

Optimization Of Chicken Feed Production Using Goal Programming Method At Pt. Japfa Comfeed Indonesia Tbk Unit Makassar

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ABSTRACT

PT Japfa Comfeed Indonesia Tbk is one of the largest and most integrated agri-food companies in Indonesia. The company's main business units are the manufacture of animal feed, chicken breeding, poultry processing, and agricultural cultivation. This company will automatically continue to increase its production results both in terms of quantity and in terms of quality to be able to compete in the market so that it can expand market share and offer products at affordable costs for consumers. At present, business progress is strongly influenced by fluctuations and variations in consumer demand. This also has an impact on the production of chicken feed carried out by PT Japfa Comfeed Indonesia Tbk Makassar unit. With the increasing demand for chicken feed, an effort is needed so that the production process runs according to available and profitable resources. This research aims to determine the optimal amount of production to generate optimal company profits. The method used in this study is the goal programming method because it can solve problems optimally with more than one goal. The results of this research show that the product of goal programming optimization is more profitable than the companies. The results obtained from this research are the optimal number of products is 4,967,155 kg, and the minimum production cost is Rp. 1,382,685,942,075, and the sales profit is Rp. 314,569,267,925 for a period of one year.

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1. INTRODUCTION

PT Japfa Comfeed Indonesia Tbk is one of the largest and most integrated agri-food companies in Indonesia. The company's main business units are the manufacture of animal feed, chicken breeding, poultry processing, and agricultural cultivation. This company will automatically continue to increase its production results both in terms of quantity and in terms of quality to be able to compete in the market so that it can expand market share and offer products at affordable costs for consumers [1][2]. At present, business progress is strongly influenced by fluctuations and variations in consumer demand. This has an impact on the production of poultry feed by PT Japfa Comfeed Indonesia Tbk Makassar unit. With the increasing demand for chicken feed, an effort is needed so that the production process runs according to available resources and is profitable [3][4].

Production is the end result of a process of economic activity that utilizes several inputs. Production activities are defined as activities in producing output by using certain production techniques to process or process inputs in such a way. Production activities are defined as activities in producing output using certain production techniques to process or process input in such a way [5][6].

Production is the process of making raw materials into finished materials that have a selling value and can be used in everyday life by consumers. With the development of the era and the rapid development of science, there are more and more products sold in the market, so every company must think about production planning carefully. Production is a method or technical method of how resources (labor, machines, and funds) are empowered to create or increase the use of an object so that it can meet human needs [7][8].

Planning is one of the main functions of the production management of a company. Production management is work related to the creation of goods and services through converting inputs (factors of production) into outputs or production results [9].

Production planning (production planning) is planning what and how many products will be produced by the company in one period to come. In production planning, companies not only pay attention to consumer demand but also need to pay attention to three elements, namely consumers, products, and manufacturing processes [10][11].

The purpose of production planning is a plan that aims to minimize risks that will occur in the future. Including minimizing various costs that are considered inefficient that may arise during the work process, a plan made must be based on the targets or priorities to be built, a well-conceived and properly executed plan can give confidence to the company, and good planning can give strength to events that occur [12][13].

According to Y. A Titilias, production optimization is a way to plan or regulate the use of company resources such as raw materials, labor, working capital, and production facilities to meet consumer demand, optimize existing raw materials and so that the production process can run smoothly, effectively and efficiently. Optimizing production can be done by improving the quality of production, optimizing resources, or making production plans [14][15].

In solving optimization there are several methods to solve it, including linear programming and goal programming methods. Linear Programming is a mathematical method of allocating limited resources to achieve a goal such as maximizing profits and minimizing costs [6]. Goal programming or (target program) is a decision-making problem in a settlement technique that involves more than one objective/objective function, by solving the problem to minimize it so that it gets the optimum solution [16].

2. RESEARCH METHODS

2.1 Time and Place of Research.

This research will be conducted at PT. Japfa Comfed Indonesia Tbk Makassar Unit on Jl. Prof. Dr. Ir Sutami No. KM. 17, Pai, Kec. Biringkaaya, Makassar City, South Sulawesi which will be carried out for approximately one month.

2.2 Data Collection.

2.2.1 Primary Data

Primary Data is the data obtained by conducting interviews with the company related to information on production process data, sales data, and sales price data in 2021.

2.2.2 Secondary Data

Secondary data is obtained through literature studies, reports related to the object of research, and documentation.

2.3 Data Processing

Data processing carried out in this study is

as follows:

1. Collecting production planning data
At this stage, the initial steps to be taken are to collect production demand data, production cost data, sales data, and sales price data in 2021.
2. Make a demand forecast.
After collecting data, sales forecasting is carried out for the following year.
3. Formulation of goal programming method.
Formulation of the goal programming model is a problem that will be solved to determine the optimal product combination. Thus, the steps to be taken in the completion of goal programming are as follows.
 - a. Determining the decision variable
 - b. Define target constraints
 - c. Determine the objective function
4. Solve goal programming problems using the simplex algorithm method.
In solving goal programming problems, there are several steps that must be taken, namely.
 - a. Changing the objective function and constraints
 - b. Arrange the equations in the table
 - c. Select key column
 - d. Select key row
 - e. Changing key row values
 - f. Changing row values other than the row key
 - g. Continuing improvements or changes

3. RESULTS AND DISCUSSION

3.1 Data on sales of poultry feed in 2021

Data on sales of poultry feed in 2021 in January – December 2021.

