

CHAPTER I

INTRODUCTION

1.1. Background

In the midst of increasingly advanced developments in information technology, inventory management has become a crucial operational aspect for business continuity. Inventory is one of the most important elements in company operations, where goods are stored and then used for the production process or for resale [1]. Effective inventory management aims to determine the optimal balance between inventory availability and customer transaction fulfillment. Inventory control needs to be carried out to maintain the availability of inventory of an item at an optimal level. Improper inventory management can lead to two main risks, namely stock outs or overstocks [2].

PT Bina Informatika Solusi Madiun, which operates in the field of fiber optic installation services, really needs the availability of vital components such as drop core cables and ONT (Optical Network Terminal). However, the stock management system currently implemented by the company is still reactive and manual, where orders to the head office in Cirebon are often placed when stock is running out, so that the company often experiences stock outs, where data shows that out of 144 ONT transactions, there were 28 stock out events. Drop core cables and ONTs are critical components in every fiber optic network installation project. Drop core cables are usually requested in large quantities and the pattern is quite stable, while ONT demand is smaller but changes in demand are more uncertain. These two components must be available on time to ensure a smooth installation project and customer satisfaction. To minimize errors in determining the purchase of stock and overcome uncertainty in future demand, forecasting is needed [3]. This forecasting function is very important because it can be the basis for short-term and long-term planning for a company [4]. It is important to use a sales information system to support performance and obtain the right information.

The component transaction data used in this research has the characteristics of irregular demand, where transactions do not occur every day and the number of requests varies significantly when they occur. This demand pattern in the inventory management literature is categorized as lumpy demand, namely random demand with

periods of no demand (zero demand), but when there is demand, the amount can vary significantly [5]. From the historical data collected for the period January 2025 to May 2026, there were 70 drop core cable out transactions with demand variations of 65 to 224 meters per transaction. Meanwhile ONT has much more uncertain characteristics, with 144 transactions consisting of 84 out transactions and 60 in transactions, of which 28 stockout events occurred on 21 different dates.

In dealing with irregular demand patterns, the Weighted Moving Average (WMA) method was chosen as the forecasting technique in this research. WMA gives different weights to each available historical data, where the most recent data will have greater weight because it is considered the most relevant for forecasting future values [4]. This method has proven effective for data with irregular patterns or lumpy demand, namely demand that does not occur every period but has significant variations when it occurs [5]. A study on Airbus A320 aircraft spare parts shows that WMA is one of the best methods with an average score of 1.6 which is the best value compared to 19 other forecasting methods for data with lumpy demand characteristics [5]. This WMA approach is very useful for smoothing irregular fluctuations in time series data, thereby increasing the accuracy of stock requirement predictions [6]. Research by Rasyidah et al. [1] shows that the weighted moving average (WMA) method has a smaller error value than exponential smoothing (ES) in forecasting SNACK X product inventory, so WMA is considered superior in forecasting accuracy. Research at PT United Tractors Tbk shows that spare parts demand data with an irregular pattern, where in February there was only 3 units of demand, can be predicted using the moving average method with an error of 18% [7]. The research found that conditions where demand does not occur consistently but has significant spikes when it does, is a direct result of the company's operational characteristics.

Apart from predicting the quantity needed, determining the right time to place a reorder is very important. For this reason, the Reorder Point (ROP) method is integrated, which is a calculated value for reordering inventory [8]. ROP is calculated by considering lead time and safety stock [9]. Safety stock is the minimum additional inventory needed to cover demand uncertainty and possible delivery delays [2]. From the Cirebon head office to Madiun, the average lead time takes 4 days, which must be calculated carefully to avoid stockouts during the waiting period. Setting appropriate reorder points can be used to ensure that the promised level of customer service can be realized [9]. Research by Brahmantyo et al. [10] implemented an inventory

management system using the safety stock and reorder point method at the Tanah Laut State Polytechnic, which succeeded in reducing empty stock conditions by up to 95%, as well as providing information on when to reorder.

This research integrates the WMA and ROP methods, where the WMA prediction results are used as direct input for ROP calculations. The safety stock (SS) value is calculated based on service level factors (Z-score), daily consumption (d), and waiting time (L). Next, the ROP is calculated by adding up the estimated needs during the waiting period with the newly calculated safety stock value. This integrative approach allows the system to be more responsive to changes in demand patterns and provide more accurate order recommendations, especially in the operational context of branch offices which have a high dependence on supplies from the head office.

Therefore, this research focuses on developing a prediction system to optimize the supply of drop core cables and ONTs at PT. Bina Informatika Solusi Madiun as a branch office. With this system, it is hoped that the ordering decision-making process can be carried out preventatively before stock runs out, so that stockout events can be minimized through predictions based on historical data, as well as providing accurate ordering recommendations by considering the operational characteristics of branch offices which depend on supplies from the head office in Cirebon.

1.2. Formulation of the problem

Based on the description in the background, there are several things that need to be resolved in this research, namely:

1. How to develop an accurate goods demand prediction system using the weighted moving average method for drop core cable components and ONT at PT Bina Informatika Solusi Madiun?
2. How to integrate weighted moving average prediction results as direct input for reorder point and safe stock calculations?

1.3. Scope of problem

Based on what has been explained in the problem formulation, the problem limitations set by the author to support research accuracy are:

1. The research was conducted at PT Bina Informatika Solusi Madiun with a focus on two types of goods, namely drop core cables and ONT (Optical Network Terminal).
2. The historical data used is stock transaction data for the period January 2025 to May 2026.

3. Evaluation of the accuracy of prediction results in this research was carried out by applying the Mean Squared Error (MSE), Mean Absolute Deviation (MAD), and Mean Absolute Percentage Error (MAPE) metrics.
4. The system does not include order automation, only providing recommendations for manual decisions.

1.4. Research purposes

Based on the problems studied, the aim of creating a prediction system for bardang and safety stock needs with reorder points at PT. Bina Informatics Solutions Madiun, namely:

1. Developing a web-based product demand prediction system that can provide accurate estimates for drop core cables and ONTs, equipped with a real-time stock monitoring dashboard to facilitate ordering decisions.
2. Implement integration between prediction results with reorder point and safety stock calculations.

1.5. Benefits of research

Based on this research, the benefits obtained include:

1. Provides opportunities for researchers to apply the knowledge they have learned, especially in integrating the Weighted Moving Average (WMA) method for predicting goods needs with safety stock and reorder point calculations in a web-based system, as well as understanding directly the application of the time series forecasting method to overcome lumpy demand characteristics in fiber optic installation components in the company's operational environment.
2. Providing a weighted moving average-based product demand prediction system that is integrated with reorder point and safety stock calculations for PT Bina Informatika Solusi Madiun, so that the company can monitor the stock status of drop core cables and ONTs in real-time via a web-based application, as well as optimize ordering decisions with automatic recommendations based on two supplier scenarios, namely Cirebon with a lead time of 4 days and local with a lead time of 1 day.
3. Increase insight and experience in developing inventory management information systems that are responsive to irregular demand patterns, and can be used as learning material regarding the integration of forecasting methods with inventory control systems to improve operational efficiency.

4. Becomes a reference for readers and other researchers in applying the weighted moving average method for forecasting the need for goods with lumpy demand characteristics, as well as contributing to the development of an inventory prediction system for companies with branch office structures that depend on supply from the head office.