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Development of Business Intelligence Success Evaluation Framework

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Abstract: The present study proposes a new theoretical framework for examining relationship between Business Intelligence (BI) Capabilities and Business Intelligence (BI) Success from the positions of Information System Success theory. A lot of attention was paid to the quality issues of BI Capabilities due to the theoretical background of IS Success Theory, especially De Lone and McLean IS Success model. Most of the hypothesized relationships were confirmed. The results of the present research suggest that BI Capabilities in the context of proposed framework are critically important to BI Success. Organizations, exploiting BI systems, should pay attention to the implementation of the abovementioned BI Capabilities. Another important notion is that the difference in the quality of these BI Capabilities may explain the success and failure of the BI implementation projects. These results are consistent with the previous research in the academic field. This study is relevant to both researchers and practitioners. This study proposes to extend current research in BI and provide a parsimonious and intuitive model for explaining the relationship between BI success and BI capabilities based on the previous research in the field of Information System (IS) Success.

Key words: Business intelligence, business intelligence capabilities, information systems, information system flexibility, business intelligence success

INTRODUCTION

BI success is the positive value an organization obtains from its BI investment (Ballantine *et al*., 1996; Burton *et al*., 2006). The organizations that have BI also have a competitive advantage, but how an organization defines BI success depends on what benefits that organization needs from its BI initiative (Jourdan *et al*., 2008). BI success may represent attainment of benefits such as improved profitability (Eckerson, 2003), reduced costs (Pirttimaki *et al*., 2006) and improved efficiency (Burton *et al*., 2006). For the purpose of this study, BI success is defined as the positive benefits organizations achieve through use of their BI (Isik *et al*., 2010). Specific BI success measures differ across organizations and even across BI instances within an organization. Organizations that have achieved success with their BI implementations have created a strategic approach to BI to help ensure that their BI is consistent with corporate business objectives (Wixom and Watson, 2001).

Finally, although previous research suggests several success models for Decision support systems-DSS (Gelderman, 2002; Clark *et al*. 2007; Hartono *et al*., 2007), there is little theory-based research solely focusing on understanding BI success from the perspective of BI capabilities.

Various approaches to examining BI capabilities may be one of the reasons behind the gaps in the research about BI success. A lack of fit between the organization and its BI capabilities is one of the reasons for lack of success (Watson and Wixom, 2007; Watson, 2009). Although BI capabilities have been studied from organizational and technological (Manglik and Mehra, 2005) perspectives, some organizations still fail to achieve BI success (Isik *et al*., 2010). BI capabilities within an organization can be divided into two groups; technological (e.g., data sources and data reliability) and organizational (Manglik and Mehra, 2005). Organizational capabilities are those that impact the way the BI is used within an organization (e.g., flexibility and risk-taking level of the organization). To better support emerging BI user needs and best practices, a coordinated effort across users, technology, business processes and data is required (Bharadwaj, 2000). This endeavor, if successful, can improve the fit between BI and the organization within which it is implemented.

MATERIALS AND METHODS

The internal relationship between BI Capabilities is rather complex and still remains not sufficiently examined (Burton *et al*., 2006), the relationship between BI

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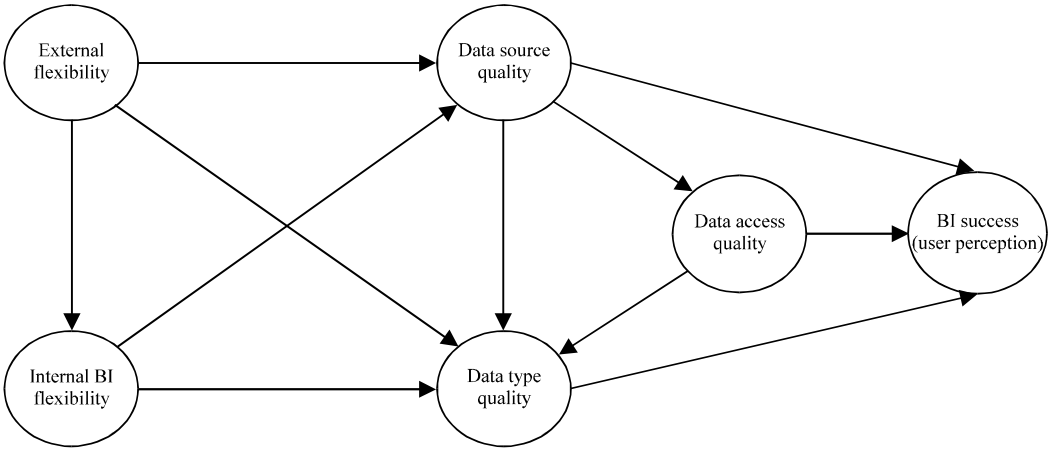

