	0.2097
OE5		0.3505	0.2868	<i>0.6552</i>	0.2725	0.3625	0.1808
OP1		0.3899	0.1749	0.3699	<i>0.8545</i>	0.2688	0.1991
OP2		0.3777	0.2289	0.3495	<i>0.8607</i>	0.2470	0.2498
OP3		0.3692	0.2587	0.3764	<i>0.8416</i>	0.2566	0.1727
OP4		0.3817	0.1990	0.4423	<i>0.8718</i>	0.3484	0.2636
OP5		0.3052	0.1778	0.4007	<i>0.8437</i>	0.2866	0.1869
OS1		0.3539	0.2087	0.4690	0.2448	<i>0.7861</i>	0.1442
OS2		0.4354	0.2039	0.4752	0.2479	<i>0.8141</i>	0.1441
OS3		0.3345	0.2030	0.4164	0.2238	<i>0.8264</i>	0.0998
OS4		0.3378	0.2275	0.4741	0.2816	<i>0.8269</i>	0.0919
OS5		0.4002	0.2009	0.4968	0.3020	<i>0.8303</i>	0.1484
OS6		0.3824	0.2820	0.4764	0.2145	<i>0.8230</i>	0.1962
OS7		0.4131	0.2529	0.4970	0.2902	<i>0.8595</i>	0.1589
OS8		0.3138	0.2660	0.4438	0.2278	<i>0.8272</i>	0.1260
OS9		0.4279	0.2605	0.4513	0.3076	<i>0.8142</i>	0.0790
OS10		0.3573	0.1918	0.4823	0.2900	<i>0.8004</i>	0.1790
OS11		0.3658	0.2506	0.4977	0.2916	<i>0.8115</i>	0.0527
OS12		0.3864	0.2899	0.5161	0.3050	<i>0.8250</i>	0.1294
OST1		0.2209	0.1330	0.2899	0.2289	0.1627	<i>0.8143</i>
OST2		0.2149	0.0528	0.2124	0.1845	0.1205	<i>0.8308</i>
OST3		0.2697	0.1405	0.2573	0.1905	0.1126	<i>0.8712</i>
OST4		0.2648	0.1697	0.2878	0.2414	0.1462	<i>0.8612</i>
OST5		0.1480	0.1031	0.2090	0.1965	0.1069	<i>0.7704</i>

**Table V.**  
The cross-loading  
matrix

$p < 0.01$ ) and organizational culture ( $\beta = 0.1714$ ;  $t$ -statistic = 2.4125;  $p < 0.01$ ) still kept their direct impacts on organizational effectiveness. In addition, BI systems' effectiveness significantly affects organizational effectiveness ( $\beta = 0.3920$ ;  $t$ -statistic = 4.5927;  $p < 0.01$ ), which is essential to represent the mediating role with the organizational factors. Thus, the results support the *H4*, *H7*, *H10* and *H13*.  $R^2$  for organizational effectiveness was 0.50, which is greater than 0.486 found in the unmediated model. The increased value of the variance explained ( $R^2$ ) of the mediated model over unmediated model indicates that the mediated model has a better fit than the original model.

Following the procedure of Baron and Kenny (1986), we further attempted to examine the mediation effect of BI systems' effectiveness. Table VIII depicts the results of the mediation hypotheses. We used the Sobel test (Sobel, 1982) to identify the significance level of the indirect effects. The outcomes indicated that the test statistic for organizational structure ( $z = 2.12$ ;  $p < 0.05$ ), organizational strategy ( $z = 3.15$ ;  $p < 0.01$ ), organizational culture ( $z = 2.49$ ;  $p < 0.05$ ) and organizational process ( $z = 2.66$ ;  $p < 0.01$ ) predicted BI systems' effectiveness as a significant mediator.

As Figure 2 shows, all organizational factors initially have a significant total effect on organizational effectiveness. When introducing BI systems' effectiveness as a mediator, all organizational factors still have a significant direct effect on organizational effectiveness. The results suggest that BI systems' effectiveness partially mediates the influence of all organizational factors on organizational effectiveness.

