ERP SYSTEM SELECTION BY AHP METHOD: CASE STUDY FROM TURKEY

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─Abstract ─

An Enterprise Resource Planning (ERP) system is a critical investment that can significantly affect competitiveness of a corporate in the future. There are many national and international ERP vendors in Turkey. This study presents a comprehensive framework for selecting a suitable ERP system by using Analytic Hierarchy Process (AHP). AHP method, directs how to determine the priority of a set of alternatives and the relative importance of attributes in a multiple criteria decision-making problem. The framework can systematically construct the objectives of an ERP selection to support the business goals and strategies of an enterprise. A real-world case from Turkey demonstrates the feasibility of the proposed framework.

Key Words: *Enterprise Resource Planning (ERP), Decision analysis; Analytic hierarchy process (AHP), Multi criteria decision-making (MCDM)*

JEL Classification: M15, L23.

1. INTRODUCTION

Since markets become more competitive, organizations seek new business opportunities to enhance their competitiveness. Often, organizations focus on improving their agility, such as the speed at which they can respond to consumers, improve service, enhance product quality and improve production efficiency. It is commonly accepted that information technology should be used to fundamentally change the business (Davenport, 2000). Many organizations, therefore, seek to improve their competitiveness by utilizing advanced information technology, such as Enterprise Resource Planning (ERP) systems.

ERP systems have been considered an important development in the corporate use of information technology in the 1990s, enhancing organizational cross-functional efficiency and effectiveness through the seamless integration of all the information flowing through a company (Davenport, 1998).

ERP is the business backbone. It is a cross-functional enterprise system that integrates and automates many of the internal business processes of a company, particularly those within the manufacturing, logistics, distribution, accounting, finance, and human resource functions of the business. Thus, ERP serves as the vital backbone information system of the enterprise, helping a company achieve the efficiency, agility, and responsiveness required to succeed in a dynamic business environment (Davenport, 1998). ERP software typically consists of integrated modules that give a company a real-time cross-functional view of its core business processes, such as production, order processing, and sales, and its resources, such as cash, raw materials, production capacity, and people. However, properly implementing ERP systems is a difficult and costly process that has caused serious business losses for some companies, which underestimated the planning, development, and training that were necessary to reengineer their business processes to accommodate their new ERP systems. However, continuing developments in ERP software, including Web-enabled modules and e-business software suites, have made ERP more flexible and user-friendly, as well as extending it outward to a company's business partners (Mabert et all, 2000). Therefore, no body could imagine a modern enterprise without ERP.

2. ERP IMPLEMENTAION

ERP selection is the milestone of the ERP implementation. Before implementation, objectives should be clear in order to select the convenient ERP

software. There are many studies in the literature about ERP implementations. One of the most popular is Umble et al, critical success factor that Umble et all (Umble, 2003) had declared as:

- Clear understanding of strategic goals
- Commitment by top management
- Excellent project management
- Organizational change management
- A great implementation team
- Data accuracy
- Extensive education and training
- Focused performance measures
- Multi-site issues

Based on the preceding review of the literature and also on the research by Bingi et al, 1999; Akkermans and van Helden, 2002; Grabski, Stewart, and Leech 2007 developed a list of ERP implementation controls and agreed on Umble's critical success factor.

As it is seen from the literature review, ERP selection and implementation have a grift relation. Therefore, critical success factors are the boundary conditions for implementation and so selection.

3. ERP SELECTION

In the Wei and Wang (2004) several methods have been proposed for selecting a suitable ERP system Teltumde A. et al., (2000); Ptak CA. et al., (2000); Chen k. et al., (1998); Lee JW. Et al., (2001); Badri MA., et al., (2001). The scoring method is one of the most popular. Although it is intuitively simple, it does not ensure resource feasibility. Teltumde suggested 10 criteria for evaluating ERP projects and constructed a framework based on the Nominal Group Technique (NGT) and the analytic hierarchy process (AHP) to make the final choice. Santhanam and Kyparisis (1995-96), proposed a nonlinear programming model to optimize resource allocation and the interaction of factors; their model considered interdependencies of criteria in the information system selection process. Lee and Kim (2001) combined the analytic network process (ANP) and a 0–1 goal-

programming model to select an information system. However, these mathematical programming methods can not contain sufficient detailed attributes, above all, which are not easy to quantify, so that the attributes were restricted to some financial factors, such as costs and benefits. Furthermore, many of them involved only the consideration of internal managers, but do not offer a comprehensive process for combining evaluations of different data sources to select an ERP project objectively.

