

**ANTECEDENT DETERMINANTS OF BELIEFS UNDERPINNING THE INTENTION
TO ACCEPT AND USE BUSINESS INTELLIGENCE SYSTEMS:
THE IMPORTANCE OF ORGANIZATIONAL FACTORS**

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ABSTRACT

By drawing together the implications from several streams of IS research, addressing the critical research question posed extensively in IS literature, this study identifies the antecedents of individual's behavioral and normative beliefs that shape intentions to use Business Intelligence Systems (BIS), explaining how those internal motivations are formed. Our comprehensive model of antecedents captures a wide range of factors including individual and organizational factors that can impact the formation of favourable beliefs triggering BIS use intentions, reflecting the specifics and nature of BIS use. The model was tested and analysed with SEM-PLS based on survey data gathered from employees of medium- and large-sized organizations. The results of our study provide several theoretical and practical implications showing that besides the self-efficacy belief entailing individual characteristics, organizational factors either directly or indirectly through building of proactive information culture impact the individual's internal schema of considerations that shape their intentions to use BIS.

Keywords: drivers of the individual's internal motivations, BIS, organizational factors, information culture.

INTRODUCTION

Although prior research has provided valuable insights to help understand the determinants of the acceptance and use of information technology (IT) by individuals in organizations (i.e. 12, 40, 41), attempts to identify the antecedents of those formed beliefs, particularly in a context-specific environment are still scarce 41. Recognizing the drivers of acceptance and use of specific information systems (IS) holds great value for organizations. This value is seen in being able to proactively design interventions 25, 41 and mitigate resistance to accepting new IS so as to improve the likelihood of success and the business value of this new IS for such organizations.

The positive impact on decision-making of the information provided by Business Intelligence Systems (BIS) is emphasized in the IS literature, particularly when organizations operate in highly competitive environments 35. It is crucial to understand effective use of BIS and determine their acceptance determinants 20, as effective long-term use of IS, is a key measure of ultimate IS success 14. The next important step for BIS success is to understand the antecedents to these formed beliefs that organizations can have an influence on in order to maximize the benefits of the implemented IS. We explore how the interplay of factors previously identified in existing IT/IS acceptance research with contextual extensions enriches the explanation of acceptance beliefs leading to the effective use of BIS, and in the process address the gap in the literature 42. We focus on the critical research question of *what* drives the motivation to use BIS and *how* and *why* do individuals form these intentions to engage in the use of BIS.

General predictors of behavioral intentions and use of technology from the Unified Theory of Acceptance and Use of Technology (UTAUT) 40 are well known in the literature. Although the UTAUT's determinants have been proven generalizable in many different settings and replications 42, we build on the fact that significantly different acceptance beliefs drive BIS use 20. Previous studies in the BIS context demonstrate that effort and performance perceptions (postulated in TAM 12 as salient beliefs of acceptance) have no direct statistically significant effect on behavioral intention to use BIS (further impacting their effective use), but instead work through social mechanisms where social influence and result demonstrability directly impact motivations to engage in the use of BIS 20. Taking this baseline of behavioral and normative beliefs into consideration, we further look for the antecedents to the formation of beliefs people hold about accepting BIS. These internal motivational beliefs to perform behavior may be influenced by a wide variety of personal, cultural and situational factors 4. The model of the antecedent drivers of

internal motivations to use BIS includes individual and organizational determinants and thus provides “actionable guidance to practitioners” 41, 30. By presenting the precursors to formed individual internal beliefs, we address the limitation of acceptance models mentioned by Lee et al. 30 and Venkatesh and Bala 41 who call for future studies to also address the antecedents of acceptance determinants in a context-specific environment. Understanding these determinants can lead to the greater acceptance and effective utilization of BIS.

The structure of the paper is as follows. In the next section, the theoretical background is elaborated. The research model is then conceptualized and hypotheses are developed. Further, the research design, methodology, and results of the estimation are given. This is followed by a discussion of the results, including the implications for research and practice and a conclusion with limitations and suggestions for future research.

THEORETICAL BACKGROUND

BIS refer to solutions that hold quality information in well-designed data stores connected with business-friendly tools. Their goal is to provide stakeholders at various levels of an organization with timely access to, effective analysis and an insightful presentation of the information generated by enterprise-wide applications, enabling them to make the right decisions or take the right actions across a broad range of business activities 35.

BIS have some specific characteristics concerning their use environment compared to operational IS 20 that impact their acceptance and effective use, such as: voluntariness of use 39, 40, 41, a different structure of users (mostly managers) related to less structured information needs, much more aggregated and integrated information with greater sharing of information 34, connected with the need for improvements in the information culture 32 and an emphasis on the relevance of the information BIS provide 14, 15, 35. All of these specifics show that different motivations 20 than those posited by traditional models impact their acceptance and use, and that a different interplay of antecedents thus influences the formation of these behavioral and normative beliefs.

