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Product Inventory Predictions at Small Medium Enterprise Using Market Basket Analysis Approach - Neural Networks

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Abstract

One of the key problems in every company, including small and medium enterprises, is how to determine the inventory level for each product that will be sold to their customers appropriately as it can suppress the build up of inventory as well as avoid the stock out. This study is aimed to understand the behavior of consumers in purchasing the products so it can be used to predict the purchasing for the next period. Later, the prediction is used as a decision support in determining the appropriate amount of inventory for each product. The study was conducted at Karomah Brass, a small and medium enterprise engaged in the sale of antique furniture accessories in which the company doesn't produce its own products but buys from the supplier. The methods that used in this study are the Market Basket Analysis (MBA) and Artificial Neural Network (ANN) Back propagation. MBA is used to examine the buying behavior of customer while ANN Back propagation is used to predict product inventory's requirements/needs for each product. The results discover that the customers frequently purchase products that serve as a kind of antique closet accessories and if customer bought that certain product, then they will also buy similar products in accordance with 21 rules that have been obtained from the mining of transaction data. Whereas, other result shows the prediction of the amount product inventory requirements/needs for one year to the next.

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1. Introduction

Inventories are defined as raw materials, works in process (WIP) or the finished products that are stored to meet the demand (Herjanto, 1999; Baroto, 2002). If the amount of inventory is less than the amount of actual need, the company will lose the opportunity to maximize their sales, gain new customers, get customer loyalties and gain the maximum profits. While, if they stock too much inventory, it will increase the costs of maintenance and storage, so that it will reduce the profits (Sari, 2010). Because of the great impact of inventory management to the company's performance, there are so many companies that choose to make inventory as their biggest investments (Winata & Abbas, 2008).

Problems that mentioned above are also encountered in a SME's named Karomah Brass (KB), which is not all of the products that are stored in KB's warehouse purchased by the consumers and often, in the same time, other products are stock out. These problems occur because KB can not read the patterns of their customer buying behavior. This study aims to answer these problems, especially in understanding the customer buying behavior and prediction of product inventory needs for the next period.

2. Customer Buying Behaviour

David & Bitta (1998) defined customer buying behavior as a decision process that makes people choose and use the products or services. Customer buying behavior is not easy to find out because of the human behavior itself. Study conducted by Joseph, Pratikto, & Gerry (2006) prove that Market Basket Analysis (MBA) is a reliable method in understanding the customer buying behavior.

2.1 . *Prediction of Inventory.*

Prediction, especially in the field of inventory, has attracted the attention of researchers and practitioners nowadays. Many studies have been conducted, one of them is Pujihastuti (2008). Pujihastuti uses moving average method in a company that has a fluctuating demand and prove that MA is able to accommodate rapid changes in information and suitable with the condition of the company that has a high variety of products and raw materials. However, this method is less appropriate when used to predict long-term predictions (Arsyad, 2001).

Another studies on the application of another forecasting methods are such as Exponential Smoothing (Tanuwijaya, 2008), Brown method (Winata & Abbas, 2008), Exponential Smoothing Winter (Paramita & Tanuwijaya, 2010), and Box-Jenkins (ARIMA) (Naibaho, 2009), but due to the limitations of each method above, it is difficult to apply in the KB. Pratama (1999) uses ANN Backpropagation to predict inventory and proves that ANN offers so many advantages, it is very accurate and the computation can be done with computer in an efficient algorithm so that the calculation does not take much time.

Based on the previous studies above, the ANN method is seen as the most appropriate method to predict the amount of product inventory needs in KB, so the prediction inventory process in this study will only focus by using this method.

2.2 *Market Basket Analysis*

MBA is a method in data mining that focus on identification of products that are purchased at the same time on each transaction. Output of MBA is a set of rules that indicate the products that are purchased on the same time. This output will be used as input for the prediction of inventory.

More detail, the rules generated by MBA are association rules that have form "If antecedent (A), then consequent (B)". each rule is equipped with a support level that indicates the number of transactions containing

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