

Chapter 36

An Expert System for Predicting ERP Post-Implementation Benefits Using Artificial Neural Network

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ABSTRACT

Implementing Enterprise Resource Planning systems (ERPs) is a complex and costly project which usually delivers only a few of expected benefits. Obtaining the expected benefits of ERPs is impressed by a variety of factors and variables which is related to an organization or project environment. In this paper, the idea of predicting ERP post-implementation benefits based on the organizational profiles and factors has been discussed. Regarding the need to form the expectations of organizations about ERP, an expert system is developed by using Artificial Neural Network (ANN) method to articulate the relationships between some organizational factors and ERP's achieved benefits. The expert system's role is in the preparation to capture the data from the new enterprises wishes to implement ERP and predict likely benefits might be achieved from the system. For this end, factors of organizational profiles (such as industry type, size, structure, and so on) are recognized and a feed-forward architecture and Levenberg-Marquardt (trainlm) neural network model is designed, trained and validated with 171 surveyed data of Middle-East located enterprises experienced ERP. The trained ANN embedded in developed expert system predicts with the average correlation coefficients of 0.745, which is respectively high and proves the idea of dependency of ERP post-implementation benefits on the organizational profiles. Besides, total correct classification rate of 0.701 shows good prediction power which can help firms in predicting ERP benefits before system implementation.

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INTRODUCTION

Enterprise Resource Planning (ERP) systems are defined as single software system allowing the complete integration of information flow from all functional areas in companies by means of single database; such a system is accessible through a unified interface of communication (Davenport, 1998). These systems have been increasingly adopted by organizations across various industries in both developed and developing countries. Organizations implement ERPs to enhance both operational efficiency and business efficacy (Gattiker & Goodhue, 2005; Ke & Wei, 2008; Wang & Chen, 2006). It improves operational efficiency by integrating business processes and providing better access to integrated data across the entire enterprise while a company that wishes to enhance its efficacy may redesign its business practices by using the best practices embedded in the ERP (Chou & Chang, 2008; Davenport, 1998). Although ERP systems can bring about benefits such as competitive advantage, decision support capabilities and business intelligence competences (e.g. Ghazanfari, Jafari, & Rouhani, 2011; McDonald, 2009; S. Rouhani, Ghazanfari, & Jafari, 2011), the high failure rate is a major concern (Zare Ravasan & Mansouri, 2014). The failure rate of ERP implementations has been estimated at between 60% and 90% (Kwahk & Lee, 2008). These projects are, on average, 178% over budget, took 2.5 times longer than intended and delivered only 30% of the promised benefit (Zhang, Lee, Huang, Zhang, & Huang, 2005). Other research findings indicate that organizations do not always achieve their desired level from their ERP investments (CSC, 2008; McDonald, 2009).

These statistics imply that ERP projects are one of the most difficult system development projects. They are quite complex projects and often require fundamental organizational changes. To avoid such costly failures and help organizations take more advantage of their system implementation, a great deal of effort has been done by researchers. Some researchers have provided valuable insights into the process of ERP implementation (e.g., Abdel-Kader & Nguyen, 2011; Soja, 2008; Soltani, Elkhani, & Bardsiri, 2014; Subramanianh & Hoffers, 2005; Wang, Shih, Jiang, & Klein, 2008) and others identified a variety of critical factors influencing the success or failure of the system (e.g., Amid, Moalagh, & Zare Ravasan, 2012; Payam Hanafizadeh, Gholami, Dadbin, & Standage, 2010; Khattak et al., 2013; Kini & Basaviah, 2013; Nour & Mouakket, 2011; Zhang, et al., 2005). Understanding the nature of Enterprise Systems (ESs) and ERPs success has also been the focus of scholarly research interest in recent years (e.g., Floropoulos, Spathis, Halvatzis, & Tsipouridou, 2010; Ifinedo & Nahar, 2007; Ifinedo, Rapp, Ifinedo, & Sundberg, 2010; Moalagh & Zare Ravasan, 2012; Wu & Wang, 2007; Zhang, et al., 2005).

Despite these studies, identifying the benefits arising from ERP implementations and the way it can be achieved is still a key challenge for practitioners (CSC, 2007). The findings of a series of recent surveys of information systems issues for senior managers reveals that whilst their essential concerns are further than just the implementation of enterprise systems (Ghazanfari, et al., 2011; McDonald, 2009; S. Rouhani, et al., 2011), businesses are still being challenged to maximize the benefits arising from enterprise systems investments. Achieving the expected benefits from IT investments ranked as the second most critical issue for organizations (CSC, 2008).

Although researchers have proposed a variety of approaches to analyze possible types of ERP benefits, but little quantitative research has been done on articulating the relationships between organizational profiles (such as industry type, size, structure, management style, IT systems and so on) and realized benefits. The current paper, has tried to fill this gap by answering the following research question:

How organizational profiles can be related to ERP benefits acquisition?

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