Fig. 1: Conceptual model-BI capabilities and BI success (use) relationship

Capabilities and BI Success is equally unexamined. BI Success depends on the relationship of different technological and organizational capabilities of the applied BIS. The focus of the present study is on the relationship between BI Capabilities and BI Success. The present study exploits the following BI capabilities: Data Types Quality, Data Sources Quality, User Access Quality and Interaction with other Systems and Flexibility. We propose the following research model of the above-mentioned relationship:

Further we are developing hypotheses for the present study based on the newly developed conceptual framework:

Hyp 1a: Interaction with other Systems is positively related to Data Source Quality
Hyp 1b: Interaction with other Systems is positively related to Data Type Quality
Hyp 2: Interaction with other Systems is positively related to BI Flexibility
Hyp 3: Data Source Quality is positively related to Data Type Quality
Hyp 4: Data Source Quality is positively related to Data Access Quality
Hyp 5: Data Source Quality is positively related to BI Success (Use)
Hyp 6a: BI Flexibility is positively related to Data Source Quality
Hyp 6b: BI Flexibility is positively related to Data Type Quality
Hyp 7: User Access Quality is positively related to Data Type Quality
Hyp 8: User Access Quality is positively related to BI Success (Use)
Hyp 9: Data Type Quality is positively related to BI Success (Use)

Integration and interaction with other Systems becomes more important especially for companies and enterprises that employ BI Systems collecting data from multiple data sources (Grover and Malhotra, 2003). The more applications the BIS exploits, the wider choice BIS users have (Sambamurthy *et al*., 2003).

Besides the data sources, data types are also among technological BI capabilities and their quality may impact BI success differently for different decisions and different management activities. BI systems could be divided into two groups: web-centric and desktop applications. The critical difference between them is amount of control and limitations of the users when they access a system. Web-centric applications usually have more data sources involved in the process, also such applications are available for large numbers of users (Sambamurthy *et al*., 2003).

RESULTS AND DISCUSSION

The model was assessed with Partial Least Squares (PLS) method, which is widely used as a research tool in the IS field (Chin, 1998). To measure the reliability and validity of data we used a Smart PLS (Partial Least Squares) Graph Version 2.0, a structural equation modeling software tool. Empirical tests of the BIS Flexibility and technological BI Capabilities are rare in the IS field. SEM's technique is rather confirmative, than exploratory. It is applied for validating of instruments and testing of constructs (Chin, 1998). To assess the construct validity and reliability, a test on Cronbach's alpha was conducted for each construct variables and underlying measurement variable. In the final model almost all the Cronbach's Alphas exceed the 0.70 thresholds. If the reliability coefficients are all within generally accepted threshold, the results suggest a high

