Analysis of grouping ABC – VED and predicting the number of requests
(case study TB. Bina Usaha Temanggung Indonesia)

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Abstract. Market competition is required for company to optimize the management, which are appropriate, effective and efficient, since it is used for a company to satisfy a demand. ABC analysis is used for sorting some items which is dominating in sales based on investment value. Meanwhile, VED analysis aims to classify commodity based on the level of importance of store owner’s sales. The result of classification using ABC – VED analysis is a matrix that differentiates into three categories, namely category I is composed of AV, AE, AD, BV and CV; category II consists of BE, CE, and BD; and the third category consists of CD. The results of the ABC-VED analysis are then predicted the number of requests for commodity with the Double Exponential Smoothing method from Brown. This forecasting method is used when the data indicate a trend. Trend is a smoothed estimate of average growth at the end of each period. Forecasting results are expected to help plan inventory for the coming year at TB. Bina Usaha Temanggung Indonesia to prioritize sales.

1. Introduction
The increasingly rapid development of the era not only has an impact for business development but also for business opportunities. The consequence of them is more competitive on market competition. One of solution to solve this problem is by increasing the efficiency and the effectiveness of management. TB. Bina Usaha Temanggung Indonesia is a trading company which sells building tools and materials.

ABC analysis is a method of grouping items based on rank values from the highest to lowest values and divided into 3 large groups called groups A, B, and C (see [1]). It is used to plan management at TB. Bina Usaha Temanggung Indonesia for sorting items that dominate sales so that these items are prioritized in increasing sales based on the investment value. Verawaty, et al (see [2]) explained that VED analysis is used to classify items based on the critical level of time where commodity is delivered to customers. VED analysis classifies items into 3 categories, namely Vital, Essential, and Desirable. In this study the classification of commodity based on the level of importance of the commodity. The functions of management are planning, organizing, staffing, motivating, and controlling. Mahagaonkar and Kelkar in [3] used ABC analysis for planning material management with the aim of minimizing waste of materials in the design of constructions. Meanwhile, [4] and [5] conducted research on ABC-VED analysis for drug supplies in pharmaceutical stores and hospitals. Gupta and Krishnappa in [6] also studied that the ABC-VED matrix is most suitable for dental shops.
Grouping results at TB. Bina Usaha Temanggung Indonesia with ABC-VED analysis will be predicted by double exponential smoothing to obtain the number of requests for the next year. This is appropriate with the one of the activities in the planning process, namely forecasting. Forecasting is useful to predict operations and possible conditions in the future through research and analysis of available and current data [7].

1.1. ABC Analysis

According to [8], inventory control decisions started by making a classification of existing materials. Material classification is done by making ABC classifications according to the Pareto rules. Material class A is the fast moving item for the company so it needs to be considered. In a while, class C is a material in the slow moving category, where the amount of inventory is small. Heizer and Render in [9] said that ABC analysis divides existing inventory into three classifications on an annual dollar volume basis. To determine the annual dollar volume of an ABC analysis, the annual demand for each inventory item is calculated and multiplied by the price per unit. Class A items are commodity with a high annual dollar volume. Although these items may only represented 15% of total inventory items, they represented 70% of overall money in use. Class B items are inventory items with a medium dollar volume. These items may represented around 30% of inventory items and 20% of the annual total dollar value. Items with a small annual dollar volume we classified in class C which represented 10% of the annual dollar volume, but represented about 55% of total inventory items.

Policies that can be based on ABC analysis are as follows.
1. Buying resources indicated for supplier development is higher for commodity A than for individual items C.
2. Items A that are opposite to items B and C has tighter physical inventory control.
3. Forecasting items A requires more attention than other items.

Forecasting, physical control, and reduction can be generated from appropriate inventory management policies. ABC analysis guides the development of these policies. The steps in grouping based on ABC Analysis are as follows
1. Sum all the total demand for commodity in 1 year.
2. Multiply the total demand for commodity with the cost per unit to obtain the value of the investment and sort the investment value of each item from the largest value to the smallest.
3. Add the investment value of all commodity to obtain the overall investment value in 1 year.
4. Divide the investment value of each item with the overall investment value to obtain the annual percentage of each item.
5. Classify each item into classes A, B and C in a row with the criteria of group A is an investment value of 70% of the total annual investment value of inventory, group B is an investment value of 20% of the total annual investment value of inventory, and group C is the annual investment value of 10% of the total annual investment value of inventory.

