Analysis of the Research Projects in Relation to Analytical Hierarchy Process

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Abstract: Nowadays, the research projects are financed from private funds granted with the purpose of achieving certain potential results that involve a high effort, both financial and human. In order to increase the efficiency of all aspects of the projects it is highly important to detect their benefit during the performance and not only in terms of exploitation of the results at the end of the project. For maximization of the evaluation benefits of the research project it is recommended to invest a lot in planning (time and effort), to integrate the evaluation in an activity in course in the project performance, the personnel participation and implication showing that this participation is important, their implication should be as earlier and as much as possible, to realistically deal with the problems occurred. This paper examines how the impact AHP following that through further studies to develop a model for assessing the economic value of research projects.

Keywords: research project; evaluation; analysis; qualica

JEL Classification: G32; O22; O32

1. Introduction

Analytical Hierarchy Process (AHP) is one method of analysis of the questionnaire based on which the research projects were analyzed. AHP is a multi-criteria decision making method used for establishing the decisional hierarchy of the problem. On the head of the hierarchy stands the objective for which the best decision will be made. The next level of the hierarchy contains those attributes of the criteria contributing to the assurance of decisions quality. Each attribute can be divided into even more detailed attributes. The lowest level of the hierarchies contains the alternatives for the decisions. After the hierarchic network is established, one can determine the priorities of the elements depending on each level and synthesize the degree in which these provide for alternative decisions.

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Reciprocal comparisons are made in order to determine the relative importance of each criterion that complies with the complete goal (***, 2012a).

2. Comparative Methods

About Expert Method

The Quality Function Deployment Method (QFD) aims to eliminate the possible errors that may occur in the whole process, even before conceiving the design of a new product or service. This method meets the customers' needs and gives to the producer or to the service provider the possibility to design this market oriented product or service. Being based upon the information gathered from customers, this method satisfies the customers' demands, thus the product or the service is conceived depending on the customers' requirements. This complex method was developed in order to maximize the customer satisfaction and to measure it using various techniques and methods.

The Quality Function Deployment (QFD) meets the customer needs and provides to the manufacturer or to the service provider answers to design this market oriented product. The whole process is based upon the information received from the customers that help the manufacturer to design the product in order to meet the customer needs. This is a complex method developed with the purpose of maximizing the customer need by using different techniques and methods (Chen and Chen, 2002). The QFD method was invented by Yoji Akao (Akao, 1997), who defined QFD as „a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demands into design targets and major quality assurance points to be used throughout the production stage" (Mazur, 1993).

Thus the purpose of QFD method can be translated as follows (Dragan, 2011):

- *Quality*, because the customer needs are transferred into the final product;
- *Function*, because all organizational units work jointly;
- *Deployment*, in order to divide all necessary activities that have to be measured and controlled, in more specific units.

The QFD method was first applied in 1974 at Toyota Company in Japan. Makabe (Japan) and D. Clausing (United States) (Hauser and Clausing, 1988) specialists in the field of quality conceived a simplified method called „House of Quality" which is a diagram made out of 6 matrices (Hauser and Clausing, 1988):

- the matrix of the customer needs;
- the matrix of the technical characteristics;
- the relationship matrix;
- the correlation matrix;

- the matrix of the technical evaluation;
- the matrix of evaluation of the customer satisfaction.

This method can be adjusted depending on the evolution of the research; furthermore it provides the option to include all matrices or only a part of these into the analysis depending on the expected result (Hauser and Clausing, 1988).

In order to get through all the work phases, we used a diagram called House of Quality, as a graphic support (Hauser and Clausing, 1988). House of quality consists of 6 matrices: the matrix of the customer needs; the matrix of the technical characteristic, the relationship matrix, the correlation matrix, the matrix of the technical evaluation; the matrix of evaluation from the market perspective (Jagdev et al, 1997)0.

The hardest think in applying this method is to complete *the matrix of the customer needs*, which requires a large number of data and information originating from different sources. The customer requirements and *the degree of importance* given by the customer to these requirements are included in this matrix (Crişan et al, 1999).

The matrix of technical characteristics includes the manufacturer or service provider requirements; more specifically it contains the characteristics of the product/service provided by the manufacturer in order to meet the customer requirements (Crişan et al, 1999).

The relationship matrix represents the central area of the diagram that determines the relationship of *customer requirements to technical characteristics of the product/ service.* Inside this matrix the translation of the customer requirements into the technical characteristics of the product/service is practically made. This is the center of the diagram due to the fact that in this matrix we can identify the nonconformities before designing the product/service (Crişan et al, 1999).

The correlation matrix is on the upper side of the diagram showing the interrelationship of the *technical characteristics*. Identification in due time these interrelationships, confers to the manufacturer/ service provider the possibility of saving a significant amount of resources during the product planning. These interrelationships/ correlations may be positive (+) or negative (-), however other scales are possible: strong positive, positive, negative, strong negative, neutral etc. (Crişan et al, 1999).