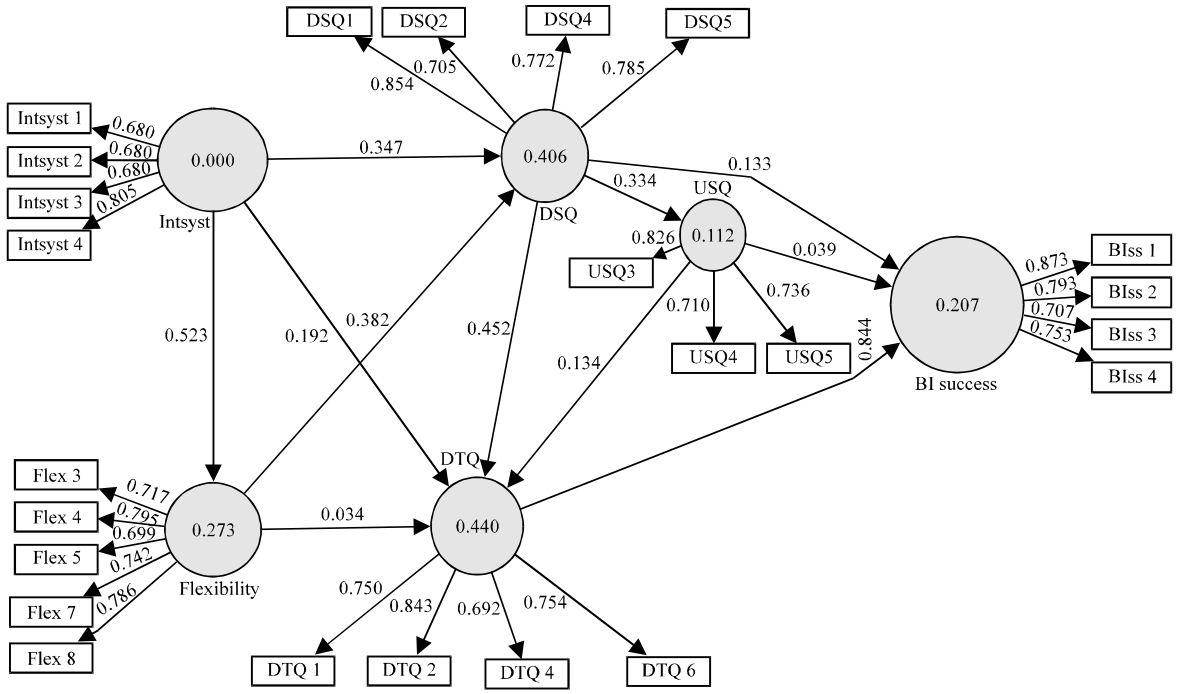

Fig. 2: CFA model

level of reliability of the construct variable and underlying measurement items. All the composite reliabilities of the latent variables are higher than 0.80 and show internal consistency of indicators and in this way confirm high level of construct reliability. The AVE (average variance extracted) is mostly higher 0.50 that means variance captured by each latent variable is significantly larger than measurement error variance. Thus, convergent validity is demonstrated. Figure 2 presents the results of CFA (confirmatory factor analysis).

By examining the factor loading of each item on the corresponding latent variable the individual item reliability can be checked. Loading above 0.6 is usually considered high, below 0.4 is low (Chin, 1998). All the construct variables are considered to be valid with a good model fit, if all the measurement items have value over 0.6. The proposed model has good construct fit as all factor loadings are above 0.6 (Chin, 1998). To test the research model the path analysis is used. CFA contains only measurement part; in SEM t-tests are seen as a special case of the analysis of variance. The path coefficients are presented in Table 1.

Analyzing factor loadings of a ll construct indicators can also evaluate convergent and discriminant validity. The standardized item loadings should be larger than 0.707 and the items should load more strongly on their corresponding constructs than other constructs (Chin, 1998).

Table 1: Path coefficients

Parameters	BI success	DSQ	DTQ	Flex	Int syst	USQ
BI success						
DSQ	1.74		8.12			6.83
DTQ	4.8					
Flex		8.01	0.69			
IntSyst		8.61	3.08	15.58		
USQ	0.512		2.82			

Table 2: Summary of hypothesis test results

Hypothesis	T-Statistic	Support
H1a: IntSyst→DSQ	8.613	Confirmed
H1b: IntSyst→DTQ	3.081	Confirmed
H2: IntSyst→Flex	15.585	Confirmed
H3:DSQ→DTQ	8.122	Confirmed
H4: DSQ→USQ	6.838	Confirmed
H5: DSQ→BI Success	1.741	Not confirmed
H6a: Flex→DSQ	8.010	Confirmed
H6b: Flex→DTQ	0.699	Not confirmed
H7: USQ→DTQ	2.821	Not confirmed
H8: USQ→BI Success	0.512	Not confirmed
H9: DTQ→BI Success	4.804	Confirmed

Table 2 shows the summary of hypothesis testing results of research model.

All t-statistics will be significant at p less than 0.001. If the probability value (p value) is less than the significance level, the null hypothesis is rejected. If the T-value is greater than 2.63, then the path is significant at $p<0.01$. T-value in between 2.63 and 1.96 is significant at $p<0.05$. Likewise, T-value below 1.96 is not significant ($p<0.01$).

CONCLUSION

The present study implies that the quality of Data Sources from which organizations obtain data of different types are crucial for the overall BIS Success (Isik *et al*., 2010). Nowadays, the majority of organizations exploit multiple Data Sources and multiple IS and applications, so the integration of technology and information is needed to avoid inconsistencies and inaccuracies when making decisions (Sambamurthy *et al*., 2003). Gaining a single view of data is becoming more and more important and makes companies go the way of integration of different applications and systems to incorporate both historical and operational data into their analysis. User Access Quality is also critical to BIS Success. This proposition is supported by existing IS and DSS literature (Clark *et al*., 2007). Some of the hypotheses were not confirmed. We believe, that decision-making issues should be taken into account when dealing with BI systems (Burton *et al*., 2006).This is a matter of future research. The present paper contributes to academic research by providing richer insight in the role of the BI Capabilities in BI success and providing a framework with which future research on the relationship between BI capabilities and BI success can be conducted.

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