According to [10], the ABC analysis process is as follows
1. Determine criteria for measuring groupings of all types of commodity.
2. Sort all types of commodity in inventory based on the standard size.

1.2. VED Analysis

According to [11] the classification of commodity using VED analysis (Vital, Essential, and Desirable) aims to classify items based on the critical time of delivering commodity to customers. The categories of commodity are as follows.
1. Vital category commodity are items that customers desperately need to save lives immediately, vital categories of commodity are available at all times in the room inventory.
2. Essential category commodity are items needed by customers, the critical time for giving items is lower than the vital category.
3. Desirable category commodity are items needed by customers, the critical time of delivering commodity is lower than essential.
1.3. ABC - VED Analysis

According to [12], classification of commodity using ABC analysis and VED analysis resulted in a matrix is divided into three categories. Category I consists of AV, AE, AD, BV, and CV. Category II consists of BE, CE, and BD. Category III consists of CDs. The first alphabet states the ABC analysis and the second alphabet states the VED analysis. The ABC analysis matrix and VED analysis are shown in Table 1.

| Kategori | A | B | C |
|----------|---|---|---|
| V        | AV | BV | CV |
| E        | AE | BE | CE |
| D        | AD | BD | CD |

Category I is a category of commodity that requires a priority management, namely AV, AE, AD, BV and CV. Category II is a category of commodity that requires lower priority management than category I, namely BE, BD and CE. Category III is a category of commodity that requires lowest priority management, namely CD.

1.4. Forecasting

Forecasting is the process of estimating several requirements in the future which includes the requirements in terms of quantity, quality, time and location to satisfy the demand for commodity or services [13]. Forecasting is an integral part of management decision-making activities. Organizations always determine goals and objectives, try to predict environmental factors, then choose actions that are expected to result in achieving these goals and objectives. The requirements for forecasting increase in line with management's efforts to reduce its dependence on things that are uncertain. Forecasting becomes scientific because each part of the organization is related to each other, great or poor predictions can affect all parts of the organization [14].

1.5. Double exponential smoothing: Brown's one-parameter linear method

According to [14], Brown's double exponential smoothing is a linear model proposed by Brown. This method is used when data shows a trend. A trend is a smoothed estimate of the average growth at the end of each period. By analogy used when departing from a single moving average to a single exponential smoothing, it can also depart from a double moving average to a double exponential smoothing. Such a move might be interesting because one of the limitations of the single moving average still exists in the last value still in the double moving average. Double exponential smoothing can be calculated with only three data values and one value for the smoothing constant (\( \alpha \)). This approach also gives decreased quality for the past observation. For this reason double exponential smoothing is prefer than the double moving average as a method of forecasting in a variety of major cases. Determination of the \( \alpha \) parameter as a smoothing constant only takes a limited range of values, although theoretically \( \alpha \) can be considered to be 0 and 1. Due to a selection of \( \alpha \) values, Brown's double exponential smoothing method is more easy to apply than double moving average.

2. Method

Here we give some steps which is used in this study.

1. Conduct ABC analysis based on investment value to look for items in groups A, B and C.
   a. Calculate the amount of usage per year for each unit of commodity.
   b. Make a price list of each item.
   c. Multiply the use of the price of each item to get the investment value.
d. Sort the investment value from the biggest to the smallest, after that make the percentage value of the investment.

e. Calculate the percentage of cumulative investment value.

f. Group inventory items by percentage cumulative value.

g. If the cumulative frequency value is 0% - 80% then it is grouped as A. If it ranges from 80% - 95% it will be grouped as B, and if it ranges from 95% - 100% it will be grouped as C.

