

Classification of Spare Parts Criticality: A Multi-Criteria Decision-Making framework with Application in an Oil & Gas Company

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Abstract

Spare parts are inventoried items stored in warehouses for immediate response to demand requirements of repair jobs and maintenance activities. Most oil & gas companies maintain large numbers of spare parts to ensure stock availability and avoid shortages. Due to the substantial contribution of spare parts to the total inventory cost, it is important to balance stock availability and the inventory holding costs of spare parts. In line with these objectives, the specification of the spare parts to keep in stock is one of the most crucial steps which requires the spare parts to be classified based on the corresponding criticality. Criticality is a key factor towards identifying the resources and the actions needed to reduce the risk or the impact of failures and losses affecting a process, including incidents relating to economy, safety, and environment, among other practical aspects. The aim of this thesis is to identify the most relevant criteria for the classification of spare parts criticality prior to assessing their impact on inventory management using a large oil & gas company in Oman as a case study. The investigations are based on a methodological framework that integrates two multi-criteria decision-making (MCDM) techniques, namely, Evaluation based on Distance from Average Solution (EDAS) and Ordered Weighted Averaging (OWA) operator. The findings of this study reveal that less than 2.5% of the spare parts require special attention regardless of the optimism level of the decision maker, which enables reducing substantially the inventory costs besides assisting the inventory team in deciding what to maintain in stock and whether to add or remove items from stock.

Keywords

Criticality, Criteria, Spare Parts DEAS, OWA, MCDM,