Research on individual-level IT acceptance provides rich theories on the determinants that influence acceptance and decisions about the use of IT. Although isolated impacts of individual, technological, social, and organizational factors on IT use are well recognized (i.e. 33, 2, 43, 14, 40, 41), a more comprehensive understanding is needed of the actionable determinants that explain how and why individuals form acceptance beliefs 44 about using a specific (in our case BIS) artefact.

Most of the models that have attempted to recognize antecedents to acceptance determinants, which in TAM model 12 include only behavioral beliefs and attitudes, focus predominantly on a variety of individual characteristics 41 or on perceptions related to the IT artefact 44, 14. Also prior research in the BIS setting has mostly focused on improvements to system quality, design characteristics, and implementation efforts with critical success factors (i.e. 43, 45, 35). All these views are important and essential for system success, but still the bottom line for organizations to realize benefits and promised outcomes of BIS implementation is that BIS have to be effectively accepted and used by employees in organizations. The significance of specific antecedents of acceptance determinants in the BIS context has not been researched yet.

For instance TAM 12 includes only behavioral beliefs (perceived usefulness and perceived ease of use) as IT acceptance determinants. However, individual intentions to engage in a behavior consist of these mentioned behavioral beliefs as well as normative (social) considerations 4, which UTAUT 40 by including social influence takes into account. Both of these are further influenced by a wide variety of cultural, personal, and situational determinants 4. Ajzen and Fishbein 4 elaborate that the antecedents of intentions and behavior represent individual personal factors, the physical environment, the social environment and exposure to information.

Taking the baseline from previous research in the BIS context 20 that social influence and result demonstrability present behavioral and normative beliefs (acceptance determinants) that directly impact motivations to engage in the use of BIS, we further look for the antecedents to the formation of beliefs people hold about accepting BIS.

Figure 1 presents the conceptual model. The proposition of antecedents to acceptance determinants (representing the added value of this research), is categorized based on Ajzen and Fishbein’s classification 4 and going in line with the previous findings that in the BIS context use social mechanisms in an organizational environment predominantly

impact its effective use 20. We assume that these organizational aspects, representing cultural and situational determinants along with personal 4 also shape the creation of beliefs underpinning intention.

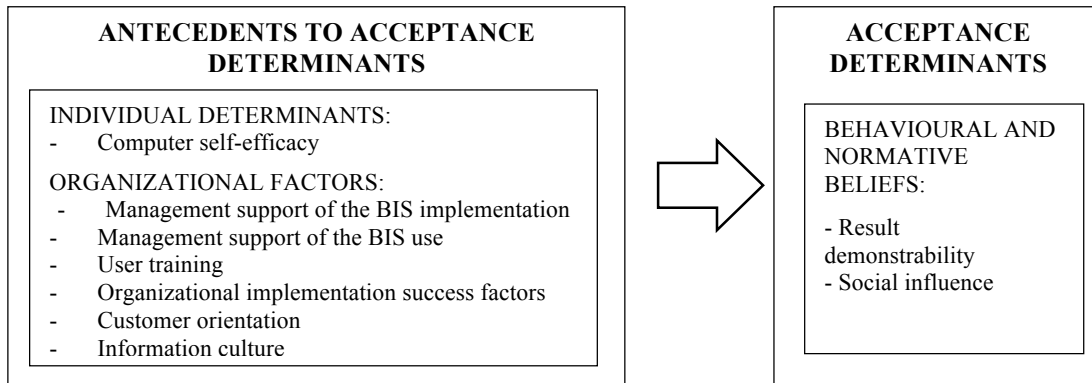


Figure 1. Conceptual Model of Antecedents for BIS Acceptance

CONCEPTUALIZATION OF THE RESEARCH MODEL

Behavioral and Normative Beliefs

Behavioral and normative beliefs represent the individual’s “internal schema” of considerations that influence the decision to perform a behavior 4. Behavioral intentions (formed by behavioral and normative beliefs) are important and good predictors of behavior particularly under volitional control 17, which is also the case of the BIS. Employees are therefore more likely to use BIS if they are internally motivated to perform and engage in this behavior. Karahanna, Straub and Chervany 27 suggest that sociological variables (i.e. result demonstrability and social influence) are more important for explaining the mental acceptance of innovation, in our case BIS.

Venkatesh et al. 40 define social influence (normative beliefs) as “the degree to which an individual perceives that important others believe he or she should use the new system”. The inclusion of social influence points to the fact that individuals also behave according to their beliefs about how others will view them as a result of having used the technology. Further, Venkatesh and Bala 41 define result demonstrability (behavioral beliefs) as “the degree to which an individual believes that the results of using a system are tangible, observable and communicable”. Agarwal and Prasad 1 found a significant relationship between result demonstrability and usage intentions. The demonstrability of the results of using BIS, such as having knowledge of the actual outcomes of work activities with BIS use and social influence, represents the key psychological state underlying the motivation to use BIS 21.

