



## INVENTORY PLANNING ANALYSIS USING THE CONTINUOUS REVIEW SYSTEM METHOD IN THE COTTON, KAPOK, AND ESTER RAW MATERIAL WAREHOUSE AT PT. UNITEX

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**Abstract.** The management of cotton, kapok, and ester raw material inventories at PT Unitex applies the Continuous Review System (CRS) method to optimize inventory control. CRS enables continuous monitoring of stock levels, allowing reordering to be conducted when inventory reaches the reorder point, thereby maintaining optimal material availability, preventing shortages and excess inventory, and reducing storage costs. This study aims to determine safety stock, reorder points, economic order quantity (EOQ), and maximum inventory levels by considering factors such as demand, lead time, and storage capacity. Historical demand data from 2024 were analyzed using the Moving Average and Single Exponential Smoothing (SES) methods, with SES providing the most accurate forecasts for cotton and ester, while Moving Average 2 was most accurate for kapok. The results indicate that cotton has the highest safety stock (54,766.6 kg), an optimal reorder point of 71,632.35 kg, and an EOQ of 35,110 kg with a purchase frequency of 10 times per year, while the maximum warehouse capacity for cotton reaches 207,000 kg. Overall, the implementation of the CRS method has proven effective in reducing the risk of stockouts and minimizing storage costs. Therefore, this study recommends periodic reviews of high-demand raw materials and the optimization of warehouse layout to further improve inventory management efficiency.

**Keywords:** Inventory management, continuous review systems, safety stock, economic order quantity, reorder point.

### 1. Introduction

Raw material inventory is an important component in the production process in manufacturing companies. Effective inventory management can support smooth operations and prevent delays caused by material shortages [8]. Therefore, inventory planning and control are crucial for maintaining a company's efficiency and effectiveness [5]. In the textile industry, warehouses for cotton, kapok, and ester raw materials play a strategic role in maintaining production continuity. As the main materials for yarn production, cotton, kapok, and ester must be available in sufficient quantities to meet production needs. An imbalance between supply and demand can hinder the production process and increase the company's operational costs [11].

PT Unitex has experienced stock shortages of raw materials, including cotton, kapok, and ester, on several occasions. Based on an interview with Mr. Mahram, the deputy supervisor, PT Unitex has experienced stock shortages on at most two occasions per year. This situation forces companies to reduce the proportion of raw materials in production, which ultimately affects product quality. To prevent this problem, a more efficient and responsive inventory management system is needed. One method for inventory planning is the Continuous Review System (CRS). This method enables continuous inventory monitoring, with reordering

occurring immediately upon reaching the reorder point [15]. By implementing the Continuous Review System, companies can ensure optimal availability of raw materials without incurring excess inventory, which can increase storage costs [19]. This method has been widely applied in various industries to improve operational efficiency. Through the Continuous Review System, companies can avoid stock shortages that hamper production and reduce the risk of excess inventory, which increases storage costs and the potential for raw material damage [2].

This study will analyze the application of the Continuous Review System method in the raw material warehouse for cotton, kapok, and ester at PT. Unitex to assess its effectiveness in inventory management. The main objective of this study is to assess the extent to which the Continuous Review System method improves inventory management efficiency and its impact on warehouse operations. For the Continuous Review System method to be implemented optimally, accurate data on raw material demand levels, ordering times, and storage capacity are required [15]. Therefore, this study will also examine various factors that influence the performance of the continuous review system method in managing raw material inventory.

PT. Unitex faces challenges in maintaining a balance between demand and raw material availability. External factors such as price fluctuations, delivery delays, and changes in market demand are also important considerations in efficient inventory management. With a deeper understanding of the implementation of the Continuous Review System, the company can make more accurate decisions regarding the timing and quantities of raw material orders. The application of this method can help reduce resource waste and increase overall profitability. In addition to improving operational efficiency, the implementation of the Continuous Review System also has the potential to strengthen PT. Unitex's competitiveness. With a better inventory management system, the company can ensure the timely availability of raw materials, thereby ensuring smooth production and optimal customer demand.