2. Conduct a VED analysis based on the level of importance according to the shop owner to look for items in groups V, E and D. Grouping of items is as follows.

a. Vital category commodity are commodity that consumers often buy immediately, vital category commodity are available at all times in the inventory of the room.

b. Essential category commodity are commodity purchased by consumers not immediately, the requirement for commodity is lower than the vital category.

c. Desirable category commodity are items that are rarely purchased by consumers but are always available, the requirement of commodity are lower than essential.

3. Make an ABC-VED analysis matrix. Grouping items from the results of ABC analysis and VED analysis produces a matrix that divide into three categories. Category I consists of AV, AE, AD, BV, and CV. Category II consists of BE, CE, and BD. Category III consists of CDs. The first alphabet states the ABC analysis and the second alphabet states the VED analysis.

4. Predict with double exponential smoothing to find the number of requests for the coming year with Double Exponential Smoothing from Brown [14].

a. Determines the first smoothing value

\[ S'_t = \alpha X_t + (1-\alpha)S'_{t-1} \]  

b. Determines the second smoothing value

\[ S''_t = \alpha X_t + (1-\alpha)S''_{t-1} \]  

c. Specifies a constant value \((a_t)\)

\[ a_t = 2S'_t - S''_t \]  

d. Determines the slope value \((b_t)\)

\[ b_t = \frac{a_t}{1-a_t} \left( S'_t - S''_t \right) \]  

e. Determine the forecasting value

\[ F_{t+m} = a_t + b_t m \]  

\( S'_t \): first period \(t \) smoothing value.

\( S'_{t-1} \): first period \((t-1)\) smoothing value.

\( S''_t \): the second smoothing value of the \(t\)-period.

\( S''_{t-1} \): second period - \((t-1)\) smoothing value.

\( \alpha \): smoothing constant \((0 < \alpha \leq 1)\).

\( X_t \): the actual value of the \(t\)-period.

\( m \): the distance of the period to be predicted.

\( F_{t+m} \): forecast for the period \((t + m)\).
3. Result and Discussions
In this study, there are 158 types of items. The data is including data on the number of requests and sales of commodity in 2017 and 2018, data on selling prices, data on purchase prices of commodity, and storage costs per unit of commodity. The cost of storing commodity in this study is the cost of depreciation. Depreciation costs are based on the value of the Bank Indonesia interest rate (BI), which is 6% per year based on information on December 30th, 2018. Save costs are obtained by multiplying the ending inventory each day with the purchase price of commodity multiplied by the interest rate per day.

3.1. ABC Method
The first step in ABC analysis is to find the investment value of each type of commodity by multiplying the selling price and the number of commodity demand. The investment value is sorted from the largest to the smallest. After that the annual percentage of investment value is calculated by dividing the investment value of each type of item with the total value of the investment. The cumulative percentage of investment value is calculated so that commodity can be grouped in classes A, B, or C. The results of the calculation of grouping based on investment value can be seen in Table 2.

| Group | The amount of commodity | Percentage of Item Amount | Value of Investment (Rp) | Percentage of Investment Value |
|-------|------------------------|--------------------------|--------------------------|--------------------------------|
| A     | 15                     | 9.5 %                    | 2.923.450.000            | 80.4 %                         |
| B     | 58                     | 36.7 %                   | 545.406.000              | 15 %                           |
| C     | 85                     | 53.8 %                   | 166.573.000              | 4.6 %                          |
| Total | 158                    | 100 %                    | 3.635.429.000            | 100 %                          |
Meanwhile, in Table 3 the names of items grouped from the results of ABC analysis are based on the value of the investment.