Table 1. Production sales data for the year 2021

No	Month	Product		Amount
		PB I	PB II	
1	January	221.804	181.530	403.334
2	February	218.768	181.710	400.478
3	March	224.730	186.876	411.606
4	April	226.446	185.220	411.666
5	May	219.247	178.020	397.267
6	June	227.370	183.204	410.574
7	July	229.350	187.884	417.234
8	August	228.380	189.485	417.865
9	September	228.162	186.300	414.462
10	October	230.890	188.892	419.782
11	November	219.536	179.010	398.546
12	December	224.224	180.792	405.016
	Amount	2.698.907	2.337.720	4.907.83
				0

3.2 Production quantity data

Table 2. Data on the amount of production

No	Month	Produk		Amount
		PB I	PB II	
1	January	222.800	182.900	405.700
2	February	220.987	183.000	403.987
3	March	225.700	187.942	413.642
4	April	227.964	186.577	414.541
5	May	220.259	179.756	400.015
6	June	228.912	184.200	413.112
7	July	230.549	188.569	419.118
8	August	229.764	190.789	420.553
9	September	229.876	187.521	417.397
10	October	231.098	189.670	420.768
11	November	220.765	180.000	400.765
12	December	225.653	181.340	406.993
	Amount	2.714.32	2.222.264	4.936.59
		7		1

Source: 2022 secondary data

3.3 Raw material data

Table 3. Raw material data

No	Bahan Baku	Jenis Produk	
		PB I	PB II
1	Corn	30	25
2	bran	1	3.5
3	Gaplek Flour	1	2.5
4	Fish flour	7	1.5
5	Blood Flour	1.5	1.5
6	Soya bean	3.5	4.5
7	Coconut Meal	2.5	2.5
8	Papaya Leaf Flour	1	1.25
9	Kapok Seed Meal	0.5	0.25
10	Poultry Feather Flour	2	1.25
11	premix	0.25	0.25
12	Sorghum		5
13	Coconut oil		0.5

Source: 2022 secondary data

3.4 Data on cost of production

Table 4. Data on the cost of production

No	Raw Material Cost	Bank Interest	Marketing Cost	Cost Inventory	Amount
2	275.000	12.375	4.125	4.125	295.625

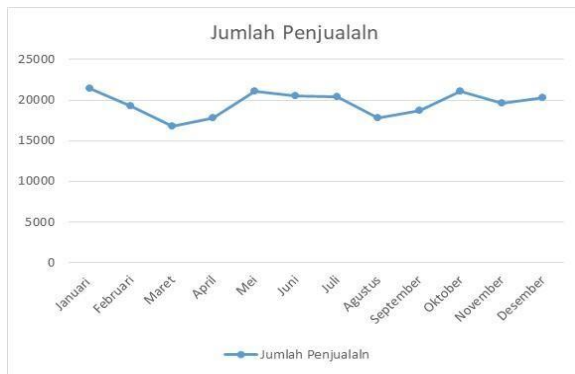
Source: 2022 secondary data

3.5 Selling price data

Table 5. Sales price data

No	Produk	
	PB I	PB II
1	Rp 335.000	Rp 350.000

3.6 Forecasting



Source: 2022 data processing

Graph 1. Graph of Total Sales of Chicken Feed in 2021

Based on the data pattern above, it shows that the graph is in a horizontal or stationary pattern. Then the processing of data requests using the method of the single moving average, single exponential smoothing, and additive decomposition.

Table 6. Forecasting results for each type of product in 2022

Month	PB I	PB II	Amount
January	226.108	183.644	409.752
February	228.671	185.316	413.987
March	226.817	183.760	410.577
April	229.379	185.431	414.810
May	227.526	183.875	411.401
June	230.088	185.546	415.634
July	228.234	183.990	412.224
August	230.797	185.662	416.459
September	228.943	184.105	413.048
October	231.506	185.777	417.283
November	229.652	184.221	413.873
December	232.215	185.892	418.107
Amount	2.749.936	2.217.219	4.967.155

Source: 2022 data processing

Table 7. Target Limits for Each Type of Chicken Feed Products

Month	PB I	PB II	Amount
January	59.794.260.600	54.289.757.500	114.084.018.100
February	60.472.045.950	54.784.042.500	115.256.088.450
March	59.981.755.650	54.324.050.000	114.305.805.650
April	60.659.276.550	54.818.039.375	115.477.315.925
May	60.169.250.700	54.358.046.875	114.527.297.575
June	60.846.771.600	54.852.036.250	115.698.807.850
July	60.356.481.300	54.392.043.750	114.748.525.050
August	61.034.266.650	54.886.328.750	115.920.595.400
September	60.543.976.350	54.426.040.625	114.970.016.975

October	61.221.761.700	54.920.325.625	116.142.087.325
November	60.731.471.400	54.460.333.125	115.191.804.525
December	61.409.256.750	54.954.322.500	116.363.579.250
Amount	727.220.575.200	655.465.366.875	1.382.685.942.075

Source: 2022 secondary data

The cost limit for the production process per month is obtained from the production cost of each type of product multiplied by the target number of products per month.

