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INVENTORY CONTROL OF MEDICINAL PRODUCTS, VITAMINS, AND VACCINES FOR ANIMALS

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ABSTRACT

The purpose of this research is to know the methods of forecasting and inventory control methods is right that produces the lowest total cost with the number of requests and the optimal purchase frequency for medicinal products, vitamins, and vaccines. The object of this research conducted at ComandoIntervetcom Ltd). a company engaged in the production of medicines, vitamins, and vaccines for animals. Research methods used in this research is forecasting for forecasting, while for the procurement of supplies, the method used is Q models, P models, the concept of Min-max, EOQ (Economic Order Quantity), and EOI (Economic Order Interval). His research is one of the results of each method of forecasting and inventory control will be selected as the appropriate method for the procurement of supplies of the company.*

Tujuan dari penelitian ini adalah untuk mengetahui metode peramalan dan metode pengendalian persediaan yang tepat yang menghasilkan total biaya terendah dengan jumlah permintaan dan frekuensi pembelian optimal untuk produk obat, vitamin, dan vaksin. Objek penelitian ini dilakukan di Comando Intervetcom Ltd, sebuah perusahaan yang bergerak dalam produksi obat-obatan, vitamin, dan vaksin untuk hewan. Metode penelitian yang digunakan dalam penelitian ini adalah forecasting untuk model peramalan, sedangkan untuk pengadaan persediaan, metode yang digunakan adalah model Q, model P, konsep Min-max, EOQ (Economic Order Quantity), dan EOI (Economic Order Interval). Penelitiannya adalah salah satu hasil dari masing-masing metode peramalan dan pengendalian persediaan yang akan dipilih sebagai metode yang tepat untuk pengadaan persediaan perusahaan.

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1. Introduction

Inventory is one of the important assets in the company, because it usually has a value that is large enough and has a great influence on his operating costs, planning and inventory control is one of the important activities to get special attention from the management company. This control aims to make finished goods or production process can result in accordance with what is desired by the customer, either in quality or handover quantity time. Inaccuracy in the procurement of supplies of the products are owned by the company will cause a buildup of goods or shortage of goods that eventually resulted in decreased sales and financial losses.

In the framework of an effective inventory control, certainly should be supported with forecasting methods of preparation. And the method to be precise, so that for each period, risks do not occur as previously mentioned at the company. Forecasting is also useful for helping a company to determine how the number of optimal inventories, how much should be ordered whenever a reservation, and when the bookings must be made to meet the needs of its products, as well as the minimum number of stock items should they provide so as not to place the risk of shortage of goods for sale.

ComandoIntervetcom Ltd*). is a company engaged in the production of medicines, vitamins, and vaccines for animals. Composed of local produce and products from abroad (imports), where 90% of their products are targeted to the chicken. Therefore, the priority of their target market is the chicken ranches. Based on the interviews that have been conducted, it turns out the company sometimes have problems in terms of their product inventory control, i.e. drugs, vitamins, and vaccines for animals. This issue looks at the times when the product inventory piling up or too little or less to meet consumer demand. This problem is often caused by changes in the number of product demand unexpectedly.In addition, the problem is also related to the occurrence of frequent delays in ordering goods, so any product deficiency incidence cannot be avoided. Vice versa, if the company is experiencing a buildup of product, then the company's costs will automatically join the increase that resulted in the company can't seem to get the maximum profit possible integrations.

Table 1. Data product sales

Month	Biosolamin	Micromix 2000	Purevax
Juny-**2013**	3,461	27,360	2,013
July	2,860	23,187	1,692
August	2,383	19,818	1,434
September	2,166	18,521	1,328
October	2,280	18,899	1,369
November	2,506	20,105	1,472
December	2,914	22,589	1,673
Jan-14	2,728	23,050	2,607
February	2,691	19,275	2,285
March	2,493	19,287	2,135
April	2,458	18,860	2,209
May	2,423	18,433	2,283
	31,363	**249,384**	**22,500**

