Purchase-oriented Classification Model of the Spare Parts of Agricultural Machinery

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Abstract Based on the classification of spare parts and the research results of the demand of spare parts, a three-dimensional classification model of spare parts of agricultural machinery is established, which includes the application axis sorted by technical characteristics, the cost axis classified by ABC method, and the demand axis classified by the demand of the spare parts of agricultural machinery. These dimension axes represent different factors, and the application of factors in purchase is analyzed. Guiding value of each dimension axis is summarized in the field of the spare parts purchase; and corresponding strategy instruction is put forward. Integrated application of these strategies by model makes the purchase have more realistic operational meaning. Application field of the three-dimensional model of spare parts is discussed; and the direction for further research is pointed out.

Key words Spare parts of agricultural machinery, Demand, Purchase, China

Equipment management is called the life line management in modern enterprise management. And spare parts management is an important content of equipment management. The spare parts management, operation management and maintenance management are together called the three mainstays of equipment management. Therefore, spare parts management directly affects the availability of enterprise equipment and the capital turnover of spare parts inventory. Classification of spare parts is the primary factor for the management of spare parts inventory. And how to effectively classify the spare parts has been the focus of both the science world and business world.

As for the agricultural machinery, its storage and purchase strategy has been a key link of management, which is determined by the property of operation. The ABC classification method is a traditional management method of spare parts[1]. However, the factors considered in this method are too simple, and can not guide the produce practice well. In the past, researches on spare parts mainly studied on the management of spare parts according to the characteristics of spare parts[2-7]. And the objective for enterprises to carry out spare parts management was to meet the demands of the normal and orderly production of enterprises. Therefore, when studying on the management of spare parts, there lacks the meaning of actual production due to the neglecting of the factor of spare parts demand.

Demand for spare parts is not only a focus of spare parts research, but also a difficult point. At present, the most commonly used method throughout the world is to divide spare parts into repairable spare parts and non-repairable spare parts. And the demands of the two can be deduced according to the equation[8]. He Yaqun *et al.* carry out research on the demand of spare parts according to the Rough Set Theory[9]; Li Jiuxiang *et al.* put forward the calculation model of spare part quantity with different distributions combining with the demand distribution of spare parts[10]. According to the continuity of spare parts demand, spare parts can be divided into continuous demand and intermittent demand. Yang Jie *et al.* summarize the forecast methods of intermittent demand, and point out the advantages, disadvantages and applicability of different methods[11]. Xu Xiaoyan *et al.* divide the demand of spare parts effectively, points out the calculation method of spare parts demand under the situation of subdivision. According to the demand research on spare parts mentioned above, it can be found out that these researches only focus on the demand characteristics of spare parts, and neglect the characteristics of spare parts of equipments. But the factor of cost must be considered during the research on spare parts[12]. Therefore, this research integrates demand into the characteristics of spare parts and equipments in order to find out a relatively comprehensive and systemic management method and to apply it into the management of spare parts of agricultural machinery.

1 Three-dimensional classification model of the spare parts of agricultural machinery

1.1 Establishment of the three-dimensional axes of the spare parts of agricultural machinery Agricultural machinery is divided into component commonality (A), special purpose component (B), and special-made component (C) according to the technical characteristics[13]. This classification method focuses on the utilization of the spare parts of agricultural machinery and is used as the application axis of the three-dimensional model. In practice, most of the enterprises still adopt the ABC method in the management of spare parts; and ERP software is developed on the basis of this method[14]. Therefore, ABC method is used in this research, which pays attention to the cost factor of spare parts and is used as the cost axis of the three-dimensional model. According to the demand of spare parts of agricultural machinery, spare parts are dived into con-

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tinuous demand (A) and intermittent demand. And the latter can be classified into the intermittent demand having nothing to do with the maintenance (B) and the intermittent demand related to the maintenance (C)[12], which can be used as the demand axis of the three-dimensional model.

1.2 Model assumption

(1) The three classification methods of the spare parts of agricultural machinery are all fuzzy; and the three types of A, B, and C can not be divided clearly. Therefore, the locations of various types can be shown in a straight line.