**Table 3. ABC Analysis Item Group**

| Group | Name of commodity |
|-------|-------------------|
| A | Iron 10, cement, iron 8, iron 6, wall paint 2.5 kg, lime stir, limestone mill, nail 1 kg, wall paint 5 kg, clear glass 1 m thick 5 mm, glass ribbon 1 m thick 5 mm, GRC 2x1, galvalum roof 6 m, galvalum roof 5 m, clear glass 1 m thick 3 mm |
| B | Paralon 3”, putty 4 kg, galvalum roof 4 m, glass ribbon 1 m thick 3 mm, pralon 4”, bendrat 1 kg, galvalum roof 3 m, paralon 2.5”, plasterboard 1x1, plywood 9 mm, oil paint 1 kg, bucket, plywood 6 mm, paralon 2”, asbestos 3 m, aplus, galvalum roll 90 cm, zinc 3 m, paralon 3/4”, paralon 1.5”, asbestos 2.4 m, C75, viber 3 m, oil paint 1/2 kg, iron sheeting 2.4 m, iron sheeting 2.1 m, asbestos 2.1 m, casting/elephant, plywood 3 mm, paralon 1”, “no drop” paint 4 kg, asbestos 1.8 m, viber 2.4 m, goose crane, plywood 1.8 m, mild steel battens, glue “kaya” 1 kg, strimin 1/2 cm, thinner super, paralon 1/2”, car paint 1 kg, strimin 1 cm, viber 2.1 m, asbestos nails 3” 1 kg, eternal ankle cable 1 roll, galvalum roll 60 cm, hullo 4x4, crane 1/2”, viber 1.8 m, medium size bucket, gutter carpet 90 cm, metre 7.5 m, zinc nail 2.5” 1 kg, zinc nail 2” 1 kg, no drop paint 1 kg, menny meiji, wall paint 1 kg, key body |
| C | Hullo 2x4, gutter carpet 60 cm, toren penguin 500 lt, cast bucket, big handle, zinc roll 90 cm, pipe 5/8”, big wash bucket, brush roll, putty 1 kg, fox glue 800 gr, metre 5 m, medium size wash bucket, board aplus, oil paint 200 cc, brush 4”, paralon ‘u’, zinc roll 60 cm, gutter carpet 70 cm, wood glue 400 gr, tarp 4x6 m, essel 4”, toren penguin 300 lt, zinc roll 70 cm, double switch, brush 3”, fox glue 450 gr, avur stainless, ankle switch, lisplang 3 m, putty 1/4 kg, essel 3” thick, metre 3 m, tweezers, neovin toren 500 lt, asbestos rubber, brush 2.5”, switch, key cylinder, hammer goat, oil paint 1 lt, oil paint 100 cc, plugs, round pock, brush 2”, auto refinish, car paint 1/4 kg, essel 4” regular, tarp 3x4 m, neovin toren 300 lt, paralon glue, remover, taper pock, branch scissor, crane 3/4”, essel 3” regular, alcite, car compound 1 kg, small handle, boots, sealtape, brush 1”, brush 1.5”, oil paint 1/2 lt, fox glue 200 gr, tarp 2x3 m, pilox, yarn, aur plastic, paint bucket, sword wood menny, sword bes menny, wire brush, screwdriver, rubber hammer, a pair of wind heels, gutter clamp ‘u’, rofin, funnel gutter ‘u’, connection gutter ‘u’, closed gutter ‘u’, mouse trap, small car compound, handyman pencil, cradle bucket |

