Research Paper

Application Optimizing the Placement of Safety Stocks Using the Max-Min Method for Printing Companies

Muhammad Wali[1]

[1]Lecturer, Information Management, AMIK Indonesia, Aceh, Indonesia.

ABSTRACT

Inventory management is an activity carried out by a company that is needed in making decisions so that the need for materials or goods for the needs of company activities both production and sales can be fulfilled optimally with the smallest possible risk. Over-inventory is a waste because it causes too high costs for storage and maintenance during storage in the warehouse. This study tries to build an inventory application by applying the Max-Min method as a basis for development. This research method is divided into three stages, namely the selection of system methods, database development, and implementation of solutions. The results of this study are inventory applications using the Max-Min method which emphasizes the results of controlling the stock to make it easier for company owners to make decisions. Inventory management system built with Hypertext Preprocessor (PHP) and XAMPP as web servers using databases from MySQL, Sublime Text for application coding, and Hypertext Markup Language (HTML) and CSS to create views and JSON (JavaScript Object Notation) to facilitate generating data. The results of this study succeeded in making the application to management to make the right and accurate decision to determine how many items were ordered to suppliers for stock replenishment, this application was able to analyze in advance the methods used so that more objective decisions would be obtained.

Keywords: Application, Safety Stocks, Max-Min Method.

INTRODUCTION

Inventory management is one of the most important and least sexy aspects of doing business. It can be said, inventory management is the business lifeline of an industrial company. [1] Over-inventory is a waste because it causes too high costs for storage and maintenance during storage in the warehouse. [2] traders add value to the products they handle by bringing them closer to the end consumer. In that case, effective control of stock levels is an important measure of operational performance, especially in the context of achieving a high level of customer service. [3]

The mechanism that has been widely applied to ERP and Inventory Management Software is the Min-max Method. This method is a simple way to optimize warehouse performance by calculating the min/max quantity for each item stored. Min/max calculation method means stock replenishment will be done when the physical amount in the warehouse has touched the minimum amount of the item and then it will be ordered as much as the maximum amount of the item. One way to control inventory is to determine the minimum stock and maximum stock in a company's warehouse. Min-max stock method is a method of controlling stock security that must exist, minimum inventory

policy, and maximum inventory. Inventory control using the min-max stock method includes several stages, namely:

1. Determine Safety Stock.
2. Determine the Minimum Inventory (Minimum Inventory).
3. Determining the Maximum Inventory (Maximum Inventory). [4]

The acceptance system can be interpreted as a policy and supervision that regulates the amount and reserves in order to determine the level that must be maintained, whenever it must be available and the amount of large orders that must be done. The purpose of this system is to determine and guarantee the right resources, according to the right, and at the right time. Two basic reasons are needed, namely, first, etc., to discuss about an item immediately when it is needed, second, if in a short time about an item needed can be presented, it does not require assistance in bringing goods whenever needed, if needed many times with a short period of time. In full or in other words, the system and the model needed to get the total cost through the amount, amount, and time of delivery are carried out optimally (optimal order point). Control of the level of expenditure of goods that can be used reaches the optimal level and the optimal needs in the supply of goods that can be used on the one hand operating needs can be completed when the other and on the other hand, investment in goods that can be consumed can be optimally increased. [5]

GoPrint as the location of the case study in Banda Aceh is one of the printing companies in the city of Banda Aceh which is a modern printing pilot company, which has been established since 2009. The operational activities of the company are highly dependent on revenue, sales and stock of goods. It is through these three main activities that GoPrint runs its business. Distributors receive goods received from distributors. GoPrint has a special agreement on determining the receipt value and stock inventory in the warehouse. The order value of receipt of goods based on estimated monthly exchange rate requirements is very fluctuating. In addition, order quantities are made irregularly, so it appears also about the inventory of goods in the warehouse which is a larger amount of value stored in the warehouse. Uncontrolled stock inventory also often causes the condition of the stock to run out when the inventory of goods is up / stored and stored in conditions if the stock of inventory in the warehouse cannot be met by the distributor of warehouse reservations because the required items are still quite large. GoPrint, determines the optimal number of orders, and determines the exact order time for redemption of goods, so as to produce the results of this study as a prototype of the goods purchase management system.