Wei and Wang (2004) stated clearly that; a successful ERP project involves selecting an ERP software system and vendor, implementing this system, managing business processes, and examining the practicality of the system. However, a wrong ERP project selection would either fail the project or weaken the system to an adverse impact on company performance (Wilson et al 1994, Hicks and Stecke 1995)

It is obvious that one firm organization needs some metrics in order to choose the right ERP and its implemetor. Thus decision needs some tools. Wei, Chien and Wang (2005) introduced AHP based approach to ERP system selection.

The AHP method, introduced by Saaty (1980), directs how to determine the priority of a set of alternatives and the relative importance of attributes in a multiple criteria decision-making problem, and has been widely discussed in various aspects. For example, Schniederjans and Wilson (1991) utilized the AHP method to determine the relative weights of attributes and applied these weights to a goal programming model for Information System selection. Lai et al. (1999) conducted a case study to select a multimedia authoring system using the AHP method. Teltumbde (2000) proposed a framework based on the Nominal Group Technique and AHP to select an ERP system. His study focused on the elaboration of some common criteria for ERP evaluation.. In the study of Wei, Chien and Wang (2005), a systematic procedure is proposed to construct the objective structure taking into account company strategies and thus extract the associated attributes for evaluating ERP systems. Their study uses the analytical framework of AHP to synthesize decision makers' tangible and intangible measures with respect to numerous competing objectives inherent in ERP system selection and facilitates the group decision-making process.

Wei, Chien and Wang (2005) developed a Procedure for selecting a suitable ERP system. it has seven steps, they are as follows:

Step 1. Form a project team and collect all possible information about ERP vendors and systems.

Step 2. Identify the ERP system characteristics.

Step 3. Construct a structure of objectives to develop the fundamental-objective hierarchy and means-objective network.

Step 4. Extract the attributes for evaluating ERP systems from the structure of objectives.

Step 5. Filter out unqualified vendors by asking specific questions, which are formulated according to the system requirements.

Step 6. Evaluate the ERP systems using the AHP method.

Step 7. Discuss the results and make the final decision.

4. MATERIALS AND METHODS

Multi criteria decision-making (MCDM) is a modeling and methodological tool for dealing with the complex engineering problems. Multi-attribute decision-making (MADM) is the most well known branch of decision-making. It is a branch of a general class of operations research models that deal with the decision-making problems under the presence of a number of decision making criteria. The MADM approach requires the selection to be made among decision alternatives described by their attributes. MADM problems are assumed to have predetermined, and limited number of decision alternatives. Solving a MADM problem involves sorting and ranking.

The AHP is a well-known method for solving decision-making problems. AHP is one of the most widely used multi-attribute decision-making (MADM) methods. In this method, the decision-maker (DM) performs pair-wise comparisons, and, the pair-wise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative.

5. CASE STUDY

In this study, following the AHP methodology, paired comparisons of the alternatives on each attribute converted to a numerical scale of 1–9. The software Expert Choice was then used to determine the normalized weights and synthesize the results. Hierarchical categorization of the problem is shown in Figure 1.

Table 1 lists the comparison matrices of decision maker for system software. As shown in Table 2, system A was the best choice for the company.

