Analysis of Supplier Ability in Providing Raw Materials Cassava and Planning the Amount and Time of Arrival Raw Materials at PT. ABC

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Abstract: *PT. ABC is a company engaged in the processing of cassava that produces tapioca flour. The smooth production of the company depends on the ability of suppliers to provide cassava raw materials. Problems that arise in the company are the frequent vacancies caused by the unavailability of raw materials and on other days there are high working hours due to the amount of raw materials received by the company exceeding production capacity per day by also considering the economic age of raw materials. Based on the research it was found that the ability of cassava processing companies based on production capacity amounted to 3,796 tons / month. In April 2019, total shipments of raw materials from suppliers amounted to 3,987 tons, which means it exceeded the company's capacity. But still visible emptiness of raw materials on certain days, this is due to lack of planning the arrival time of raw materials. Based on the analysis using forecasting methods, it is found that the amount of raw material provided is able to meet the production capacity each month but has not been able to meet customer demand. The steps that must be taken are determining the amount of raw materials that can be provided by the supplier, determining the amount of raw material usage, determining the amount and time of delivery of raw materials. Delivery of raw materials can be done 2 or 3 times per week with the amount of raw materials sent adjusted to the needs of the day the company.*
Keywords: *inventory; forecasting; scheduling*

I. Introduction

The development of the food industry at this time cannot be separated from the use of raw materials of various types of flour. Tapioca flour is one of the raw materials for flour which is often used in making various types of products in the food industry. PT. ABC is one of the companies engaged in tapioca flour processing. Continuation of tapioca flour production at PT. ABC is very dependent on the ability of suppliers to provide raw materials in the form of cassava.

Data on the ability of suppliers to provide cassava raw materials in the past 5 years can be seen in table 1.

Table 1. Supply of raw materials by suppliers (in tons)

Month	Provision of Raw Materials (in tons)					
	2014	2015	2016	2017	2018	2019
Januari	2820	2800	2560	2860	3126	4208
Februari	2654	2760	2800	3758	3985	3681
Maret	3012	2590	3216	3012	2963	3650
April	3465	3650	3480	3686	2996	3987
Mei	3660	3500	3252	5210	4021	4027
Juni	2861	2970	3600	3658	5126	
Juli	3127	3042	3440	4230	4230	
Agustus	3343	3120	3330	3865	3015	
September	3057	2997	3800	4120	3842	
Oktober	3169	3290	3765	3890	4125	
November	3661	3568	3700	4100	3560	
Desember	3456	3660	3220	3600	3560	

In the course of its production, PT. ABC often experience shortages of cassava raw materials so that production activities are not running optimally, thus affecting the work time of employees where when there is no raw material, production will stop and employees are closed. However, when raw materials enter the amount exceeds the capacity so high overtime is needed. This is to meet consumer demand and maintain good quality raw materials that do not exceed their economic life. Clean production can be used as a model of environment management that forwardinghigh efficiency in an industry. Clean production implementation will be an advantage for industry because it can decrease production cost, economize and environment performance is better. Clean production implementation in an environmental sound industrial area. Purwanto in Mardiana, (2020). Data related to tapioca flour demand by regular and non-permanent customers in the past 5 years can be seen in the following tables 2 and 3.

Table 2. Demand for tapioca flour by regular customers

Month	Tapioca Flour Request (in tons)					
	2014	2015	2016	2017	2018	2019
Januari	620	450	483	650	489	536
Februari	600	580	489	786	887	688
Maret	620	568	650	800	668	557
April	589	663	656	600	800	489
Mei	689	621	567	605	897	897
Juni	558	593	689	654	731	
Juli	587	632	663	854	661	
Agustus	725	698	625	662	456	
September	650	650	496	689	798	
Oktober	779	699	820	700	812	
November	825	810	779	700	812	
Desember	780	650	700	698	683	
Total	**8022**	**7614**	**7617**	**8398**	**8694**	**-**

