

Abstract

Efficient and effective spare parts inventory management plays a significant role in maintaining a firm's competitive advantage. The major focus of spare parts inventory management practices is to have the required spares to be ready at right time, in right place with minimum cost. Maintaining more spare parts in inventory result high holding and obsolescence cost and on the other hand, lower inventory level causes severe production loss due to shortage. Many industries store thousands of spare parts in inventory which share the major percentage of inventory cost. If the spare parts are not properly categorized on the basis of management attention, it may cause severe production down situation. Most often, decision makers are not aware of frequent spare parts usage and their correlation in particular equipment or any maintenance activities. Among these spares, if one particular spare is out of stock, there is a chance that other spare parts consumption may also get affected like decline in demand rate or cause of blockage in inventory and the whole maintenance activity may get stopped.

The aforesaid issues have been addressed in this thesis by introducing the concept of spare parts dependency based on the past consumption records for various maintenance activities of equipments. This dependency measures are computed using data mining techniques such as itemset mining, sequential pattern mining and association rules mining. Utilizing this spare parts dependency, we have developed models for finding optimal spare part kits satisfying the maintenance activities and predicting the sequence of maintenance activities and intervals along with frequent spare part groups for given threshold support values. The interesting measures like support, confidence, lift and Chi-square values are computed to validate the strength of association rules. Further, a model is developed to estimate the order up to level quantities considering dependency among the spare parts using periodic review policy. Lastly a clustering model is developed for grouping of dependent spare parts based on normal support and weighted support similarity. The total costs of replenishment are computed for each level of clusters and an optimal number of clusters are estimated based on the minimum cost variation.

Keywords: Data mining, dependency, itemset, support, item correlation, association rule, sequential pattern, optimal kit, confidence, spare parts inventory, multi-item inventory, joint replenishment, hierarchical clustering.