



A fuzzy model to evaluate the suitability of installing an enterprise resource planning system

P.J. Sánchez^a, L. Martínez^{a,*}, C. García-Martínez^b, F. Herrera^c, E. Herrera-Viedma^c

^aDept. of Computer Science, University of Jaén, 23071 Jaén, Spain

^bDept. of Computer Science and Numerical Analysis, University of Córdoba, 14071 Córdoba, Spain

^cDept. of Computer Science and A.I., University of Granada, 18071 Granada, Spain

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ABSTRACT

The use of enterprise resource planning (ERP) as a foundation for the integration of the complete range of business processes and functions, is clearly useful and economically profitable in most very large organizations which manage a great deal of data in their information systems. However, the decision of installing an ERP system in all the companies is not always so clear, it will depend on the size, future profits and other features of the company. Therefore, different parameters (features, aspects) will be evaluated to make a decision about the suitability of the ERP system. These parameters might have different nature or the knowledge about them could be vague or imprecise. Thus, this implies that it would be suitable that the evaluation process can manage heterogeneous information. In this paper we shall present a fuzzy evaluation model to evaluate the suitability of an ERP system based on a multi-expert decision-making (ME-DM) process that is able to deal with heterogeneous information.

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1. Introduction

The information technologies (IT) have an enormous impact on the productivity of the organizations. Companies have implemented systems such as enterprise resource planning (ERP) [13,17,19,23], material resource planning [4], electronic data interchange [20], etc., for improving their productivity. However, ERP systems have received much more attention recently for their potential in more effective decision-making. The installation of the ERP systems in big companies has produced an optimization of the companies internal value chain and hence important advantages and profits. This success has induced to other companies to install these costly systems expecting similar successful results. However, the installation of an ERP system is always very complex, expensive and has a massive impact on the entire organization. Due to these reasons the installation of the ERP should be evaluated carefully in order to avoid unsuccessful results in its implementation [17,19]. The use of decision analysis techniques in evaluation processes has provided successful results [3,15].

Our aim is to present a fuzzy evaluation model that studies and manages different parameters of a company to support the decision of installing an ERP system. To do so, we propose:

- (1) **An evaluation scheme to study the suitability of an ERP system based on a multi-expert decision-making process:** We present a scheme that models our evaluation problem in a similar way to a decision-making process, where different experts provide their opinions and preferences about several parameters related to the implementation of an

* Corresponding author.

E-mail addresses: pedroj@ujaen.es (P.J. Sánchez), martin@ujaen.es (L. Martínez).

ERP in a company. Usually these parameters have different nature (qualitative or quantitative) and the knowledge about them are vague or imprecise. The use of the fuzzy logic provides tools to deal with this type of uncertain information [27–29].

- (2) **A fuzzy model for evaluating the suitability of an ERP system:** The experts provide their knowledge about different parameters that are involved in the study of the suitability of an ERP system by means of heterogeneous information and we shall then present an evaluation model able to deal with such a decision situation [9], in which quantitative parameters are assessed by numerical, interval-valued values and, qualitative ones are assessed by using the fuzzy linguistic approach [26] that has got successful results managing qualitative information [5,6,10,12,22,25].

We propose a resolution process for this evaluation model based on a classical decision-making resolution process [18], but slightly modified:

- (a) *Aggregation phase:* it obtains a collective value for each parameter, but as this model deals with heterogeneous information. This phase is a three-step process:
- (i) Make uniform the information: The heterogeneous input information is unified into fuzzy sets in a basic linguistic term set (BLTS) using different transformation functions [9].
 - (ii) Aggregation process: Once all the input information is expressed by fuzzy sets, this process obtains a collective value for each parameter by using an aggregation operator.
 - (iii) To facilitate the computation processes in the next phase and improve the comprehensibility of the results these fuzzy sets will be expressed by means of linguistic 2-tuples [7].
- (b) *Exploitation phase:* in an evaluation problem this phase computes a global measurement of the evaluated item. In our case, this phase will compute a suitability degree from the collective values obtained in the aggregation phase. This suitability degree will be used to make a decision regarding the installation of the ERP system.

This paper is structured as follows: in the Section 2 we shall make a brief introduction to enterprise resource planning systems and present the evaluation scheme to study the suitability of an ERP system dealing with heterogeneous information; in Section 3 we shall show a brief review of the fuzzy linguistic 2-tuple representation model that will be used during the evaluation process to deal with heterogeneous information; in the Section 4 we present the fuzzy evaluation model for studying the suitability of an ERP system; in the Section 5 we shall present an application of the fuzzy model. Eventually, some concluding remarks are pointed out.

2. Studying the suitability of an ERP system

In this section, we review the ERP systems and define the evaluation scheme based on an ME-DM problem to evaluate the suitability of an ERP system in a company.

2.1. Enterprise resource planning

An ERP system is a structured approach to optimize a company's internal value chain. The software, is fully installed across an entire enterprise, connects the components of the enterprise through logical transmissions and sharing common data with an integrated ERP. When data such as a sale becomes available at one point in the business, it courses its way through the software, which automatically calculates the effects of the transaction on other areas, such as manufacturing, inventory, procurement, invoicing, and booking the actual sale to the financial ledger [13,17,19,23].

What ERP really does organize, codify, and standardize an enterprise's business process and data. The software transforms transactional data into useful information and collates the data so that it can be analyzed. In this way, all the collected transactional data become information that companies can use to support their business decisions. When an ERP system is fully developed in a business organization, it can yield many benefits: reduce cycle time, enable faster information transactions, facilitate better financial management, lay groundwork for e-commerce, and make tacit knowledge explicit.

ERP software is not intrinsically strategic; rather, it is an enabling technology, a set of integrated software modules that make up the core engine of internal transaction processing. The installation of an ERP, implies a great investment, because of, requires major changes in the organizational, cultural and business processes. The most important changes are those referred to individual roles inside the organization. A lot of ERP products have forced the companies, to redesign their business processes for removing useless tasks and focusing the released employees in value added activities, increasing dramatically the company's productivity and hence its profits.

These improvements have produced that all world wide organizations and increasingly small- and medium-sized companies are interested in the installation of this type of product. However, the suitability of the ERP is not always profitable. Because ERP systems are very complex and have a massive impact on the entire organization. Implementing an ERP system is always very expensive and time consuming, furthermore the productivity and profits of the company can not increase dramatically in some cases, such as it could be expected. Therefore, before installing an ERP must be evaluated its suitability in each company, analyzing a set of parameters of the organization to decide the viability of the ERP implementation [13,14]. In

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