Table 3. Demand for tapioca flour by non-permanent customers

Month	Tapioca Flour Request (in tons)					
	2014	2015	2016	2017	2018	2019
Januari	250	321	369	402	489	436
Februari	320	320	339	339	356	388
Maret	336	269	243	276	356	357
April	360	296	366	332	322	389
Mei	430	461	468	339	462	497
Juni	412	337	442	465	331	
Juli	326	396	431	211	365	
Agustus	271	236	260	296	296	
September	269	369	496	374	338	
Oktober	389	496	331	421	431	
November	411	326	336	346	446	
Desember	431	331	400	456	456	
Total	**4205**	**4168**	**4481**	**4257**	**4648**	**-**

Inventory is an asset that includes goods belonging to a company for the purpose of being sold within a normal business period or inventory of goods that are still in the process / production process or inventory of raw materials and supporting materials awaiting their use in a production process. So the inventory is a number of materials, parts provided and materials in the process contained in a company for the production process.

Inventories contained in the company can be distinguished according to several ways. Judging from the function of the inventory can be divided into:
1. Batch stock or lot size inventory is inventory held because we buy or make materials in quantities greater than the amount needed at the time.

2. Fluctuation stock is inventory that is held to deal with fluctuations in consumer demand that cannot be predicted.
3. Anticipation stock is inventory held to deal with predictable fluctuations in demand, based on seasonal patterns that occur within one year and to deal with increased use or sales / demand.

Besides differences according to function, the inventory can also be distinguished or grouped according to the type and position of the goods in the order of product execution, namely:
1. Inventory of raw materials, namely inventory of tangible goods used in the production process.
2. Inventory of product parts or parts purchased, this inventory is goods consisting of parts received from other companies, which can be directly assembled with other parts without going through a previous production process.
3. Inventory of auxiliary materials or equipment, namely inventory of goods or materials needed in the production process or used in the operation of a company but not a part or component of finished goods.
4. Inventory of semi-finished goods, i.e. inventory of goods coming out of each part in a factory or materials that have been processed into a form but still need to be reprocessed to later become finished goods.
5. Inventory of finished goods, namely inventory of goods that have been processed or processed in factories and are ready to be sold to customers.

The cost elements contained in the inventory are classified into 4, namely:
1. Ordering costs are costs incurred with respect to ordering goods or materials from the seller, from the time the order is made and sent to the buyer until it is submitted as well as inspection in the warehouse or processing area.
2. Storage costs are costs required with respect to holding inventories that include all expenses incurred by the company as a result of the existence of a number of inventory or also called inventory procurement costs.
3. Shortage costs are costs that arise as a result of the occurrence of inventory that is smaller than the amount needed.
4. Costs related to capacity are costs that consist of unemployment costs incurred due to the addition or reduction of capacity or if too much or at least the capacity is used at a certain time.

To regulate the availability of an optimum level of inventory that can meet the needs of materials in quantity, quality and at the right time and the amount of low costs as expected, and then we need an inventory control system that must meet the requirements.

In order to achieve the goals of production planning and supervision, the role of inventory control is very important. Therefore, inventory control activities carried out must be based on planned and controlled production that has been established and carried out. The amount of production volume and the production schedule that has been determined will determine the amount of optimum supply, the size of the order and the planned schedule of orders to be carried out.

Production and operations management uses forecasting results in decision making regarding the selection of processes, capacity planning and facility layouts as well as for a variety of sustainability decisions regarding planning, scheduling and inventory.

Forecasting methods generally used are as follows:
1. Top down forecasting, often starting with the use of forecasting results for various general conditions. Forecasts are made according to orders purchased from the organization.
2. Bottom up forecasting, starting with product demand forecasts. Analysts also need to observe past sales patterns and add other product forecasts and obtain total forecasting

results called aggregate forecasts.

Forecasting is an attempt to predict the state of the future through testing the situation in the past. The essence of forecasting is the estimation of future events based on past patterns and the use of policies against past time projections.