Agarwal and Fishbein 4 point out that behavioral and normative beliefs can vary as a function of a wide range of background factors including individual, social, and information (i.e. knowledge, interventions) aspects.

Individual Characteristics

Individual characteristics or personal traits are well recognized in traditional acceptance models (i.e. 38, 2, 40, 41) for having an impact on how individuals form beliefs about accepting or using a new system. From these personality characteristics we include in our model computer self-efficacy 38 that captures individual beliefs and perceptions associated with computers and computer use. Computer self-efficacy relates to judgments about ability/knowledge or an individual’s control beliefs regarding their ability to use a new system 41. Karahanna et al. 27 argue that the concepts of effort perceptions and performance perceptions are actually incorporated in the computer self-efficacy construct. We test the possibility of computer self-efficacy having an impact on result demonstrability, because BIS use is recognized to be innovative and research-oriented in nature, and the identification of information needs is based on performance management and the efficiency of operations 19. Accordingly, we would expect that users with a positive judgment about being able to successfully handle this new system should be more able to demonstrate the results of its use. These personality traits regarding computer use should impact on how users believe they are able to communicate and demonstrate the results of using BIS, whereas beliefs concerning the social influence of how the organization supports BIS use and how others will view them as a consequence of BIS use should be influenced by some other determinants. Applying this reasoning, we hypothesize:

H1: Computer self-efficacy positively influences result demonstrability.

Organizational Factors

The existing acceptance models mostly focus on individual determinants and system characteristics (i.e. 12, 14, 44) and do not consider organizational traits as an important contributor to the individual's IS acceptance. Isolated impacts of the importance of management support, facilitating conditions and user training for inducing intentions to use IS have already been demonstrated (i.e. 24, 26, 40). Organizational factors have been shown to exert a crucial external influence that shapes the individual's intentions and use of BIS in a case study analysis 19. Organizational factors can influence the way in which the information that forms the behavior is perceived and judged. More specifically, Ajzen and Fishbein 3 argue that "external variables may influence the beliefs a person holds or the relative importance he attaches to the attitudinal and normative considerations". We argue that a broad spectrum of organizational impacts forms the creation of the individual's intentions to use BIS.

Management support for implementing the system is found in the literature to be one of the key success factors for the system to be favorably received and for the implementation to be deemed successful 22. Since BIS often change traditional flows of information, it is absolutely necessary that support from top management comes in the early phases of BIS development 45. Management support of the BIS implementation motivates people in the organization to support the BIS initiative and the organizational changes that inevitably accompany it 43. One of the most evident organizational changes that comes with BIS implementation is the change in the information culture, particularly in the areas of information transparency, information sharing and information proactiveness 32. Information deriving from these systems is more aggregated and integrated at the organizational level, with lots of sharing of information, and the desired result of these systems is the proactive use of information from BIS for better decision-making 19. Active management support of the BIS implementation should emphasize the organizational value of BIS and thus improve the information culture throughout the implementation process. Based on this, we hypothesize:

H2: Management support of BIS implementation positively impacts information culture.

Management support of BIS use concerns all types of management's sponsorship of the use of BIS following the implementation, such as leading by example by using BIS and encouraging decision-making based on the information provided by BIS. Users tend to conform to the expectations of management and are more likely to use a system they perceive to be backed by the management of their organization 43. Management support of BIS use represents the most salient aspect of the social normative component with respect to the individual's motivation to use IS in organizations, along with supervisors, peers, and the organization's MIS department 27. Following this, we hypothesize:

H3: Management support of BIS use positively impacts social influence.

Research suggests that user training influences user attitudes, behavior, and performance and that the impact of training on behavioral intention is mediated by behavioral belief mechanisms 46, 6. Training allows users to interact with the BIS, provides mechanisms to disseminate useful and pertinent information about it and how it fits with the existing and proposed organizational work system 6. "Effective training can prevent the lack of skills from impeding potential effectiveness gains from decision technologies", state Yi and Davis 46. Training outcomes can be measured by three dimensions of learning: cognitive (knowing), skill-based (acting), and affective (feeling), serving as important precursors to behavior 29. Learning through training induces knowing, skills, and perceptions of ease of use and usefulness (affect), leading to behaviors on the job and desired organizational results 46. We thus posit that user training will positively influence recognition of the results of using BIS and finding it easy to communicate the outcomes of its use to others:

H4: Organizational user training positively impacts result demonstrability.

Any IS implementation can cause organizational change that people tend to resist, increasing with the scope and magnitude of the changes 32. BIS in particular have profound effects on organizations as changes occurring upon their implementation include shifts in data ownership, use and access patterns; changes in how jobs are performed; and modifications in business processes execution, leading to strong potential resistance to change from managers,

data suppliers and end users 43. The changes that come with BIS particularly impact the organizational information culture 32. Information culture encompasses all those elements of organizational culture that influence the management and use of information throughout the organization 10. Organizational implementation success factors represent the encouragement needed to effectively address the issues that arise from change in order for BIS to be successfully integrated into the organizational work process. These include change management practices that effectively deal with political resistance when it arises, and encouraging people throughout the organization to embrace BIS 43. When integrating these arguments, organizational implementation success factors including effective change management should have a positive influence on addressing potential issues that emerge with changes in the organizational information culture and induce a more open information culture:

H5: Organizational implementation success factors positively impact information culture.