Thus, this research is expected to assist PT. Unitex in designing a more effective inventory management strategy. The results of this research are also expected to serve as a reference for companies in optimizing inventory management to increase productivity and operational efficiency.

## 2. Methods

### 2.1 Moving Average

The moving average forecasting method is implemented by calculating the average of a number of observation values [17]. The moving average formula can be seen in equation [17]:

$$F_{t+1} = \sum_{t=1}^n \frac{X_t}{n}$$

### 2.2 Exponential Smoothing

Exponential smoothing is a forecasting method used to reduce fluctuations in forecasts. In this method, each data point is assigned a weight parameterized by alpha, so that the resulting forecast is more accurate [17]. The formula for exponential smoothing can be seen in equation 2 [17]:

$$F_{t+1} = \alpha X_t + (1 - \alpha)F_t$$

### 2.3 Weighted Moving Average

The weighted moving average method is a forecasting technique that assigns specific weights to the data used. The determination of weights is subjective, depending on the analyst's experience and the data analyst's judgment. In this method, each historical data point has a different weight, with the largest weight assigned to the latest data in each period. This is done because the most recent data is considered more relevant in the forecasting process [18]. The formula for the weighted moving average can be seen in equations 3 and 4 [18]:

$$F_{t+1} = \sum_{i=1}^n W_i X_t$$

$$F_t = W_i X_{t-1} + W_i X_{t-2} + W_i X_{t-3} + \dots + W_i X_{t-n}$$

### 2.4 Continuous Review System

The continuous review system method is an approach to inventory management that focuses on closely monitoring stock to determine when to reorder (reorder point) and ensure that the order quantity (economic order quantity) remains constant each time an order is placed. In other words, when inventory reaches a certain point, the system automatically places an order for a fixed quantity. Because there is a lead time before the ordered goods arrive, orders must be placed when sufficient stock is available to meet demand during that period. Therefore, the main challenges in implementing this method are determining the optimal order quantity and the reorder point. Optimization not only considers the estimated total inventory cost over the planning period but also accounts for the availability level of the goods. Thus, the main objective is to ensure that inventory is always available at the lowest possible cost [2].

## 3. Results And Discussion

### 3.1. Description

Several types of data are collected from PT. The Unitex raw material warehouse serves as the basis for inventory control calculations and analyses using the Continuous Review System (CRS) method. The data used includes data on the demand for cotton, kapok, and ester raw materials during 2024, raw material cost data calculated based on the unit price per kilogram, ordering cost data covering transportation, insurance, customs duties, and taxes, as well as storage cost data consisting of employee salaries and warehouse electricity costs. In addition, warehouse capacity data for each type of raw material were collected to determine the maximum storage capacity. All of this data is used in a series of calculations that include demand forecasting using the Moving Average and Single Exponential Smoothing methods to determine the demand trend for the following year, safety stock calculations to determine safety stock, reorder points to determine the optimal time for reordering, economic order quantity (EOQ) to determine the efficient order quantity, and maximum inventory to determine the ideal maximum storage limit in the warehouse.



### 3.2. Figures and Tables

Data on 2024 demand are derived from monthly recapitulations for January-December 2024. The unit of weight used in the data is bales, with 1 bale equaling 181.44 kilograms. Data demand is shown in Table 1.

Table 1 Data Demand for 2024

Data Demand for 2024 (bale)	ITEM TYPE		
	COTTON	KAPOK	ESTER
JAN	318.9084	2.7997	163.2261
FEB	268.6156	98	272.7356
MAR	178.9494	1.66	136.3583
APR	72.622	3.2997	48.8125
MAY	146.744	6	136.9945
JUN	153.653	0.7099	149.0621
JUL	194.3953	6.4291	196.5999
AUG	156.8679	0.9598	123.4249
SEP	207.8506	0	128.5465
OCT	46.11465	55.75	91.11465
NOV	361.3817	1.32	360.6653
DEC	77.8849	0.3031	79.0753

Raw material cost data are derived from calculations assuming a 20% reduction in the original price. The unit of weight used in this dataset is pounds, with 1 kilogram equal to 2.2 pounds. Raw material cost data are presented in Table 2.

