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Optimization of Production Plastic Sacks Using POM-QM Application for Windows (Case Study: PT Rajawali Tanjungsari Engineering)

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Abstract **- This Company is a manufacturing company that produces plastic bags. That the achievement of the 2019 production target of 21.600.000/Lbr while at the PT. Rajawali Tanjungsari Engineering production in 2019 was 18,045,150/Lbr. And the 2020 target is 22.350.000/Lbr while the PT. Rajawali Tanjungsari Engineering production in 2019 was 17,805,656/Lbr. Based on these data, the production target has not been achieved yet. The purpose of the study was to determine the optimal level of plastic bag production and the company's optimal level of profit. Methods this research is a quantitative descriptive study, namely the description and analysis of linear programming and sensitivity analysis. Based on the results of the research, the level of optimization of production at PT Rajawali Tanjungsari Enjiniring is to produce Woven Bags as much as 18,232,800 Lbr with the percentage level generated from the production of Woven Bag products showing 29% of the actual condition, while the Inner Bag is 13,445,630 Lbr with the same percentage level. The result from the production of Woven Bag products shows 2% and from the optimization results using Linear Programming with the Pom-Qm for Windows tool. While the total sales profit in optimal conditions is Rp. 75,528,738,000, - with a total percentage rate of 35% of the actual sales.**

Keywords: Production Optimization, Linear Programming, Sensitivity Analysis, Pom QM Software for Windows.

I. INTRODUCTION

Modern industry is growing rapidly and competition is getting tougher. Therefore, companies need to adapt by improving all processes as well as possible, including the production process, which is the heart of the company's survival. An effort to earn a profit to ensure the survival of a company is to increase the value of the productivity of the production process. There are many methods that can be used to measure the productivity of a production process and find the causes of the decline in productivity.

PT Rajawali Tanjungsari Enjiniring is a subsidiary of PT Rajawali Nusantara Indonesia (Persero), engaged in the industry and trading of animal skins, established in 1988. Experience in leather production has been started since 1980, starting with the leather factory Wonocolo – Surabaya. Furthermore, he built his own leather factory located in Tanjungsari village, Sidoarjo with an area of 30,000 m^2. Then in 2015 PT Rajawali Tanjungsari Engineering expanded its business to the plastic bag industry. In the development of PT Rajawali Tanjungsari Enjiniring experienced several problems, namely the company did not achieve the expected target. Based on the information obtained from the production division of PT. Rajawali Tanjungsari Engineering that the production results in 2019-2020 are as follows:

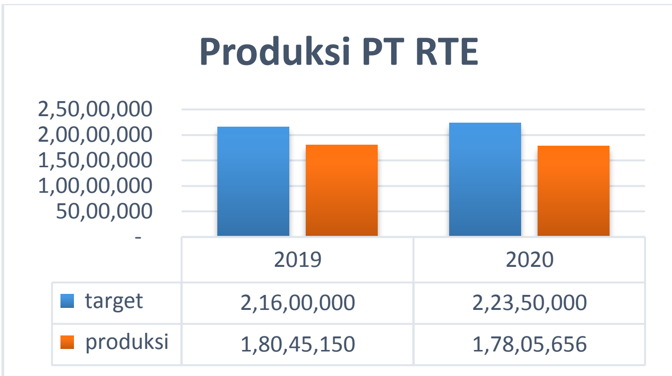

Figure 1: Production Target of PT RTE for 2019-2020

Source: Data from PT Rajawali Tanjungsari Engineering, 2021

In the graph above, it can be seen that the achievement of the production target in 2019 was 21,600,000 while the company PT. Rajawali Tanjungsari Engineering production in 2019 was 18,045,150. And the 2020 target is 22.35 million while the PT. Rajawali Tanjungsari Engineering production in 2019 was 17,805,656. Based on these data, the production target has not been achieved yet. So that with such conditions will have a direct impact on the results (output) on the company's profit.

Profits can occur if sales exceed production costs, and losses can occur if production costs exceed production costs.

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Profit is closely related to several factors, such as production levels and production costs. The measure of the success of an activity related to the company's business is when the company makes a profit, namely by maintaining the flow of income and expenses. Therefore, if a company wants to expand its business and requires a large profit, then the profit is very influential, and vice versa if the profit is low then the owner of the capital is motivated to withdraw his capital. Profit is so important to any business that businesses take different steps to maximize their profits.

This is due to the limited amount of production in each unit which is not proportional to the expected high target, thus affecting the number of products that are less than optimal and profits are not maximized. There are several ways that can be used to solve the problem of production quantity in a company, one of which is the Linear Programming method. In mathematics there is an optimization technique that aims to determine the solution to the optimization problem, namely maximizing a profit or minimizing costs with the capacity of existing raw materials in order to produce optimal results.

