



# Fuzzy AHP-based decision support system for selecting ERP systems in textile industry by using balanced scorecard

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## ARTICLE INFO

**Keywords:**  
ERP system  
Fuzzy AHP  
Textile  
Balanced scorecard  
Request for proposal

## ABSTRACT

An enterprise resource planning system (ERP) is the information backbone of a company that integrates and automates all business operations. It is a critical issue to select the suitable ERP system which meets all the business strategies and the goals of the company. This study presents an approach to select a suitable ERP system for textile industry. Textile companies have some difficulties to implement ERP systems such as variant structure of products, production variety and unqualified human resources. At first, the vision and the strategies of the organization are checked by using balanced scorecard. According to the company's vision, strategies and KPIs, we can prepare a request for proposal. Then ERP packages that do not meet the requirements of the company are eliminated. After strategic management phase, the proposed methodology gives advice before ERP selection. The criteria were determined and then compared according to their importance. The rest ERP system solutions were selected to evaluate. An external evaluation team consisting of ERP consultants was assigned to select one of these solutions according to the predetermined criteria. In this study, the fuzzy analytic hierarchy process, a fuzzy extension of the multi-criteria decision-making technique AHP, was used to compare these ERP system solutions. The methodology was applied for a textile manufacturing company.

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## 1. Introduction

ERP systems are becoming more necessary for almost every firm to improve the competitiveness. According to the success of the implementation of ERP system; companies can obtain a competitive advantage in the global market rapidly. Over the past decade, many ERP projects have resulted in substantial tangible and intangible improvements in a variety of areas for the organizations (Davenport, 2000; Umble, Haft, & Umble, 2003; Yusuf, Gunasekaran, & Abthorpe, 2004). However, there are a number of examples where organizations were not successful in reaping the potential benefits that motivated them to make large investments in ERP implementations (Davenport, 2000; Umble et al., 2003).

Implementations of ERP systems are one of the most difficult investment projects because of the complexity, high cost and adaptation risks. Companies have spent billions of dollars and used numerous amounts of man-hours for installing elaborate ERP software systems (Yusuf et al., 2004). A successful ERP project involves selecting an ERP software system and co-operative vendor, implementing this system, managing business processes change and examining the practicality of the system (Wei & Wang, 2004). Karsak and Özogul (2009) presented a novel deci-

sion framework for ERP software selection, employing quality function deployment, fuzzy linear regression and zero-one goal programming. Teltumbde (2000) proposed a methodology based on the nominal group technique and the AHP for evaluating ERP systems. Chang et al. (2008) proposed a neural network evaluation model for ERP performance from SCM perspective. The survey data was gathered from a transnational textile firm in Taiwan (Table 4).

Determining the best ERP software that fits with the organizational necessity and criteria, is the first step of tedious implementation process. Hence, selecting a suitable ERP system is an extremely difficult and critical decision for managers. An unsuitable selection can significantly affect not only the success of the implementation but also performance of the company. However, many companies install their ERP systems hurriedly without fully understanding the implications for their business or the need for compatibility with overall organizational goals and strategies (Hicks & Stecke, 1995). The result of this hasty approach is failed projects or weak systems whose logic conflicts with organizational goals. This paper aims:

- to manage the early stages of ERP selection according to the vision and strategies by using balanced scorecard and
- to provide an analytical tool to select the most suitable ERP software for textile industry.

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Kumar, Maheshwari, and Kumar (2003) investigated the key considerations and successful strategies in ERP implementation projects. Byun (2001) explored the use of AHP for deciding on car purchase. Cebeci and Ruan (2007) investigated some quality consultants using fuzzy AHP. Wei, Chien, and Wang (2005) proposed a comprehensive framework for selecting a suitable ERP system based on an AHP-based decision analysis process. The AHP is one of the extensively used multi-criteria decision-making methods. One of the main advantages of this method is the relative ease with which it handles multiple criteria. In addition to this, AHP is easier to understand and it can effectively handle both qualitative and quantitative data. Perry, Sohal, and Rumpf (1999) described quick response supply chain alliances in the Australian textiles, clothing and footwear industry. Calisir, Kulak, and Dogan (2005) explored the influence of various factors on textile companies' satisfaction with ISO 9000. Chand, Hachey, Hunton, Owoso, and Vasudevan (2005) provided a balanced scorecard (BSC)-based framework for valuing the strategic contributions of an ERP system. This paper illustrates that an ERP system does indeed impact the business objectives of the firm. Eilat, Golany, and Shtub (2008) presented a multi-criteria approach for evaluating R&D projects by using the balanced scorecard and data envelopment analysis (DEA).

