

ERP SELECTION USING EXPERT CHOICE SOFTWARE

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Summary: *Usage of enterprise applications is becoming widespread every day and Enterprise Resource Planning (ERP) systems are among these applications. ERPs are preferred because of their organization-wide information sharing capability, component-based structure and capability to be integrated with other systems. Choosing which ERP to use is a complex decision that has significant economic consequences, thus it requires a multi-criterion approach. Analytic hierarchy process (AHP) is a method widely used for this kind of complex decision-making problems. In this paper, a multi-attribute ERP selection decision model is introduced, based on the AHP methodology. The model is illustrated with an example and managerial implications are discussed. Based on the AHP, Expert Choice (EC) is a decision support software that reduces complex decisions to a series of pair wise comparisons and then synthesizing the results. In this study, EC is used to perform the ERP selection procedure, provided the objectives and criteria.*

1. Introduction

Computer-based information systems cover every sphere of management. They are pointers of a new 'Information Age', where information is a key organizational resource, and where management activities become more information-intensive. Enterprise applications are used widely in every sector and become more widespread every day.

An enterprise resource planning (ERP) is one of these enterprise applications, which involves all departments of an organization and is the backbone of the enterprise. Since it has a long and problematic implementation process, and is a very expensive investment, it is important to make a healthy selection about which ERP fits the organization the most.

ERP selection process involves identifying criteria and their relative weights, and evaluating the alternatives. AHP methodology overcomes such an evaluation process using a hierarchical structure for prioritizing objectives.

This paper focuses on an ERP selection problem using AHP methodology with the use of Expert Choice Software. In the following section, the ERP selection criteria are discussed while introducing two alternatives used in our model, SAP and Axapta. After structuring the problem, it is solved with the Expert Choice software. Sensitivity analysis is included and three different user perspectives to the solution are presented in the conclusion.

It is important to note that usage of this methodology is not restricted to software selection; it can be used for various multi-attribute decision problems.

2. ERP Selection Process

2.1 ERP Selection Criteria

An ERP system is the information backbone of an organization and reaches into all areas of the business and value-chain. Thus, long-term business strategy of the organization will form the basis of the selection criteria of an ERP system.

The selection of the most appropriate solution is a semi-structured decision problem because only a part of it can be handled by a definite or accepted procedure such as standard investment calculations and on the other hand the decision maker needs to judge and evaluate all relevant business impact aspects. There is no agreed-upon and formal procedure for this important task (Laudon and Laudon, 1998; Hecht, 1997).

The modules that an ERP offers, are the most important selection reasons; varying according to the needs of the organization. In this paper, it is assumed that the decision-maker has gone through the module selection process, has found very similar applications on modular design, and thus eliminated modules according to preference. And, there remain the following criteria, which are listed in order of priority;

- *Customization*: Since different organizations need different software, they need to adapt the available software in the market for their own use. But, customizations shouldn't cause difficulties in updating to future software releases.
- *Implementability*: Different ERPs have different requirements, thus it is important to choose an implementable one. If the organization ventures infrastructural change, the feasibility problem this change may cause shouldn't be disregarded.
- *Maintenance*: The software should support multi-company, multi-division and multi-currency environments. There shouldn't be any restrictions to this type of environment so that whenever an add-on procedure or a patch is available, it can be updated immediately.
- *Real Time Changes*: The modules should work in real time with online and batch-processing capabilities, so that no errors would occur because of the system being not up-to-date and information available to a department wouldn't be different than the other department's.
- *Flexibility*: Flexibility denotes the capability of the system to support the needs of the business over its lifetime.¹ As the business requirements of the organization change, it should be able to add extra modules. The ERP should be flexible in order to suit the organizational culture and business strategy.
- *User Friendliness*: Most of the time, the end-users of an ERP system are not computer experts, thus their opinions about the software are highly valuable. The product shouldn't be too complex or sophisticated for an average user since the efficiency of end users directly affects the efficiency of the organization.
- *Cost*: Cost is an important issue since the implementing organization may be a small or medium sized enterprise (SME) that may not act as comfortable as a large, multi-national organization. ERPs are generally complex systems involving high cost, so the software should be among the edges of the foreseen budget.
- *Systems Requirements*: Technology determines the longevity of the product.² It is important to choose an ERP that is independent of hardware, operating system and database systems. At

¹ Teltumbde A., 2000.

