Conceptualization of BIS Embeddedness Determinants

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ABSTRACT

Actual and effective use of Business Intelligence Systems (BIS) is considered as one of the main sources of competitive advantage for long-term survival of organizations and presents a link between the information provided by BIS and the business value of BIS. Acceptance of BIS should not be understood only as frequency and intensity of use, which was the focus of most previous research focused mostly on operational IS. Using BIS must become embedded in the business value generation process. In this study we develop a conceptual model of BIS embeddedness with a specific set of determinants identified using exploratory analysis based on semi-structured interviews among professionals in the field. Understanding acceptance and use of BIS presents a priority item for both researchers and practitioners in the field alike, as better understanding of these factors might improve the utilization and business value of BIS in organizations.

Keywords

Business intelligence systems, IT acceptance, specifics of BIS, BIS embeddedness, acceptance and use of BIS.

INTRODUCTION

In the information systems (IS) literature the positive impact of information provided by business intelligence systems (BIS) on decision-making has been emphasized, particularly when organizations operate in highly competitive environments (Popovič, Hackney, Coelho and Jaklič, 2012). Technological innovations such as BIS are one of the main sources of competitive advantage for long-term survival of organizations (Jourdan, Rainer and Marshal, 2008, p. 121), but in cases where these promising innovations cannot be completely accepted and adopted, their benefits cannot be fully realized. Despite the fact that initial acceptance and use are considered an important step towards IS success (DeLone and McLean, 1992), long-term sustainability of an IS and its eventual success depend upon its ability to embed with organization’s processes, routines, and strategy rather than merely being used (Shanks, Bekmamedova, Adam and Daly, 2012) since infrequent, inappropriate, disconnected, and ineffective long-term use of IS often leads to business failures (Lyytinen and Hirscheim, 1987). While the distinction between intensity of use and embeddedness of IS in business processes is much smaller for operational IS where the processes are more structured and explicitly implemented in IS, acceptance and use of BIS should not be understood only as frequency and intensity of use (Davis, Bagozzi and Warshaw, 1989), which was the focus of most previous research, but also if users are acting on the basis of information provided by BIS, where using BIS becomes an integral part of the business value generation process. Therefore it is important, if BIS are deeply embedded within the business to create “BI-driven decision-making routines and BI-enabled organizational processes that takes managerial decision making to new levels of understanding and foresight” (Shanks et al., 2012).

BIS are different from operational IS from the use point view in several respects. The use of BIS is primarily voluntary and the benefits of BIS are more indirect and long-termed as compared to operational IS. Structuredness of information needs and processes within which IS is used, and structuredness of instructions for using the BIS is much lower, since the use is usually more research and innovative. Thus, understanding adoption, acceptance and use of BIS presents a priority item for both researchers and practitioners alike, since better understanding of these factors might improve the utilization and business value of BIS in organizations.

Many different models and theories that incorporate a variety of behavioral, social and other control factors were developed to explain IT usage (i.e. Davis, 1989; Venkatesh, Morris, Davis and Davis, 2003; Venkatesh and Bala, 2008). Main goal of such models is to “develop diagnostic tools to predict IS acceptance and facilitate design changes before users have experience with a system” (Taylor and Todd, 1995, p. 561). However, previous research has mainly focused on the narrower aspect of acceptance and not on how IS is used. Since BIS have some previously mentioned specific features compared to other operational systems, this also makes it necessary to research the BIS acceptance and embeddedness separately.

This study applies a structured case methodology through a combination of literature review and primary data collection (interviews) in an attempt to identify the determinants of BIS embeddedness. Determinants of embeddedness have not been
researched much before, therefore from literature we use mostly acceptance theories, but through qualitative data collection the focus is also on additional determinants which are important from the point of view of routinization, embeddedness and continuous use.

The rest of the paper is structures as follows. In the next section determinants and models of user acceptance of IT are summarized. The third section provides a description of the methodology used and findings from the semi-structured interviews are elaborated. This is followed by a discussion and conclusion.