The matrix of product/service evaluation in the relationship with the market and the market requirements is placed in the right side of the diagram. In order to fill in this matrix a market research is required. Furthermore, the importance of each requirement and possible suggestion of improvement can be made (Crişan et al, 1999).

The matrix of product/service evaluation from the technical perspective is placed in the lower part of the diagram. This matrix established the importance of each technical characteristic for satisfying the customer requirements. This method of quality management can be successfully applied for designing a service (Opruţa et al, 2008), being extremely useful for the competitive development of a study program and its orientation to meet the market requirements (Crişan et al, 1999).

In order to analyze the course of the research project, I have introduced the data in the QFD Qualica in order to analyze data obtained from questionnaire.

In order to apply this method the following stages should be considered (Akao, 1997):

- determination of the requirements and their importance depending on the importance given by the client (Akao, 1997);
- setting up by the qfd team of the quality characteristics. the degree in which the quality characteristics cover the requirements will be underlined in the relationship matrix using a scoring system. (from 1 to 10) (Akao, 1997);
- establishing the values of the quality characteristics that are to be achieved for the new product or service and evaluation of the difficulty degree of their achievement. concurrently, it is defined the preferable direction of variation for these values (increase, decrease, or indifference) (Akao, 1997);
- evaluation of the interactions, of correlations between the quality characteristics, the results are written in the correlation matrix which represents the roof of the house of quality (positive or negative) (Akao, 1997);
- the comparative analysis of the planned product or service with the products or services provided by competitors, taking into consideration two aspects: the customer point of view and comparison of the technical level of the products and services with those of the competitors (Akao, 1997);
- establishing the quality characteristics of the new product or service (Akao, 1997).

3. Analysis of Data with the Empiric Method and the Expert Method

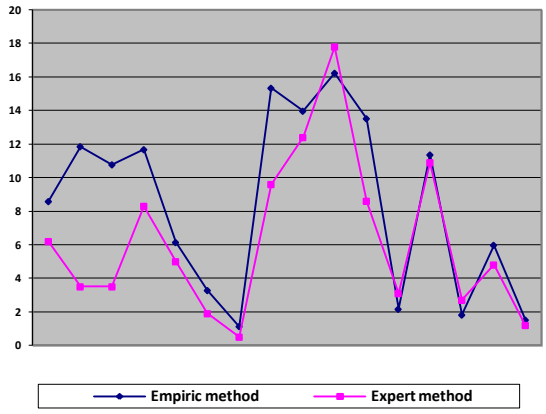
By filling in the data of the questionnaire related to the course of the research project in Qualica QFD Program I succeed in performing an analysis of the quality characteristics, the importance of each component part of the research project taking into account the multiplicative effects. After analyzing the House of Quality, we found out that the most important multiplicative effects occurred in the course of the research project are VAT (17.80%), maintenance/ development of the companies providing products and services (12.40%), dividends (10.90%).

Data related to the exploitation of the research project results analyzed using Qualica QFD allowed us to obtain certain data related to the importance of the

components, of the multiplying effects and the importance of different components. Analysis of data related to the research project results shows an increased importance of the profit (29.90%), of dividends (11.70%) and of VAT (8.50%).

Following the analysis of data using the two individual methods (the empiric method and the expert methods) we reach to conclusions related to the component elements considered distinctly.

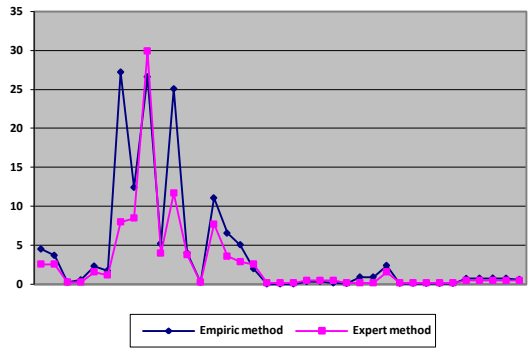
Using the comparative analysis of data related to the performance of the project by means of comparative analysis based on the results obtained from the questionnaire related to the research projects and using the expert method by means of filling in the data from the questionnaire into the Qualica QFD we noticed a constant evolution of data, excepting the outcomes related to the maintenance of/increasing the production of equipment, the maintenance of/ increasing the production of raw materials, consumables, the work places constancy/ creation, the maintenance of/increasing the purchasing capacity, in accordance with the graph no.1



Graph 1. Comparative Analysis of the Course of the Research Projects Using the Empiric Method and Expert Method

Source: According to the Study Performed During Doctoral Program

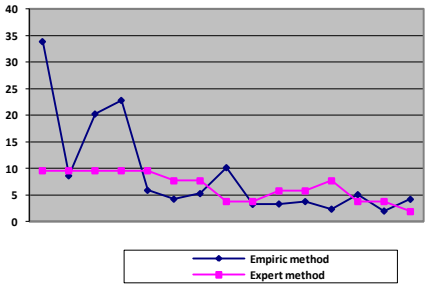
Using the comparative analysis of data related to the exploitation of the project result by empirical method based on the results obtained from the questionnaire regarding the research projects and using the expert method by filling in the data from the questionnaire into Qualica QFD program we noticed a constant evolution of data excepting the effects concerning the profit, the maintenance/ development of the companies providing goods and services and the dividends, according to the graph no. 2.



