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# Control excess stock and calculating damaged products as the effort to increase revenue (case study of SME FBS)

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**Abstract**. Of small and medium scale (SME) is a business engaged in production. The growth product innovation of each year to year made competitiveness every SME very tight, and the sales must be high that avoid goods the product last year will be tough sold in the following year. Forecasting demand is needed so that no its production. In production process, besides products should also be considered about damaged products, resulting in a loss. In this study, researchers conducted a observations on SME FBS producing pants, shirts and shirts. SME FBS not having planning previous production, also in any period of production there always products be damaged. This study attempts to increase their SME FBS by controlling waste products, and those damaged products. According to the research conducted other products in some excess pants 1609 unit , and the shirts 187911 unit, and increase the income through control over the excess product obtained by 1% to the pants, and 52% to the shirts. For damaged product on period last year and future, increase 0.07% if the damaged on shirts can be sold, and 0.29% on pants if the broken sold.
**Keywords**: Fuzzy Averaging For Forecasting, Excess Stock, Interpolation, Reject Product

## 1. Introduction

Small and medium-sized enterprise (SME) is one of the driving force of the Indonesian economy today. This has proven to be able to survive during economic crisis and become the dynamist of the economic growth after the crisis. Home based businesses as part of SME has become the backbone of the Indonesian economy. There are many business advantages in the house; besides it does not cost for renting a place, this business could grow into not only a merely side business, and the transportation costs can also be minimized [6]. SMEs are required to make innovations in their various products to survive in the market.

Forecasting is an attempt to predict any future circumstances through testing the past condition. Forecasting sales means to determine the approximate amount of sales volume, even to determine the potential sales and market area that is controlled in the future. The usefulness of forecasting is to make the right decisions based on the past events [4].

A company should be able to predict the size of customer demand for its products. This kind of forecasting is also called sales forecasting. Demand forecasting is an attempt to know whether the number or group of the future products is in a certain constraint or condition and to reduce the risks or uncertainty faced. It also deals with production control activities, capacity, and scheduling systems and becomes input for financial, marketing, and human resources planning. The maximum result of a

forecasting activity is to minimize the uncertainty that may occur in the future. To be able to reach the optimal decision, it requires ways/methods of accurate, systematic and accountable forecasting.

This study will calculate to increase the SME FBS profits and sales. The SME FBS does not have production planning; it relies on market demand that refers to market conditions at the time. Since there is no systematic production planning, there are many unsold products because the production is not in accordance with demand. The large number of unsold products drives us to know the production planning in the next year to minimize the product that accumulates in the warehouse.

In this research, the production planning will be conducted using forecasting demand method. The result is to anticipate when the production will experience a surge in demand, and the warehouse will bear for excessive goods. Through this way, SME FBS can be more anticipate and maximize its sales, so that the product can be sold entirely. As for the unsold products, the researcher uses excess stock method to find out the number of the residual products and the minimum price of the outdated products, and to determine the price of the damaged products, so that the products can come out quickly and can increase the profit.

