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Determining ERP customization choices using nominal group technique and analytical hierarchy process

Sudhaman Parthasarathy [a,*], Srinarayan Sharma [b]

[a] Department of Computer Applications, Thiagarajar College of Engineering, Madurai, India
[b] Indian Institute of Management (IIM) Kashipur, Uttarakhand, India

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ABSTRACT

An enterprise resource planning (ERP) system is an information system that supports and integrates many facets of a business. A critical issue in ERP implementation is how to bridge the gap between the ERP system and an organization's business processes by customizing either the system, or the business processes of the organization, or both. Literature review shows that customization is a major hindrance in most of the ERP implementation projects. This research applies nominal group technique (NGT) and analytical hierarchy process (AHP) techniques to Luo and Strong's framework to help organizations determine feasible customization choices for their ERP implementation initiatives. A case study is presented to illustrate its applicability in practice. The study has theoretical and practical implications for our understanding of ERP implementation process.

1. Introduction

An enterprise resource planning (ERP) system is an information system that supports and integrates many facets of a business. A significant characteristic of this integrated software system is that it is developed for multiple organizations located in different geographical locations with varying requirements and incorporates the best practices and processes [1–3]. In traditional information systems, the product is typically developed for one client organization, using software development processes to collect requirements at the initial stage of development, with the expectation that the resulting product will meet these requirements [6]. With packaged software solutions like ERP systems, it is difficult to completely mold the system to fit the existing business processes as the requirements for its development are collected from multiple sources [1,4,5]. As a result, in most ERP implementations, some degree of customization of both ERP systems and business processes is required [2,7–9].

Several prior studies [10–15] identify the impact of ERP customization on ERP implementation. Keeping the existing business processes and customizing ERP to a minimum are both important for a successful implementation [16]. In a comparative case study of two ERP implementations, Skok and Legge [17] showed that a lack of acceptance of ERP standard processes contributed to the failure of the project. On the other hand, highly customized ERP projects require extensive efforts from the implementation team. For this reason, there has to be a balance between the degree of customization of business processes and that of an ERP system. Thus, the objective of this paper is to identify feasible customization choices for the ERP implementing organizations using nominal group technique (NGT) and analytical hierarchy process (AHP) techniques.

This research addresses a significant gap in our understanding of ERP implementation as the issue of ERP customization by and large remains unaddressed [1,18–21] despite its being recognized as essential for successful ERP implementation [2,22–24]. By addressing this gap, the current study makes contribution to both theory and practice. From a theoretical perspective, it extends Luo and Strong [1] by applying NGT and AHP techniques. It extends Sarfaraz et al. [20] by supplementing AHP with NGT. From a practical perspective, it identifies various customization possibilities for the business processes as well as ERP systems and makes managers aware of the options available to them, allowing them to explore these options instead of accepting the road map drawn by the ERP vendor/implementation partner to fit the existing businesses processes to the chosen ERP system.

The remainder of this paper is organized as follows. Section 2 reviews the past literature on customization. Section 3 describes ERP implementation framework. Sections 4 and 5 describe NGT

* Corresponding author. Tel.: +91 9952203385.
E-mail addresses: parthatce@gmail.com, partha_s79@yahoo.com (S. Parthasarathy), sri.sharma@iimkashipur.ac.in (S. Sharma).

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and AHP techniques, respectively. Section 6 illustrates the application of the NGT and the AHP techniques through a case study. The following section provides a discussion of results. The paper is concluded with implications for practice and research. Lastly, some directions for future research are identified.

2. Related work

ERP systems have been designed and developed by ERP vendors in response to new technologies and emerging business requirements [4,25]. Although ERP systems can bring competitive benefits to organizations, various implementation issues of ERP are a major concern [26–28]. About 70% of ERP implementations fails to deliver anticipated benefits [42] and three quarters of these projects are unsuccessful [7,9,28]. Past studies have attempted to identify significant issues during ERP implementation. A summary of these issues is presented in Table 1.

As Table 1 shows, there are various managerial as well as technical issues involved in the ERP implementation. Customization is one of the most, if not the most important, factor for the successful implementation of ERP systems [27,28,33,34]. In fact, the functionality and reliability of packaged software like ERP depend to a large extent on the degree of customization [2].