Graph 2. The Comparative Analysis of the Exploitation of the Research Project Results Using the Empiric Method and Expert Method

Source: According to the Study Performed During Doctoral Program

Using the comparative analysis of data related to the economic value in the course of the project by means of the empiric method based on the results obtained at the questionnaire regarding the research projects and by means of the expert method by filling in the data from questionnaire into the Qualica QFD program we noticed a constant evolution of data according with the graph no. 3. The capital gain determined using the empiric method is given by the human resources component involving salaries, taxes and contributions and by the following components: equipment purchase, raw materials acquisition, materials and consumables purchase and the component of human resources from indirect costs (operating costs).



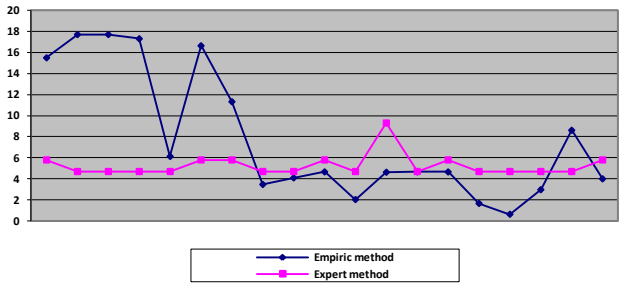
Graph 3. Comparative Analysis of the Economic Value in the Course of the Research Project Empiric Method and Expert Method

Source: According to the Study Performed During Doctoral Program

Using the comparative analysis related to the economic value of the exploitation of data regarding the economic value of the exploitation of the research project results by means of empirical analysis based on the results obtained at the questionnaire

concerning the research projects and by means of the expert method we noticed a sinuous evolution of data, in accordance with the graph no. 4.

The biggest differences occur in the empiric method for the following results: creation of the new work places, the environment quality, the environment safety, and preservation of the natural resources, development – innovation, chances equality, and technological transfer. This characteristic represents the confidence in obtaining these results and orientation of the research projects towards such results. To the contrary, the expert method underlined other types of results as being important: networks, processes, projects, models, copyrights, trademarks and products patents, computer programs, patents applications, scientific publications with the project results, consulting activity, opportunities of access to new financing sources.



Graph 4. The Comparative Analysis of the Economic Value of the Research Project Results Exploitation Using Empiric Method and Expert Method

The analysis of the two phases will continue with the generalized method of dimensional analysis. This type of analysis consists in the association of certain measuring units of the economic indicators based on which we establish a relationship between a constant and an economic value, followed by a new comparative analysis of the three methods. Based upon this analysis I will conceive a pattern for assessing the economic value of the research projects, that will be applied to several research projects developed in certain research centers from Cluj-Napoca.

4. Conclusion

The comparative analysis of the two methods highlights that important positive effects occur in the course of the research project, as well. In order to obtain financing funds for the research projects the degree of recover of the investment is considered taking into account the exploitation of the results obtained at the project finalization, notwithstanding the project effects occurred in the course of the project.

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6. References

Akao, Y. (1997). QFD: Past, Present and Future. *International Symposium on QFD '97*. Linköping.

Chen, J. & Chen, J. C., (2002). QFD-based Technical Textbook Evaluation – Procedure and a Case Study. *Journal of Industrial Technology, Vol. 18, No. 1, November 2001 to January 2002.*

Crişan, L.; Popescu, S.; Brad, S. & Lemeni, L. (1999) *Tehnici şi metode ale managementului calităţii/ Management of Quality: Techniques and Methods.* Cluj-Napoca: Ed. Casa Cărţii de Ştiinţă.

Drăgan, Mihaela (2011). *Methods, Techniques and Tools for Quality Management.* Cluj-Napoca: Babes Bolyai University, Faculty of Economics and Business Administration.

Hauser, John R. & Clausing, Don (1988). The House of Quality. *Harvard Business Review, May–June*, pp. 63-73.

Jagdev, H.; Bradley, P. & Molloy, O. (1997). A QFD Based Performance Measurement Tool, Elsevier Science. *Computers in Industry 33*, pp. 357-366.

Mazur, G. (1993). *QFD for Service Industries. From Voice of Customer to Task Deploymen*t, Japan Business Consultants, Ltd.

Opruţa, D.; Drăgan, M. & Popescu, S. (2008). Technique for identifying competences necessary for the orientation of study programs towards Occupational Requirements. *Proceedings of the 5th International Conference of Quality Management in Higher Education, 12-14 June*. Tulcea. pp. 45-50; http://www.is iwebofknowledge.com/.

*** (2012a) Concurrent Engineering, http://6profu.ro/search/metoda-ahp accessed 02.10.2012.