



# Learning and performance in ERP implementation projects: A learning-curve model for analyzing and managing consulting costs

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## ABSTRACT

Consulting fees form a large portion of enterprise resource planning (ERP) costs and may cause serious budget overruns. The extent and duration of the consulting support required by a team is dependent on the team's expertise. The choice of a training strategy significantly impacts project costs, but analytical tools to predict the extent of this impact have not been available. This research offers three major contributions: a means of selecting a training strategy that minimizes project consulting costs, an analytical method for accurately predicting a project completion date, and a theoretical basis for empirical studies of learning and ERP (and other IT) implementations.

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## 1. Introduction

Almost 19 percent of the companies across North America had enterprise resource planning (ERP) software installed by 1999 (Robey et al., 2000), and it had become a strategic instrument that allows organizations to overcome the limitations of legacy systems. Research provides convincing evidence that implementation projects consume a large portion of a company's resources (Haines et al., 2000; Portougal and Sundaram, 2005), are risky (Sheldon, 2005), and have caused serious adverse consequences for many companies (Hong and Kim, 2002; Stedmen, 1999; Whittaker, 1999). Scott and Vessey (2002) attribute project risks to the challenge of finding resources capable of configuring and testing a complex system that must artfully integrate technology, personnel, and almost every area of the organization (Davenport, 1998). ERP projects cannot be completed by the company's personnel

alone: The project team must be augmented with external consultants (Baccarini et al., 2004; Boyer, 2001; Davenport, 1998). Consulting fees form a large portion of project costs (Haines et al., 2000), and consultant involvement should therefore be carefully controlled to avoid serious budget overruns.

The extent and duration of external support is directly related to the capabilities of the internal resources, so management has two choices: They can train the company's own resources extensively—which delays the system configuration phase of the project, but raises the initial performance level of the team so that less consulting support is needed—or they can reduce upfront training and start the project sooner, but at a lower performance level. The latter choice requires significant consulting support for the project team, with a probable resulting increase in project duration. In making their decision, management must recognize that an ERP project team is cross-disciplinary by nature and will require an extended integration period, during which the team's performance level will be less than optimal (Al-Mashari et al., 2003; Baccarini et al., 2004; Boyer, 2001; Davenport, 1998; Robey et al., 2000). Ayas (1996) strongly advises

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managers to balance training and knowledge-transfer investments with short-term performance demands, in order to support the project team's long-term performance goals.

Reduced initial performance must be taken into account during the planning phase of the project: Performance levels will be decreased due to the learning curve (Barry et al., 2002), and this will affect project duration and costs (Chatzoglou and Macaulay, 1996). When a project plan is based on a series of guesses and performance reductions are not anticipated, the result inevitably involves unreliable schedules, extended duration, and escalation of costs (Barry et al., 2002; Callaway, 1999; Chatzoglou and Macaulay, 1996; Depledge, 2003; Keil, 1995; Keil et al., 1995; Wallace and Keil, 2004; Wieggers, 2003). Accurately predicting the duration of any IS project is as difficult and complicated as establishing the best possible project team (Schwalbe, 2006).

The concept of learning (or progress) curves has been used for decades to describe performance changes related to learning. It would make a demonstrable contribution to improving calculations during the planning of an ERP project. A model based on learning-curve theory should therefore be integrated into the project manager's toolbox. As consulting costs make up the lion's share of the project costs, it is critical that the model enable managers to (1) optimize consulting costs, including the cost of training, (2) evaluate various training and knowledge-transfer alternatives, and (3) analyze the impact of training on project duration and cost. Although industrial applications of the learning curve have been extensively discussed in the literature (Adler and Clark, 1991; Argote, 1996; Badiru, 1992, 1995; Blancett, 2002; Briscoe and Roark, 1991; Globerson and Shtub, 1995; Lyles and Easterby-Smith, 2003), the use of the learning curve in ERP projects has received negligible attention.

This paper focuses on the relationship between the capabilities of a project team and consulting-cost management, and develops an analytical model to study the impact of training on project cost and duration. Our research is of interest to project managers because it (1) provides a methodology for consulting-cost optimization, (2) facilitates evaluating various knowledge-transfer alternatives and assessing the required duration of training, and (3) offers an analytical tool—and therefore a theoretical basis—for empirical studies of learning and ERP, and increasing the accuracy of the calculation of project parameters. The study is based on the combination of analytical modeling and empirical case study, in which the practical application of the model is demonstrated.

The paper is organized as follows. The importance of training and the impact of knowledge transfer on ERP projects are discussed in Section 2.1. The critical connection between training and a team's performance—and therefore project duration and cost—is represented by the learning curve, which is the key element in our model. We select the functional form of the learning curve in Section 2.2, where the application of learning curves to information technology and systems is discussed. We describe the development of the model in Section 3, and illustrate its

application with a case study in Section 4. Research contributions are presented in Section 5.

## 2. Literature review

### 2.1. Impact of training on ERP project

Extensive training, knowledge transfer, and proper project management are identified in the literature as the critical success factors for any ERP implementation (Holland and Light, 1999; Hong and Kim, 2002; Kumar and van Hillegersberg, 2000; Lee and Lee, 2000; Motwani et al., 2002; Tchokogua et al., 2005; Verville and Halington, 2002; Willcocks and Sykes, 2000), and studies provide evidence that sufficient training is one of the key ingredients for success (Al-Mashari et al., 2003; Bingi et al., 1999; Sumner, 2000). A survey conducted in Norway by Karlsen and Gottschalk confirms that IT project success is significantly related to knowledge transfer (Dixon, 2000; Karlsen and Gottschalk, 2003). Researchers also agree that managers must ensure team stability and trust, and allocate sufficient time to learning-by-doing, in order to increase overall efficiency as quickly as possible (Edmondson et al., 2003; Fedorowicz et al., 1992). As technology is most often implemented by cross-disciplinary teams, tacit knowledge is required (Edgington and Chen, 2002). If sufficient training is not provided, the project staff learns on the job, and project duration increases (City of Tampa, 2002).

Understanding the importance of training, Multnomah County, Oregon developed 44 different courses and 493 training sessions for its ERP implementation (Boyer, 2001). Unfortunately, numerous studies show that training time is often underestimated and training budgets are often set at very low levels (Fletcher et al., 1992; Rocheleau, 2006; Wu and Rocheleau, 2001). In an attempt to prevent the consequences of insufficient training, the Government Finance Officer Association advises that budgets allocate at least 20 percent of the total system implementation costs to training alone (Miranda et al., 2002). Robey et al. (2000) conducted a study of 13 North American manufacturing firms and divisions that implemented ERP systems, and compared these firms by the attributes of their dialectical learning processes. The published results provide empirical evidence that extensive team training has a positive impact on the successful outcome of the ERP project. The study concludes that firms that managed to overcome knowledge barriers and successfully assimilate new processes invested approximately 15–20 percent of their project budgets in formal team training. The companies that were less successful, however, spent a maximum of 10 percent of their project budgets on training (Robey et al., 2000).

When choosing the training strategy, managers must carefully consider the learning curve of the project team, as various training strategies will have different degrees of impact on team performance levels. Even though project managers acknowledge that transferring and retaining knowledge in the organization is absolutely essential, they tend to underestimate the learning curve initially

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