Table2.*Development of poultry population in Indonesia*

Year	Free-range Chicken	Layer Chicken	Broiler	Duck
2000	259,257	69,366	530,874	29,035
2001	268,039	70,254	621,870	32,068
2002	275,292	78,039	865,075	46,001
2003	277,357	79,206	847,744	33,863
2004	276,989	93,416	778,970	32,573
2005	278,954	84,790	811,189	32,405

2006	291,085	100,202	797,527	32,481
2007	272,251	111,489	891,659	35,867
2008	243,423	107,955	902,502	39,840
2009	249,963	111,489	1,026,379	40,676
2010	257,544	105,210	986,872	44,302
2011	264,340	124,636	1,177,991	43,488
2012	274,564	138,718	1,244,402	49,295
2013	290,455	147,279	1,355,288	50,931

On the basis of existing problems, then problem identification to be made are as follows: (1).Which of the following most forecasting method for predicting the demand for each product (period of June 2013 - June 2014) on a company, (2). Where is the inventory control methods that result in the lowest total cost and how the number of requests optimized each product (period of June 2013 - June 2014) on the company;(3). What is the optimal frequency of purchases and re-orders point for each product (period of June 2013- June 2014) on the company.This research to limit the problem only related to planning and controlling supplies of raw materials to manufacture products in ComandoIntervetcom Ltd*). And the necessary data is data sales, booking fees, storage fees, price per-product safety, product, and service level.

The contribution in this research is the method applied, which use five inventory methods: Q models, P models, the concept of Min-max, EOQ (Economic Order Quantity), and EOI (Economic Order Interval), for companies engaged in the field of production of drugs, vitamins, and vaccines for animals which will ultimately get the most profitable method for the company, while the purpose of this research is to help companies determine the optimal amount of inventory, how much to order every time they place an order, and when the order must be made to meet the needs of its products, as well as the minimum amount of stock of goods they must provide to avoid the risk of lack of goods for sale.

2. Literature review and Hypotheses development

Understanding Inventory

According to Pardede, Pontas M.; (2005), the supplies are a number of raw materials or finished goods which are already available for use in the future.Herjanto, Eddy; (2007), supplies the stored product is serving to fulfill specific purposes, e.g. for the production process, for resale, and others. According to Assauri, Sofyan; (2005), the inventory is current assets that included the company's goods that will be sold in a given period or goods that are still in the process of production.

According to Nicholas J. Aquilano, Nicholas J., Jacobs, F. Robert, Chase, Richard B.; (2009), they mention some of the objectives of inventory control, IE: maintaining the smooth operation of the company's business, knowing the variations in demand, production scheduling flexibility, keeping things unpredictable delays delivery of materials and take advantage of the size of the purchase of raw materials.

The notion of forecasting according to Nasution, Arman; judges (2006), forecasting is a estimated how much it needs in the foreseeable future which includes the necessity in the size of the quantity, quality, time and location in order to meet consumer demand. Can be classified into two methods, namely, qualitative and quantitative.

According to Heizer and Render (2009), a method of forecastinginclude:

- *Moving Average*

$$F_t = \frac{\sum \text{Request on the previous n period}}{n}$$

- *Weighted Moving Average*

$$\mathbf{F_t} = \frac{\sum (\text{Period Weight n})(\text{demand in period n})}{n}$$

- *Exponential Smoothing*
  $\mathbf{F_t} = F_{t-1} + \alpha\,(A_{t-1} - F_{t-1})$
  $\mathbf{F_t}$ = A new forcasting
  $\mathbf{F_{t-1}}$ = Previous Forecasting
  $\boldsymbol{\alpha}$ = The constant rare faction (weighting) $(0 \le \alpha \le 1)$
  $\mathbf{A_{t-1}}$ = Demand and the actual period of last request