(2) Cost not only includes the cost value of spare parts, but also the cost related in the management of the spare parts of agricultural machinery.

1.3 Establishment of the model The three-dimensional classification figure of spare parts is obtained according to the cost, usage and demand of spare parts. Based on the current classification, a total of 27 classification methods are developed. Thus, the following three-dimensional model is obtained (Fig. 1):

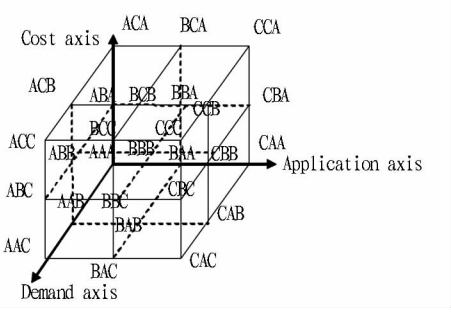

Fig. 1 The three-dimensional classification model of spare parts

2 Application of the model in purchase

The model in Fig. 1 has certain application value for the purchase. Therefore, analysis on the three axes is carried out.

2.1 Application axis Starting from the technical characteristics of the spare parts of agricultural machinery and combining with the utilization of spare parts, this model adopts the classification mode of component commonality, special purpose component, and special-made component. Different strategies should be used during the purchase of the three spare parts of agricultural machinery. Since component commonality has sufficient supply and mature processing condition, the strategy of competitive pricing should be used during purchase in order to reduce the purchase price. Cost pricing should be adopted in the purchase of special purpose component. And as for the special-made component, cooperation pricing should be adopted with the participation of supplier due to the constraints of processing method and condition. Therefore, the application axis has three different purchase modes, which are competitive pricing, cost pricing and cooperation pricing.

2.2 Demand axis Determination of demand characteristics of spare parts is the key to the demand axis, which can effectively guide the purchase. Due to the demand of continuity, Exponential Weighted Moving Average, short for EWMA, is used to forest the demand quantity[15]. As for the intermittent demand having nothing to do with the maintenance, it is relatively appropriate to use Croston method[16]. As for the intermittent demand related to the maintenance, Integrated Forecasting Method, short for IMF, can be adopted to forecast the demand[17]. Therefore, demand axis has three different spare parts demands, which are ES, Croston, and IMF.

2.3 Cost axis Since the type – A spare parts of agricultural machinery needs relatively large cost, service level and qualification of the supplier should be fully considered; and strategic alliances should be adopted during the purchase. As for the type – A spare parts, standardized ordering system should be applied. As for the type – C spare parts, the method of economic order quantity should be implemented. Thus, the cost axis also has three different purchase strategies, which are strategic alliances, standardized ordering, and economic order quantity.

In the three-dimensional classification model, different axes offer different purchase references. These factors can be combined together to obtain a relatively objective purchase scheme. Based on the indices of cost, usage and demand, purchase will become an easy work.

3 Conclusion

Since the previous researches usually separate the characteristics of spare parts from the demand of spare parts, this research puts forward a three-dimensional classification model which integrates the demand factor into the classification of spare parts, which is more operational during the management of spare parts. Decision makers can manage the spare parts effectively according to the model established in this research. At the same time, different spare parts of agricultural machinery can find their own positions in this model during purchase. Making purchase strategy based on the three-dimensional aspect can significantly reduce the difficulty in purchase and solve the problems in the past during purchase.

Classification of the spare parts of agricultural machinery is the basis for equipment management. Effective classification of spare parts not only can guide the purchase strategy of enterprise, but also can strengthen the inventory management of the spare parts of agricultural machinery and make it more reasonable. At the same time, classification of spare parts of agricultural machinery is a relatively complex work. As for a spare part, it is difficult to judge what type it is, or what law it accords with. Therefore, fuzzy mathematics should be introduced in the future research; and fuzzy clustering should be utilized to make the classification of the spare parts of agricultural machinery more scientific.

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