LITERATURE REVIEW

For any research endeavour, a thorough review of literature is of paramount importance. Such an effort will highlight the past attempts made and provide clear comprehension of similar studies. The cycle calculation method plays an important role in measuring the level that exists, and reaches a certain level of accuracy, and increases accuracy. Cycle calculation methods such as classifying items into fast or slow moving items and making peace with the system and stock bin for each individual SKU (Stock Keeping Unit) at a frequency of three times, twice and once a year. The cycle calculation process includes three phases of activity, the Problem Identification phase, the 80/20 phase, and the Implementation phase. And this study reveals that to achieve the desired accuracy goals, cycle times must be adjusted to compensate for the increase or decrease in inventory system integrity. [6,1]

In other studies, discuss issues related to forecasting and inventory management in a wholesale environment and discuss recommendations submitted in such contexts in case study organizations. This finding shows the scope that exists to

improve current practice and offer insight into possible managerial problems. In that case, effective control of stock levels is an important measure of operational performance, especially in the context of achieving a high level of customer service. [3]

Further research on production environments where demand and waiting times vary, a significant level of inventory of safety supplies is needed to ensure the production and delivery of final products on time. The traditional model for determining the appropriate level of safety inventory can produce more security stocks at the level of sub-assembly and finished goods than is needed and thus cause inventory storage costs to be higher than desired. Such models generally mistakenly assume that demand during the waiting time follows a normal distribution. This study compares the proposed model with the traditional model by conducting a simulation analysis using three data sets obtained from electronic manufacturers. The results indicate that the proposed model produces closer to the target service level and inventory costs which are lower than the traditional model, regardless of the data set used. [7]

RESEARCH METHODOLOGY
Max-Min Method
The calculation used in the Min-Maks method is: [8]

1. Safety Stock
$$SS = A/N \qquad (1)$$
Where:
SS = Safety Stock
A = Demand
N = Number of periods (transaction frequency)
2. Minimum Stock
$$Min - Stock = (A \times L) + SS \qquad (2)$$
3. Maximum stock
$$Max - Stock = 2 \times (A \times L) + SS \qquad (3)$$
4. Order Quantity
$$Q = (Max\text{-}Stock) - (Min\text{-}Stock) \qquad (4)$$
5. Average Inventory Level
$$I = SS + (\tfrac{1}{2}) \times Q \qquad (5)$$
6. Turn Over Ratio
$$TOR = A/I \qquad (6)$$
7. Total Inventory Cost
$$TC = A \times C + (A/Q) \times Co + (i.\ A \times C) \qquad (7)$$

Description of the function of the Min-Max method can be seen in Figure 1.
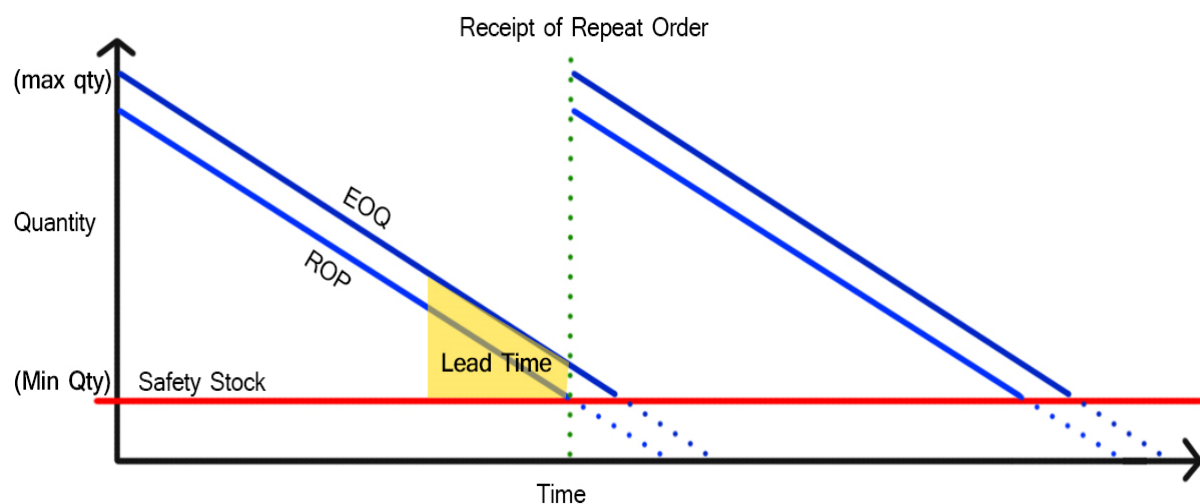
Figure 1. Min-Max method

