MULTI-CRITERIA ASSESSMENT OF SPARE PARTS OF HYDRAULIC SYSTEMS

Nuno M. M. Torre
Sao Paulo State University, Brazil
nuno_torre@hotmail.com

Valerio A. P. Salomon
Sao Paulo State University, Brazil
valerio.salomon@unesp.br

ABSTRACT

Spare parts of production line assets must be readily available at the lowest possible cost. Hydraulic systems can be found in a wide variety of industrial applications that demand control of large loads and high-power density. The assessment of spare parts of hydraulic systems involves multiple criteria. Multi-criteria decision-making (MCDM) methods were developed to solve problems with several criteria. The AHP (Analytic Hierarchy Process) is a leading MCDM method. This paper presents an AHP application in a steel mill plant located in the Brazilian State of Rio de Janeiro. With the application of AHP, it was possible to identify the highest priority factor for the inventory management of spare parts.

Keywords: AHP, MCDM, hydraulic systems, spare parts.

1. Introduction

Due to global competition, organizations need to reduce their production costs and increase the profitability of their business. In industrial plants, operations are widely equipped with hydraulic systems for several types of processes. The role of inventory management for high-quality spare parts is a challenge since it is not always possible to avoid unscheduled breakdowns. The research question of this paper is: How to use a multiple criteria approach to develop an evaluation framework of hydraulic spare parts criticality assessment in the steel industry? The Analytic Hierarchy Process (AHP) is a method of multi-criteria decision-making (MCDM) with great efficiency and flexibility (Saaty & Vargas, 2001).

2. Literature Review

According to Ayu Nariswari, Bamford, and Dehe (2019) *criticality* is the most important characteristic of spare parts management. The most used criteria are the criticality of the equipment, the probability of failure, and the type of maintenance, among others. The spare parts' criticality assessment shall be based on the logistics and maintenance requirements (Antosz & Ratnayake, 2019). Logistics requirements include the number of potential suppliers, price, and lead time. Maintenance factors are the maintenance policy, frequency of use, failure type, and employees' qualification (Durán, 2015).

3. Hypotheses/Objectives

The general objective of this paper is to present an evaluation framework for managers of spare parts for hydraulic systems. Specific objectives include allowing a better compromise for the trade-off between *risks* and *service levels*, aiming to assist managers in decision-making that meet the needs for a critical assessment of spare parts for hydraulic systems.

4. Research Design/Methodology

A detailed analysis was performed by a committee of experts: managers from a steel mill plant locate in Southern Brazil. The proposed hierarchy with the criteria, sub-criteria, and assigned ratings is presented in the Figure 1.

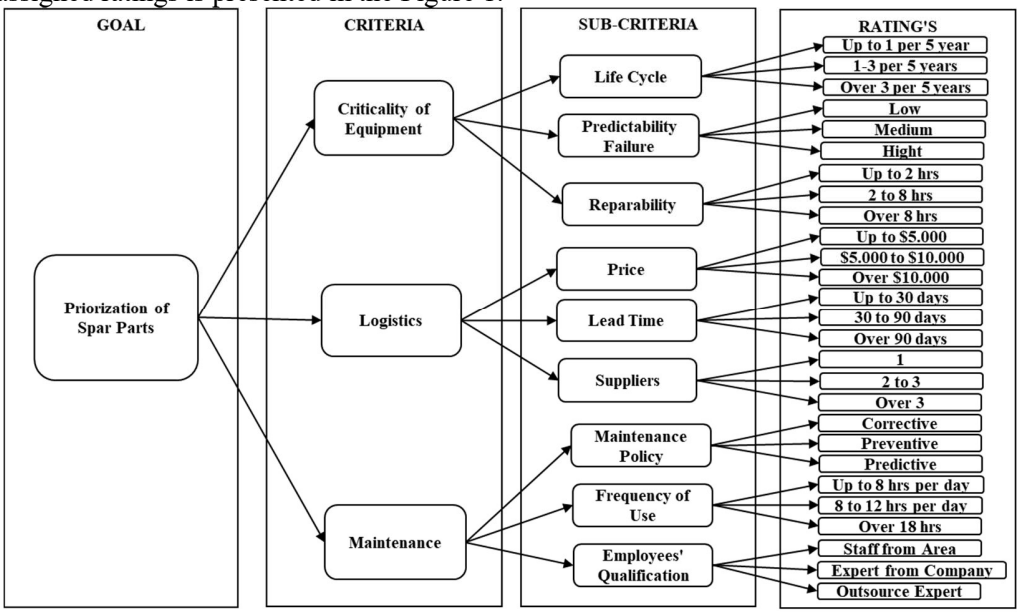

Figure 1 Hierarchy of AHP application

5. Data/Model Analysis

The assessment of the critical spare parts in the proposed hierarchy includes quantitative and qualitative criteria. The quantitative criteria were based on the existing data, and the qualitative criteria will be carried out through expert judgments.

6. Limitations

This study is limited to a single plant in the steel mill industry. However, our results may be extended to other companies, *mutatis mutandis*.

7. Conclusions

This paper presents ongoing research. Mainly due to page limitation results are not presented. Only the framework is presented in this paper. Perhaps during the international symposium and in a further extended expert paper results will be validated.

8. Key References

Antosz, K., & Ratnayake, R. M. C. (2019). Spare parts' criticality assessment and prioritization for enhancing manufacturing systems' availability and reliability. *Journal of Manufacturing Systems, 50*, 212-225.

Ayu Nariswari, N. P., Bamford, D., & Dehe, B. (2019). Testing an AHP model for aircraft spare parts. *Production Planning and Control, 30(4),* 329-344.

Durán A., O. (2015). Spare parts criticality analysis using a fuzzy ahp approach. *Tehnicki Vjesnik, 22(4),* 899-905.

Saaty, T. L., & Vargas, L. G. (2001). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process*. Boston, MA: Springer US.