

# A WEB APPLICATION FOR EVALUATING IT INVESTMENTS

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## KEYWORDS

IT investments, IT ROI, AHP, ASP

## ABSTRACT

For many managers, planning and evaluating IT investments causes daily problems. To be able to plan capital expenditures into information technology, the decision makers need the methodology and analytical tools that enable them to evaluate and compare different decision possibilities.

In this paper, an interactive web application will be described as a decision supporting analytical tool, through which a manager can evaluate and compare different IT related investment projects. When dealing with the criteria describing the different investment alternatives, one can use two types of values: quantitative values, i.e. those measurable by money (profits, expenses) and qualitative or “soft” benefits, those that do not have standard measurement scales (quality, reliability etc.).

In developing the model, the Analytical Hierarchy Process (AHP), also called the Saaty Method after its author, is used as the theoretical base. The application is developed using the technology of MS Active Server Pages, as well as the programming language VBScript. It is assumed that a web browser will be used as the user interface.

The usage of the analytical tool described in this paper provides a manager with subjective and objective input values and that makes it possible for him/her to reach an objective investment decision.

## INTRODUCTION

In the world that is technologically developing very fast, managers have the task of making decisions which in best circumstances are in accordance with the goals of the company, as well as with new challenges. Information technology, which not long

ago served mainly the purpose of decreasing costs and work time or had other operative goals, has by today changed into a strategic instrument for many companies. Similar to planning other capital expenditures, the goal of IT investments is to choose the most optimal alternative.

IT investments can by their nature be divided into operative and strategic IT investments. Operative IT investments are projects where the help of information technology is used to guarantee the functionality of basic business processes: accountancy, communication, production management etc. Strategic IT investments, on the other hand, are implemented to create new values: new web applications, automated sales systems, electronic banking – solutions which lead to increase in product range, in market share and improvement of company image, etc.

When deciding in matters of operative IT investments, one usually has quantitative, numerically evaluated criteria at his/her use: savings, effectiveness, decrease of work time etc. When evaluating such investments, generally recognized profitability or cost analysis methods (NPV, TCO etc.) can be used, as well as generally recognized tools. Such combination enables one to reach a well-justified decision. Dealing with strategic IT investments is more complicated and that for several reasons:

- Criteria dictating the decision could be quantitative (economical, monetary), as well as qualitative (image, quality, job security, client satisfaction, etc.)
- There is usually more than one criterion describing different alternatives.
- There is no generally known methodology or effective tools for evaluating strategic IT investments.

## PROBLEM OF QUANTITATIVE BENEFITS

As mentioned, the evaluation of IT investments is made more difficult by the fact that assessed alternatives can be characterized by quantitative, as



well as by qualitative benefits. Unfortunately, a standard measuring system exists only for economical values: ones describable by currency, work hours or profitability percentages. For the evaluation of other, not less important values, there is no universal scale. It is impossible to place the turnover of lats and of "client satisfaction" to the same scale.

"Not everything that counts can be measured and not everything that can be measured counts" – Albert Einstein.

What is a manager's actual goal when making decisions about IT investments? It is probable the goal is not always tied to the economical parameters of the different alternatives (ROI or NPV etc.), but choosing one specific alternative or a decision which in best circumstance corresponds to set goals and possibilities. In the simplest case, one could assess two alternatives where one is not accepting the alternative - the *do nothing* alternative.

The author thinks that when evaluating strategic IT investments, managers need a methodology and the tools that would enable the following:

- Handle all criteria (qualitative and quantitative) together, taking the importance of different criteria into consideration.
- Compose an objective comparison scale for alternatives based on all the data.

## SAATY METHOD

Thomas L. Saaty, from Wharton School of Business, developed the analytical Hierarchy Process (AHP), also called the Saaty method, in the United States approximately 20 years ago. The method is foremost intended for organizing those systems whose operation is based on subjective evaluations (Võhandu, 1998).

The Saaty method enables us to model a complicated decision problem with the help of a hierarchical structure that is composed of the goal, criteria, sub criteria and alternatives (Forman, 1999). The advantage of this method is the possibility to handle both qualitative, as well as quantitative objects. The output of this method is a mathematically correct quantitative evaluation of alternatives being assessed.