² Teltumbde A., 2000.

least, the requirements of the software should worth changing into. The ERP system design should also not conflict with the organization's business strategy.

- *After Sales Support & Training:* The vendor should be providing the training as well as the after sales support, since ERPs are fairly complex applications for learning by oneself. Also it should be considered that every department within the organization would have its own piece of software to use, so a kind of specialized training will be needed for each department.
- *Back-up System:* To obtain the security for highly complex systems with huge databases, providing a very well-formed network is not enough; the back-up unit of the system should be more than reliable. Users should be able to schedule routine and partly back-ups. Besides, the back-up unit should also offer a solution for restoring the system within the shortest time.
- *Reporting & Analysis Features:* Besides standard reports, management team should be able to implement their own reporting and analysis tools and dump them into the system for alter use.
- *Vendor Credentials:* Vendor's market share, reputation, number of consultants, number of installations performed, support infrastructure and demonstration of previous implementations are critical factors showing the commitment of the vendor to the product.
- *Integration with Other Software/Applications:* The modules should be integrated and provide seamless data flow among the other modules, increasing operational transparency . In case a third party application is needed, the ERP should be available to exchange data with the application, since data import/export is widely used techniques.
- *Internet Integration:* The software should support e-business, e-commerce and EDI transactions. At least, even if it doesn't have as built-in modules, Internet adaptation should be available as add-on modules.
- *Financing Options:* 'Financing options' may not be a technical criterion, but it is very important for an organization how to pay for the investment and how long pay for it.

2.2 Challenger ERP vs. Defender ERP

Applying the AHP methodology onto an ERP selection process means evaluating alternative software with respect to previously determined criteria. In this project, it is assumed that the decision maker has studied many ERPs and eliminated them until two left; SAP and Microsoft Axapta. Another assumption is that the selecting organization is not a small or medium-sized, but a large enterprise with the end users greater than or equal to 250. SAP is chosen as the defender, since it is the most popular ERP among all, and the most experienced one. Founded in 1972, SAP is the world's largest inter-enterprise software company, and third-largest independent software supplier.³ The most competitive solution that SAP offers as a whole is named "mySAP Business Suite". It includes modules for Customer Relationship Management, Supply Chain Management, Supplier Relationship Management, Product Lifecycle Management and mySAP ERP, which includes the core business functions grouped under sub-modules financials, corporate services, operations, human capital management and analytics.

Axapta is chosen as the challenger because of its fast development during last few years and effective entry into the markets. In December 2000, Navision Software, merged with its Danish rival Damgaard. Then, Microsoft bought the whole and put forward Axapta as the business solution for large enterprises. Axapta's main power is its integration capability with widely used Microsoft products, reducing the training costs. Its main modules are Analytics, Customization, Distribution, E-commerce, Foundation, Human Resources Management, Manufacturing, Supply Chain Management, Project Management and Sales & Marketing.

³ SAP web site. <http://www.sap.com> [online]

3. Problem Structuring and Solution

3.1 Criteria Grouping and Prioritization

For the sake of ordering, it is useful to group the previously stated selection criteria under 3 titles; technology-related, user-related and vendor-related. These three main objectives with their related sub-objectives, can be seen in figure 3.1.

In fact, the user-related criteria can also be listed under the technology-related title since technology-related criteria can affect the user friendliness of the system. But It is better to make a distinction between these two titles; for example system requirements or real-time changes criteria are not directly user-related but have serious technological background, or, although the flexibility or integration with third party applications features have technological requirements, their aim is to easy the use of the whole system for the users, thus they have a direct effect as user-related criteria.