The organization of this paper is as follows. First textile and clothing industry and the case of Turkey are analyzed. Then the balanced scorecard method is explained and the proposed methodology is introduced. Fuzzy sets and fuzzy numbers are introduced because our comparison method, fuzzy AHP, includes fuzzy numbers and their fuzzy algebraic operations. Then, a comparison among ERP vendors is made by using fuzzy AHP for a textile firm as a real life case study.

## 2. Textile and clothing industry and the case of Turkey

The industrialization efforts of the sixties and seventies gave birth to the modern textile industry in Turkey. At the beginning, this sector operated as small workshops. In time the sector showed rapid development and during the seventies began exporting. Currently it is one of the most important sectors in the Turkish economy in terms of GDP, employment and exports. Turkey is one of the main actors in the world textile and clothing industry. The Turkish clothing industry is the fourth largest supplier in the world, and the second largest supplier in the EU. The Turkish textile industry is in the world's top ten exporters [[www.yarnsandfibers.com](http://www.yarnsandfibers.com)].

As a quality cotton-producing country, Turkey has an integrated and diversified production in all sub-sectors of the textile industry, produces and exports all types of yarn, fabric, clothing, household textiles and other ready-made products.

Today, the Turkish textile and clothing industry is aware of the trend in international markets towards increasing demand for healthier and more environmentally friendly products and tries to adapt it to these developments within legal and technical regulations.

Some major markets for Turkish clothing exports are Germany, the USA, the Russian Federation, the UK, France, the Netherlands and Poland [[www.igeme.org.tr](http://www.igeme.org.tr), 2005].

Textile industry means from cotton to textile, sewing. The textile industry has a great importance for Turkish export goods. The industry is facing a serious competition because of cheap workforce in some Far East countries, Pakistan and India. The textile companies in Turkey used to supply clothes that are ready to be used in sewing production, but nowadays most of them should first buy cotton (raw material), then they should send for thread production, after the clothes prepared, they are sent for dyeing;

at last the clothes for sewing are ready. Although processes are more complicated, the costs are cheaper in this way. Even some big firms prefer the outsourcing of sewing, especially after the cutting the clothes. As a result, the supply chain management concept becomes more important. To select and implement a suitable ERP system are vital for the textile industry.

## 3. The balanced scorecard

Many companies have mission statements and visions, which are translated into business strategies. However, often these strategies never fully implemented in the organization. The balanced scorecard is a tool that can help translate visions and strategies into an integrated set of performance and action. Kaplan and Norton (1992) introduced. The balanced scorecard concept as a strategic performance management system. Kaplan and Norton (1996) define balanced scorecard concept as follows:

“The balanced scorecard retains traditional financial measures. But financial measures tell the story of past events, an adequate story for industrial age companies for which investments in long-term capabilities and customer relationships were not critical for success. These financial measures are inadequate, however, for guiding and evaluating the journey that information age companies must make to create future value through investment in customers, suppliers, employees, processes, technology, and innovation.”

A strategic planning study such as balanced scorecard is very useful from vision to action. Kaplan and Norton (1996) state that “the balanced scorecard translates an organization's mission, vision and strategy into a comprehensive set of performance measures and provides the framework for strategic measurement and management”. The balanced scorecard concept measures organizational performance across four balanced perspectives: financial perspective, customer perspective, internal business perspective and learning and growth perspective. They state that balanced scorecard tells you the knowledge, skills and systems that your employees will need (learning and growth perspective) to innovate and build the right strategic capabilities and efficiencies (internal processes perspective) that deliver specific value to the market (customer perspective) which will eventually lead to higher shareholder value (financial perspective) (Fig. 1).

Financial perspective: financial objectives serve as the focus for the objectives and measures of the other three perspectives. Every measure should be part of a cause-and-effect relationship culminating in long-term, sustainable financial performance. Customer perspective: financial success is closely linked to customer satisfaction. Satisfied customers mean repeat business, referrals and new business, and thereby contribute to the financial results of the company. Internal operations perspective: customer satisfaction is directly achieved through the operational activities of the company. The objectives and measures for this perspective thus enable a company to focus on maintaining and improving the performance of processes that deliver the established objectives that are key to satisfying customers, which in turn satisfy shareholders. Learning and growth perspective: the ability, flexibility and motivation of staff support all of the financial results, customer satisfaction and operational activities measured in the other three quadrants of the balanced scorecard.

The balanced scorecard shows how the overall strategic objectives are translated into the performance drivers that the company has identified as critical success factors. The performance drivers are translated into more tangible measures that allow the company to quantify the performance drivers. Measurements should continue over time allowing comparisons.

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