International Journal of Information Management xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

International Journal of Information Management

journal homepage: www.elsevier.com/locate/ijinfomgt

A case analysis of embryonic data mining success

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Data mining
Predictive analytics
Critical success factors
Case analysis

ABSTRACT

Within highly competitive business environments, data mining (DM) is viewed as a significant technology to enhance decision-making processes by transforming data into valuable and actionable information to gain competitive advantage. There appears, however, to be a dearth of empirical case studies which consider in detail the initial stages in DM management to enable apt foundation for its later successful implementation. Our research applied a multi-method strategy to determine the critical success factors of embryonic DM implementation. We propose and validate, through a series of cases, a conceptual framework to guide practitioners' adoption of DM. Our findings reveal additional issues for applied decision making in the context of DM success.

1. Introduction

The successful implementation of information technology (IT) innovations remains a theoretical as well as a managerial challenge. Many IT innovations, introduced by organizations, are either rejected or under-used by end users (Sharma & Yetton, 2003). While IT implementation projects have a high-risk profile (Kutsch, Denyer, Hall, & Lee-Kelley, 2013), project management has been regularly reported as a key issue amidst organizations operating in competitive and uncertain environments (Keil, Lee, & Deng, 2013).

To alleviate the persistent business pressures, an effective way for organizations is to use data mining (DM) technologies for analyzing business data. DM is considered a business intelligence (BI) technology (Wang & Wang, 2008) demanding a different implementation approach from conventional application-based IT projects. A BI implementation is a rather "complex undertaking requiring appropriate infrastructure and resources" (Yeoh & Koronios, 2010). Some researchers observe DM as an extension of a data warehouse, others view it as an independent, stand-alone initiative (Davenport, Harris, & Morison, 2010; Kohavi, Mason, Parekh, & Zheng, 2004). While there has been substantial evidence, both from academia and practice, about the increasing interest for DM technologies (Bhattacharyya, Jha, Tharakunnel, & Westland, 2011; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011), extant studies draw attention to the lag between the demand for DM technologies and their actual implementation, and further call for a comprehensive approach to bridge this gap (Cao, 2010).

From an IT implementation perspective organizations aiming at DM implementation either engage in "full-steam-ahead" or "prove-it" approach (Davenport & Harris, 2007). While the former approach counts on up-front top management support, the latter is considered an embryonic implementation initiative facing high risk. An embryonic DM initiative implementation process, consists of identifying a business problem within organization with significant potential to benefit from DM implementation, developing a localized project to show its successful application, and publicizing the benefits among key decision makers until enough success has been achieved to secure top management support (Davenport & Harris, 2007). If such early-stage DM implementation fails, broader DM integration may be delayed, or even abandoned, consequently leading to loss of opportunities and competitiveness.

Whereas large-scale DM implementation projects have been previously extensively researched (Sinha & Zhao, 2008), embryonic DM implementation projects are still sparsely addressed in the literature despite their documented importance and relevance (Wang & Wang, 2008). Moreover, early reported methodologies and guidelines have been criticized for focusing on the technical concerns while overlooking organizational issues (Cao, 2010). Although the purpose of a DM process is to discover new knowledge within the

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http://dx.doi.org/10.1016/j.ijinfomgt.2014.12.001
0268-4012/

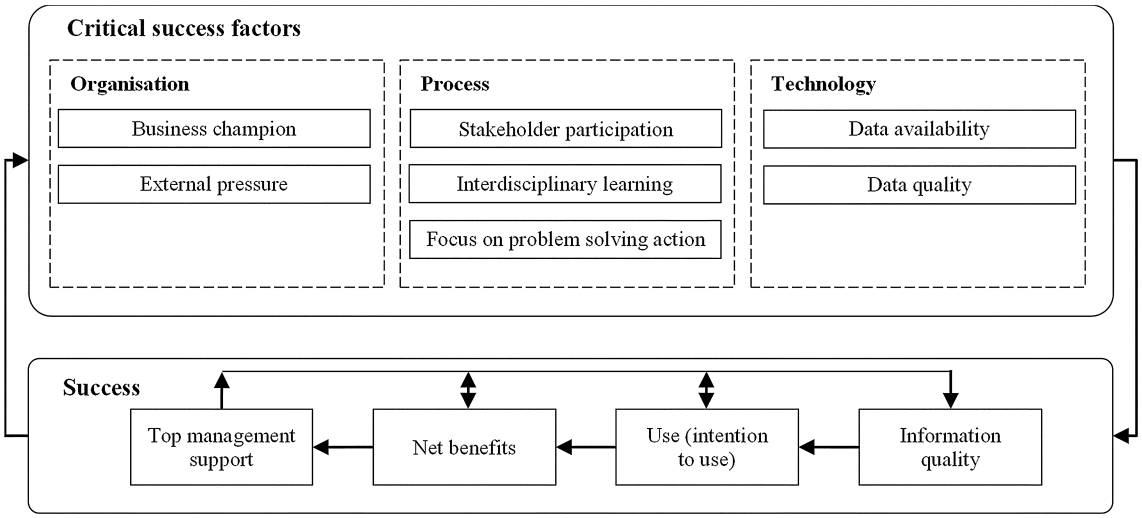

Fig. 1. Conceptual framework.