A second point is that the cost-related title also includes the vendor-related criteria. It is needless to form a fourth group since any factor of the vendor influences the total cost of the system; so there is no misleading in taking cost-related criteria as vendor-related.

During the rest of the paper, these three groups and their related sub-criteria will be used. Please note that these criteria are grouped according to personal opinions improved by the previous studies, and are subject to change from person to person, according to the point of view.

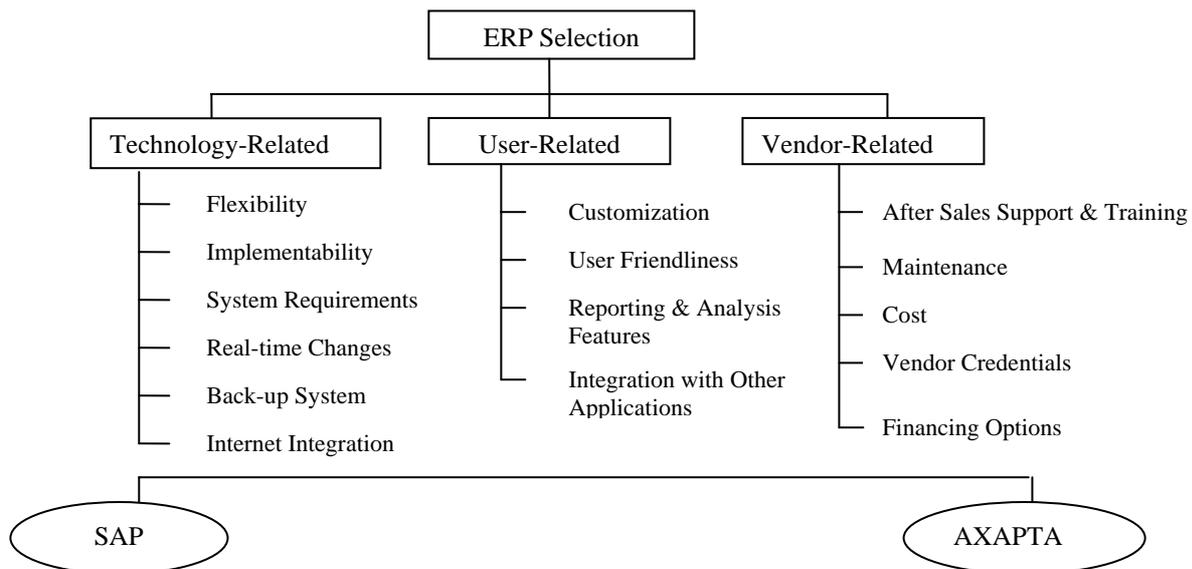


FIGURE 3.1 Tree Structure of ERP Selection Problem

3.2 Solution With Expert Choice

In order to solve the “ERP Selection” problem with Expert Choice (EC) software, we need to structure the hierarchy first. While building the hierarchy tree, including more than nine elements in any objective group is not considered since it is cognitively challenging for humans to evaluate more than nine factors at a time. Once the model is built, the next step is to evaluate the elements by making pair wise comparisons.

Since judgments about the relative importance of the objectives may depend on the alternatives being considered, it is most appropriate to make a judgment from the “bottom up”, which is first for the

alternatives with respect to the sub-objectives, then for the sub-objectives with respect to the objectives, and then for the objectives with respect to the goal. Only one example per level is demonstrated below.

Flexibility	SAP	Axapta
SAP	1	1/4
Axapta	4	1

TABLE 3.1 Pair wise comparison of alternatives with respect to the sub-objective “flexibility”

The judgment value pointed to 4 on the third row - second column, means that Axapta is 4 times more flexible than SAP, according to the decision maker. Next, sub-objectives are compared with respect to the objectives.