Figure-1: Decomposition of the Problem into a Hierarchy

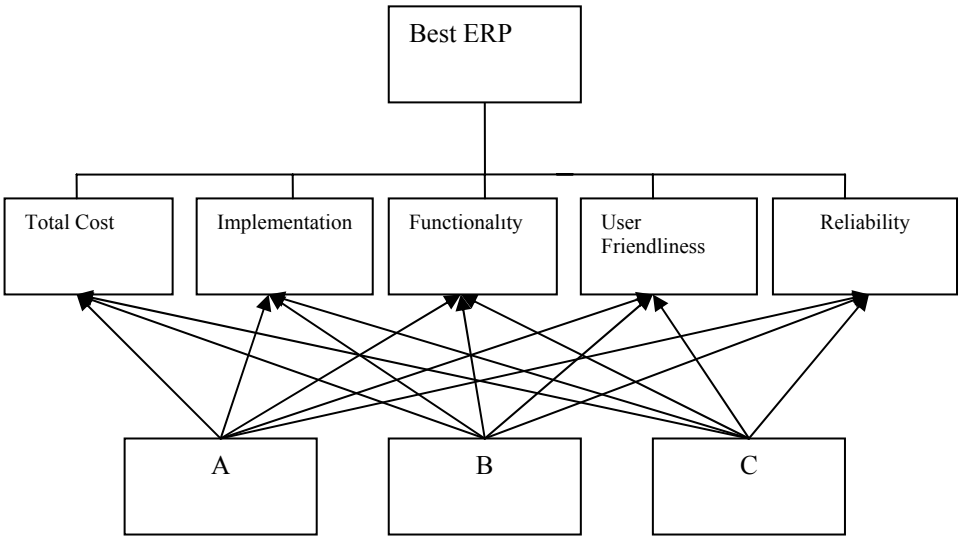

Table 1: Comparison judgment matrices (decision maker)

	Total costs	Implementation time	Functionality	User-friendliness	Reliability
Total costs	1	1/3	5	1/5	3
Implementation time	3	1	7	3	5
Functionality	1/5	1/7	1	1/5	1/3
User-friendliness	5	1/3	5	1	3

Reliability	1/3	1/5	3	1/3	1

Total costs	System A	System B	System C
System A	1	1/5	1/3
System B	5	1	3
System C	3	3	1

Implementation time	System A	System B	System C
System A	1	5	3
System B	1/5	1	3
System C	1/3	1/3	1

Functionality	System A	System B	System C
System A	1	1/9	1/3
System B	9	1	5
System C	3	1/5	1

User-friendliness	System A	System B	System C
System A	1	3	5
System B	1/3	1	3
System C	1/5	1/3	1

Reliability	System A	System B	System C
System A	1	1/9	1/5
System B	9	1	5
System C	5	1/5	1

Table 2: Results of AHP analysis

Alternative	Score
System A	0.48398
System B	0.38412
System C	0.13159

Throughout the evaluation process, the consistency index (CI) and consistency ratio (CR) of each decision maker paired comparison matrix should be less than the threshold value 0.1 (Saaty, 1980) to ensure that the decision maker was consistent in assigning paired comparisons.

As shown in Table 2, the project team thus achieved sufficient agreement to choose System A.

5. CONCLUSION

This study presents a comprehensive framework for selecting a suitable ERP system based on an AHP-based decision analysis process. The proposed procedure allows a company to identify the elements of ERP system selection and formulate the fundamental-objective hierarchy and means objective network. The pertinent attributes for evaluating a variety of ERP systems and vendors can be derived according to the structure of objectives

The proposed comprehensive ERP system selection framework has some advantages like: ensuring that the structure of objectives is consistent with corporate goals and strategies, the proposed framework can accelerate the reaching of consensus among multiple decision makers. It can not only reduce costs during the selection phase, but also mitigate the resistance and invisible costs in the implementation stage.

In this research because of confidentiality the ERP vendors' exact names are hidden. As a result AHP is a reliable and practical tool in MCDM in ERP selection. None of the voters did not claim anything negative about the selection process. They could realize their selection by using parameters of ; total costs, implementation time, functionality, user-friendliness and reliability.

For further studies in this topic it is possible to make the decision by using Fuzzy AHP and compare with AHP.

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