3.2. **VED Method**

On VED analysis in TB. Bina Usaha Temanggung Indonesia, grouping of commodity are according to the level of interest to the shop owner. The grouping is based on interviewing and filling out questionnaires to owners of TB. Bina Usaha Temanggung Indonesia. From the interview results, the items included in the Vital group, the Essential group, and the Desirable group. Table 4 is a table of commodity for groups V, E, and D.
| Group | Name of commodity |
|-------|-------------------|
| V     | Iron 10, cement, iron 8, iron 6, limestone stir, limestone mill, nail 1 kg, clear glass 1 m thick 5 mm, ribbed glass 1 m thick 5 mm, clear glass 1 m thick 3 mm, paralon 3”, ribbed glass 1 m thick 3 mm, paralon 4”, bendrat 1 kg, paralon 2,5”, paralon 2”, asbestos 3 m, paralon ¾”, paralon 1,5”, asbestos 2,4 m, fiber 3 m, asbestos 2,1 m, paralon 1”, asbestos 1,8 m, fiber 2,4 m, mild steel battens, paralon ½”, fiber 2,1 m, asbestos nail 3” 1 kg, eternal ankle cable 1 roll, fiber 1,8 m, nail zinc 2,5” 1 kg, zinc nail 2” 1 kg, pipe 5/8, paralon ‘u’, essel 4” thick, double switch, stainless aur, ankle switch, essel 3” thick, switch, key cylinder, plugs, essel 4” regular, essel 3” regular, brush 1”, brush 1,5”, plastic aur |
| E     | Wall paint 2,5 kg, wall paint 5 kg, roof galvalum 6 m, roof galvalum 5 m, roof galvalum 4 m, roof galvalum 3 m, plywood 9 mm, plywood 6 mm, roll galvalum 90 cm, zinc 3 m, c75, zinc 2,4 m, zinc 2,1 m, plywood 3 mm, zinc 1,8 m, strimin ½ cm, strimin 1 cm, roll galvalum 60 cm, carpet gutter 90 cm, key body, carpet gutter 60 cm, cast bucket, big handle, roll zinc 90 cm, big washbak, medium size washbak, roll zinc 60 cm, carpet gutter 70 cm, roll zinc 70 cm, tweezer, round poock, auto reffinish, paralon glue, remover, taper poock, small handle, sealtape, yarn, a pair of wind heels, handyman pencil, cradle bucket |
| D     | GRC 2x1, dempul 4 kg, plasterboard 1x1, oil paint 1 kg, bucket, aplus, oil paint ½ kg, casting/elephant, no drop paint 4 kg, swan cran, wood glue 1 kg, thinner super, car paint 1 kg, hollo 4x4, kran ½”, medium size bucket, metre 7,5 m, no drop paint 1 kg, menny meiji, wall paint 1 kg, hollo 2x4, penguin toren 500 lt, roll brush, dempul 1 kg, fox glue 800 gr, metre 5 m, board aplus, oil paint 200 cc, brush 4”, wood glue 400 gr, tarp 4x6, penguin toren 300 lt, brush 3”, fox glue 450 gr, lisplang 3 m, dempul ¼ kg, metre 3 m, neovin toren 500 lt, asbestos rubber, brush 2,5”, goat hammer, oil paint 1 lt, oil paint 100 cc, brush 2”, car paint ¼ kg, tarp 3x4 m, neovin toren 300 lt, branch scissor, crane ¾”, alcasit, car compound 1 kg, boots, oil paint ½ lt, lem fox 200 gr, tarp 2x3 m, pylonx, paint bucket, sword wood menny, sword bes menny, wire brush, screwdriver, rubber hammer, lamp gutter ‘u’, roofing, funnel gutter ‘u’, connection gutter ‘u’, closed gutter ‘u’, mouse trap, small car compound |

3.3. ABC - VED Method

The results of ABC Analysis and VED Analysis are conducted to determine priorities in the inventory management system. The ABC-VED analysis matrix is the result of grouping based on investment value and level of importance. The following is an example of the calculation, namely:

1. AV group is an item contained in group A and group V (vital), obtained by a number of 10 items.
2. The AE group is the items contained in group A and group E (essential), obtained by a number of 4 items.
3. The AD group is the item contained in group A and group D (desirable), obtained by a number of items.
4. The BV group is items that are in group B and group V (vital), obtained 23 items.
5. CV groups are items that are in groups C and group V (vital), obtained a number of 15 items.
6. The BE group is the item contained in group B and group E (essential), obtained by a number of 16 items.
7. The CE group is the item contained in group C and the E (essential) group, obtained by 21 items.
8. The BD group is an item contained in group B and group D (desirable), obtained by 19 items.
9. The CD group is the item contained in group C and group D (desirable), obtained a number of 49 items.

For more details, the division of the ABC-VED analysis matrix group can be seen in Table 5.

**Table 5. ABC - VED Analysis Matrix**

| Category         | A | B | C |
|------------------|---|---|---|
| The amount of    |   |   |   |
| commodity V      | 10| 4 | 1 |
| commodity E      | 23| 16| 19|
| commodity D      | 15| 21| 49|

From Table 5 the management priority categories are made as follows.
1. Category I is a group of priority commodity, namely the AV, AE, AD, BV, and CV groups with 53 items.
2. Category II is a medium group of commodity whose priority is lower than category I, namely group BE, CE, and BD with a total of 56 items.
3. Category III is a group of lowest commodity, namely the CD group with 49 items.