## 2. Methods

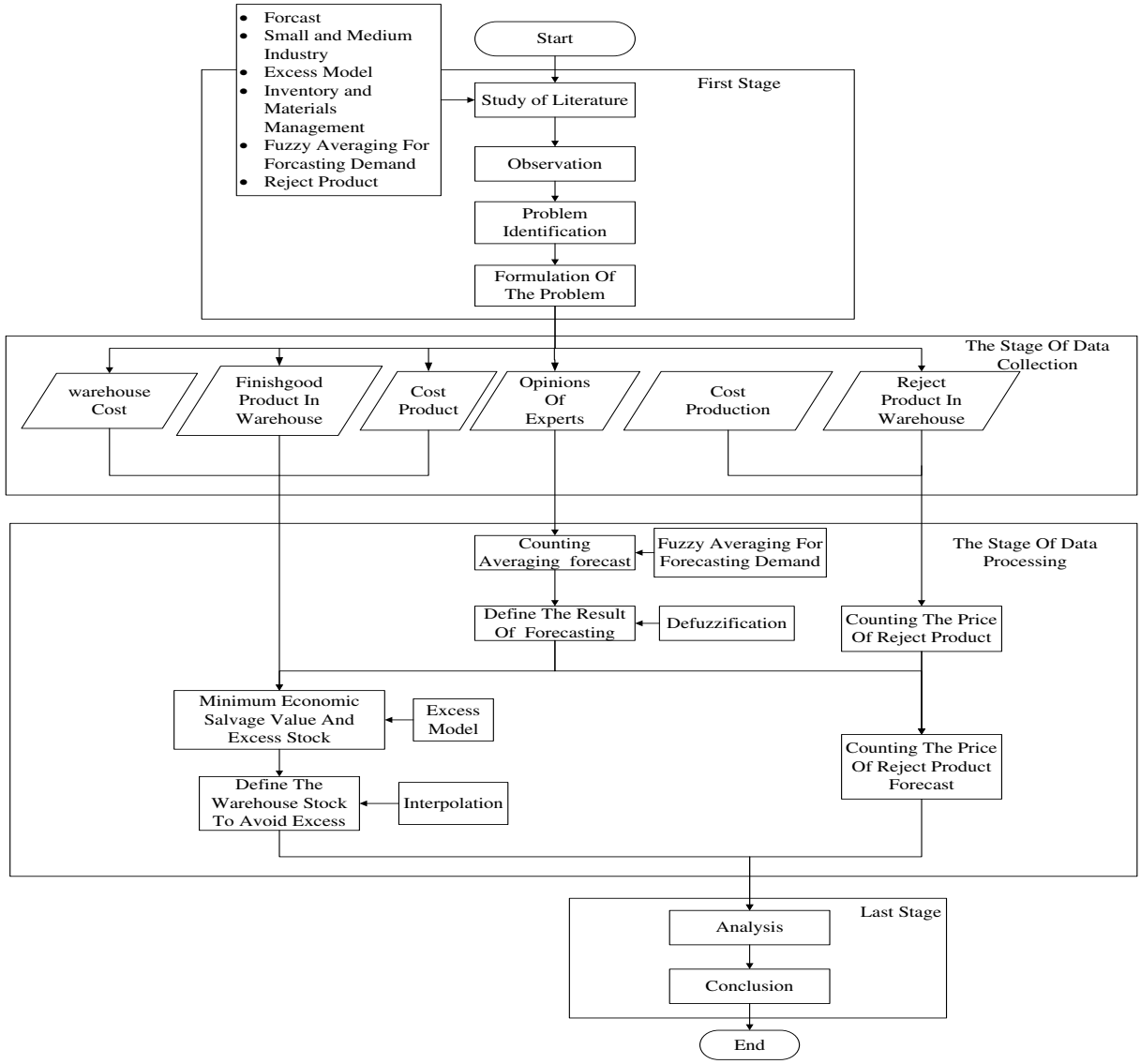


**Figure 1**. Flowchart Research

This study consists of 4 stages. The first stage is to conduct a review of the previous research and study of scientific articles related to this research topic. The second stage is to observe and collect data related to expert opinion, inventory cost, production quantity, number of products stored in warehouse, number of reject goods stored in warehouse, and production cost.

The third stage is the data processing, which consists of the calculation of product demand planning for 2018. The method used for demand planning is fuzzy averaging for forecasting method [1]. This method is processed by the expert opinion, calculating the excess model to specify the excess stock, and fixing the reject product price. The last stage is to do the analysis based on the calculations that have been done, then validate them with the company. Figure 1 presents the research flow diagram.

## 3. Result and discussion

### *3.1 Forecasting Demand*

The way to forecast with the fuzzy averaging for forecasting demand method from interview with SME FBS as an expert (Ei) is as follows:

- Calculate $A_{ave}=( m_1 , m_M, m_2 )$

$$\mathbf{A}_{ave} = (m_1, m_M, m_2) = (\frac{1}{n}\sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1|}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_2^{(i)}). \quad (1)$$

  Explanation:
  $m_1$ : the smallest production value
  $m_M$ : medium production value
  $m_2$ : the largest production value