Technology Related Sub-objectives	Flexibility	Implementability	System Requirements	Real-time Changes	Back-up Systems	Internet
Flexibility	1	2	3	5	7	9
Implementability	1/2	1	2	4	6	8
System Requirements	1/3	1/2	1	2	5	7
Real-time Changes	1/5	1/4	1/2	1	2	4
Back-up Systems	1/7	1/6	1/5	1/2	1	2
Internet	1/9	1/2	1/7	1/4	1/2	1

TABLE 3.2 Pair wise comparison of sub-objectives of the objective “technology-related”

After completing the same step for each objective, comparison of the objectives with respect to the goal remains.

Objectives	Technology-related	User-related	Vendor-related
Technology-related	1	1/8	1/3
User-related	8	1	4
Vendor-related	3	1/4	1

TABLE 3.3 Pair wise comparison of main objectives with respect to the goal

Expert Choice first calculates the local, and then the global weights of each objective and sub-objective, according to the AHP methodology. The final situation is seen in the figure 3.2; the most important objective is the User Related one, followed by the Vendor Related and then the Technology Related objectives. The values in parentheses next to the criteria indicate their global weights, reached after the final calculations.

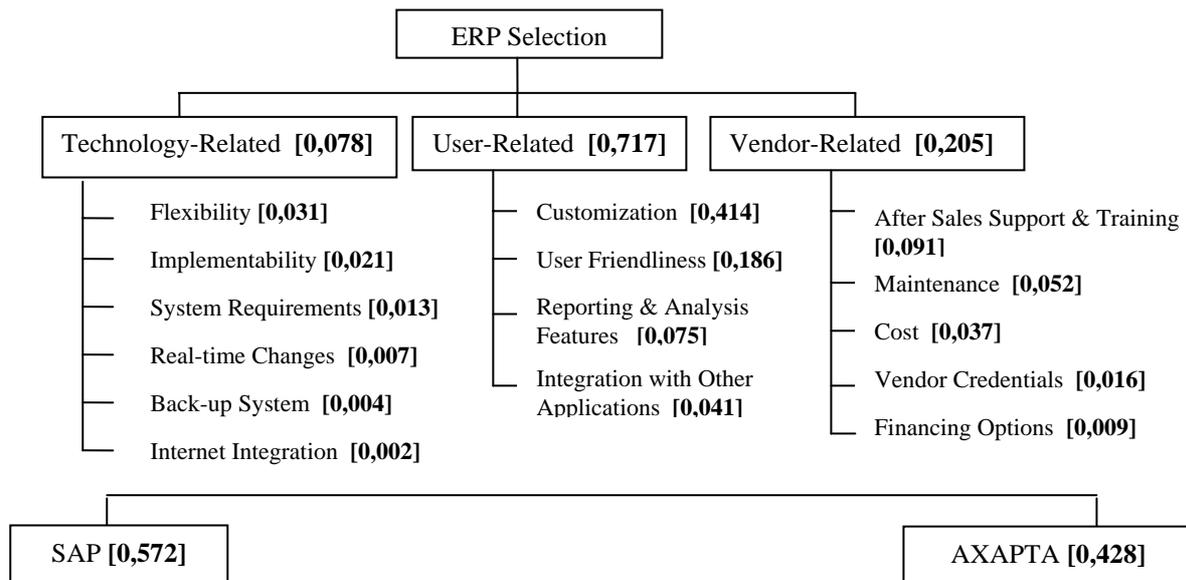


FIGURE 3.2 Tree Structure of ERP Selection Problem – Solved

It is clear from the above figure that; SAP has a weight of 0,572 whereas Axapta has 0,428. But, since this is only an example, one should not infer from this in anyway that SAP is better than Axapta. Since all variables are chosen randomly, it could have been just the opposite.

According to the above results, the most appropriate ERP software that should be selected according to the listed criteria and relative judgments, is SAP.

3.3 Sensitivity Analysis

In any definition of sensitivity analysis, the core theme is to investigate the effect of input variables on the output variables. Sensitivity analysis can be used to see if the small variations in the weights would change the decision. If not, we would be reassured that our choice was reasonable.