- *Exponential Smoothing with Trend*
  $\mathbf{F_t} = \alpha\,(A_{t-1}) + (1 - \alpha)(F_{t-1} + T_{t-1})$
  $\mathbf{T_t} = \beta\,(F_t - F_{t-1}) + (1 - \beta)\,T_{t-1}$
  $\mathbf{F_t}$= forecasting with an exponential mashed from the data series of the t period
  $\mathbf{T_t}$ = A trend with an exponential that smoothed in the t period
  $\mathbf{A_t}$ = The actual demand in the t period
  $\boldsymbol{\alpha}$ = The constant rarefaction to an average $(0 \le \alpha \le 1)$
  $\boldsymbol{\beta}$ = The constant rarefaction to trend $(0 \le \beta \le 1)$

- *Linear Regression*

  $\hat{y} = a + bX$

  $$\mathbf{a} = \frac{\sum Y}{n} - \frac{b \sum X}{n}$$

  $$\mathbf{b} = \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2}$$

  $\hat{\boldsymbol{y}}$ = Value of a variable will be predicted (dependent variable)
  a = Intersection the y-axis
  b = The regression coefficients /slop
  Y = The value of the variable is bound to a known
  X = Free variable value is known
  b = Free variable value is known (the level of change in y for a change that occurs in x)
  n = The amount of data or observation

- *Naïve Method*
  $Y_{t+1} = Y_t$

  $\mathbf{Y_t}$ = current period
  $\mathbf{Y_{t+1}}$ = next period

Of each method of forecasting, there is a measure of the accuracy of forecasting results, where it is used as a determinant in the decision's conclusion at the end of the forecast. According to Nasution, Arman judges (2006), a measure of the accuracy of forecasting the results are:

- *Mean Absolute Deviation = MAD*

  $$\text{MAD} = \sum \left| \frac{A_t - F_t}{n} \right|$$

  Description:

  A = Actual demand in t period
  $\boldsymbol{F_t}$ = Forecasting in t period
  n = The number of forecasting period involved

- *Mean Square Error = MSE*

$$MSE = \sum \frac{(A_t - F_t)^2}{n}$$

The assumptions of EOQ according to Nasution (2006):

- Only one product which is count.
- Needs (demand) every period known to (certain).
- Ordered goods can be assumed to be available shortly (instaneously) or the level of production (production rate) ordered goods galore (infinity)
- Constanslead time.
- Each order is received in a single delivery and can be used directly.
- No order is reset (back order) out-of-stock (shortage).
- There is no discount for volume purchases that much (quantity discount).

The formula of the EOQ is:

$$EOQ = Q^* = \sqrt{\frac{2DS}{H}}$$

Description:

Q* = the optimum number of units per order (EOQ)
D = demand per-period
S = ordering cost for every orders
H =holding cost per-unit per-year
TC = total cost

According to Aquilano et al. (2009), Q Models are models that refers to the amount of the booking size fixed for each message, and the time the reservation is made for variety.

$Q^* = \sqrt{\frac{2DS}{H}}$
$SS = zs\sqrt{L}$
$R = dL + SS$
SS = Safety Stock
R = Reorder Point

According to Aquilano, Nicholas J., Jacobs, F. Robert, Chase, Richard B.; (2009), P Model is a model which refers to a regular booking rules follow a fixed period, but the quantity of goods ordered vary.

$Q^* = d\,(T^* + L) + SS - I$
$T^* = \sqrt{\frac{2S}{HD}}$
$SS = Zs\sqrt{(T* + L)}$
$I = SS + \frac{1}{2}(dT^*)$

I = inventory in stock
T* = re-order point
L = lead time
s = standar deviation
SS = Safety Stock
d = demand average

The concept of Min-Max is the concept that when supplies have passed minimum limit and the limit of safety stock, then re-bookings must be made. Maximum limit (maximum stock) is the company's willingness to invest his money in the form of supplies of raw materials.