### Discussion

Overall, the study provides empirical evidence for the hypotheses proposed in the research. This study found strong positive relationship between BI systems' effectiveness and organizational effectiveness. This finding is consistent with past

**Table VI.**  
The summary of the results of the unmediated model

Effect	Coefficient	$t$ -statistics	Conclusion
Organizational strategy → Organizational effectiveness	0.4177	4.8076	Supported
Organizational structure → Organizational effectiveness	0.1559	2.4963	Supported
Organizational process → Organizational effectiveness	0.2217	3.0731	Supported
Organizational culture → Organizational effectiveness	0.2171	3.1436	Supported
BI systems → Organizational effectiveness	0.6180	7.6298	Supported

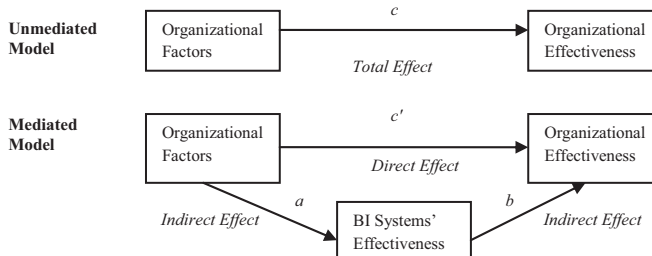
**Table VII.**  
The summary of the results of the mediated model

Effect	Coefficient	$t$ -statistics	Conclusion
Organizational strategy → BI systems	0.3019	4.2661	Supported
Organizational strategy → Organizational effectiveness	0.3702	4.2571	Supported
Organizational structure → BI systems	0.1394	2.1952	Supported
Organizational structure → Organizational effectiveness	0.1354	2.1815	Supported
Organizational process → BI systems	0.2537	3.6772	Supported
Organizational process → Organizational effectiveness	0.1422	2.2164	Supported
Organizational culture → BI systems	0.1800	3.1603	Supported
Organizational culture → Organizational effectiveness	0.1714	2.4125	Supported
BI systems → Organizational effectiveness	0.3920	4.5927	Supported

Organizational factors	Path	Path coefficient	SE	<i>t</i> -test	Sobel test	Mediation type
Organizational strategy	<i>c</i>	0.418	0.087	4.808***	$z = 3.15 (p < 0.01)$	Partial
	<i>a</i>	0.302	0.071	4.266***		
	<i>b</i>	0.392	0.086	4.593***		
	<i>c'</i>	0.370	0.089	4.257***		
Organizational structure	<i>c</i>	0.156	0.061	2.496**	$z = 2.12 (p < 0.05)$	Partial
	<i>a</i>	0.139	0.063	2.195**		
	<i>b</i>	0.392	0.086	4.593***		
	<i>c'</i>	0.135	0.064	2.182**		
Organizational culture	<i>c</i>	0.217	0.072	3.144***	$z = 2.49 (p < 0.05)$	Partial
	<i>a</i>	0.180	0.057	3.160***		
	<i>b</i>	0.392	0.086	4.593***		
	<i>c'</i>	0.171	0.071	2.413**		
Organizational process	<i>c</i>	0.2217	0.073	3.073***	$z = 2.66 (p < 0.01)$	Partial
	<i>a</i>	0.254	0.068	3.677***		
	<i>b</i>	0.392	0.086	4.593***		
	<i>c'</i>	0.142	0.067	2.216**		

Notes: \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

**Table VIII.**  
Summary of the  
results for mediation  
effect



**Figure 2.**  
The total effect vs  
direct effect vs  
indirect effect

studies which support the facts that organizational effectiveness is influenced by BI systems' effectiveness (Elbashir *et al.*, 2008). In the unmediated model, we found that organizational factors such as organizational strategy, organizational structure, organizational process and organizational culture have positive effect on organizational effectiveness. Our findings are consistent with the results of previous studies on the relationship between organizational factors and organizational effectiveness (Hansen and Wernerfelt, 1989; Angle and Perry, 1981).

Organizational strategy has a significant impact on organizational effectiveness above and beyond that of organizational context (Zheng *et al.*, 2010). The contingency theories of organization indicate that different types of organizational structures are appropriate for different types of situations. Duncan (1973) found that different organizational structures were related to the decision unit's effectiveness and organizational effectiveness. The culture can be studied as an important part of the adaptation process of organizations and that specific culture may be useful predictors of performance and effectiveness of the organization (Denison and Mishra, 1995).