DETERMINANTS OF USER ACCEPTANCE

Several competing models of acceptance have been previously developed; each with different range of acceptance determinants (Venkatesh et al., 2003, p. 425), although with some overlapping among them. One of the streams of research are theories that investigate the psychological impact on technology acceptance by intention to use and systems use as the dependent variable or innovation aspects and processes; on the other hand, other streams focus more on the success of planning and implementation of new technologies and on technology fit to the tasks of users and also on organizational and other determinants (Dillon and Morris, 1996, p. 3). Determinants and models identified so far already provide a high degree of reliability in predicting IT acceptance of which TAM model (Davis, 1989) is the most influential and most commonly used in this field. TAM model proposes that two distinctive behavioral beliefs, perceived ease of use and perceived usefulness provide the individual’s behavioral intention to use a technology, and the actual use is determined by behavioral intention (Venkatesh and Davis, 2000, p. 187). Several other models have been proposed and validated, among which the most influential are Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), TAM 2 (Venkatesh and Davis, 2000) TAM 3 (Venkatesh and Bala, 2008), and Social Cognitive Theory (Bandura, 1986) which Compeau and Higgins (1995) have used and adapted it to the field of acceptance and use of IT. Another type of research of psychological effects has studied the acceptance and use from the diffusion of innovation and is named the Innovation Diffusion Theory (Rogers, 1983).

Many researches therefore exist that have described and synthesized the determinants of user acceptance of IS, but there is still no coherent overview of all the determinants that have been used to explain IS acceptance. Therefore we have conducted an extensive literature review (Grublješić, 2013) where we have identified nearly fifty additional determinants that influence IT acceptance and have been included in researches either as additional external factors affecting the basic TAM construct and by that better predict the technology acceptance, or as antecedent factors that better explain the two main belief constructs, perceived usefulness and perceived ease of use. The determinants that have been used in studies to explain IT acceptance constitute of determinants relating to (1) individual, (2) technological, (3) organizational, (4) social, and (5) macro environmental characteristics, from which those that apply for BIS embeddedness are summarized in Table 1 where selected referred studies that used the variable in their research are also given.

QUALITATIVE DATA COLLECTION

Data for this stage of the research was collected via face-to-face semi-structured interviews with BIS practitioners who were sufficiently familiar with the field to permit in-depth exploration of the research question and to develop an understanding of the relevant issues as seen from the independent perspective (Blumberg, Cooper and Schindler, 2008). Purposeful, criterion-based sampling was used to identify decision makers representing both IT and line-of-business functions at two different organizations of various sizes and operating in different industries (Paris, 2004). According to Strauss and Corbin (1998) new informants should be identified until theoretical saturation is achieved. But because we insisted on the richness of practitioners’ experience and were pressed by our research schedule the number of informants is low. We considered the richness of practitioners’ BIS experience such as active participation in BIS implementation and by that having knowledge of different types of following problems and issues with BIS implementation, adoption, acceptance and embeddedness in different organizations and sectors. We interviewed three different experts in one organization, namely a CIO and sponsor of the BIS project, a BIS project leader and a key user to gain different perspectives within one organization and in addition to that we interviewed also a head of the IT department in another organization to gain additional insights in the researched issue. Interviews were conducted in June and the beginning of July in 2012. Interviews lasted on average from 50 minutes to one hour. They were recorded and transcribed by the researchers to yield a total of approximately 48 single-spaced pages of text. The data were analysed by content analysis technique, a constant comparison technique, to identify major themes (Miles and Huberman, 1994). Results are interpreted and elaborated in accordance with Saunders, Lewis and Thornhill (2006, p. 535) who suggest that result section “may also contain verbatim quotes from interviewees”, which is “a particularly powerful way in which you can convey the richness of your data”.