The steps in the forecasting process are:

1. Determination of objectives, consisting of determining the type of estimation desired, otherwise the goal depends on the information needs of managers.
2. Development of the model, is a simpler presentation related to the system being studied. The model is an analytical framework that, when entered data, results in an estimate of future demand.
3. Model testing, the model is tested to determine the expected level of accuracy, validity and reliability.
4. Using the model, historical data is included in the model to produce a forecast.
5. Revisions and evaluations, predictions made must always be improved and reviewed.

A variety of qualitative forecasting techniques commonly used are:

1. Delphi method, a technique that uses a systematic procedure to get a consensus of opinions from a group of experts.
2. Market research, is a useful forecasting tool especially if there is a lack of historical or unreliable data.
3. Historical analogy, carried out using historical experiences of a similar product.
4. Panel consensus, which is a discussion conducted in an open exchange of ideas meeting.

The time series forecasting model tries to predict future events on the basis of a series of past data. This data set is an observation of various variables according to time and is usually tabulated and illustrated in graphical form showing the subject's variable behavior. Time series analysis is concerned with a series of historical observations of a forecast variable. Analysis of the importance of past patterns in this data for future production.

Forecasting procedures commonly used are as follows:

1. Get historical data and describe it in a scatter diagram.
2. Look for trend equations.
3. Look for the season index.
4. Projecting trends into the future.
5. Multiply the value of the monthly trend with the season index.
6. Modifying the predicted value.

Several trend estimation methods for time series data are available. In summary, the methods of trend analysis can be described as follows:

1. Freehand, trend lines are made freely without using mathematical formulas. Forecasts can be obtained simply by drawing a trend line for the forecast period.
2. The least square, the most widely used method to determine the trend data equations because this method produces what is mathematically described as "line of best fit".
3. Moving averages, obtained through the addition and search of averages of a certain number of periods, each time removing the oldest values and adding new values. The weakness of this method is that it has no equation for forecasting.
4. Calculation of the season index, calculated by finding the average various real quarterly sales ratio to the trend line (Y) for each quarter. This forecast is a sales estimate based on a time series analysis that only includes trend and seasonal components without regard to cyclical effects.

II. Research Methods

The data collection method used in conducting this research is to collect primary and secondary data. Primary data collection is done by collecting raw material supply data from suppliers, tapioca flour demand data and raw material usage data

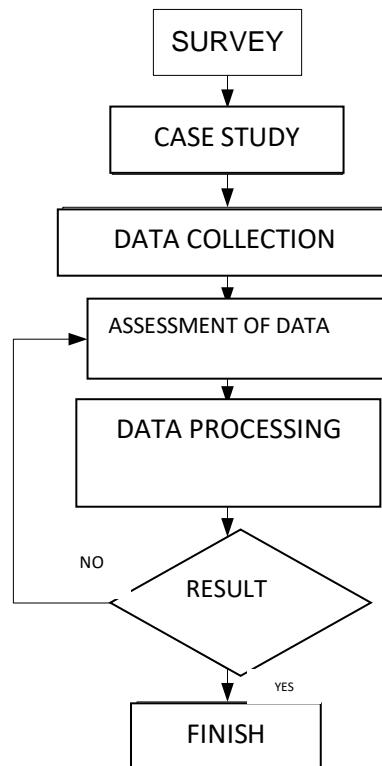The method used in this study can be seen in Figure 1.

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Figure 1. *Research Method*

III. Result and Discussion

Based on data on the use of raw materials for the production process in April 2019 obtained:

1. There are unproductive days for several days, while shipping raw materials from suppliers is 3,987 tons (greater than the production capacity of 3,796 tons).
2. The high number of hours of overtime work that must be done to finish the raw material before it passes its economic life.

Seeing this it can be stated that the vacancy that occurs is due to the late arrival of raw materials and the high amount of overtime, this is due to lack of planning of production.