Database
The database consists of 2 words, namely base can more or less be interpreted as a base or warehouse, nesting/gathering place. While data is a real-world representation that represents an object such as humans (employees, student, buyers, customers), goods animal, events, concepts, circumstances and so on, which are realized in the form of numbers, letters, symbols,

text, images, sounds or combination. Basically, the process of creating a database is like making an information system. There are three basic phases in designing a database, namely:

Table 1. Database Development Phase Table

Database Development	Database	Application
Requirement	Build data model Specifies data items Define boundaries and rules	Determine the application requirement
Design	Table Correlation Index Boundaries	Form Report Queries Application Code
Implementation	Creating tables Creating correlations Creating limits Fill in the database Test	Creating Form Creating Report Creating Queries Writing Application Code Test

Data models developed in the requirements phase are data item types, lengths another property. For the design phase, the data model is transformed into tables and correlation. While the implementation phase, tables, and correlation are created in the phase.

Programming Tool

In designing and developing information system certainly requires several tools in the form of programming languages or tools. in this information system using several tools, namely: Hypertext Preprocessor (PHP) and XAMPP as web servers using databases from MySQL, Sublime Text for application coding, and Hypertext Markup Language (HTML) and CSS to create views and JSON (JavaScript Object Notation) to facilitate generating data.

RESULT AND DISCUSSION
System Design

The design of a system will be done after analysis of a system is skipped, designed as drawing, planning, masking a pattern sketch of a number of separate elements into one whole unit or often called an interface. The tools used to describe system design in general that will be built are context diagrams, level data flow diagrams, and entity correlation diagrams.

Solution Implementation

Implementation is a system application that we have analyzed. Implementation steps cannot be carried out before the system analysis phase has been completed. The implementation phase starts with the interface system design interface process. This interface design will be a place to enter, change, and delete data to be managed. After the interface is created, the system will also be used. Following is the Application Optimizing Safety Stock Placement Using the Max-Min Method for Printing Companies.

Application Optimizing Safety Stock Placement Using the Max-Min Method will be implemented and tested. This application developed to work as follows, see figures 2 to 8:

1. The user launches the application and login to access the start page
2. Users fill in supplier data
3. Users fill in item data
4. Users fill in the purchase data
5. Users fill in the order data
6. The user fills out the item expenditure data
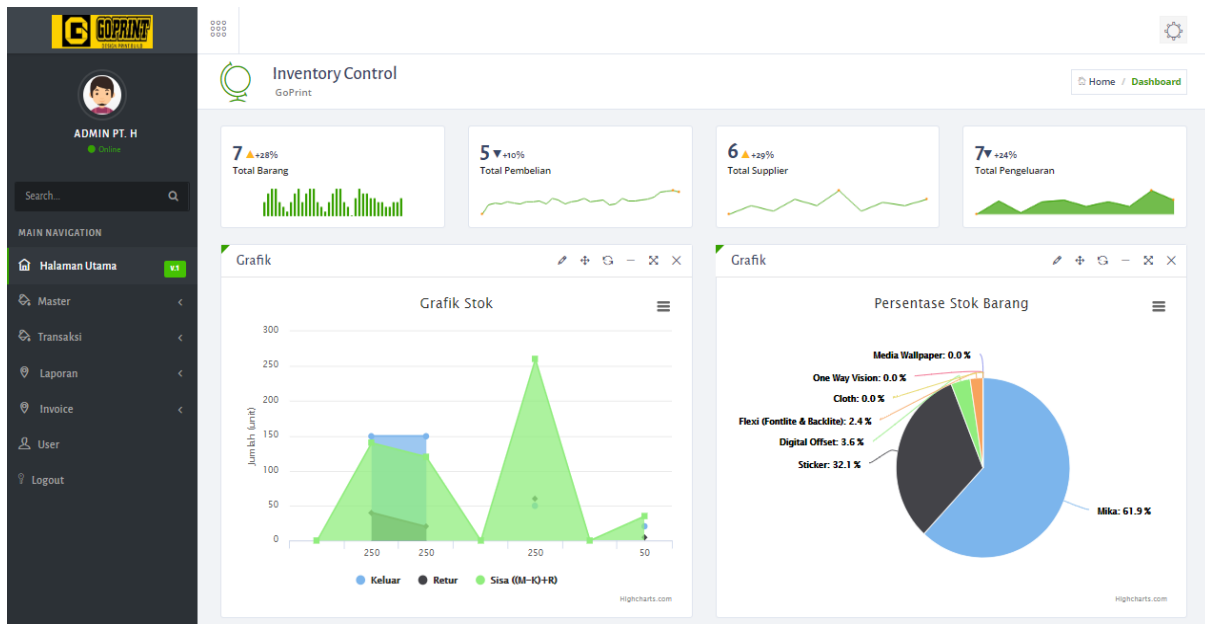7. Users get the results and stock items left