II. LITERATURE REVIEW AND METHOD

2.1 Definition of Optimization

Optimization is a normative approach that involves identifying the best solution to a problem directed to the maximum or minimum point of the objective function. Production optimization is needed for companies to optimize the resources deployed so that production facilities can produce products in the expected quantity and quality so that the company can achieve its goals.

2.2 Definition of Capacity

Capacity is the rate at which a manufacturing system (labor, machines, work centers, departments, factories) produces. In other words, capacity is the level of output that can be achieved with existing product specifications, product mix, labor, and equipment. (Gaspersz, 2017).

2.3 Productivity Definition

Productivity is the ratio of results (goods and services) divided by inputs (resources, such as labor and capital). The operations manager's job is to increase (improve) the ratio of returns to inputs. Increased productivity means increased efficiency. This increase can be achieved in two ways: reducing the input while keeping the output constant and/or increasing the yield while the input remains constant. Both ways represent an increase in productivity (Heizer and Render, 2015). Yunarsih and Siswanto in Mahanggoro (2018) explain that "Work productivity is a concrete result (product) produced by individuals or groups during a certain time in a work process".

2.4 Definition of Linear Programming

Linear Programming is a method that can be used to solve problems that arise within the company, with the aim of obtaining the existing situation. The optimal condition is an effort that aims to get the greatest profit (maximum) or the smallest cost (minimum).

2.5 Linear Program Model

The general form of the linear programming model is as follows (Puryani and Risono, 2012):

Maximize or minimize

$$Z = C_1X_1 + C_2X_2 + C_3X_3 + \cdots + C_nX_n$$

With the following constraints:

$$a_{11}X_1 + a_{12}X_2 + \cdots + a_{1n}X_n (\leq, =, \geq) b_1$$

$$a_{21}X_1 + a_{22}X_2 + \cdots + a_{2n}X_n (\leq, =, \geq) b_2$$

$$\vdots \vdots \qquad \vdots \qquad \vdots$$

$$a_{m1}X_1 + a_{m2}X_2 + \cdots + a_{mn}X_n (\leq, =, \geq) b_m$$

And:

$$X_1, X_2, \ldots \geq 0$$

Where:

m= kinds of limitations of available resources or facilities.
n = kinds of activities that use resources or facilities.
i = number of each type of source or facility available (i = 1,2, … , m)
j = number of each type of activity that uses available resources or facilities.
Xj = the decision variable.
aij = the number of resources i need to produce each unit of output of activity j.
bi = number of resources (facilities) available to be allocated to each type of activity.
Z = the value of the objective function that is maximized or minimized.
Cj = increase in the value of Z if there is an increase in the level of activity/decision variable (Xj) by one unit, or is the contribution of each unit of activity output to the Z value.

$$Z = \Sigma\, C_j X_j = 1N_j \qquad (2.1)$$

With constraints:

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$$\Sigma A_{ij} X_j \{<,=,>\} B_i = 1 \text{ for } i = 1,2,3,\ldots,m (2.2)$$

$$X_j \geq 0 \; for \; j = 1,2,3,\ldots,n (2.3)$$

Information:

Z = value of the objective function.
Cj = contribution per unit of activity, for the maximization problem Cj shows profit or revenue per unit, while in the case of minimization shows the cost per unit.
Xj = number of activities j, where j = 1, 2, 3, ..., n.
Aij = number of resources i consumed by activity j.
Bi = number of resources i (i = 1, 2, ..., m).

Equation (2.1) is called the objective function, which is a mathematical function of the decision variables that shows the relationship with the value of the right side. Equation (2.2) is called the main constraint, which is a mathematical function of the deviation variables that represents the combination of an objective. Equation 2.

2.6 Method

The research method is basically a scientific method to obtain data for certain purposes and uses. Research methods are methods and procedures for data collection used for validation, discovery, and development based on scientific principles. This research was conducted at a plastic sack company, namely PT. Rajawali Tanjungsari Engineering. The object of research is optimizing the production of plastic sack products.

This research is a quantitative descriptive study, namely the description and analysis of data, as well as the current status and comparison. Prediction method and linear programming research where forecasting uses time series method by determining the number of questions for the next year. Programming linear method is used as an analytical tool to optimize the mutual benefit of the company by maximizing the functionality of the company's resources. The existing limiting function is minimizing the availability of normal working hours, machine working time, amount of inventory, availability of product demand.