- Specifying Defuzzification
  Explanation:
  Maximum value of forecast $A_{ave}$: $m_M$

$$Xmax = m_M \quad (2)$$

Here are the results of calculations from the forecast demand for pants, shirts and T-shirts presented in tables 1, 2, and table 3:

**Table 1**. Calculation Result of Demand Forecasting for Product Type of Pants

| Pants | | | | |
|---|---|---|---|---|
| Ei | Ai | smallest production a1(i) | medium production aM(i) | largest production a2(i) |
| E1 | A1 | 3300 | 3600 | 3750 |
| E2 | A2 | 3000 | 4000 | 5000 |
| E3 | A3 | 3100 | 3500 | 4200 |
| Total | | 9400 | 11100 | 12950 |
| Average | | 3133 | 3700 | 4317 |

From the table above, we get the result $A_{ave}$= (3133, 3700, 4317) based on the calculation using formula (1). By using the second (2) formula, the forecast value for pants is 3700 dozen.

**Table 2**. Calculation Result of Demand Forecasting for Product Type of Shirts

| Shirts | | | | |
|---|---|---|---|---|
| Ei | Ai | smallest production a1(i) | medium production aM(i) | largest production a2(i) |
| E1 | A1 | 16500 | 18000 | 18750 |
| E2 | A2 | 16500 | 17000 | 18750 |
| E3 | A3 | 16600 | 17600 | 18500 |
| Total | | 49600 | 52600 | 56000 |
| Average | | 16533 | 17533 | 18667 |

From the table above, we get the result $A_{ave}$= (16533, 17533, 18667) based on the calculation using formula (1). By using the second (2) formula, the forecast value for shirt is 17533 dozen.

**Table 3**. Calculation Result of Demand Forecasting for Product Type of T-Shirt

| T-shirts | | | | |
|---|---|---|---|---|
| Ei | Ai | smallest production a1(i) | medium production aM(i) | largest production a2(i) |
| E1 | A1 | 27500 | 30000 | 31250 |
| E2 | A2 | 27500 | 29000 | 31250 |
| E3 | A3 | 28000 | 30000 | 31000 |
| Total | | 83000 | 89000 | 93500 |
| Average | | 27667 | 29667 | 31167 |

From the table above, we get the result $A_{ave}$= (27667, 29667, 31167) based on the calculation using formula (1). By using the second (2) formula, the forecast value for T-shirt is 29667 dozen.

*3.2 Excess Stock*

After calculating the forecast for each product, the researcher can calculate the product surplus in the coming period. The excess stock can be calculated using the following formula:

- calculating actual time supply (t)

$$t = {}^{M}/_{R} \quad (3)$$

Explanation :
M :available stock in unit
R :annual demand in unit

- calculating economic time supply (t*)

$$t^* = \frac{P - Ps + {}^{C}/_{Q}}{PF} + \frac{Q}{2R} \quad (4)$$

Explanation :
P :unit cost or market value of the item
Ps :unit resale or salvage value of the item
C :order cost per order
Q : lot size per unit
F : annual holding cost fraction

After the t and t* is known, the next is to compare both results; if t> t*, the calculation can be proceed, but if the opposite happens, no further action is required because the supply is sufficient.

- specifying excess excess (q)

$$q = ( t - t^* ) \times R \quad (5)$$

- Calculating Net Benefit

$$\textit{Net benefit} = \textit{salvage revenue} + \textit{holding cot saving} - \textit{repurchase cost} - \textit{reorder cost} \quad (6)$$

$$\textit{salvage revenue} = qP_s = P_s (M - tR) = P_s M - P_s Rt \quad (7)$$

$$\textit{holding cot saving} = (M^2 PF / 2R) - (M - q)^2 PF / 2R) - ( QqPF / 2R ) = (M^2 PF / 2R) - ( RPFt^2/2 ) - (MQPF/ 2R) + ( QqPF/2) \quad (8)$$

$$\textit{repurchase cost} = Pq = PM - PRt \quad (9)$$

$$\textit{reorder cost} = (Cq / Q) = (CM / Q) - (CRt / Q) \quad (10)$$

If the net benefit is positive (+), the product can be sold at the price of Ps; but if not, the process is continued to find the minimum economic salvage value (Ps*).