After making judgments about the relative importance of objectives, sub-objectives and alternatives, Expert Choice’s sensitivity graphs were used to test the possible changes in the decision. There are five different graphical modes of Expert Choice and each of them provides a different viewpoint to sensitivity analysis. Under any of these five modes, the user can easily manipulate criterion priorities and immediately see the impact of the change over the result.

Let’s examine the sensitivity analysis in cases, where the priorities of objectives are changed;

- The technology-related objective has approximately 0,1 priority; if it is raised to 0,4 or above, the overall priorities of alternatives change and Axapta becomes more preferable.
- If the vendor-related objective, which has an approximately 0,2 priority, is raised up to almost 0.8 priority, the result of the decision dramatically changes and Axapta becomes a better choice.
- Like the vendor-related case, changes in the user-related objective priority may change the result of the problem. Although the given priority to user-related criterion is nearly 0,7, when it is reduced to a value below 0,35, again Axapta turns to be a better choice.

Since given weights may vary from person to person, each individual in an organization may respond differently to this selection problem. The weights assigned above were all personal ideas upon the subject, even though they were designated to be as realistic as possible. Now, let’s examine 3 different positions in a producing organization and how they may solve our example problem.

3.3.1 Production Manager Perspective

Assuming that a production manager focuses on effectiveness and efficiency of the product, an ERP software to be implemented should provide better productivity to the production department by better management of capacity, producer goods and duration of implementation. So, what he prioritizes would be the technological and user-related aspects of the software. Relatively, the weights he would assign to the objectives would be as in figure 3.3.

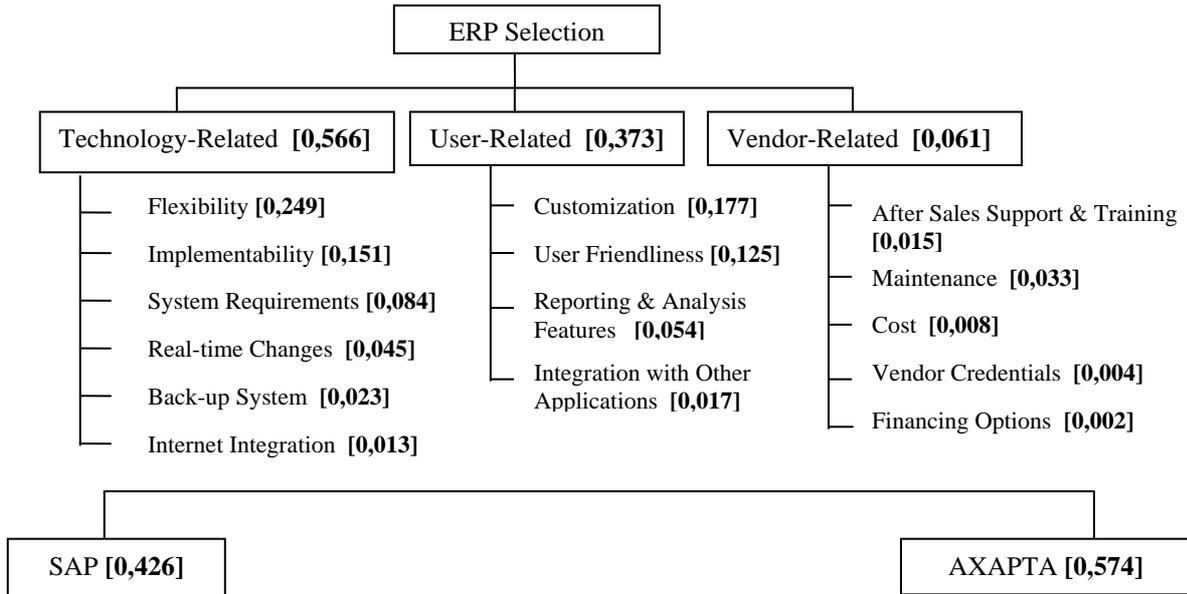


FIGURE 3.3 Problem Hierarchy – as a Product Manager

Axapta is the to-be-selected software, but when we look at the sensitivity analysis, we can see that the user-related and technology-related objectives can change the result. If the weight of user-related is increased above 0,7 or the weight of technology-related is decreased below 0,2, SAP becomes the leading ERP.