List of names of items included in categories I, II, and III can be seen in Table 6.

**Table 6. ABC - VED Analysis Item Group**

| Category | Name of commodity |
|----------|-------------------|
| I        | Iron 10, cement, iron 8, iron 6, limestone stir, limestone mill, nail 1 kg, clear glass 1 m thick 5 mm, ribbed glass 1 m thick 5 mm, clear glass 1 m thick 3 mm, wall paint 2.5 kg, wall paint 5 kg, roof galvalum 6 m, roof galvalum 5 m, GRC 2x1, paralon 3”, ribbed glass 1 m thick 3 mm, paralon 4”, bendrat 1 kg, paralon 2.5”, paralon 2”, asbestos 3 m, paralon ¾”, paralon 1.5”, asbestos 2.4 m, fiber 3 m, asbestos 2.1 m, paralon 1”, asbestos 1.8 m, fiber 2.4 m, mild steel battens, paralon ½”, fiber 2.1 m, asbestos nail 3” 1 kg, eternal ankle cable 1 roll, fiber 1.8 m, zinc nail 2.5” 1 kg, zinc nail 2” 1 kg, pipe 5/8”, paralon ‘u’, essel 4” thick, brush 3”, aur stainless, ankle switch, essel 3” thick, switch, key cylinder, plugs, essel 4” regular, essel 3” regular, brush 1”, brush 1.5”, aur plastic |
| II       | Roff galvalum 4 m, roof galvalum 3 m, plywood 9 mm, plywood 6 mm, galvalum roll 90 cm, zinc 3 m, c75, zinc 2.4 m, zinc 2.1 m, plywood 3 mm, zinc 1.8 m, strimin ½ cm, strimin 1 cm, galvalum roll 60 cm, carpet gutter 90 cm, key body, dempul 4 kg, plasterboard 1x1, oil paint 1 kg, bucket, aplus, oil paint ½ kg, casting/elephant, no drop paint 4 kg, swan crane, wood glue 1 kg, thinner super, car paint 1 kg, hollo 4x4, crane ½”, medium bucket, metre 7.5 m, no drop paint 1 kg, meny meiji, wall paint 1 kg, carpet gutter 60 cm, cast bucket, big handle, zinc roll 90 cm, big washbuk, medium washbuk, zinc roll 60 cm, carpet gutter 70 cm, zinc roll 70 cm, tweezers, round pock, auto refinish, paralon glue, remover, taper pock, small handle, sealtape, yarn, 1 pair of wind heel, handywood pencil, cradle bucket |
3.4. Forecasting with Double Exponential Smoothing from Brown

Based on the ABC-VED Analysis matrix calculation, a forecasting of consumer demand in 2019 (F_3) used sales of commodity in 2017 (X_1) and sales of commodity in 2018 (X_2). Data on sales of commodity group A in Figure 1 shows an increase.

![Diagram of Data on sales of commodity group A](image)

**Figure 1.** Diagram of Data on sales of commodity group A

The one of the forecasting methods for data patterns in Figure 1 is Double Exponential Smoothing. The smoothing constant (α) is 0.6. This is due to the increasing sales of commodity plentiful enough, so we used α which is close to 1. For example of a double exponential smoothing calculation of the items in group I is iron 10, with the parameter α = 0.6 based on data on the number of sales in 2017 and 2018 as follows.

1. Determine the first smoothing value \( S'_1 \)
   \[ S'_1 = \alpha X_1 + (1 - \alpha) S'_{t-1} \]
   a. For \( t = 1 \)

   When \( t = 1 \) the value of \( S'_1 \) is not available, then we fix by setting the value of \( S'_1 \) equal to the value of the first period data (X_1) of 10,800 so that \( S'_1 = 10,800 \).
b. For $t = 2$
\[ S'_2 = 0.6 \times 11.600 + (1 - 0.6)S'_{2-1} \]
\[ S'_2 = 0.6 \times 11.600 + 0.4 \times 10.800 = 11.280 \]

