



Efficiency analysis of ERP projects—software quality perspective

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Abstract

Enterprise resource planning (ERP) projects are susceptible to changes in the business environment, and the increasing velocity of change in global business is challenging the project managers of ERP. Literature on ERP projects reveals that the success of the ERP system greatly depends on the rigour of the software quality processes. The objective of this paper is to analyse the efficiency of ERP projects based on their quality measures (defect counts) using the Data Envelopment Analysis Constant Returns to Scale (DEA CRS) model and identify the most efficient ERP projects. Such projects may serve as potential role models and the quality processes of these projects may be adopted by the future ERP projects leading to successful implementation. The implications of the findings for both practice and research are discussed, and probable areas of future research identified.

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Keywords: Enterprise resource planning (ERP); Data envelopment analysis (DEA); Software quality; Efficiency; Process; Software projects

1. Introduction

Enterprise resource planning (ERP) systems are integrated information systems, also referred to as packaged software, the key function of which is to integrate all core functions of an enterprise regardless of business type or charter. ERP systems are viewed as vehicles which the modern organisations use to achieve true business connectivity, a state in which everyone knows what everyone else is doing in the business all over the world at the same time (Daneva, 2010). Growing demand for ERP projects on the one hand and the failed or out of control ERP projects on the other hand should certainly give the project managers the pause (Daneva, 2010; Shaul and Tauber, 2013). To improve the efficiency of the upcoming ERP projects, it is essential to analyse the efficiency of past ERP projects. For practitioners and consultants involved in ERP implementation,

extracting the efficient ERP projects is an invaluable source of learning. By measuring the efficiency of ERP projects, one can create incentives that are likely to yield higher performance.

The development and deployment of ERP is quite different from the conventional IT systems (Luo and Strong, 2004). Most ERP systems often involve business process or system customisation during the ERP implementation (Luo and Strong, 2004). Hence implementing an ERP system cannot be viewed in the same way as implementing a conventional IT system. ERP packages are not systems with just software and hardware, but business processes, organisational structure and also culture.

In recent years, the IT industry has been focusing on delivering software products with utmost quality. Researchers have also indicated that in view of the less efficient software product being deployed in the organisations, the IT industry needs to focus on the “quality” related measures of its software products (Carmel and Agarwal, 2002; Davis et al., 2006). Past research (Aversano and Tortorella, 2013; Parthasarathy and Anbazhagan, 2008; Paschalidou et al., 2013; Stefanou, 2001; Stensurd and Myrtveit, 2003; Teltumbde, 2000) has analysed

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the efficiency of ERP projects either from software productivity measures (e.g., project efforts in person-months and software size) or from managerial aspects of ERP. Researchers admit that there is inadequacy and insufficient studies on analysing the efficiency of ERP projects from their quality perspective (Kannabiran and Sankaran, 2011; Stensurd and Myrtveit, 2003), despite the fact that the software quality is a key factor in evolving strategy for both offshore vendors and customers (Kannabiran and Sankaran, 2011). Therefore, this paper analyses the efficiency of 10 ERP projects based on their quality measures using the DEA CRS model.

In this paper, we define the term ‘efficiency’ as the software productivity of ERP projects measured in terms of its project efforts and software size, with due consideration for its quality measure (defect counts). We consider ‘defect counts’ as a quality measure, as it is the most widely accepted metric to assess the quality of a software product (Conte et al., 1986; Jalote, 2008). By the term ‘defect’, we mean something in software that causes the software to behave in a manner that is inconsistent with the requirements or needs of the customer (Conte et al., 1986).

The term ‘efforts’ (also called ‘project efforts’) refers to the manpower required for the development of the software product in a software project (Pressman, 2010). As the main cost of developing software is the manpower employed, the cost of developing software depends on the project efforts and it is generally measured in terms of person-months. However, different methods exist for measuring the project efforts and, accordingly, the project costs would also vary.

