

Fuzzy AHP and Factor Analysis Application in Maintenance Strategy Selection

Sh. Parhizi¹, M.H. Salimi², M. Pariazar³

^{1,2,3} Department of Industrial Engineering, Amirkabir University of Technology, Tehran, Iran

¹ Sh_parhizi@cic.aut.ac.ir, ² Salimi@aut.ac.ir, ³ M_pariazar@aut.ac.ir

Abstract

Many companies think of maintenance as an inevitable source of cost. Maintenance plays an important role in keeping availability and reliability levels, product quality, and safety requirements. The managers have to select the best maintenance policy for each piece of equipment or system from a set of possible alternative.

In this article, we with the help of going over expertise of experts and their relevant specialized literature try to recognize variables and effective criteria in selecting maintenance strategy. Then, by using factor analysis, we will process the data so that we can designate fundamental variables and summarize them in some factors. Then after, we will apply the results from factors analysis for nomination of criteria in a hierarchy structure. Consequently, by utilizing FAHP, we will choose the best strategy.

Key words: Maintenance strategies, Factor Analysis, Fuzzy Analytical Hierarchy Process

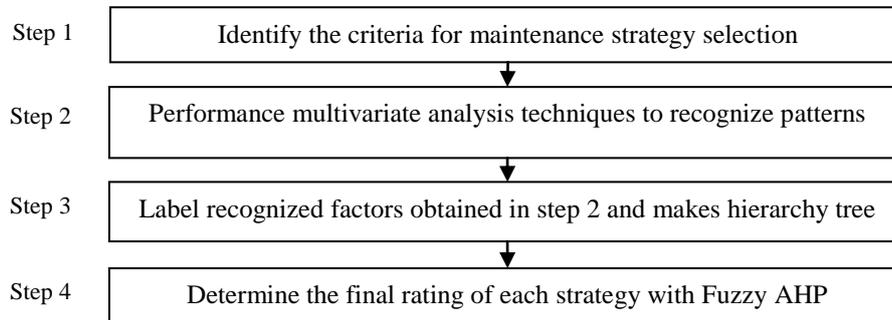
1. INTRODUCTION

Nowadays with increasing Technology's development and develop Industry's automation and increase of machinery's quantity, volume of investment in organization's physical assets and machineries have increased significantly [1]. In this article, we will go through the five most important kinds of strategies put forward that include: corrective, preventative, opportunistic, condition-based and predictive maintenance. Implementation costs both in terms of fixed investments and assignment of people are high; hence, we don't want to repeat it for some time [2]. On the other hand, there exist multiple criteria and multiple perspectives that should be considered and taken heed of in this decision making [3]. We try to recognize variables and effective criteria in selecting maintenance strategy. Then, we apply the results from factors analysis for nomination of criteria in a hierarchy structure. Consequently, by utilizing FAHP, we will choose the best strategy.

2. METHODOLOGY

Proposed methodology comprises 4 steps. Generally this methodology after recognizing important criteria with the help of one of multivariate analysis techniques have formed the decision tree and with the application of FAHP has assessed each maintenance strategy. Methodology 4 steps have been shown in figure 1. These steps have been detailed as it continues.

Figure 1: Proposed methodology diagram



Step 1: We with the help of going over expertise of experts and their relevant specialized literature try to recognize 19 variables and effective criteria in maintenance strategy selection.

Step 2: Since considering all criteria for maintenance strategy selection seems to be impossible, it seems to be necessary to use a dimension decreasing technique for extracting pattern and summing up criteria. In this methodology factor analysis has been used as one of the most applicable and suitable techniques of multivariate analysis.

Step 3: With regard to the essence of each group criteria placed in each factor, we have labeled recognition factors in preceding stage. Then hierarchical tree is formed.

Step 4: By using Fuzzy Analytical Hierarchy Process, we can calculate the final weight of each maintenance strategy.

3. CONCLUSION

In this article, one model has been provided for deciding best maintenance strategy. Five kinds of most important mentioned strategies that include corrective, preventative, opportunistic, condition based and predictive have been considered in this methodology. One optimal maintenance strategy could result in reduction of unnecessary maintenance costs and promotion of reliability and availability of equipments. Evaluation of these strategies is a decision making problem in multiple condition and numerous factors are effective in decision making. In this methodology by utilizing the combination of two techniques of factor analysis and fuzzy analytical hierarchy process, first we try to recognize key factors from amongst effective factors and then making a hierarchy structure and evaluation of strategies by fuzzy analytical hierarchy process. In a case study it has been mentioned that this methodology can help us effectively for selecting optimal strategy.

4. REFERENCE

- [1] Bevilacqua, M., Braglia, M. (2000);" The analytic hierarchy process applied to maintenance strategy selection", *Reliability Engineering and System Safety* 70, 71–83.
- [2] Al-Najjar, B., Alsayouf, I (2003);" Selecting the most efficient maintenance approach using fuzzy multiple criteria decision making", *International Journal of Production Economics* 84,85–100.
- [3] Wang L. et al. (2007), "Selection of optimum maintenance strategies based on a fuzzy analytic hierarchy process", *International Journal of Production Economics*, 107(1): 151-163.