The first question the interviewees were asked was how their BIS solution was generally accepted by users after the implementation and about the extent of use of information that BIS provide. All the interviewees answered that BIS was not accepted as planned and did not achieve the expectations of acceptance. One of the informants said BIS is used by the principal “the less you know the less you are responsible for”. The only light exception in one of the organizations is the general director who uses BIS heavily and by that does not promote the use of the system by the rest of the organization, since he gets all the necessary information from the system. He himself says that “now I have all the necessary information, available 24 hours, and I no longer need to accelerate the planning and analytical services, since all data is in BIS and there is no longer a need for validation of the data”.

All of the interviewed organizations exposed the importance of facilitating conditions. In one of the organizations, BIS project leader, who helped a great deal for a wider BIS use throughout the organization, left the organization after one year and a half after the introduction of BIS, which led to a decrease in BIS use and more broader in a “decrease of BI culture”. In another organization the facilitating conditions were not as adequate. After two years of the project the offer was lower than the expectations and also the reliability was lower. As the informant from this organization said “the relevancy and quality of data are two key determinants for the acceptance and also the key is to observe what users actually need, since BIS can provide some functionality which users then never need or use”. The first user satisfaction was evident only almost after two years of the project when the environment somehow stabilized, and the quality of data increased.

All organizations had user trainings for BIS use, but that did not per se encourage the use of the system. In one of the organizations they have observed a higher use and embeddedness of the system right after the trainings when as the informant said “BIS use was in its high peak”, and later on the system used only those who have seen the benefits of using this system as they realized that “the customer is the one, why they have to be informed”. In one of the organizations they have almost weekly workshops, so the key users get familiar with the BIS and understand the functionality and logic of the tool, and to get familiar with the content. As one of the interviewees stated that very important is “that users understand the semantics, how it came to that what users see or get from the system”.

Demand for data is very much connected with the management philosophy. If superiors expect to be kept informed about the effectiveness and efficiency, the embeddedness of BIS will be higher. As one if the informants said “on one hand you need a certain level of management maturity for BIS to be used, and on the other hand you offer a system, which somehow increases this level of maturity, so it has a two sided impact”. In the other organization they say that “some of the management uses the system on a daily basis but this is largely a reflection of individual personal characteristics”. Also important is the information culture, how fact based decision making is important for the organization and management. In one of the organizations they do not have such information culture; management still receives the information they need directly from the accounting department and does not seek information from BIS, which is also the reason why BIS was not accepted and embedded as much there. In the other organization they have a very open information culture, as they have invested significantly to raise it with the introduction of BIS and other information systems, and they have done this successfully. In one of the organizations the informants said that “80% of the users do not use the system in its full capacity, and only 20% of the users conduct activities that are resulting from the use of the system”. All others do not act on the outcomes they receive from the system, as one of the informants said, users mostly work in terms “I do my work faster and easier, but do not take action”.

In the other organization they had big problems with perceived usefulness as informant said “the quality of the data and instability of the system were big issues”. Perceived ease of use of BIS is quite high in all of the organizations. Most of the users only know how to use the basic features of the system, but many of them do not know how to use the system more in depth. In one of the organizations the informant said that “every change is hard for the user but most of them accepted BIS as correct and easy to use as they got familiar with it”. In the other organization it was said that “the system is complex to use in terms of content rather than the technology perspective, so that users must be able to correctly interpret what they would like to get as output from the system”. The users therefore had to get familiar with the content terminology, otherwise technologically BIS is easy to use. Other informant also exposed “readiness (openness) for changes and new ways of working”. Of technological characteristics one of the informants exposed “the ease of use of the system and that it is important to think to which tool users are already accustomed to”, since if BIS was very much different from the other systems it would be harder to accept. The third informant highlighted the importance of “content or relevancy of data”, since it is important that business users determine the content not the IT department.