Table 2 Raw Material Cost Data

RAW MATERIAL COST			
Raw Material	Unit (Lbs)	Raw Material Cost (\$)/Pounds	Raw Material Cost (\$)/Kg
COTTON	US\$/ pounds	38,526.40	84,758.08
KAPOK	US\$/ pounds	15,270.38	33,594.84
ESTER	US\$/ pounds	28,000.07	61,600.16

Ordering cost data was obtained from calculations and assumptions. Transportation and insurance costs were assumed based on company-relevant sources. Customs duty and PPN percentages were assumed based on official Indonesian tax information. Lead time data was obtained by inquiring with the spinning supervisor at the company. Raw material cost and lead time data are presented in Table 3.

Table 3 Ordering Cost Data

Raw Material	ORDERING COST (\$)						Lead Time (days)
	Raw Material Cost	Transport	Assurance	Bea Cukai (10%)	PPN (11%)	Total Cost/Kg	
COTTON	84,758.08	6.16	12.32	8,475.81	10255.7	103,508.09	14
KAPOK	33,594.84	6.16	12.32	0	3695.43	37,308.76	7
ESTER	61,600.16	6.16	12.32	0	6776.02	68,394.66	10

The data store contains employee salaries and electricity usage. There are two employees working in the warehouse. The storage cost data used in the calculation are in dollars, converted at an exchange rate of Rp 16,200.00. Storage cost data are presented in Table 4.

Table 4. Storage Cost Data

Type of Cost	Storage Cost	
Salaries	Rp 105,907,736.00	\$ 6,537.51
Electricity	Rp 4,071,385,690.00	\$ 251,320.10
Total Storage Cost/Year	Rp 4,177,293,426.00	\$ 257,857.62

Each warehouse comprises three storage areas for each raw material. Raw materials arrive from suppliers in balls, with each ball weighing a different amount in kilograms. One ball of cotton weighs 230 kilograms, one ball of kapok weighs 100 kilograms, and one ball of ester weighs 300 kilograms. Warehouse capacity cost data are presented in Table 5.

Table 5. Warehouse Capacity Data

RAW MATERIAL	CAPACITY		
	BALL	KG	BALE
COTTON	900	207000	1140.87
KAPOK	500	50000	275.573
ESTER	576	172800	952.381

Forecasting is conducted to predict the demand for raw materials for the period from January to December 2025. The forecasting calculations will use several methods: the Moving Average 2 Method ( $k=2$ ), the Moving Average 3 Method ( $k=3$ ), the Moving Average 4 Method ( $k=4$ ), and Single Exponential Smoothing ( $\alpha=0.8$ ). Each method will include calculations of forecasting error metrics: MAD, MSE, and MAPE. The selected forecasting method will be determined by the lowest MAPE. The results of the forecasting error accuracy calculations for cotton, kapok, and ester items are presented in Tables 6 to 8.

Table 6 Calculation Results for Cotton Forecasting

Forecast Method	ITEM COTTON		
	MAD	MSE	MAPE
Moving Average 2	68.2647	8054.05	60%
Moving Average 3	71.2241	8619.22	60%
Moving Average 4	70.1312	8492.12	59%
Single Exponential Smoothing	34.7135	3769.82	23%

Table 7 Calculation Results for Forecasting Kapok

ITEM KAPOK			
Forecast Method	Indicator		
	MAD	MSE	MAPE
Moving Average 2	15.5489	1050.6	66%
Moving Average 3	19.2549	935.68	630%
Moving Average 4	18.6474	772.511	721%
Single Exponential Smoothing	5.69032	69.2117	223%

Table 8 Calculation Results for Forecasting Ester

ITEM ESTER			
Forecast Method	Indicator		
	MAD	MSE	MAPE
Moving Average 2	72.1665	7697.82	62%
Moving Average 3	61.8408	6675.22	59%
Moving Average 4	63.8806	6747.75	56%
Single Exponential Smoothing	22.5014	1002.68	19%

In calculating safety stock using 2024 demand data. Before calculating safety stock, the standard deviation, service level, and Z value (multiplier factor) are required. The company has experienced stockouts an average of twice a year. From these stockout values, the company's service level can be determined. The results of the safety stock calculation are shown in Table 9.