Organizational customer orientation, most commonly measured in marketing research, is defined as a “set of beliefs that customer needs and satisfaction are the priority of an organization” 31, while not excluding the needs of “all other stakeholders such as owners, managers, and employees, in order to develop a long-term profitable enterprise” 13. A customer orientation should have a favorable impact on the business performance and enhance customer satisfaction as well as organizational productivity 13, 28. Market- and customer-focused firms use IT to create or enhance a value proposition for their customers 28. As BIS enable greater information sharing, increase knowledge reach and richness, and improve the profundity of analyzing information and knowledge about customers 5, they represent a prerequisite for many organizations to successfully compete in the marketplace 43. Research shows that an organizational customer orientation has an impact on the embeddedness of BIS into the routines of workers and the organizational environment 20. We therefore expect that, if the organizational business objective and strategy are focused on customers, the analysis and management of customer information should be a high priority which should induce behavioral and normative beliefs leading to stronger motivations to use BIS. Indicators of customer orientation also measure the free communication of information about the customer experience across all business functions and proactive acting based on this information 31. An organizational customer orientation should therefore induce an open information culture in terms of information transparency, sharing, and proactiveness 32, leading to our next hypothesis:

H6: Customer orientation positively impacts information culture.

We have hypothesized that many organizational aspects supporting BIS implementation and use (such as management support of BIS use, effective change management and customer orientation) drive improvements in the organizational information culture. According to Marchand et al. 32, six information behaviors and values characterize the information culture of an organization: information integrity, formality, control, sharing, transparency, and proactiveness. An open information culture concerning BIS use includes behaviors and values in the organization regarding information transparency, information sharing, and information proactiveness 32. *Information transparency* captures openness in the reporting and presentation of information on errors and failures, allowing members to learn from mistakes. *Information sharing* is the willingness to exchange information with others in the organization in an appropriate and collaborative manner. *Information proactiveness* represents an active concern and thinking about how to obtain and apply new information in order to respond quickly to business changes and to promote innovation 32, 10. A highly developed information culture indicates to BIS users that the organization values the importance of information use, the exchange of information and action upon the information provided by BIS. In this kind of environment, users would therefore perceive that information use is an organizational norm or expected behavior, and they will also recognize the value of BIS use and find it easier to recognize and demonstrate the results of BIS use. We thus hypothesize:

H7: Information culture positively impacts result demonstrability.

H8: Information culture positively impacts social influence.

RESEARCH DESIGN AND METHODOLOGY

Our questionnaire was developed by building on the previous theoretical basis to assure content validity. To ensure face validity, the questionnaire was pre-tested using a focus group comprising practitioners and IS academics from the field who were not included in the subsequent research. Minor changes were made based on their suggestions, mostly involving the adaptation of the questionnaire items to the specific context of BIS use, i.e. integrating

voluntariness of use in the indicators and unifying the operationalization of all indicators to measure perceptions. We used a structured questionnaire with seven-point Likert scales for all items used in our study.

The measurement items were developed based on the extensive literature review and supported by expert opinions. All constructs in the proposed models are based on reflective, multi-item scales. We employed three items from Venkates and Bala 41 to measure computer self-efficacy. To measure management support of the BIS implementation, three items from Hartono et al. 22 were used. The management support of the BIS use scale was developed by using one item from Wixom and Watson 43 while we ourselves developed two more items (supported by expert opinions) deriving from the specifics of BIS. The organizational implementation success factors scale was drawn from Wixom and Watson 43 as was the scale. The user training construct was measured using three items provided by Amoako-Gyampah and Salam 6. The information culture scale was developed by taking one item from each of the components of information quality from Choo, Bergeron, Detlor and Heaton 10 who developed the scale based on Marchand et al. 32. The customer orientation construct was measured using six items with the highest factor loadings from the customer orientation construct of Liu et al. (2002). Result demonstrability was measured by four validated items taken from Venkatesh and Bala 41 based on Moore and Benbasat 33. Four items for measuring social influence were adapted from Venkatesh et al. 40. Detailed questionnaire with the indicators of the measurement model can be obtained from the authors upon request. Our proposed measurement model includes 36 manifest or observable variables loading onto 14 latent constructs: (1) *Computer self-efficacy*; (2) *Management support of the BIS implementation*; (3) *Management support of the BIS use*; (4) *User training*; (5) *Organizational implementation success factors*; (6) *Information culture*; (7) *Customer orientation*; (8) *Result demonstrability*; and (9) *Social influence*.