From organizational factors one of the informants exposed that “in those environments where responsibilities are more clarified; regardless of the type of organizational structure it is easier to implement the BIS”. Other informant said that such a system “requires a different organizational structure and the reorganization of the existing one”. Another informant said that the factor that hinders embeddedness of BIS is that “our management is not directed towards leadership; they are
unwilling to delegate responsibility and increase powers to subordinates”, as BI is related to the transfer of responsibility. Managers also have to accept that “the customer is important”, and then the embeddedness of BIS would be higher. Also it would be necessary to “have one BI manager, the one who would be responsible for the content and not only during the project but especially in the later stages of use”. The fourth informant exposed that there is a problem with organizational culture, “as responsibilities are not settled adequately and there is always a problem with limited costs which are available for the implementation of such a project”.

Competitiveness of the environment was identified as the most important factors of the macro-environmental characteristics. One informant stated that for them that are market oriented, “BIS acceptance, use and embeddedness are necessary, as large vendors can be good only if they have good timely information in order to act on them”. In this organization the users were not the ones who said “another one of the new applications, which we must learn”, but have claimed this system. This is because they are more responsible for the success, as they are rewarded for performance and results.

Interviewees were further given a list of all determinants of user acceptance of IT that have been identified in the literature (Grublješić, 2013) and were asked to choose which of them are important for BIS embeddedness and use. The BIS embeddedness determinants model (see Table 1) includes perceptions of information system success that have been investigated within two primary research streams – the user satisfaction literature and the technology acceptance literature as proposed in Wixom and Todd (2005). Thus the model distinguishes beliefs and attitudes about the system (object-based beliefs and attitudes) from beliefs and attitudes about using the system (behavioral beliefs and attitudes). The user satisfaction literature explicitly enumerates system and information design attributes and also evaluation of individual characteristics and environmental factors; however user satisfaction is a weak predictor of behavior and consequently of system usage (Davis et al., 1989, Wixom and Todd, 2005). By contrast, the technology acceptance literature provides sound predictions of usage, “by linking behaviors to attitudes and beliefs that are consistent in time, target and context with the behavior of interest” (Wixom and Todd, 2005, p. 85). The behavioral beliefs and attitude side of the model accordingly includes performance perceptions, result demonstrability, effort perceptions, social influence and facilitating conditions consistent with TAM, UTAUT and TAM3. The model proposes that BIS embeddedness (the target behavior) is driven by behavioral intention and also directly by facilitating conditions.
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<th>Determinant</th>
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<td>Trialability</td>
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<td>User interface</td>
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<td>Focus on customer</td>
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<td>Management support</td>
<td>Wixom and Watson, 2001</td>
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<td>User participation in implementation</td>
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<td>Iterative development approach</td>
<td>Yeoh and Koronios, 2010</td>
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<td>Organizational culture</td>
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<td>Business sector</td>
<td>King and Teo, 1996</td>
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<td>Competitiveness of the environment</td>
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<td>Relative advantage</td>
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<td>Job relevance</td>
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<td>Perceived usefulness</td>
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<td>Voluntariness</td>
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**Notes:** + - important, ++ - very important, o - not important

Table 1. Interviewees answers about determinants influencing on BIS acceptance
DISCUSSION
Findings show that of individual characteristics age, computer literacy, education, attitude, computer self-efficacy, personal innovativeness, computer anxiety, prior experience and readiness for change have an important influence, which supports the existing literature, with prior experience and personal innovativeness serving particularly important roles. Specifically, personal innovativeness is particularly exposed as it allows information to be used properly in the less structured business processes, where BIS is commonly used and provides long-term embeddedness in managerial (less structured) business processes where new requirements for using information are constantly emerging.

