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Relationships among ERP post-implementation success constructs: An analysis at the organizational level

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ABSTRACT

Enterprise resource planning (ERP) systems implementation success factors have been widely researched; however, few have investigated ERP post-implementation success in organizational contexts. The paucity of research into ERP system success evaluations partly motivates this research. To that end, the objective of this study is twofold. First, it primarily investigates the relationships among six constructs or dimensions in a respecified ERP system success measurement model, which was developed from prior relevant frameworks. Second, this research adds to the body of knowledge in the information system (IS) success evaluation domain, especially with its focus on ERP packages. The extended ERP system success model was tested using data collected in a cross-sectional field survey of 109 firms in two European countries. Structural equation modeling (SEM) was used to test six relevant hypotheses. The SEM results showed that five out of the six hypotheses have significant, positive associations. Namely, the constructs of *System Quality*, *Service Quality*, *Individual Impact*, *Workgroup Impact*, and *Organizational Impact* have strong relevance in ERP success conceptualization, whereas *Information Quality* does not, at least, in the context of our data. The pertinence of the study's findings for IS success evaluation as well as its implications for practice and research are discussed.

1. Introduction

The drive for higher levels of productivity, effectiveness, and organizational performance continue to push modern businesses towards adopting enterprise resource planning (ERP) systems (Davenport, 1998; Ifinedo, Udo, & Ifinedo, 2010; Mabert, Soni, & Venkatraman, 2003). ERP systems are applications that facilitate the integration of business information processes across functional units in an organization (Klaus, Rosemann, & Gable, 2000; Markus & Tanis, 2000). Research studies and industry reports indicate that both practitioners and information systems (IS) researchers place a lot of interest in this software (Esteves & Pastor, 2001; Hamerman, 2008; Mabert et al., 2003). For example, Esteves and Pastor (2001) draw attention to several ERP studies published in IS literature, and a recent industry report by Hamerman (2008) reveals that "The ERP applications market, currently about $38 billion in total revenue, is growing at an annual rate of 6.9% and will reach $50 billion by 2012." Despite the popularity of ERP systems globally, many adopting organizations have come to realize that the deployment of such systems were not as effective as expected (Wang, Shih, Jiang, & Klein, 2008; Zhu, Li, Wang, & Chen, in press).

Much of the extant literature on ERP applications tends to focus on issues related to their adoption, implementation critical success factors (CSF), and implementation methodologies (Akkermans & van Helden, 2002; Esteves & Pastor, 2001; Hong & Kim, 2002). Very few studies have appeared which focus on other aspects of ERP applications (Ifinedo & Nahar, 2007; Ifinedo et al., 2010; Yoon, 2009; Zhang, Leeb, Huanga, Zhang, & Huang, 2005; Zhu et al., in press; Zviran, Pliskin, & Levin, 2005). The assessment of post-implementation success of ERP packages in adopting organizations is one area that is not sufficiently researched (Sedera, Gable, & Chan, 2004; Wu & Wang, 2006a, 2007; Zhu et al., in press). The paucity of research into ERP system success evaluations partly motivates this current research study. It has been suggested that IS success measurement is a fuzzy concept; it has different meanings to different stakeholders in their assessment of different types of IS across different cultural contexts (Agourram, 2009; Jiang & Klein, 1999; Seddon, Staples, Patnayakuni, & Bowetell, 1999; Soh, Kien, & Tay-Yap, 2000; Zhu et al., in press). Citing Jiang and Klein (1999), DeLone and McLean (1992, p. 17) comment that "users prefer different success measures, depending on the type of system being evaluated." Measuring the success of ERP is particularly

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difficult perhaps due to the complexity of the system (Klaus et al., 2000; Markus & Tanis, 2000; Zhu et al., in press) and the sort of expertise required to carry out such an exercise (Gable, Sedera, & Chan, 2008; Robbins-Gioia, 2006; Seddon, 1997; Sedera et al., 2004). Unlike other traditional, single-function IS, the deployment of ERP systems is accompanied by business process engineering efforts that are intended to bring about radical, organizational change to enhance greater effectiveness for the adopting organization (Davenport, 1998; Holsapple, Wang, & Wu, 2005; Klaus et al., 2000; Yoon, 2009). Further, the integrative nature of ERP applications makes their implementation more complex than that of traditional IS (Markus & Tanis, 2000; Wang & Chen, 2006).

Seddon (1997, p. 11) discussed the general poor state of IS evaluations in organizations by noting "many firms do not conduct rigorous evaluations of all their IT investments" because they lack knowledge in such areas. Further evidence of this deficiency of knowledge regarding how firms assess the benefits of ERP is illustrated in a study conducted by Robbins-Gioia (2006). In this study, a survey of 232 respondents in American organizations reported that "46% of the participants noted that while their organization had an ERP system in place . . ., they did not feel their organization understood how to use the system to improve the way they conduct business." The inference from the foregoing information is that ERP adopting firms do not know what to assess or evaluate in order to realize the benefits from their investments in such technologies. Thus, lack of knowledge on the part of some practitioners as to what to measure or assess with regard to ensuring the effectiveness of their ERP application is another motivation for this study. It is a fact that little consensus exists between researchers and practitioners about what to assess when it comes to the impacts and effectiveness of IS in organizations (DeLone & McLean, 1992; Gable et al., 2008; Saarinen, 1996; Sabherwal, Jeyaraj, & Chowa, 2006; Stefanou, 2001).