The main benefit of the Saaty method is to free decision makers from the need to give objects, that are being analyzed, absolute values (scale of weights). Instead, objects are compared in pairs and that is more acceptable taking human's evaluation capabilities into consideration (Forman, 1999). For example, lets assume we have three

physical items with different weights: A, B and C. When holding them in our hands in pairs it is easy to asses that A is "a little heavier" than B, that C is "considerably more heavier" than A and that C is "many times" heavier than B. Now, when assessing all of these items individually (especially if there are more than three items), we will probably experience difficulties estimating the weight of each item i.e. in composing a correct absolute scale of weights.

The idea of the Saaty method is based on the fact that it is easier for a person to come up with relational evaluations rather than with absolute evaluations (especially when there is no standard scale). In addition, comparing items in pairs renders the most accurate evaluation of an assessed characteristic; the Saaty scale (see the table below) is used for that. After conducting such comparisons, what follows is the derivation of different alternatives' weights, as well as that of the criteria. This means composing absolute scales by using mathematical methods described by Saaty (Saaty, 1996). It is an important fact that in conducting measurements, no standard scale has to be used - experience, intuition or knowledge is usually sufficient (Võhandu, 1998).

Num. Value	Verbal Scale	Explanation
1	Equal importance of both elements	Two elements contribute equally
3	Moderate importance of one element over another	Experience and judgement favor one element over another
5	Strong importance of one element over another	An element is strongly favored
7	Very strong importance of one element over another	An element is very strongly dominant
9	Extreme importance of one element over another	An element is favored by at least an order of magnitude
2, 4, 6, 8	Intermediate values	Used to compromise between two judgements

The Saaty method makes it possible to handle measurable criteria (money, time), as well as qualitative or "soft" benefits (quality, client satisfaction, level of service, social importance, company image etc.) in the context of the goal in assessment. This process makes it possible to compile a comparison scale of alternatives by subjective evaluations and a system of calculations.

## WEB APPLICATION "ITChoice"

### General

In order to provide decision support in the field of IT investments, company NetExpert OÜ and Tallinn Technical University are developing an analytical tool called "ITChoice" – a new and modern software solution through which managers can make justified and objective decisions when weighing different IT investment possibilities.

"ITChoice" is, by its nature, a web application based on Microsoft ASP (Active Server Pages) technology. The application is written in the programming language VBScript. An ASP document can contain both HTML syntax and server-side script logic. When the Web Server receives an HTTP request for the ASP document, a "virtual" output HTML file is generated (in memory) for the response using a combination of both the HTML static information plus any HTML that is generated by the scripting (Fedorov et al. 1998).

Programming tool MS Visual Basic 6.0 is also used for writing the code for specific functions and processes. These few are ActiveX type of modules that belong to the system and are saved in the server as .dll files.

The application is completely server based. All programs run in the service provider's web server; the platform of the later is Microsoft NT Server and ISS (Internet Information Server). There are some exceptions, in that some programs are written in JavaScript and activated in the user's browser upon loading HTML documents. The reason for that is simply to improve the quality of user interface. Clients can access the program through any web browser (e.g. MS Internet Explorer or Netscape).

From the user viewpoint, the solution is just a service to use application software that is necessary for him/her and is accessible through the Internet. This direction has become popular in the world lately and is known by the term of ASP (Application Service Provider).

Advantages of web application:

- Users do not need to buy the program and install it in their computer; accessing the application takes place through the Internet using a standard web browser;
- Users do not need to worry about updated versions of the program; all updates are carried out by the service provider centrally in the server files and are functional immediately after being saved;

- The requirements for the client's computer are minimal: only a functional operating system and a web browser is needed;
- The geographical location of users is not important, and it is also possible to design application versions in different languages, the choice is client's;
- Client case data is saved in the service provider's server (in the database there); security of data i.e. making backup copies of information, is guaranteed.

### Inputs

Program inputs are information provided by the user and answers to questions generated by dialogues. Inputs include:

- Number of alternatives (minimum is two, one can be *do nothing*) and names for each;
- Evaluation criteria; their number and names;
- With the help of on-line dialogues, a user is able to evaluate the importance of different criteria using the pair-comparison method based on the Saaty scale;
- Values of quantitative criteria for each alternative that is measurable in currency (profits, costs or other financial figures);
- Qualitative criteria are handled with the help of on-line dialogues; pair comparison is conducted for each criterion (based on the preferences of the specific criterion).