Table 9 Calculation Results of Safety Stock

Item Type	Total Demand	Demand Average	Service Level	Z	Safety Stock (Bale)	Safety Stock (Kg)
Cotton	2183.987	181.998	99.91%	3.11628	301.8441587	54766.6
Kapok	177.2313	14.769	98.87%	2.28065	69.4366001	12598.58
Ester	1886.616	157.218	99.89%	3.07286	264.3769616	47968.56

The reorder point calculation aims to determine the appropriate time to reorder materials to prevent stock shortages in the company's warehouse. Several factors must be considered when calculating the reorder point, including lead time, average daily demand from forecasts, and safety stock. The average daily demand is assumed to be 25 working days. Table 10 shows the results of the reorder point calculation.

Table 10 Calculation Results of Reorder Point

Item Type	Demand Average/Month	Demand Average/Day	Lead Time (Day)	Safety Stock (bale)	Reorder Point (bale)	Reorder Point (Kg)
Cotton	165.991014	6.639640561	14	301.8441587	394.7991266	71632.35352
Kapok	14.57287151	0.58291486	7	69.4366001	73.51700412	13338.92523
Ester	151.0033847	6.04013539	10	264.3769616	324.7783155	58927.77757

After determining the reorder point, the economic order quantity (EOQ) can be calculated to determine the optimal quantity of cardboard to order. The EOQ calculation aims to determine the optimal order quantity to minimize costs associated with material ordering and storage. In the EOQ calculation, three components must be considered: demand, storage costs, and ordering costs. Table 11 shows the results of the economic order quantity calculation.

Table 11 Calculation Results of EOQ

Item Type	Total Demand (Kg)	Storage Cost (\$)	Shipping Cost (\$)	EOQ (Kg)	EOQ Rounding (Kg)	Purchase Frequency/Year	Rounding Purchase Rounding
Cotton	361408.9 15	60.70	103,508.09	35107.13312	35110	10.29362	10
Kapok	31729.22 167	60.70	37,308.76	6245.164625	6250	5.076675	5
Ester	328776.6 495	60.70	68,394.66	27218.88745	27220	12.0785	12

After determining the EOQ or efficient order quantity, the maximum inventory or maximum storage quantity in one warehouse can be recalculated. This is to avoid overstocking and determine the efficient storage quantity. Table 12 shows the results of the maximum inventory calculation.

Table 12 Calculation Results of Maximum Inventory

MAXIMUM INVENTORY			
Item Type	EOQ Rounding (Kg)	Safety Stock (Kg)	Max Inventory (Kg)
Cotton	35110	54766.60416	89876.60416
Kapok	6250	12598.57672	18848.57672
Ester	27220	47968.55592	75188.55592

#### 4. Conclusion

The amount of safety stock that the company can apply is 54,766.60416 kilograms for cotton items. For kapok items, it is 12,598.58 kilograms. For ester items, it is 47,968.56 kilograms. The company can reorder raw materials when the remaining stock is 71,632.35352 kilograms of cotton, 13,338.92523 kilograms of kapok, and 58,927.77757 kilograms of ester. The optimal order quantity or EOQ for the company is 35,110 kilograms for cotton, 6,250 kilograms for kapok, and 27,220 kilograms for ester. The company can place orders 10 times per year for cotton, 5 times per year for kapok, and 12 times per year for ester. The maximum storage limit for each item is 207,000 kilograms for cotton, 50,000 kilograms for kapok, and 172,800 kilograms for ester.

#### 5. Acknowledgement

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