Research in the specific area of ERP systems success measurement, evaluations or assessment is just beginning to evolve (Gable et al., 2008; Ifinedo, 2006; Ifinedo et al., 2010; Sedera, Gable, & Chan, 2003, 2004). Some ERP success researchers have used a single-dimension of success, i.e., user satisfaction, to assess the effectiveness of the software (Nelson & Somers, 2001; Somers, Nelson, & Karimi, 2003; Wu & Wang, 2006a, 2007; Zviran et al., 2005). Others have proposed frameworks that do not readily lend themselves to empirical testing and validation (e.g., Markus & Tanis, 2000; Tan & Pan, 2002). This present study builds upon the ERP success measurement framework proposed by Sedera and colleagues (Gable et al., 2008; Sedera et al., 2004). Their model was based on the widely accepted IS success measurement developed by DeLone and McLean (1992) hereafter referred to as the D&M (1992) IS success model. The Sedera and colleagues' ERP success framework was considered for this study given the recent support it received from the proponents of the D&M (1992) success model (see Petter, DeLone, & McLean, 2008) and for its simplicity.

To consolidate IS success evaluation theory in general and ERP system success measurement in particular, it is critically important that any emerging model(s) be empirically tested (DeLone & McLean, 1992, 2003; Gable et al., 2008; Rai, Lang, & Welker, 2002; Sabherwal et al., 2006; Seddon, 1997). DeLone and McLean (1992) and Petter et al. (2008) note that the science of IS success evaluation stands to benefit from research efforts which empirically test and validate the relationships between the dimensions or constructs in any emerging success measurement model. In fact, DeLone and McLean (1992, p. 88) conclude that "By studying the interactions along these components of the model [i.e., dimensions of IS success], as well as the components themselves, a clearer picture emerges as to what constitutes information systems success." Along the same line of reasoning, Sabherwal et al. (2006) assert that much needs to be done with regard to enhancing insights about the relationships among constructs of IS success frameworks. They further add that such studies could benefit from the testing of potentially important constructs from prior parsimonious IS success models.

To that end, this present research effort is designed to contribute to the literature by investigating relationships among constructs of an extended, respecified ERP system success measurement model. Moreover, given the lack of much scholarship on IS success evaluation at the organizational level (Petter et al., 2008); we also hope to increase insight regarding assessment in that context as well. It is important to mention that the purpose of this present work is not to test the original D&M (1992) IS success model *per se*, as several IS researchers (see, e.g., Iivari, 2005; Petter et al., 2008; Rai et al., 2002) have already published works in that domain. Rather, this present effort is directed at complementing and advancing the work of Sedera and colleagues in the area of ERP system success measurement.

To the best of our knowledge, this present effort is among the first of its kind to examine interrelationships among ERP success dimensions beyond the implementation stage. Other researchers including Akkermans and van Helden (2002) have already studied interrelations among CSF in the early stages of ERP implementation. This current study complements such efforts by focusing on the evaluation of the system's success at later stages in its life cycle. It is important to avoid conflating ERP implementation success issues with "success matters" occurring at latter stages in the system life cycle.

Our study did not deem it necessary to utilize single-construct assessments of success, i.e., the user satisfaction instrument, which others (e.g., Somers et al., 2003; Wu & Wang, 2006a, 2007; Zviran et al., 2005) have employed in prior studies. We accept that the discourse of ERP success assessment in adopting organizations from the viewpoint of user satisfaction alone is simplistic, incomplete, limited, and may be misleading (DeLone & McLean, 1992; Saarinen, 1996; Sedera et al., 2004). As noted above, ERP packages present the adopting organization (and its sub-units) with broad impacts that exceed usage satisfaction for the individual (Davenport, 1998; Klaus et al., 2000; Markus & Tanis, 2000; Zhu et al., in press). An endeavor that takes such an issue into account is welcoming.

2. Research context and theoretical background

2.1. Research scope and setting

Our notion of ERP system success is different from *ERP implementation success* in that the former refers to the utilization of such systems to achieve organizational effectiveness (Gable et al., 2008; Myers, Kappelman, & Prybutok, 1996, 1997). In IS literature, the term "success" has been used synonymously with effectiveness (see Markus & Tanis, 2000; Thong, Yap, & Raman, 1996), and we concur with Thong et al. that the effectiveness of an IS can be "defined as the extent to which an information system actually contributes to achieving organizational goals" (p. 252). Our ERP success excludes the technical installation success of such systems that employ cost overruns, project management metrics, and time estimates among other issues as measurement indicators (Markus & Tanis, 2000; Martin, 1998).

Some researchers have discussed the value, benefit, or success of ERP systems using financial indicators (e.g., Stefanou, 2001); this study did not operationalize ERP success with such markers owing to the inherent limitations of this approach. DeLone and McLean (1992, p. 74) note that "MIS academic researchers have tended to avoid performance measures (except in laboratory studies) because of the difficulty of isolating the effect of the I/S effort from other effects which influence organizational performance." Fur-