The data were collected through a survey of a whole population of 2,173 medium- and large-sized registered business organizations with more than 50 employees in an EU country, published by the national Agency for Public Legal Records and Related Services. The questionnaires were sent to the contact persons, with a request to distribute the questionnaires to relevant users of BIS that could meaningfully contribute to the research results. A total of 195 completed surveys were collected after a follow up survey. The final response rate was 9.3%.

RESULTS

A form of structural equation modelling (SEM), namely PLS path modelling using Smart PLS 36, was employed to carry out the data analysis. These techniques are widely selected in the IS field, since they are suitable for predictive applications and theory-building because they examine the significance of the relationships between research constructs and the predictive power of the dependent variable 9. The suitability of choosing PLS for data analysis was motivated mostly by the facts, that PLS models can be very complex and used in the case of relatively small sample sizes. The guideline for a sample size when using PLS modelling is that the sample should be equal to or larger than ten times the largest number of paths directed at a particular construct in the model 9. The minimum acceptable sample size for our model is thirty, derived because the largest number of structural paths directed at the construct result demonstrability or information culture is three. Thus the actual sample size is more than adequate.

We first examined the reliability and validity measures for our reflective measurement model, which can be seen in Table 1 along with the means and standard deviations of the manifest variables. In the initial model, not all the reliability and validity measures were satisfactory. The loadings of the items were tested against the value 0.7 23 on the construct being measured. The manifest variables CSE3, IC1, IC4, IC6, IC7, and RD4 had very weak, although statistically significant loadings (except IC6) on their respective latent constructs and were thus removed. Once the manifest variables that did not load satisfactorily had been removed, the model was rerun and all reliability and validity measures in the final model showed a substantial increase 9.

Table 1. Means and Std. dev. and Reliability and Validity Measures of the Measurement Model

Construct	Indicator	Mean	St. Dev.	Initial model		Final model		Estimates (initial model)		Estimates (final model)	
				Load.	t-values	Load.	t-values	Composite reliability	AVE	Composite reliability	AVE
Computer self-efficacy	CSE1	5.3560	1.4864	0.9131	25.6710	0.9466	57.2282	0.8298	0.6353	0.9325	0.8736
	CSE2	5.2760	1.5011	0.9185	41.7617	0.9226	39.8518				
	CSE3	5.4688	1.5916	0.4782	3.6349						

Management support of the BIS implementation	MGM-IMPL1	5.8000	1.0828	0.8670	26.8639	0.8686	29.9591	0.9133	0.7783	0.9134	0.7785
	MGM-IMPL2	5.4229	1.3058	0.8992	44.8903	0.8983	45.0664				
	MGM-IMPL3	5.3966	1.3929	0.8801	42.5825	0.8796	41.5041				
Management support of the BIS use	MGM-USE1	5.6171	1.3072	0.9168	55.8083	0.9167	51.9950	0.9250	0.8044	0.9250	0.8045
	MGM-USE2	5.1462	1.4579	0.8672	27.3846	0.8675	26.2123				
	MGM-USE3	5.5581	1.1956	0.9059	63.3837	0.9058	66.1922				
User training	UT1	4.9112	1.4753	0.8616	31.9576	0.8633	34.4251	0.9361	0.8302	0.9361	0.8302
	UT2	5.3434	1.3426	0.9280	56.7880	0.9272	51.7749				
	UT3	5.3212	1.3159	0.9419	84.0418	0.9411	80.9539				
Organizational implementation success factors	OISF1	4.6196	1.6148	0.8532	27.5013	0.8635	29.0741	0.9064	0.7635	0.9062	0.7631
	OISF2	4.9448	1.3665	0.8778	24.9050	0.8726	24.7597				
	OISF3	4.9217	1.3706	0.8900	45.6046	0.8844	42.3254				
Information culture	IC1	3.6089	1.9554	-0.4637	5.2255	0.7926	18.8334	0.6084	0.3228	0.8053	0.5812
	IC2	5.2404	1.2954	0.7327	14.7368						
	IC3	5.8085	0.9949	0.7760	20.4793						
	IC4	4.5249	1.6383	0.5857	7.9178						
	IC5	5.5753	1.0792	0.6249	9.5410						
	IC6	4.2324	1.5725	0.0454	0.3537						
	IC7	5.7243	1.2575	0.4124	3.6396						
Customer orientation	CO1	5.5082	1.5330	0.6511	9.3389	0.6449	8.9531	0.9045	0.6136	0.9033	0.6106
	CO2	5.4190	1.3648	0.8296	23.6779	0.8311	22.5517				
	CO3	5.0391	1.4663	0.8215	24.2965	0.8258	23.7604				
	CO4	5.4689	1.4773	0.8177	20.1398	0.8256	21.6891				
	CO5	4.7232	1.6778	0.7660	13.5588	0.7599	13.3541				
	CO6	4.7273	1.6541	0.7996	18.7772	0.7929	19.2631				
Result demonstrability	RD1	5.6457	1.0934	0.8823	40.8141	0.8870	42.2226	0.8748	0.6448	0.9124	0.7766
	RD2	5.6069	1.0764	0.9025	58.1046	0.9069	53.8701				
	RD3	5.7200	1.1226	0.8461	14.2493	0.8488	13.9606				
	RD4	4.9770	1.7369	0.5198	5.9546						
Social influence	SI1	5.0581	1.5842	0.6768	6.9168	0.6587	6.1757	0.8600	0.6092	0.8568	0.6041
	SI2	5.1226	1.5219	0.6866	6.7763	0.6683	6.0665				
	SI3	5.5756	1.2519	0.8954	36.6130	0.9043	41.3282				
	SI4	5.6949	1.2421	0.8401	15.4411	0.8486	16.3447				

