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Balancing the costs of human resources on an ERP project ☆

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ABSTRACT

ERP projects cannot be completed without external consulting support due to insufficient expertise of internal resources. The need for external consulting during project execution could be reduced if the capabilities of internal resources are improved through team training that is provided before the commencement of a project. Previous studies demonstrate that the most cost-effective approach to ERP implementation is to balance formal initial team training with external consulting support. This paper expands previous research by adding a decision model that allows a manager to: (1) assess the impact of a training strategy on the accumulative weekly cash outflows, (2) forecast the performance and track the progress of an ERP implementation, and (3) calculate the amount and experience level of the consulting support required to reduce the duration of a project. Feedback from practitioners suggests that this type of tool would be welcomed by the project management community.

1. Introduction

ERP implementations are complex IT projects which usually take between six months and two years to complete [1]. Before the year 2000, almost all ERP projects involved the implementation of a new system. During the last decade, a second category of ERP projects emerged, in which the previously installed systems were expanded or upgraded [2]. Some companies have pursued the development of their own in-house ERP solutions but on the majority of projects the packaged system from a software vendor is configured [3]. ERP consultants with specific industry knowledge assist the team of internal resources with the system configuration. If a system must be customized, contractors specializing in system development are also hired.

Formal team training in a classroom setting can be provided to the project team before the implementation. This training improves the capabilities of the internal resources and leads to the reduction of consultant involvement and costs [4–6]. During the implementation, the consultants transfer knowledge to the internal resources through on-the-job training. When the implementation is complete, the consultants can also be involved in training end users. This training is limited to the transactions processed by the respective business functions but does not explain the configuration of a system [7–9].

During an ERP project, external resources learn company processes and internal resources learn the new system so the capabilities and performance of both groups improve [10,11]. Due to the lack of decision models that consider the correlation between performance changes and project parameters [12] it is difficult to accurately predict the degree to which external help is necessary [13]. In order to avoid the negative impact of uncertainty [14] managers tend to hire too many resources [15]. As a result, the cost of consultants on an ERP project often adds up to eight times the cost of a software alone [16]. To that end, the significant savings will be achieved if an impact of training and performance changes on project parameters is analyzed during planning of ERP projects.

This paper discusses the impact of changes in a team's aggregated performance on the costs and duration of a project, which is multi-disciplined, requires an extended integration period, and is most effective when executed in a stable environment [17]. Note that system development projects wherein the contractors are paid based on output are not covered by this research. In Section 2, we argue that reductions in consulting support, the most expensive component of project costs, can be achieved if the project team is given more formal training. A decision model that can be used to support that argument is developed in Section 3.

In Section 4, we analyze two ERP projects implemented by Canadian and European companies. In Section 4.3 we address the following three research questions: (1) How much formal training should be provided before the commencement of a project in order to implement the system in a cost effective way? (2) How does training impact the schedule, output and baseline performance of a project? (3) What is the impact of consultants' experience and rate on project timelines and cost? Managerial insights are offered in Section 5. The limitations of our research are discussed in Section 6.

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2. Literature review

2.1. Consulting support versus team training

Although ERP software packages are used by thousands of companies world-wide, only one-sixth of all ERP implementation projects are completed on time and within budget [5]. Only 30% of all ERP projects are considered successful [18] and many of the projects have failed to deliver expected benefits [19]. ERP projects consume a large portion of company resources [4], thus it is not surprising that many researchers have devoted their attention to the critical factors that lead to a successful implementation [3,17,20–22].

Project teams with high capabilities and experienced consultants are the primary contributing factors leading to successful implementations [5,23], while inadequate training is associated with failure [24] and also has a negative impact on project duration [25]. A balanced project team is instrumental to any project [21,26,27] and must be assembled from the most knowledgeable employees in order to accomplish the required transformation [4]. However, an ERP project can rarely be completed by company personnel alone and requires consulting support [28,29]. The number of consultants employed may be anywhere from four to 40, and in extreme cases, as many as 150 consultants can be involved [20].

Research shows that consulting fees are a significant part of project costs and together with the salaries of internal resources may add up to over 70% of all ERP costs [1,28]. The extent of consultant involvement is different among each of the two project categories [30,31]. For example, new system implementation projects are usually supported by a much larger number of consultants than system upgrades [28,32], thus management must always carefully assess the use of external help and explore the ways in which its extent can be reduced to the absolute minimum [1,28].