2. Determine the second smoothing value ($S''_t$)
\[ S''_t = \alpha S'_t + (1 - \alpha)S'_{t-1} \]

a. For $t = 1$
When $t = 1$ the value of $S''_t$ is no available, then we fix by specifying the value of $S''_t$ equal to the value of the first period data ($X_{1}$) of 10,800 so that $S''_1 = 10,800$.

b. For $t = 2$
\[ S'_2 = 0.6 \times 11.600 + (1 - 0.6)S'_{2-1} \]
\[ S'_2 = 0.6 \times 11.280 + 0.4 \times 10.800 = 11.088 \]

3. Determine the value of a constant ($a_t$)
\[ a_t = 2S'_t - S''_t \]
a. For $t = 1$
\[ a_1 = 2S'_1 - S''_1 \]
\[ a_1 = 2 \times 10.800 - 10.800 = 10.800 \]

b. For $t = 2$
\[ a_2 = 2S'_2 - S''_2 \]
\[ a_2 = 2 \times 11.280 - 11.088 = 11.472 \]

4. Determine the value of the slope ($b_t$)
\[ b_t = \frac{a_t}{1 - \alpha} (S''_t - S'_t) \]
a. For $t = 1$
\[ b_1 = \frac{0.6}{1 - 0.6} (S''_1 - S'_1) \]
\[ b_1 = 0 \]

b. For $t = 2$
\[ b_2 = \frac{0.6}{1 - 0.6} (S''_2 - S'_2) \]
\[ b_2 = \frac{0.6}{0.4} (11.280 - 11.088) = 288 \]

5. Determine the value of forecasting
\[ F_{t+m} = a_t + b_t m \]
For $m = 1$
\[ F_3 = a_2 + b_2 (1) = 11.472 + 288 = 11.760. \]
Calculation of forecast demand for iron 10 in 2019 is 11,760 units. With the same calculation, the forecast for the number of consumer requests for categories I, II and III in 2019 is obtained for the first five commodity in Table 7.

**Table 7.** Prediction of the number of consumer requests for the first five commodity in categories I, II and III in 2019 (parameter $\alpha = 0.6$)

| Name of commodity      | Number of Sales in 2017 | Number of Sales in 2018 | Prediction of the Number of Consumer Demand for 2019 |
|------------------------|-------------------------|-------------------------|-----------------------------------------------------|
| Iron 10                | 10.800                  | 11.600                  | 11.760                                              |
| Cement                 | 13.824                  | 14.360                  | 14.467,2                                            |
| Iron 8                 | 10.800                  | 11.000                  | 11.040                                              |
| Iron 6                 | 10.800                  | 11.500                  | 11.640                                              |
| Wall paint 2,5 kg      | 405                     | 450                     | 465                                                 |
| Limestone stir         | 4.320                   | 4.800                   | 4.896                                               |
| Limestone mill         | 6.480                   | 7.200                   | 7.344                                               |
| Nail 1 kg              | 2.520                   | 2.800                   | 2.856                                               |
| Wall paint 5 kg        | 298                     | 350                     | 360,4                                               |
| Clear glass 1 m thick 5 mm | 368                  | 400                     | 406,4                                               |
| Ribbed glass 1 m thick 5 mm | 368                  | 400                     | 406,4                                               |
| GRC 2x1                | 540                     | 600                     | 612                                                 |
| Roof galvalum 6 m      | 165                     | 153                     | 186,6                                               |
| Roof galvalum 5 m      | 169                     | 180                     | 182,2                                               |
| Clear glass 1 m thick 3 mm | 290                  | 300                     | 302                                                 |

4. **Conclusion**

ABC-VED Analysis is a method of grouping commodity can be used to improve efficiency and effectiveness in company management in TB. Bina Usaha Temanggung Indonesia. The grouping results show that there are items with high or low investment value, so the commodity always exists in warehouse. Similarly, the owners has plan commodity with high or low investment values but low interest rates. This means that as long as the commodity are still available in the store the owner does not need to immediately add inventory, so the company could get a maximum profits.

Forecasting methods with double exponential smoothing from Brown are considered suitable for this study. This is due to TB. Bina Usaha Temanggung Indonesia is a small company which always needs evaluation every year. This forecasting method produces a forecast calculation every year from the previous two years.
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