All constructs' composite reliabilities reach the threshold of 0.8 and in many cases are even above 0.9 (which are the thresholds for more advanced stages of research), showing the high internal consistency of the indicators measuring each construct and thus confirming the construct reliability. The average variance extracted (AVE) was used as a criterion of convergent validity, and is generally around 0.6 or higher, hence exceeding the threshold of 0.5 [18]. The reliability and convergent validity of the final measurement model was also confirmed by computing standardized loadings for the indicators and Bootstrap t-statistics for their significance (see Table 1). All standardized loadings of the indicators in the final model exceeded (or were marginal to) the 0.7 threshold and without exception were found to be significant at the 0.001 significance level.

The discriminant validity is tested by two procedures [18, 9]. The assessment of the indicator loadings on their corresponding constructs is the first procedure for testing the discriminant validity. The results indicated that manifest variable correlations with their theoretically assigned latent variables are an order of magnitude larger than other loadings to other constructs. Therefore, all the item loadings met the criteria. For the second procedure, we compared the square root of the AVE for each construct with the correlations with all other constructs in the model. All of the square roots of the AVE are significantly higher (and also substantially larger than the threshold of 0.5) than the correlations between the constructs [18]. The results of both tests show sufficient discriminant validity, thus confirming that all the measurements are assigned to appropriate and theoretically different concepts.

For the purpose of estimating the inner path model, bootstrapping with 1,000 replicates was conducted. The structural model (see Figure 2) was then assessed by examining the coefficients of determination (R^2) of the endogenous latent variables, the estimates for the path coefficients of the relationships in the structural model and their significance levels via bootstrapping [9]. The influence of computer self-efficacy, user training, and information culture together explain about 38.4% of the variance in result demonstrability. Looking at the explained variability of the social influence, it can be seen that 36.6% of the variance is explained by the influence of management support of the BIS use and information culture. Further, the results show significant direct effects of management support for the BIS implementation, organizational implementation success factors and customer orientation on

information culture, accounting for 22.9% of the variance in information culture. The $\hat{\beta}$ estimates vary from 0.464 to 0.174.

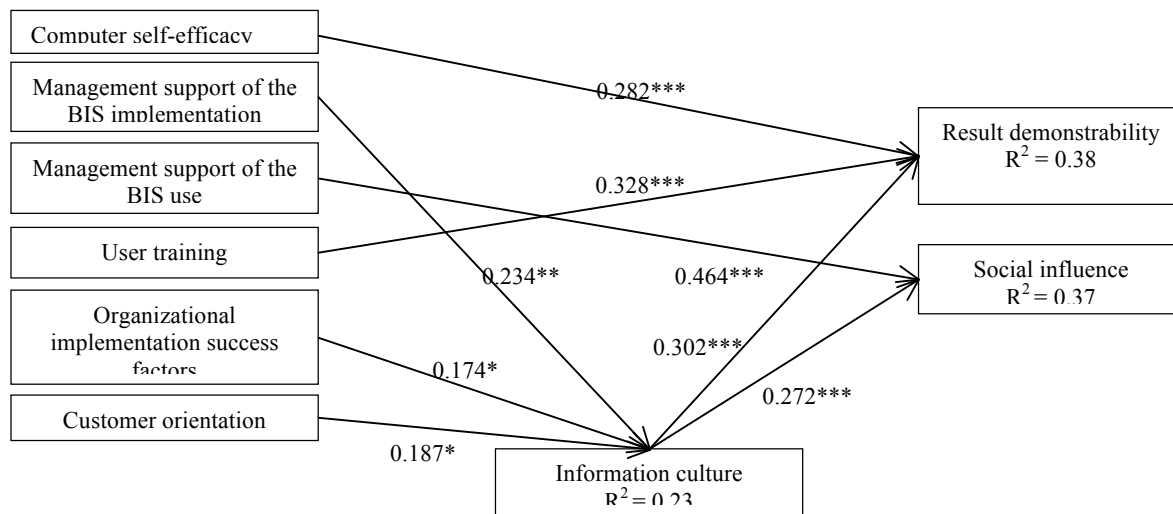


Figure 2. Research Model Results.