- minimum economic salvage value (Ps*)

$$Ps^* = P + \frac{C}{Q} - \frac{PF(M - {}^{Q}/_{2})}{R} \quad (11)$$

After the value of Ps* is known, the product can be sold more than Ps* or its equivalent.

Here are the results of the calculations of pants, shirts and T-shirts using the excess stock, which is presented in tables 4. 5 and 6.

**Table 4**. Excess Stock Calculation Result on Pant Products

| Output | | | |
|---|---|---|---|
| Symbol | Description | Denomination | Value |
| t | Actual Time Supply | Year | 1 |
| t* | Economic Time Supply | Year | 0.97 |
| q | Excess Stock | Unit | 1522 |
| *Net Benefit* | Profit | Rupiah | 89864 |
| Ps* | Minimum Economic Salvage Value | | 49882 |

**Table 5**. Excess Stock Calculation Result on Shirt Products

| Output | | | |
|---|---|---|---|
| Symbol | Description | Denomination | Value |
| t | Actual Time Supply | Tahun | 1.0 |
| t* | Economic Time Supply | Tahun | 2.1 |

In the calculation of shirt product, it is obtained t < t*, there is no further action required because the stock is sufficient.

**Table 6**. Excess Stock Calculation Result on T-Shirt Products

| Output | | | |
|---|---|---|---|
| Symbol | Description | Denomination | Value |
| t | Actual Time Supply | Year | 1 |
| t* | Economic Time Supply | Year | 0.47 |
| q | Excess Stock | Unit | 187761 |
| *Net Benefit* | Profit | Rupiah | 98946825 |
| Ps* | Minimum Economic Salvage Value | | 28946 |

- Interpolation
  To determine the result 0 on q, which means there is no excess, the calculation using interpolation is done with the following formula:

$$\text{Interpolation ( xe )} = xs0 + \frac{xs1 - xs0}{xe1 - xe0}(x - xe0) \quad (12)$$

  Explanation:
  Xe : The sought/desired excess value which in this case is 0
  Xso : stock value before
  Xs1 : stock value after
  X0 : excess value before
  Xe1 : excess value after

Here are the results of interpolation calculations on pants and t-shirts, presented in table 7, and for increase profit from excess to zero excess on pants and t-shirts are presented in table 8 and 9:

**Table 7**. Interpolation Calculation Result to Eliminate Excess on Pants and T-shirts

| Available Stock in Unit (M) | | |
|---|---|---|
| Product | Excess | No Excess |
| Pants | 44400 | 42878 |
| T-shirts | 356000 | 168239 |

For stock on pants it will be excess if the warehouse have 44400 unit, but no excess is 42878 unit, and for T-shirt if the warehouse have stock 356000 it will be excess, for no excess is 168239 unit in warehouse.

**Table 8**. Profit Calculation Result From Excess to Zero Excess and The Percentage of Profit Increase on Pants

| **Pants** | | |
|---|---|---|
| IncomeWith Excess | Rp | 2,329,576,078.70 |
| Income Without Excess | Rp | 2,352,053,211.43 |
| Increase | | 1% |

**Table 9**. Profit Calculation Result From Excess to Zero Excess and The Percentage of Profit Increase on T-Shirt

| **T-shirts** | | |
|---|---|---|
| IncomeWith Excess | Rp | 5,271,236,167.05 |
| Income Without Excess | Rp | 10,944,757,200.00 |
| Increase | | 52% |

*3.3 Damaged Product*

To determine the price of damaged products is as follows:

- Calculating the percentage of damaged products at once production
  Percentage T = (number of damaged products/amount of production) *100% (13)
- Calculating the Damaged Product Price Based Cost Production
  The Price of Damaged Products = total production/number of the produced goods (14)
- Calculating the profits derived from damaged products
  Profit of Damaged Product (PDP) = (total production/number of produced goods) *number of damaged products (15)
- Calculating the percentage of additional profit if the damaged products are sold
  Percentage P = (PDP/sales profit)*100% (16)