Figure 2. Early Form (Dashboard)

Figure 3. Users fill in supplier data

Figure 4. Users fill in item data.

Figure 5. Users fill in the purchase data

Figure 6. Users fill in the order data

Figure 7. user fills out the item expenditure data

Figure 8. Users get the results and stock items left

In the process, the inventory results are pages that display minimum and maximum inventory items where the author uses the MIN MAX method. With this method, the inventory results are implemented at each minimum and maximum number of items where if the amount of stock is below the minimum amount it will automatically be red and if it is green if the maximum number of stocks. A simple example is; if the minimum price of item A is 15 it will be red and if the maximum number of items A is 30 then it will be green and so on.

CONCLUSION

The conclusions obtained after conducting this research are:
1. With this application, management can make the right and accurate decisions to determine how much goods should be ordered to suppliers for stock replenishment.
2. This application is able to do an analysis in advance of the method used so that a more objective decision will be obtained.
3. In resolving cases conducted by writers in printing companies in Banda Aceh, the use of the Max-Min method implication function is easier to get more precise output.

REFERENCES
1. Kumari KP, Jagadeeswaran S. A study on inventory control techniques in apparel industry. International Journal of Research and Review. 2018; 5(2):61-66.
2. Iqbal T, Aprizal D, Wali M. Aplikasi Manajemen Persediaan Barang Berbasis Economic Order Quantity (EOQ). Jurnal JTIK (Jurnal Teknologi Informasi dan Komunikasi). 2017;1(1):48-60.
3. Syntetos AA, Babai MZ, Davies J, Stephenson D. Forecasting and stock control: A study in a wholesaling context. International Journal of Production Economics. 2010 Sep 1;127(1):103-11.
4. Kinanthi AP, Herlina D, Mahardika FA. Analisis Pengendalian Persediaan Bahan Baku Menggunakan Metode Min-Max (Studi Kasus PT. Djitoe Indonesia Tobacco). PERFORMA: Media Ilmiah Teknik Industri. 2016 Sep 1;15(2).
5. Ariesty A, Andari TT. Metode Economic Quantity Interval (EOI) Untuk Optimalisasi Persediaan Barang Consumable Adem Sari Chingku Pada PT Sari Enesis Indah Ciawi Bogor. Jurnal Visionida. 2018 Apr 11;2(1):1-4.
6. Lakshmi Narasimha A. A Concept Note on the Relationship Between Empowerment, Collaboration and Selected Outcomes in a Supply Chain.

IUP Journal of Supply Chain Management. 2017 Sep 1;14(3):26-48.

7. Ruiz-Torres AJ, Mahmoodi F. Safety stock determination based on parametric lead time and demand information. International Journal of Production Research. 2010 May 15;48(10):2841-57.

8. Ginting RB. Analisis Fungsi Implikasi Max-Min dan Max-Prod Dalam Pengambilan Keputusan. Creative Information Technology Journal. 2014; 1(2):128-38.

******