SS $= \frac{D}{n}$

Min. Stock = (DL) + SS

Max. Stock = 2(DL) + SS

f $= \frac{D}{Q}$

T $= W\frac{D}{Q}$

Q = Max. Stock - Min.Stock

Economic Order Interval is period between orders that minimizes the total inventory cost under the given assumptions. EOI is estimated by comparing the cost of placing an order with the cost of holding inventory.
Formula in this concept is:

$$EOI = \frac{\sqrt{2(Co)}}{\text{Ch.D}}$$

Maximum Inventory Level (E) = SS+D(EOI+L)
Average Interval Level (I) = SS + ½D (EOI)

Turn Over Ratio $= \frac{D}{\text{I}}$

Order Quantity = E-I

Total Inventory cost $= \frac{Co}{\text{EOI}} + \text{I.Ch}$

3. Research Methods

Research methods used in this research is forecasting. As for the procurement of supplies, the method used is Q models, P models, the concept of Min-max, EOQ (Economic Order Quantity) and EOI (Economic Order Interval).

Data collection technique

In this study, researchers used three data collection techniques: 1. survey. 2. interview and 3. library study (internet and textbook)

Data Analysis Stages

In analyzing the data in this study, here are the stages in analyzing data. (1) Perform forecasting calculations for the number of future product requests. (2) Use appropriate inventory control methods so companies can find out how many orders and the optimal frequency of purchases

4. Results and Discussion

Under this data is needed in this research.

Forecasting Analysis

Here is the result of forecasting for june 2014 after use six a method of divination to each products.

1. Biosolamin

- Moving Average = 2,617.83 ml (MAD=186.08; MSE=40,343.31)
- Weighted Moving Average= 2,447.5 ml (MAD=227.53; MSE=87,979.55)
- Exponential Smoothing = 2,533.63 ml (MAD=381.94; MSE=21,1870.85)
- Exponential Smoothing with Trend= 2,339.9ml (MAD=381.94; MSE=22,3022.6)
- Linear Regression = 2,388.83ml (MAD=232.72; MSE=97,385.45)
- Naïve Method = 2,423ml (MAD=85,815.82; MSE=230.36)

2. Micromix 2000

- Moving Average = 20,249 kg (MAD=1,652.41; MSE=2993641.01)
- Weighted Moving Average= 18,731.9kg (MAD=1,960.87; MSE=4976071.47)
- Exponential Smoothing = 19,582.57kg (MAD=2,922.26; MSE=11412710.05)
- Exponential Smoothing with Trend= 17,752.14kg (MAD=2,475.43; MSE=10508605.9)
- Linear Regression = 18,005.86kg (MAD=16,06.87; MSE=4595131)
- Naïve Method =18,433kg (MAD=1,637.18; MSE=4821984)

3. Purevax

- Moving Average = 2,198.66ds (MAD=453.80; MSE=318054.34)
- Weighted Moving Average= 2,231.2 ds (MAD=248.52; MSE=149532.69)
- Exponential Smoothing = 2,150.14ds (MAD=333.03; MSE=176414.64)
- Exponential Smoothing with Trend= 2,285.79ds (MAD=349.44; MSE=218319.9)
- Linear Regression = 2,357.5 ds (MAD=1,606.87; MSE=105588)
- Naïve Method = 2,283ds (MAD=234.90; MSE=113002.2)

Inventory Control Analysis

Here is the resulting total cost after using five inventory control methods for each product.

1. Biosolamin

☑ Q Model = IDR. 3,800,366,650,-
(SS=813,1001 ml; R=3,427.1001 ml; Q=6,626.326 ml; *f*=5 times; T=78 day)

☑ P Model = IDR. 3,839,650,350,-
(T=78 day; SS=1537 ml; I=4936 ml; Q=6012 ml; *f*=6 kali)

☑ Min-max Concepts = IDR. 4,757,200,350,-
(SS=2,614 ml; Min.Stock=33,977 ml; Max.Stock=65,340 ml; Q=31,363 ml; *f*=1 time; T=365 day)

☑ EOQ = IDR. 3,781,682,979,-

- Q = 6,626.32 ml
- Average Inventory = 3,313.16 ml
- Orders per period (year) = 4.73 times
- Annual Setup Cost = IDR. 331,316,629,-
- Annual Holding Cost = IDR. 331,316,000,-
- Total Unit Cost = IDR. 3,119,050,350,-
- Daily Demand Rate = 120.62 ml
- ROP = 10,118.6 ml