In the mediated model, it was confirmed that BI systems' effectiveness partially mediates the organizational strategy, organizational structure, organizational process and organizational culture's influence on organizational effectiveness. This finding suggests that how well BI is managed is largely associated with how well strategy, structure, process and cultural values are translated into values to the organization. It seems that a logical next step in research on strategy, structure, process, culture and effectiveness could proceed to a deeper level by examining the specific mechanism(s) through which organizational factors influence organizational performance. The findings of this study also strengthen the call for attention to creating a strong organizational strategy, decentralized structure, process and organizational culture that are conducive to implement BI systems.

### **Managerial implications**

The results of the present study indicate that BI systems are likely to have a positive impact on organizational effectiveness, when there is a close match between BI systems and organizational strategy, structure, culture and process. The influences of these organizational contextual resources ensure better environmental fit, alignment of organizational resources and ultimate firm performance. Although organizational and BI systems' effectiveness display the deficiencies in operational performance occurred in process level, the problem may lie in the internal environment level, which is crucial for BI systems' utilization. This study sheds light on the friendly environment of BI systems that is consisted with a perfect match among organizational strategy, structure, culture and process.

While the pervasive role of BI systems has accentuated by increasing operational, supply chain and customer service performance in recent years, the utmost influence of BI systems is to facilitate strategic decision-making. The results indicate that organizational strategy has the highest impact on BI systems' effectiveness in comparison with the other organizational factors. It is obvious that aligning organizational strategy with BI systems is the most critical to organizational success. The numerous acceptability and utilization of the BI systems also reflect the strategic soundness of the organization that touches every stage of business process beginning from suppliers to satisfying the end customers.

BI systems' success varies in terms of firm, industry, the size of the firm, while any failure in utilization of BI systems demonstrates that the problem lies in not only the operational level, but also the core level of business such as structure, strategy, culture and process. To achieve successful change initiatives, the concentration should be paid in how organizational factors can be aligned with organizational demands and activities. This alignment meets success when the change initiatives are taken through focusing equal consideration in diagnosing process level and organizational factor-level deficiencies.

The study has found the simultaneous impact of organizational factors on BI systems, such that organizational strategy, structure, culture and process act as interdependent systems that influence organizational effectiveness through BI systems. Any change in one or two factors requires a change in the remaining organizational factors. This finding provides new insights, as we addressed the impact of all components of organizational factors on BI systems, rather than one or two components of organizational factors.

### Limitations and future directions

As like with most researches, the outcomes of this study should be interpreted in light of its limitations. First, the sample of this study is drawn from one single vendor of BI software. Although it ensures the internal validity of the measures, the external validity might be affected if multiple BI software vendors were chosen with different software specifications.

Second, a large number of our respondents are the only informants of their organizations. Among 154 organizations, only 63 organizations had multiple respondents. Although responses from single informant as well as managers might overstate or understate the current scenario of the organization, this limitation cannot be overlooked.

Third, the nature of this study is cross-sectional, unless we gathered information on different time frames, we cannot confirm the causality. Further study replicating our hypothesized model with longitudinal data can unfold the causal relationship among variables. Finally, the length of operations in a single industry can give organizations to be matured and benefited from the proper utilization of organizational factors and BI systems as well. Moreover, with the advancement of BI systems and applications of innovative technologies, organizations can ensure the maximum optimization of the usages. With the passage of time, customization of BI software provided by the vendors, may impact organizational effectiveness and competitive advantage over other firms. Future research can replicate the present study on organizations that are using other BI software provided by other BI vendors.

### Conclusion

The primary objective of this study is to identify the impact of organizational factors on BI systems. Although it is concluded that the effective BI systems brings better organizational performance, it is important to unfold the influence of organizational strategy, structure, culture and process on this relationship. The results reveal that organizational strategy, structure, culture and process are positively related to BI systems' effectiveness. Furthermore, BI systems' effectiveness partially mediates the relationship between the organizational factors and organizational effectiveness. This study contributes to the present understanding of the relationship between BI systems and organizational effectiveness by incorporating organizational factors as antecedents, such that appropriate and effective organizational factors act as a catalyst to engender the benefits of BI systems.

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