In order to limit consulting costs, companies turn their attention to various forms of training that can improve project team capabilities and internal readiness [7,33]. For example, organizations have an 80% chance of success if at least 15% of the total implementation budget is reserved for formal training [34] and if knowledge transfer occurs during project execution [35,36]. Firms that successfully assimilated a new system had invested approximately 15–20% of the project budget into formal team training, while those that were less successful had spent only 10% or less [37,38].

Formal training can take the form of standard courses available at training locations or customized training delivered at the company's site. The first form is cost effective only if a limited number of personnel are to be trained, since five-day course fees alone can be as high $4000 per student. Even if all the expenses are not included and the wages of internal resources are not accounted for, the costs of training delivered in remote centers can add up very quickly. On the other hand, five-day fees of one consultant delivering training on site often costs between $8000 and $10,000. Therefore, if more than three students are to be trained, companies prefer to arrange for in-house customized training by consultants instead [39].

2.2. Impact of training on project and team's performance

Although it is relatively easy to justify the location of training, it is much more difficult to assess its impact on the team's performance during the execution of a project [38,40]. For technology projects, a logistic function is recommended to track the non-linear changes in performance due to experiential learning, which takes place during formal and on-the-job training [41–45]. The logistic function accurately measures improvements in performance as a rate, in which a predefined output is completed [46–50]. In the case of an ERP project, the output can be defined as the number of ERP transactions processed in a unit of time [2]. Performance improvements are related to the performance ceiling through a learning curve coefficient, k [51].

Several models that measure performance are discussed in the literature [52–54]. Stummer et al. propose a competency model, in which each employee receives a profile consisting of competence efficiencies indexed using a catalogue [47]. Gutjahr suggests that the competency scores should be estimated by experts [48]. Coefficient k can be indirectly derived by retrofitting a learning curve to a plot of the schedule performance index [55]. Learning curve coefficient can also be measured directly using an algorithm, in which the time required to complete a set of transactions is measured at the beginning and at the end of the formal training [56], or the time required to complete the data conversion procedure is measured at various times during the early stages of a project [52]. The algorithms for the direct assessment of k can effectively measure the impact of either formal or on-the-job training.

The value of k was examined by the extant research on various project settings [53,57–59]. For example, in the experimental study of one-month projects executed by multi-skilled resources, the individual learning curves were established for internal resources assuming that a cross-skill or team-learning effect can be neglected and the efficiency of external resources is static. Since the employees were allowed to switch between different tasks, knowledge depreciation was expected and relatively low values of k (between 0.012 and 0.02) were used [57]. Since a team-learning effect in an ERP project is strong, a composite learning curve is required to assess the aggregated team's performance changes. However, knowledge depreciation can be neglected due to the lack of significant interruptions [32,60,61]. The external resources need to learn the company processes, so a static performance of consultants cannot be assumed [2]. As a result, relatively high values of k were recorded (between 0.6 and 0.9) [2,56].

The performance function is critical during the development of a training strategy [4,9,17,18,62], which balances the cost of training with the costs of consulting support and allows sufficient time for formal training while avoiding unnecessary implementation delays [56,63]. The various forms of training must be considered when such a strategy is evaluated. However, due to the lack of analytical tools, the evaluation of a training strategy is extremely time consuming and currently impractical [56]. As a result, training is frequently underestimated and training budgets are often set too low [33,39].

The Consulting Costs Model (CCM) which links training duration to implementation duration partially closes that gap [56]. CCM focuses on minimizing the cost of external resources and is best suited for cases where the cost of internal resources can be ignored. The model has four important limitations: (1) the impact of a training strategy on cash outflows cannot be evaluated, (2) the project baseline cannot be forecasted, (3) the number and level of resources required to reduce the project duration (compress the schedule) cannot be calculated, and (4) the application of the model in project management is limited due to unwieldy calculations required to balance training and consulting costs.

The analytical model developed in this paper (RCM) addresses the first, second, and third limitations of CCM. RCM consists of Resource Cost Formulas, a Baseline Equation and a Resource Requirement Equation. Resource Cost Formulas include all relevant costs of both internal resources and external consulting involved in an ERP implementation, such as: labor costs, travel costs and living expenses. In contrast to the previous model, the formulas can assess the impact of a training strategy on accumulative cash outflows and on the overall costs of a project. The Baseline Equation allows for the forecasting of an output in the form of the value to be delivered on a project over time. The forecasts are expressed in the same units as