Consistent with DeLone and McLean (1992) IS success model information quality and system quality were found particularly important of BIS quality characteristics, of which complexity, accessibility, trialability and user interface serve as antecedent beliefs to system quality, with complexity and accessibility having the strongest effect. Of information quality relevance of information is particularly pertinent as the most pressing issue in unstructured business processes is providing quality information for management. Complexity of the system is the next important issue as there is always a problem with ensuring the right balance between, on the one hand, the need for complex analysis of information, which is the essence of BI and increasingly complex technologies which make this possible and, on the other hand, the ability of users to use this advanced technology. Developers of BI systems need to ensure that BIS meets these requirements but should not be too complex, because users will then not accept it. Also compatibility from innovation diffusion theory (Moore and Benbasat, 1991; Rogers, 1983) and task-technology fit which Goodhue and Thompson (1995) expose were found important of BIS quality characteristics for BIS embeddedness.

Interviewees exposed organizational factors as having a critical impact in the BIS context which supports the findings of critical success factors for BIS that Yeoh and Koronios (2010) researched. Unlike with operational systems, where use is mostly mandatory, for BIS acceptance organizational factors are more important as it is important how BIS is used, that it is embedded into the routines of decision-makers. In previous studies of IT acceptance organizational factors were not specifically highlighted, but were detected in individual studies such as Wixom and Watson (2001). Management support, user participation in implementation, user training and information culture were found to have the strongest impact. User training was already confirmed in the literature to have an impact, but for BIS acceptance the training for understanding the content is exposed, since the process of use is generally not embedded into the application as for operational IS and there is a greater gap between the use of the system and use of the information provided by the system. Management support, information culture and change management are all heavily related to changes in management practice and to changes in operational processes and thus to effective use of information provided by BIS. Another pressing factor which interviewees exposed and was not found in the literature is focus on customer. Organizations which focus on customer satisfaction use BIS more and this is found more important for organizations that are market oriented.

Findings show that the behavioral based beliefs and attitudes side of the model fits with technology acceptance literature especially with TAM and UTAUT. Performance perceptions were exposed as important of which relative advantage, job relevance and perceived usefulness have the greatest role. Job relevance was particularly highlighted which means that, on the one hand, as already described for the complexity of the system, users need to be provided with appropriate analytical tools and with relevant information. As in TAM3 model (Venkatesh and Bala, 2008) result demonstrability also has an effect on BIS embeddedness. Facilitating conditions which directly influence usage behavior were exposed as very pressing which is found important already in previous literature especially in UTAUT model (Venkatesh et al., 2003). If we look at operational systems, support is necessary mostly at the beginning and in the early stage of use until the system stabilizes, but for BIS use the long-term constant support for system use is important, otherwise use declines as experts also pointed out.

CONCLUSION
Although this study clearly confirms some of the determinants of IT acceptance as were identified in previous studies, it also identifies and points out some determinants that are specific or more important for a long-term, sustainable, and efficient use of BIS embedded in business processes. A key implication of this study for practice is thus that managers now have a way to assess individual characteristics, system and information characteristics and organizational factors and then reliably investigate their impacts on ultimate usage through the proposed causal chain. As Wixom and Todd expose (2005, p. 99) “this can help with management activities such as task prioritization and resource allocation”. Second the model can help designers understand which characteristics in the context of BIS have the most relative importance (e.g. complexity, accessibility and output quality) for BIS to be used. Third, we believe that the proposed determinants have diagnostic value at any stage of system’s implementation or usage process. All these implications can help for BIS to be used extensively and effectively in its full capacity and for it to be embedded into the routines of decision makers.
This study also yields implications for research as it follows the encouragement of Wixom and Todd (2005, p. 100) that researchers should “investigate the effects of the IT artifact itself as an antecedent to ease of use, usefulness and related factors”. Also Benbasat and Barki (2007, p. 215) call for this saying that “we need to identify the antecedents of the beliefs contained in the adoption models … focusing on the mediators of the impact of IT design on adoption is beneficial to the extent that this identifies which ones are important”.

The limitation of this study is that it examined a cross-section of interviewees’ perceptions about determinants influencing BIS embeddedness. Results further might be biased because of a limited number of interviewees as it would be useful to include a larger number of interviewees for results to be more representative to the whole population of BIS users.

REFERENCES