Customization is done in several ways such as customizing the business processes, customizing the ERP system, or a combination of both [1]. Business process customization involves changing the business processes to match the ERP package [35]. Customization of ERP involves the modification of an ERP software package to match the organization's existing business processes (also known as technical customization) [1]. Business processes are customized by business process re-engineering (BPR). However, engaging in BPR during the ERP implementation has been proven to be a herculean task for organizations [9,36]. Similarly, the technical customizations that must be carried over from one version of enterprise software to the next are the biggest technological hurdle in ERP implementation and incur substantial maintenance. Luo and Strong [1] have provided a framework to support the management decision making on these ERP customization choices. In this framework companies have three types of technical customization options available, namely, module selection, table configuration and code modification. They also have three process customization options available, namely, no change, incremental change and radical change in the business processes. Thus there are nine customization options available to the management and the ERP consultants. This framework facilitates the matching of the requirements of the implementing organization with several customization choices. However, this framework does not provide any guidance to the implementing organization as to how to select a customization choice. Sarfaraz et al. [20] have applied fuzzy AHP to the Luo and Strong's framework [1] to evaluate an ERP for implementation purposes and discuss the pros and cons of the business process and technical customization choices for the implementing organization. However, they do not discuss the basis for providing requirement inputs to the fuzzy AHP matrices. Inputs from different ERP team members may yield different results and hence the strategy and criteria have to be defined by the ERP team.

Organizations that adopt ERP systems have multiple options when fitting or customizing the system to their business processes. Brehm et al. [37] discusses a typology of such ERP customization approaches, which consists of extended reporting, workflow programming, interface development, source code modification and user interface. However, they do not provide any guidelines or define a procedure for choosing feasible ERP customization choices, given the constraints and business requirements of the organization. Parthasarathy and Anbazhagan [19] apply AHP to the Luo and Strong's [1] framework to prioritize feasible customization choices. However, the strategy behind the assignment of values to the AHP is not discussed. Also, only small to midsize organization is considered in this study, which needs validation for large organizations.

During ERP implementation, various problems such as costs and reliability of the ERP arise which become unpredictable due to extensive customization. Along this line, Light [7] contends that the customized version of ERP may not support the future releases from the ERP vendor. He recommends the implementing organization to consider the factors such as perceived business benefits of packaged software and various social influences during the customization process; however, no guidelines are given to the ERP team.

Melao and Pidd [38] have proposed a conceptual framework for understanding business processes and business process models, which can be used for ERP customization. Robinson [39] has proposed a requirements monitoring framework for enterprise systems such as ERP and CRM. This framework provides real-time feedback on requirements satisfaction, and thereby provides visibility into requirements compliance of enterprise information systems. This framework can also support ERP system customization to some extent.

These findings from the past research studies are mostly buried under their focus on the managerial aspects of ERP. They do not identify facilitators and inhibitors to manage ERP customization, nor do they offer specific algorithms, methodology or models to help the implementing organization to carry out the customization phase successfully. Not much work has been done in the past to simplify the process of customization either. Also, no methods and models are in place for the ERP team to make a successful ERP implementation despite customization. This leaves a gap in the literature and provides motivation for our study.

We use Luo and Strong's framework for this study. This framework focuses on both business process and technical aspects of ERP and is more comprehensive than other available frameworks [37–39]. We apply two most widely used techniques namely the NGT and the AHP to this framework to prioritize the feasible customization choices available for the implementing organization and thus help the implementing organization in selecting an appropriate customization choice.

Table 1
Summary of ERP implementation issues.

Primary ERP implementation issues faced by the organization	Studies
Customization (business process customization, system customization, and business process re-engineering)	[2,6–10,13,18,19, 21–24,27–32,34,36,67–71]
Top management support	[58–61]
Project management	[10,32,36,58,62]
IT infrastructure	[10,59,60,62,63]
Change management	[27,61,62,65–67]
Risk management	[9,28,54,64]

3. ERP customization framework

The customization phase during ERP implementation is intended to achieve a close fit between the chosen ERP system and the business processes of the implementing organization. This is possible by either changing the ERP system to reflect the business processes of the organization, or, modifying the business processes to implement the chosen ERP system without any changes. Table 2 shows the ERP customization framework proposed by Luo and Strong [1]. In Table 2, the cell "No Customization" indicates the scenario where the organization's