3.3.2 Financial Manager Perspective

If we look from the financial manager perspective, in the same manner as the product manager's, the weights should be revised. Because, a financial manager would try to reduce any costs, minimize the amount of money to be spent for software and decrease the time spent for implementation, in order to increase time for work. The weights that a financial manager would assign to our criteria can be seen in figure 3.4. The result shows that Axapta would be financial manager's choice, since his priorities are money related subjects.

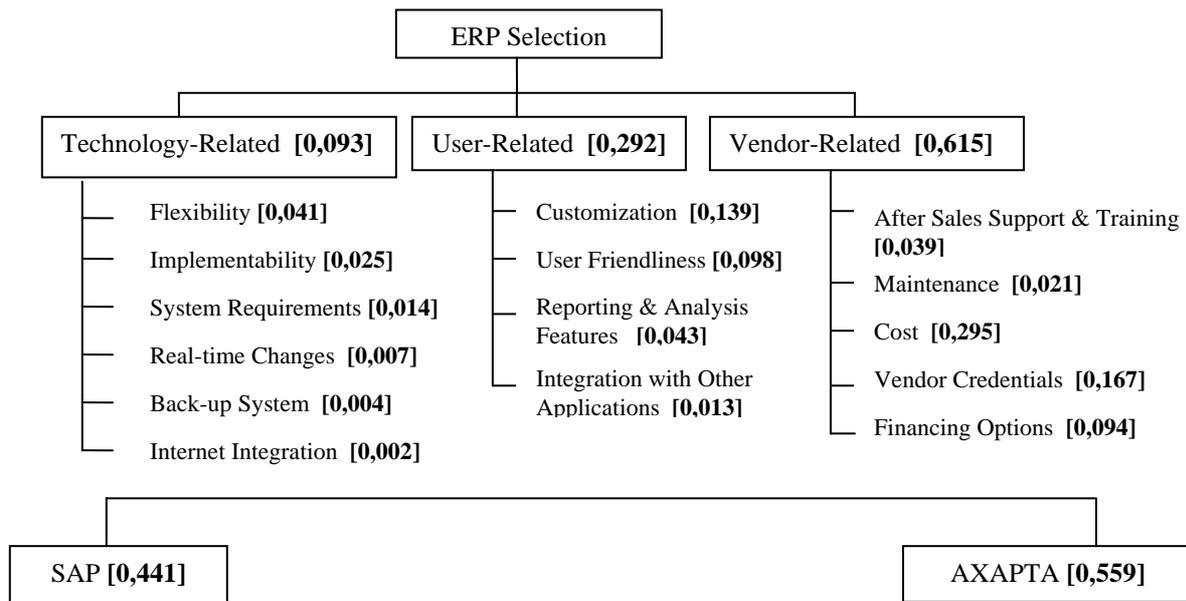


FIGURE 3.4 Problem Hierarchy – as a Financial Manager

However, sensitivity analysis shows that if the financial manager increases the weight of user-related objective up to 0,6 and above, i.e., gives more importance to the user-related criteria, or decrease the weight of technology-related objective down to 0,1 and below, i.e., gives less importance to the technology-related criteria, SAP becomes the decision result.