Table 8. Benefits of Each Type of Product

Product	Product Type Advantage
x1	70.550
x2	54.375

Source: 2022 data processing

The advantages of each type of product are obtained from the selling price of each type of product is reduced by the production cost of each type of product.

Table 9. Sales Profit Target

Month	PB I	PB II	Amount
January	15.951.919.400	9.985.642.500	25.937.561.900
February	16.132.739.050	10.076.557.500	26.209.296.550
March	16.001.939.350	9.991.950.000	25.993.889.350
April	16.182.688.450	10.082.810.625	26.265.499.075
May	16.051.959.300	9.998.203.125	26.050.162.425
June	16.232.708.400	10.089.063.750	26.321.772.150
July	16.101.908.700	10.004.456.250	26.106.364.950
August	16.282.728.350	10.095.371.250	26.378.099.600
September	16.151.928.650	10.010.709.375	26.162.638.025
October	16.332.748.300	10.101.624.375	26.434.372.675
November	16.201.948.600	10.017.016.875	26.218.965.475
December	16.382.768.250	10.107.877.500	26.490.645.750
Amount	194.007.984.800	120.561.283.125	314.569.267.925

Source: 2022 data processing

The profit target from the sale of animal feed is obtained from the product of the forecast for the amount of production per month with the profit per sack of chicken fodder.

3.7 Model formulation

- Determine the objective function

$$\text{Min } Z = P_1 \sum^2 (d_i^- + d_i^+) + P_2 d_3^+ + P_3 d_4$$

- Define the limiting function

- Limiting target market demand

$$X_1 + d_1^- - d_1^+ = 2.749.936$$

$$X_2 + d_2^- - d_2^+ = 2.217.219$$

- Production cost limiter

$$264.450 X_1 + 295.625 X_2 + d_3^- - d_3^+ = 1.382.685.942.075$$

- c. Sales profit limiter
 $70.550X1 + 54.375X2 + d4- - d4+$
 $=314.569.267.925$

3.8 Model completion

After formulating the production problem into a goal programming model, the next step is to solve the model using the simplex algorithm.

Table 10. Simplex iteration 1

Cj	Basis	335000	350000	0	0	0	Quantity	Rasio
	Variabel	X1	X2	S1	S2	S3		
Iterasi 1								
0	S1	2,749,936	2,217,219	1	0	0	4,967,155	2.24
0	S2	727,220,572,200	655,465,366,875	0	1	0	1,382,685,942,075	2.11
0	S3	194,007,984,800	120,561,283,152	0	0	1	314,569,267,925	2.61
	Zj	0	0	0	0	0	0	
	Cj-Zj	335000	350000	0	0	0		

Source: 2022 data processing

In table 4.12, the results for S1 quantity are 4,967,155 with a ratio of 2.24, S2 is 1,382,685,942,075 with a ratio of 2.11, and S3 is 314,569,925 with a ratio of 2.61.

Table 11. Simplex iteration 2

Cj	Basis	335000	350000	0	0	0	Quantity	Rasio
	Variabel	X1	X2	S1	S2	S3		
Iterasi 2								
0	S1	532,717	0	1	-2,217,219	0	289,993	0.54
350000	X2	1	1	0	1	0	2,1095	1.90
0	S3	73,446,701,648	0	0	-120,561,283,152	1	60,248,597,761	0.82
	Zj	388315,2538	350000	0	350000	0	738315,2554	
	Cj-Zj	53315,253	0	0	-350000	0		

Source: 2022 data processing

In table 4.13, the optimal solution for X1 is 289,993 and X2 is 21,095.

Table 12. Simplex iteration 3

Cj	Basis	335000	350000	0	0	0	Quantity	Rasio
	Variabel	X1	X2	S1	S2	S3		
Iterasi 3								
335000	X1	1	0	0	-4	0	1	
350000	X2	0	1	0	6	0	2	
0	S3	0	0	-137,872	185,130,899,341	1	20,266,679,070	
	Zj	335000	350000	-0.10008	571903.1749	0	709,292	
	Cj-Zj	0	0	0.100082	-571903.1749	0		

Source: 2022 data processing

In table 4.23 the optimal solution is obtained because the entire value of $Cj-Zj = 0$. Thus, the profit to be obtained in the sale of chicken feed is 709,292.

4. CONCLUSIONS

After processing and analyzing the production of poultry feed, it can be concluded that the optimal amount of product is 4,967,155 kg, and the minimum production cost is Rp. 1,382,685,942,075, and the sales profit is Rp. 314,569,267,925 for the period of one year. The

results of production planning using the goal programming method get a maximum profit of 709,292.

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