☑ EOI (Total Cost) = IDR. 18,568,289,259,979,-

- EOI =0.00000377
- Maximum Inventory Level(E) = 947,390.1182
- Average Interval Level(I) =6,500.026845
- Turn Over Ratio = 4.825056995
- Order Quantity = 940,890.0914

2. Micromix 2000

☑ Q Model = IDR. 79,397,869,800,-
(SS=6,331.51 kg; R=27,113.51 kg; Q=18,685.22 kg; *f*=14 times T=28 days)

☑ P Model = IDR. 79,603,008,800,-
(T=26 day; SS=11,819 kg; I=20,825 kg; Q=29,788 kg; *f*=9 times)

☑ Min-max Concept = IDR. 90,022,808,800,-
(SS=20,782 kg; Min.Stock=270,166 kg; Max.Stock=519,550 kg; Q=249,384 kg; *f*=1 time; T=365 days)

☑ EOQ = IDR. 79,352,131,211,-
- Q = 18,685.22 kg
- Average Inventory = 9,342.61 kg
- Orders per period (year) = 13.34 times
- Annual Setup Cost = IDR. 934,261,411,-
- Annual Holding Cost = IDR. 934,261,000,-
- Total Unit Cost = IDR. 77,483,608,800,-
- Daily Demand Rate = 959.16 kg
- ROP = 103,774.8 kg

☑ EOI(Total Cost) = IDR. 147,545,064,021,319,-
- EOI =0.0000047
- Maximum Inventory Level(E) = 7,556,520.117
- Average Interval Level(I) =75,000.05861
- Turn Over Ratio = 3.325117402
- Order Quantity = 7,481,520.059

3. Purevax

☑ Q Model = IDR. 2,653,124,000,-
(SS=1,007.07 ds; R=2,882.07 ds; Q=5,612.48 ds; *f*=4 times; T=91 day)

☑ P Model = IDR. 2,676,850,000,-
(T=90 day; SS=4,029 ds; I=6,842 ds; Q=4,687 ds; *f*=5 times)

☑ Min-max Concepts = IDR. 3,287,500,000,-
(SS=1,875 ds; Min.Stock=24,375 ds; Max.Stock=46,875 ds; Q=22,500 ds; *f*=1 times; T=365 day)

☑ EOQ = IDR. 2,653,824,000,-
- Q = 5,612.48 ds
- Average Inventory = 2,806.24 ds
- Orders per period (year) = 4 times
- Annual Setup Cost = IDR. 280,700,000,-
- Annual Holding Cost = IDR. 280,624,000,-
- Total Unit Cost = IDR. 2,092,500,000,-
- Daily Demand Rate = 86.53 ds
- ROP = 8,259.9 ds

☑ EOI(Total Cost) = IDR. 13,311,749,513,616,-
- EOI =0.00000526
- Maximum Inventory Level(E) = 680,700.1184
- Average Interval Level(I) =5,700.059175
- Turn Over Ratio = 3.947327442
- Order Quantity = 675,000.0592

Following are the results of total costs based on the calculation of each inventory control method for the three types of products.

Table 3. Recapitulation of Inventory Control Calculations

Method	Biosolamin (IDR)	Micromix 2000 (IDR)	Purevax (IDR)
Q Model	3,800,366,650,-	79,397,869,800,-	2,653,124,000,-
P Model	3,839,650,350,-	79,603,008,800,-	2,676,850,000,-
Min-Max Concepts	4,757,200,350,-	90,022,808,800,-	3,287,500,000,-
EOQ	3,781,682,979,-	79,352,131,211,-	2,653,824,000,-
EOI	18,568,289,259,979,-	147,545,064,021,319,-	13,311,749,513,616,-

Through the analysis that has been done, the method that produces the lowest total cost of the five methods used is the EOQ (Economic Order Quantity) method for Biosolamin and Micromix 2000 products, while for Purevax products there are in the Q model count.