If a user wishes to store the information he/she entered in the database, he/she will be registered and in the course of registration, such information as the client's name, e-mail, company name, etc. is collected and saved.

### Algorithm

The application shall perform the following tasks (see Fig. 1.):

- Display the necessary HTML forms for entering data;
- Generate questions in the form of dialogues, display forms in the necessary order and on necessary conditions;
- Calculate, on specific conditions, and when all information has been gathered, the normalized weights of investment alternatives that were entered;

- Control the stability of the solution, calculating the consistency ratio;
- Provide users with access to the following: entered values, evaluation results, parameters describing a solution, etc.
- Perform user registration and case data storage in server database.

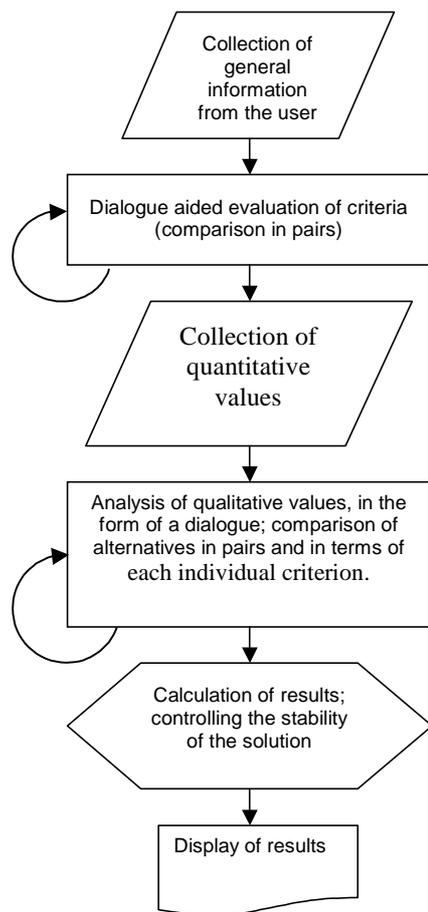


Fig.1. The algorithm of the application

### Outputs and features

The outputs of "ITchoice" are evaluation results and parameters characterizing the stability of the solution. A user can display the results on the screen or print them out on paper with the help of each web browser's features. When necessary, all proceedings can be repeated, changing input values and starting the dialogues again. This enables one to simulate different solutions when input values or terms are different.

All information entered by users will be stored in the application's database. Processes "Save Case" and "Open Case" are available for registered users.

The database locates physically in the web server of the service provider. It is an .mdb type of MS Access file that is accessed through a special server component (ADO).

To get acquainted with the application faster, a "Sample Case" is available, and manipulating this version enables one to get to know the program's features faster.

Users can use the web application 24 hours a day. To enter the system and to activate a previously saved case, a client is identified by his/her username and password.

### CONCLUSION

This paper analyzes the problem of evaluating IT investments. A method has been described in brief through which one can use both quantitative, as well as qualitative benefits to evaluate alternative investment projects (the Saaty method).

The paper includes a description of a web application intended for the evaluation of IT investments. The interactive web application "ITChoice" is an analytical tool based on MS ASP technology that managers can use daily when making decisions about alternative IT investments.

The application is currently in the development process. The beta version is due to be released on 25.08.2000. Afterwards, "ITChoice" will be available from the address: [www.netekspert.com](http://www.netekspert.com)

### REFERENCES

- Fedorov, A.; Francic, B.; Harrison, R.; Homer, A.; Murphy, S.; Smith, R.; Sussman, D.; Wood, S.; *Professional Active Server Pages 2.0*, Wrox Press, 1998
- Forman, E.; *Decision By Objectives*, Expert Choice Inc., 1999, available at: <http://www.technology.sbpw.gwu.edu/forman/>
- Forman, E.H.; *The Analytic Hierarchy Process as a Decision Support System*, Proceedings of the IEEE Computer Society (Fall , 1983)
- Saaty, T.L.; *The Analytic Hierarchy Process*, New York, N.Y., McGraw Hill , 1980, reprinted by RWS Publications, Pittsburg, 1996
- Võhandu, L.; *Subjektiiivsetest hinnangutest objektiiivsete tulemusteni*, TTÜ Informaatikainstituut, 1998