The size of the software is measured by means of function points (FP). The FP measure functionality from the user’s point of view, that is, on the basis of what the end user actually requests and receives in return from the software system (Pressman, 2010).

There are numerous definitions of software quality. In many previous studies, the term ‘quality’ is referred to as the ‘the totality of features and characteristics of a product or service that bears on its ability to satisfy given need’ (Agarwal and Chari, 2007). Software quality is a multidimensional measure and it is essential to determine what aspects of quality are important to organisations (Kannabiran and Sankaran, 2011). To ensure software quality, two approaches exist in the IT industry, namely: (i) software quality assurance of the process by which the software product is developed, and (ii) the evaluation of the quality of the end product (Kannabiran and Sankaran, 2011). In this study, we follow the second approach, that is, to measure the defects of the ERP product deployed in the organisation to assess its quality.

Even though there are different dimensions of quality, in practice, quality management often revolves around defects. Hence, in this paper, we define the term ‘quality’ as the number of defects per unit size in the delivered software (Jalote, 2008). In other words, we view the quality of a software product in terms of its defect counts.

For the project managers, the practitioners and the consultants, this research study identifies the efficient ERP projects and enables them to adopt the software processes and the quality models of these projects for their future ERP projects. This study extends the previous research work of Stensurd et al. (2003), and Parthasarathy

et al. (2008) on evaluation of ERP projects from a software engineering dimension. This study contributes to research by demonstrating the application of the DEA CRS model to analyse the efficiency of ERP projects based on quality measures.

The remainder of this paper is organised as follows: Section 2 presents the observations made in previous studies, emphasising the need to assess the efficiency of ERP projects based on their quality measures. It also summarises related previous research works on evaluating ERP projects from technical as well as managerial aspects. Section 3 presents our research objective. Section 4 briefly describes our methodology, followed by Section 5, which discusses the data collection and analysis. Section 6 presents our results, followed by the implications for practice and research, and discussion on validity threats. Section 7 concludes the paper with the directions for future research.

2. Literature review

2.1. Efficiency of ERP — quality perspective

Many IT firms have been making initiatives to strengthen their quality processes, as it offers them opportunities to reduce costs, improve efficiency and save time (Kannabiran and Sankaran, 2011; Rothenberger et al., 2010). Any IT solution would be recognised as efficient, only when it is defect free and delivers the functionality desired by the organisation (Jalote, 2000). Numerous previous studies claim that software quality is capable of determining the success or failure of a software product (Luftman and Kempaiah, 2008; Tian, 2004). Evaluation of software systems from a quality perspective is a relevant issue for the developers/programmers, and various quality models have been discussed in the literature (Aversano and Tortorella, 2013). The traditional models are McCall and Boehm’s models (Kan1994); the most widely used model being ISO/IEC 9126 model and its recent version SQuaRE ISO 25000 (Aydin, 2012).

Software quality and IS project performance are inseparable entities and performance enhancement of IT products is possible through its quality process management (Subramanian et al., 2007). A previous study by Jalote (2000) observes that software quality is a way to determine how well the product satisfies the customer. Another study observes that customer satisfaction is the key to determine the efficiency of an IT product (Rajendran et al., 2006). Thus, connecting the previous research studies (Jalote, 2000; Rajendran et al., 2006) we observe that the analysis of the efficiency of ERP projects based on their quality measures is pertinent to the success of ERP implementation.

In the past decade, research initiatives were put into understanding the reasons for failure of ERP implementation (Chen et al., 2009; Light, 2005; Parthasarathy, 2012; Shaul and Tauber, 2013), the factors that contribute to ERP’s performance (Chen et al., 2009; Hwang and Grant, 2011; Parthasarathy, 2011; Rothenberger and Srite, 2009), the need to identify efficient ERP projects (Aversano and Tortorella, 2013; Kannabiran and Sankaran, 2011; Parthasarathy and Anbazhagan, 2008), learning the quality processes, and models and project management aspects of such projects to implement the future ERP projects successfully (Botta-Genoulaz et al., 2005; Kannabiran and

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