data, an a priori justification of a sound business case, consisting of expected strategic benefits, resource utilization, potential risks, estimated costs, and schedule, is not feasible with DM initiatives (Viaene & Van Den Bunder, 2011). As a well-established business case is a prerequisite for obtaining top management support in BI system implementation projects (Yeoh & Koronios, 2010), it is more likely to achieve top management support for DM implementation projects through the embryonic DM implementation approach. Sturdy top management commitment to broad DM implementation at the outset is still rare (Davenport et al., 2010).

To advance the current body of knowledge we explore managerial concerns affecting the process of winning top management support. Leveraging a structured-case framework (Carroll & Swatman, 2000), a multi-method strategy to investigate critical success factors (CSFs) (Remus & Wiener, 2010), and blending IT/IS adoption and success literature facilitated the development of a conceptual framework for gauging the issues affecting top management support in early-stage DM implementation projects.

2. Embryonic DM success

When constructing a research model, researchers are called to treat IS success as a multi-faceted construct, choose several relevant success measures based on the research objectives and the phenomena under investigation, and consider possible relationships among the success dimensions. To guide the identification of appropriate success measures for DM success we used DeLone and McLean's (2003) IS success model. It proposes six dimensions of IS success, namely system quality, service quality, information quality, use/intention to use, user satisfaction, and net benefits. For new BI system implementations system quality, information quality, system use, and perceived net benefits have been previously recognized as the most appropriate success measures (Yeoh & Koronios, 2010).

Information quality refers to the understandability, usefulness, and relevance of DM as judged by business users, *information use* denotes the attitude of the stakeholders towards the use (current or future) of DM results, whereas user satisfaction corresponds to "recipient response to the use of the output of an IS" (Delone & McLean, 2003). As DM results use may be deferred in time (Kohavi et al., 2004), we observe *user satisfaction* as intention to use DM in the future. While *net benefits* reflect DM impacts on decision-making performance, job effectiveness, organization, and inter-organizational relations (Delone & McLean, 2003), literature identifies return on investment (Kohavi et al., 2004; Lavrač et al., 2004) and increased efficiency (Davenport et al., 2010; Nemati & Barko, 2003) as objective measure of net benefits. Although it is difficult to assign an economic value to DM-enabled improvements (Kohavi et al., 2004), we included these measures as an issue to be explored in the latter phases. Last, but not least, we included *top management support*, defined as the extent to which top management commitment to the use of DM is obtained through embryonic DM initiatives, as an explicit success measure in our model. This is unique in relation to most IS and BI implementation studies where, conversely, executive support is considered a success factor. The inclusion is warranted by the identification of top management support as a success element of many BI-related (e.g. Wixom & Watson, 2001; Yeoh & Koronios, 2010) and enterprise-wide IS success studies (e.g. Bose & Luo, 2011; Davenport et al., 2010).

In the following subsections we introduce CSF candidates and the rationale for their inclusion within the Organization-Process-Technology framework (Wixom & Watson, 2001) that resulted in a parsimonious a priori conceptual framework CF_1 (Fig. 1).

2.1. Organization

A ***business champion*** within the organization understands the potential of DM, has a business problem that may be solved with the use of DM, is actively involved in the DM process, and promotes DM internally. The literature provides abundant evidence about top management support as CSF of IS initiatives (e.g. Bose & Luo, 2011; Dong, Xu, & Zhu, 2009). Within decision support environment the distinction is made between top management support and business champion, who is likely to have closer ties to the daily actions and goals of the project team (Yeoh & Koronios, 2010). With lack of top management support for embryonic DM initiatives, the primary focus shifts toward the business champion. Such supporter tends to be a mid-level manager whose goal is to build some initial DM successes locally in order to attract executive support for enterprise-wide DM projects (Davenport & Harris, 2007).

External pressures refer to outside factors (e.g. competitors, regulations) supporting embryonic DM implementation and the extent to which they are leveraged in its favour. Competitive pressures have previously been established as an important IT adoption driver (e.g. Bose & Luo, 2011; Ramakrishnan, Jones, & Sidorova, 2012). Analysis of the strategic rationale underlying competitive pressure as an IT adoption driver proposed that, by adopting a technology, organizations might be able to amend the rules of

Please cite this article in press as: Bole, U., et al. A case analysis of embryonic data mining success. *International Journal of Information Management* (2015), http://dx.doi.org/10.1016/j.ijinfomgt.2014.12.001