So that the amount of raw materials that come does not exceed the production capacity per day, the company must plan the time of arrival and the amount of raw materials that must be sent from the supplier. The steps that must be taken are:

1. Determine the amount of raw materials that can be sent by suppliers, based on the results of the July forecast of 5,394 tons.
2. Divide the amount of raw material sent by the number of work the company is 207 tons per day.
3. Delivery must be done at least 2 times a week to maintain the economic life of cassava for 4 days.

Table 4. Comparison of forecasting results of cassava supply

| Bulan	Jumlah Bahan Baku yang Disediakan	Faktor Scrab	Jumlah Tepung yang Dihasilkan	Kapasitas Produksi /bulan	Pemintaan Pelanggan (ton)		
					Tetap	Tidak Tetap	Total
Juni	5438		1256,178		744	585	1329
Juli	5394		1246,014		784	508	1292
Agustus	4975		1256,178		730	399	1129
September	5321	76,90%	1229,151	876,87	758	543	1301
Oktober	5444		1257,564		879	609	1488
November	5549		1281,819		906	549	1455
Desember	5222		1206,282		810	610	1420
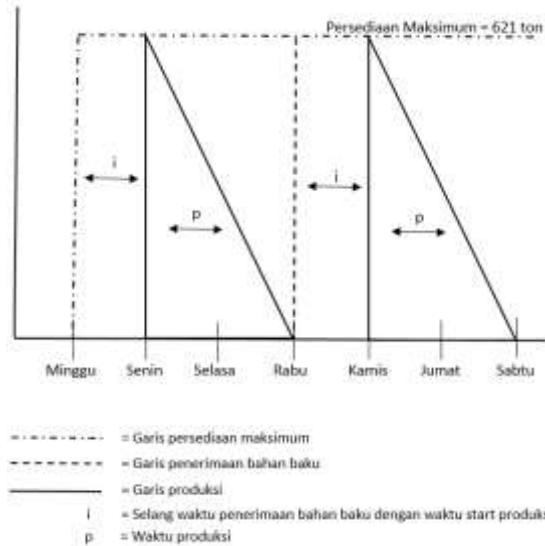
Figure 2. Delivery of cassava 2 times per week

Based on the picture above it can be seen that:
1. Delivery time for raw materials is Sunday and Wednesday with an interval of 1 day before the time of production.
2. Production time starts on Monday to Wednesday and Thursday to Saturday (a period of 3 days).
3. The maximum amount of raw materials sent is 621 tons with the use of 207 tons per day.
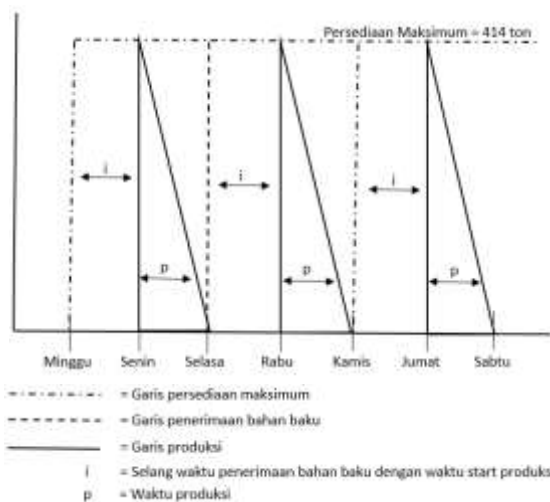

Figure 3. Delivery of cassava 3 times per week

For delivery 3 times a week, it is done as follows:
1. Deliveries are made Sunday, Tuesday and Thursday with an interval of 1 day before the time of production.
2. The amount of raw material sent is 414 tons per shipment.

IV. Conclusion

Based on the results of the study it can be concluded that:
1. Based on the comparison of forecast results for June to December 2019, it can be stated that the supplier is able to meet the company's production capacity even though it has not been able to meet the total customer demand as a whole.
2. From the data of raw material usage in April 2019, it is known that the amount of raw material supply is 3,987 tons and greater than the production capacity of 3,796 tons.
3. The amount of raw material usage based on forecast results is 207 tons per day. And the amount of raw material delivery can be done 2 or 3 times per week.

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