The following this is the result the determination of the minimum price products damaged, and the reckoning increase in revenue if products broken can be sold a whole by the selling price minimum specified shown in table 10 until 13:

**Table 10**. Percentage calculation result of the damaged products at once production

| Product | Production | Damaged Products | Precentage |
|---|---|---|---|
| Shirts | 187906 | 3579 | 2% |
| Pants | 40178 | 205 | 0.51% |

**Table 11**. Calculation Result of Damaged Products Cost in Unit

| Product | Production | The Production Cost | | Cost Of Damaged Product in Unit |
|---|---|---|---|---|
| Shirt | 210,400 | Rp 8,828,384,000.00 | Rp | 6,250.00 |
| Pants | 44,400 | Rp 1,960,082,400.00 | Rp | 6,250.00 |

**Table 12**. Profit calculation result if the damaged products on shirts are sold and the percentage of profit increase

| Shirt | Production | Profit Increase | Precentage |
|---|---|---|---|
| Good Product | 184327 | Rp 7,734,360,920.00 | |
| Damaged Products | 3579 | Rp 22,368,750.00 | 0.29% |
| Total | | Rp 7,756,729,670.00 | |

**Table 13**. Profit calculation result if the damaged products on Pants are sold and the percentage of profit increase

| Pants | Production | Profit Increase | Precentage |
|---|---|---|---|
| Good Product | 39973 | Rp 1,764,662,773.33 | |
| Damaged Products | 205 | Rp 1,279,166.67 | 0.07% |
| Total | | Rp 1,765,941,940.00 | |

For performing calculations products broken in the period next calculation products they would damaged old as has been in count before, that to the product of a shirt had damaged of 2 % and for products pants namely 0,51 %.
The following the calculation on damage will happen to shirts and pants , and calculation increase in revenue for them shown in table 14 until 16:

**Table 14**. Percentage calculation result of the damaged forecast products at once production

| Product | Production | Damaged Products | Precentage |
|---|---|---|---|
| Shirts | 44400 | 0.51% | 226 |
| Pants | 210400 | 2% | 4007 |

**Table 15**. Profit calculation result if the damaged products on shirts are sold and the percentage of profit increase

| Shirt | Production | Profit Increase | Precentage |
|---|---|---|---|
| Good Product | 206393 | Rp 8,660,231,911.53 | |
| Damaged Products | 4007 | Rp 25,046,486.01 | 0.29% |
| Total | | Rp 8,685,278,397.54 | |

**Table 16**. Profit calculation result if the damaged products on Pants are sold and the percentage of profit increase

| Pants | Production | Profit Increase | Precentage |
|---|---|---|---|
| Good Product | 44174 | Rp 1,950,097,743.44 | |
| Damaged Products | 226 | Rp 1,413,584.55 | 0.07% |
| Total | | Rp 1,951,511,327.99 | |

To product price damaged same as product price damaged last year, Rp.6.250 in unit, because the value of the debt is considered as minimum from the sale of products based on the production costs on a shirt, pants, and t-shirts.

## 4. Conclusions

According to the data processing done, these conclusions as follows:

1. Using fuzzy averaging for forecasting demand, and produced planning production to the product of 3700 dozen pants, shirts 17533 dozen, and t shirt 29667 dozen, converted into units be 44400 unit for products pants, 210400 unit for shirts , and 356000 unit for shirts.
2. Based on the calculation of uses the excess stock producing shirts and pants will experience in excess of products 1522 unit, and t shirt about 187761 unit. To avoid excess products to the pants and shirts, then came the determination of the capacity the warehouse with reducing the stock be 42878 unit for trousers with the time of a cycle of 0.96 years or 352 day, and 168239 unit for shirts with the time of a cycle of 0.47 years or 172 days
3. By calculation both method of excess stock products on pants be obtained minimum price is Rp.49.882 per unit, and the price they shirts the minimum for Rp.28.946 per unit. Accounting for damaged products, obtained the minimum price sales for the damaged product Rp.6.250 per unit based on the production costs.
4. Excess control stock has been done get to the income rose by 1 % pants, and for producing shirts of 52%, the calculation damaged products, obtained income rose for products pants of 0.07% and for shirts 0.29 %

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