Note: (ns) non-significant; * significant at the 0.05 level (two-tailed test); ** significant at the 0.01 level (two-tailed test); *** significant at the 0.001 level (two-tailed test)

DISCUSSION WITH IMPLICATIONS FOR RESEARCH AND PRACTICE

This work's broadest and most important *contribution to research* is the development of a comprehensive model of the antecedent drivers of BIS acceptance determinants. The article integrates the findings of several IS research streams (i.e. organizational-level IS adoption, IS success, IS acceptance, and theories of human social behavior) into a nomological network of drivers that shape the individual's behavioral and normative beliefs leading to intentions to engage in BIS use. In doing so, it follows several recommendations and calls made in IS research, i.e. "the need to consider context-relevant variables when designing research to study technology adoption and use" 42; it investigates and identifies antecedents to the formation of beliefs behind intention, which acceptance models were criticized for lacking (calls in 40, 30, 25, 41); and it exposes the importance of organizational factors in shaping an individual's intentions to use BIS, following the suggestion of Benbasat and Zmud 8 that researchers should focus on the "managerial, methodological, and operational practices for directing and facilitating IT artefact usage".

The main message conveyed by our study's results is that, besides the self-efficacy belief, believing that one can produce desired effects by using BIS 7, impacting on the demonstrability of the results of using BIS; organizational factors, either directly (user training and management support of BIS use) or indirectly through the building of an open information culture impact an individual's cognitive process and internal motivation to use BIS.

Individual or personal characteristic of computer self-efficacy shows how individual differences impact the formation of behavioral belief - the result demonstrability of using BIS. The importance of self-efficacy beliefs is already widely recognized in the literature (e.g. 7, 38, 4). For intentions to use BIS self-efficacy, affecting whether one makes good or poor use of the skills one possesses – "the strength of commitment to them and the outcomes they expect for their efforts" 7 is also important.

The results of our study show that organizational factors are major significant predictors of behavioral and normative beliefs that influence the decision to engage in the use of BIS. Apart from the impact of the individual's self-efficacy, they explain all of the other captured variance in these two beliefs leading to intention. These findings represent an important contribution to theory, demonstrating that organizational variables should be incorporated in models investigating employees' acceptance and use of IT in the organizations in general as important antecedents driving beliefs that lead to intention.

Important direct predictors of beliefs leading to intention are user training and management support of BIS use. Management support of BIS use is an important predictor of an individual's normative beliefs. This impact refers to the "internalization" mechanism 39 that is particularly enhanced under volitional control. If management supports, encourages and leads by example in the use of BIS individuals incorporate these norms into their own belief structure 39. Management support of BIS use represents a salient influence on the normative belief structure, entailing the component of social influence where individuals consider their peers' approval of a behavior. Positive perceptions of the approval and encouragement of BIS use will strengthen motivations to engage in the use of BIS. We have theorized and conceptualized two distinct management support mechanisms, and demonstrated that they have different impacts. Venkatesh and Bala 41 called for richer conceptualizations of management support in order to enhance the understanding of its role in the IT acceptance context. The findings show that management support of BIS implementation does not have a direct impact on creating an individual's intentions, but it induces the building of a higher-level information culture, with a subsequent direct impact on intentions. On the other hand, management support of BIS use demonstrates organizational normative practices that are important for employees' morale, and in turn directly and positively shapes individuals' normative beliefs leading to favorable intentions to use BIS.

User training directly impacts individual behavioral beliefs. Research has already provided proof of the impact of training on behavioral intention mediated by behavioral belief mechanisms 46. Successful training affects the ability to communicate the results of using BIS. The training program should focus on understanding the content, i.e. the information provided by BIS 19. This highlights the different specific context of BIS use as compared to operation IS, namely that BIS are predominantly used in unstructured business processes, reinforced by the fact that the instructions for using BIS are less developed and systemized. Yi and Davis 46 point out that learning through training, particularly for decision technologies, is "more effective when the training environment promotes more meaningful symbolic transformation of the action patterns and deeper processing of information". Effective training improves understanding level and gives confidence to individuals and thereby increases motivations to use BIS.

A particularly important finding is that the organization's information culture directly drives an individual's internal motivation to use BIS. It impacts on the behavioral belief of result demonstrability and on the normative belief of social influence. Therefore, an organization's values, norms, and practices regarding the information reflected in the organizational information culture 10 impact an individual's considerations that then form their intention to use BIS. The pure nature of BIS use exposes the importance of using the information that comes from BIS, the importance of the relevance of this information 15 and the sharing of information where information collected in BIS is aggregated at the organizational level 34. The results of the factor analysis showed that the information behaviors and values that are important in the BIS context are information transparency, sharing, and proactiveness. In order for BIS to be favorably and desirably embraced and accepted by users, organizations should establish and maintain an open information culture, treating information as an organizational resource shared openly and freely, while supporting proactive use of it 32.