3.3.3 End User Perspective

What an end user demands from an ERP is an easy-to-use and easy-to-learn software. So, the criteria would be shaped according to the user's needs. The related priorities would be as follows in figure 3.5;

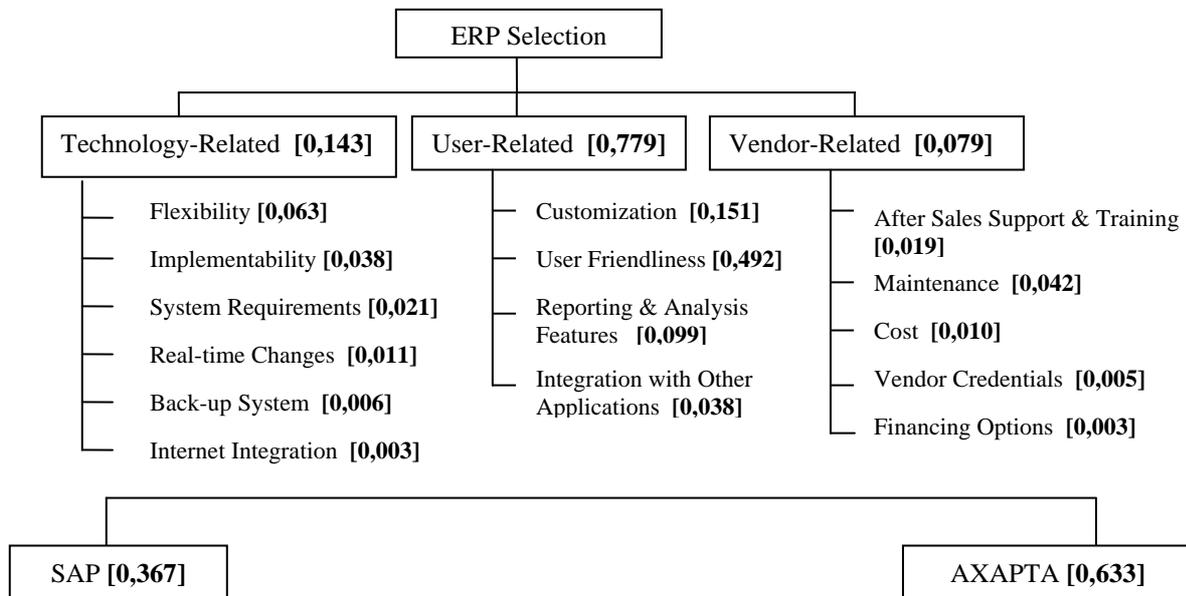


FIGURE 3.5 Problem Hierarchy – as an End User

The sensitivity analysis wouldn't change the leadership of Axapta in any means; moreover, weights given by an end user increased the difference between the final points of SAP and Axapta.

The number of these examples can be increased; any other departments' managers or even the Board of Trustees can make a choice using Expert Choice, according to their priorities. The point is, the whole decision making process is subjective and the result is about to change since priorities always shaped with the personal point of view & experiences.

4. Conclusion

AHP is a decision-making methodology for multi-attribute and multi-alternative problems. Thus, it is mostly appropriate to use this methodology during a software selection process, which is a structured decision making problem, especially for complex software systems like ERPs. However, usage of AHP is not limited to software selection; it can be applied to a wide range of decision-making problems with multi-attributes and alternatives. Although the result may differ according to the view point (since decisions are subjective by their nature) mechanism of the methodology is the same.

In this paper, Expert Choice software was used to structure and solve the problem. Using sensitivity analysis functionality of the software, three different decision maker perspectives were discussed in order to show how different positions may change the result, in spite of using the same criteria.

There are a few important points to underline: this project is neither about which ERP is better, nor about how good Expert Choice (EC) is. The aim is to prompt people to use the AHP methodology. The reason preferring EC for this project is that it is the first software developed for AHP applications and is among the best commercial software for multi-attribute decision making. Previous experiences and trainings on SAP and Axapta, canalized the author to select them as alternatives, and it doesn't imply any other meaning.

The criteria chosen mostly depends on academic researches but the weights assigned are personal points of view; any other person could have reached a totally different result by assigning different weights to criteria & sub-criteria. Although the method is the same, results may change.

Finally, the aim of this paper was to show that the systematic approach of AHP is applicable to any kind of decision making problem. It is practical and easy-to-learn and the methodology can reassure users about reasonable results.

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