Table 4. Details method for the third type of product

Description	Biosolamin	Micromix 2000	Purevax
Safety Stock (SS)	6,500 ml	75,000 kg	1,007.07 ds
Re-order Point (ROP)	10,118.6 ml	103,774.8 kg	2,882.07 ds
Quantitiy Purchase (Q)	6,626.32 ml	18,685.22 kg	5,612.48 ds
Frequency Purchase (f)/1 tahun	4.73 times	13.34 times	4 times

Based on the analysis of data is already done, so the authors can conclude that:

1. Procurement forecasting calculation of inventory, have obtained the proper method for the third product because it has the error rate (MAD and MSE) much smaller than other methods, i.e.:
   - Biosolaminproduct usingMoving Average method (MAD=186.0833333and MSE=40,343.31019)
   - Micromix 2000product usingMoving Averagemethod (MAD=1,652.416667 dan MSE=2,993,641.015).
   - Purevaxproduct using Linear Regressionmethod (MAD=1,606.876 dan MSE=105,588).

2. Inventory control methods that result in the lowest total cost for each product is a method of Q models for products, as well as the EOQ method Purevax (Economic Order Quantity) for Biosolamin and Micromix products 2000, with details as follows:
   - Biosolaminproduct amounted to IDR. 3,781,682,979,-with the number of requests optimized as much as 6,626.32 ml or 6,626 ml.
   - Micromix 2000product amounted toIDR. 79,352,131,211,-with the number of requests optimized as much as18,685,22 kg or 18,685 kg.
   - Purevaxproduct amounted to IDR. 2,653,124,000,-with the number of requests optimized as much as 5,612.48 ds or 5,612 ds.

3. After learning the proper inventory control methods, it can be concluded as well as the frequency of purchases and re-orders the optimum point for each product, including:
   - Biosolaminproduct as much as 4.73 timesor5 times in a year with re-order point of 10,118.6 ml.
   - Micromix 2000product as much as 13.34 times or 13 times in a year with re-order point of103,774.8 kg.
   - Purevaxproductas much as 4 times in a year, withre-order point of2,882.07 ds.

5. Limitations

In this study ignores the costs of depreciation, such as products being stolen, lost in inventory, damaged, deleted, or waste, so it is necessary to do physical calculations within a period of time, for example once a year (periodic system). Another limitation is the possibility that employees of the inventory section can enter data incorrectly, informing inaccurate data which can later interfere with a manager's decision making.

6. Conclusion

Forecasting calculations for a product, from the 6 available forecasting methods, the smallest MAD and MSE values are taken, so that the results of the forecasting will be in accordance with reality in the next period. In this study obtained Moving Average forecasting method for Biosolamin and Micromix 2000 products, while for Purevax products used Linear regression method. For the inventory method, from the five inventory methods, the method that has the lowest total cost will be selected, in this case Purevax products use the Q model calculation method, while for Biosolamin and Micromix 2000 products, the Economic Order Quantity calculation is chosen.

Implication

Theoretical implication, choosing the correct forecasting and inventory method for the calculation of the Total Cost will have a major impact on the company in the calculation of expenditure that will be done later. The results of this study can be proposed as an input for companies to recalculate the inventorythey use today.

References

Aquilano, N.., Jacobs, F. R, Chase, R.B. (2009). *Operations and Supply Management*. (12th edition). The McGraw-Hill Companies.

Assauri, S. (2005). *ManajemenProduksi dan Operasi*, EdisiRevisi Lembaga PenerbitFakultas Ekonomi Universitas Indonesia.

Heizer, Jay; and Barry Render;Alih Bahasa oleh Sungkono, C. (2009). *ManajemenOperasi*. (edisi 9, Buku 1). Jakarta: Indonesia, SalembaEmpat

Herjanto, E. (2007). *ManajemenOperasi*. (3rd edition). Jakarta: Indonesia, Grasindo.

Nasution, A.H. (2006). *ManajemenIndustri*. (edisi 1). Yogyakarta: Indonesia, Andi Offset.

Pardede, P.M.; (2005). *ManajemenOperasi dan Produksi*. Jakarta: Indonesia, Andi Offset.

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