Many organizational factors can help build higher levels of an open information culture. The results show that management support of BIS implementation, organizational implementation success factors, and customer orientation are significant drivers of information culture. We can see that *management support of BIS implementation* has an impact by building higher levels of information culture during the BIS implementation activities. Further, *organizational implementation success factors*, comprising effective dealing with the potential resistance and change that come with BIS implementation due to changes in data ownership, how jobs are performed and business process executions 43 also drive higher levels of information culture. Another important significant predictor of information culture is *customer orientation*. Previous studies showed that a customer orientation directly impacts the embeddedness of BIS in the organizational work system 20. This is because customer orientation as an important external or environmental factor drives individuals in market-oriented and more competitive environments to integrate BIS use into their routines as a mandatory step. We tested the possibility of whether a customer orientation also drives an individual's internal motivations. The results show that a customer orientation does not have a direct impact on beliefs leading to intention but has an impact via improvements in information culture. An organizational customer orientation includes collecting customer information, monitoring organizational commitment to customers, open communication of customer experience information, and proactively acting based on customer satisfaction information all incorporated in the business strategy 31. All of these actions improve information transparency, sharing, and proactiveness, making up an information culture that drives an individual's internal motivations to use BIS.

This research *contributes to practice* in important ways. It highlights several factors that play a role in influencing and inducing beliefs leading to intention or internal motivations to use BIS. Since the main drivers of such beliefs to use BIS are organizational, this gives actionable guidance to organizations since these are factors organizations can influence. These motivational drivers could be called *trans-implementation* issues, including pre- and post-implementation aspects, that should be constantly nurtured and continuously evolving 19. These should move in the direction of building up a “BI culture”, that is creating a culture that values business intelligence. The results of the model point to some enablers or propose a mechanism through which this can be achieved and fostered.

First, management should support BIS use by encouragement, leading by example, and supporting fact-based decision-making based on the information provided by BIS. This conveys the organization’s normative values and practices, thus motivating users to engage in such behavior. The next important organizational factor is building up an open information culture, featuring information sharing, transparency, and proactiveness, which gives a message to users to embrace the right behavior and values for working with information 32. This can be induced by management support of the BIS implementation, showing the importance of BIS not being an IT-driven initiative but more a business-driven one 45. Through management support of the BIS initiative, the information culture starts to develop by raising awareness of working with information. Effective change management goes along with this by dealing with the political resistance and organizational change that come with BIS implementation, such as changes in data ownership, the shift to sharing and the transparency of information and changes in business processes that stimulate a more open information culture. Incorporating in the business strategy an organizational customer orientation, including open communication and the collection of customer information and action on customer satisfaction information, again reflects and builds information sharing, transparency, and proactiveness by building higher levels of information culture, driving users to engage in the use of BIS. If organizations are customer-oriented they realize the potential of good data and information impacting on a higher-level information culture, increasing an individual’s awareness of the meaning of working with data and information. Organizations should also provide adequate user training, focusing on training for understanding the content or information provided by BIS. Venkates and Bala 41 already suggested that the role of training can be even more important in the context of decision-support systems that are more disruptive in nature and more likely to invoke resistance. Through content training, users improve their level of understanding and are more likely to develop favorable perceptions about BIS. They build their confidence along with their skills, improving their self-efficacy 11 and motivating them to engage in the use of BIS, particularly in a more explorative and innovative manner.

Understanding what shapes beliefs leading to an intention to perform a behavior is particularly important in volitional situations where intentions are core predictors of actual behavior 4. A conducive organizational environment conveying the support and promotion of the use of business intelligence through an open information culture can shape the thinking of individuals and motivate them to use BIS. This is especially important for effective BIS use, exposing the specific nature of BIS use involving unstructured, i.e. research-oriented and innovative, use. The development of positive internal motivation to use BIS is not essential for simply using the basic functionalities of the system that might actually be mandatory or necessary for carrying out business processes, but for the deep structural use of BIS which in particular depends on an individual’s efficacy and motivation to do so, in turn based on volitional control. This deep usage involves advanced analytics with the creation of competitive and innovative knowledge, that “takes managerial decision making to new levels of understanding and foresight” 37 and represents the main added value of using BIS to lead to a better organizational performance.

This study has some *limitations* that should encourage *future research*. The first limitation concerns the generalizability of the findings to other settings and information technologies. Since the objective of this study was to find antecedents to beliefs leading to the intention to use BIS, some of the significant determinants might only be context-specific. However, we provided a broad framework of antecedents that should also be tested in other settings. Perhaps a different set of significant intention drivers will emerge. Second, this study tested the impact of the antecedents on behavioral and normative beliefs that drive internal motivations to use BIS. Actual use might also depend on some other determinants that can also influence the performance of a behavior, based on external and situational motives and mandates. System attributable characteristics and other infrastructural facilitators might come to fore. We encourage future research to test this framework of antecedents as a direct impact on use, preferably on different types of uses.

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