Based on the research title of optimizing the production of plastic sack products, the variables in this study can be seen in the table as follows:

Table 1: Definition of Operational Variables

Variable	Indicator	Size	Data Type
Production Optimization	Production Request	Unit	Secondary
	Workforce	Number of Workers	Secondary
		(persons), Total Working Hours (Hours/day) Secondary	
	Inventory of Finished Products	Number of Products (Units)	Secondary

Source: Processed Data, 2021

Data collection in this study did not use primary data, because researchers did not use instruments or did not make direct observations of the object of research, but this study used secondary data, namely tracing company documents with the aim of obtaining the data we need.

From the data obtained and collected at the data collection stage, the data is then processed with the following stages:

1. Creating a Linear Programming Model
a) Setting Decision Variables

The decision variable is the output that will be optimized so that it meets the target criteria and constraints. The decision variable for production planning at PT Rajawali Tanjungsari Enjiniring is the number of each type of product to be produced.

X1 = Woven Bag (3700)
X2 = Inner Bag (600)

b) Constraint function

The use of raw materials in accordance with the standard of use is the coefficient value of the function of the raw material constraints and requires costs in carrying out the production activities of each product produced. In this study, the constraints of this research are used in the production activities of each Woven Bag and Inner Bag. The constraints can be written as follows:

Polypropylene (PP)= $0.070 X_1 \leq 1.276.296$
Calsium (PO) $= 0.020 X_1 + 0.020 X_2 \leq 716.532$
Pellet A (PP) $= 0.020 X_1 \leq 501.402$
Polyethylene (PE)= $0.040 X_2 \leq 537.825$
Pellet MK (PE) $= 0.020 X1 \leq 250.701$
Woven Bag $= 1 X_1 \leq 21.300.000$
Inner Bag $= 1 X_2 \leq 21.300.000$

c) Goal Function

Target selection is based on information from company management and also based on conclusions drawn from observations and data collection. The targets to be achieved

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are maximizing production volume, maximizing profits and maximizing the use of working hours. These targets are arranged based on priorities according to the interests of the company. In the optimal production of three types of brands based on the benefits of each package, it can be determined by formulating the objective function model. The formulation of the objective function of the linear programming model is as follows:

$$Max\ Z = 3700\ X_1 + 600\ X_2$$

III. RESULTS AND DISCUSSIONS

The company PT Rajawali Tanjungsari Engineering produces Plastic Sacks with various sizes or specifications. To produce these products, factors of production are needed, such as:

- Raw material

The main raw materials used to produce plastic sacks are Polypropylene (PP), Calcium (PO), Pellet A (PP), Pellet B (PP), Polyethylene (PP), Pellet Mk (PE). These raw materials are used to produce Woven Bags and Inner Bags. PT Rajawali Tanjungsari Engineering will produce Woven Bags and Inner Bags with the formula as shown in Table 2.

Table 2: Production Needs for Woven Bags and Inner Bags

No	Description	Quantity	Unit
1	*Woven Bag*		
	Polypropylene (PP)	0.056	Kg
	Calsium (PO)	0.022	Kg
	Pellet A (PP)	0.011	Kg
	Pellet B (PP)	0.011	Kg
2	*Inner Bag*		
	Polyethylene (PP)	0.05	Kg
	Calsium (PO)	0.02	Kg
	Pellet Mk (PE)	0.03	Kg

Source: Data from PT Rajawali Tanjungsari Engineering, 2021

- Workforce

Production PT Rajawali Tanjungsari Engineering in production, employs ± 200 people in the production department. The workforce used comes from the area around the factory.

- Production Availability

From these various production factors, the production of PT Rajawali Tanjungsari Enjiniring Plastic Bags has the availability of production factors in 1 (one) year as shown in Table 3.

Table 3: Production Availability in 1 (One) Year (January – December 2021)

No	Factors of Production	Availability	Units
1	Raw Material		
	Polypropylene (PP)	1.276.296	Kg
	Calsium (PO)	716.532	Kg
	Pellet A (PP)	250.701	Kg
	Pellet B (PP)	250.701	Kg
	Polyethylene (PP)	537.825	Kg
	Pellet Mk (PE)	322.695	Kg
2	Production Restrictions		
	Woven Bag *Inner Bag*	21.300.000	Lbr

Source: Data from PT Rajawali Tanjungsari Engineering, 2021

a) Optimization of Plastic Bag Production Capacity

PT Rajawali Tanjungsari Engineering in carrying out plastic bag production activities will always be limited by various obstacles. These constraints are raw materials and operational costs. Data processing using linear programming method of linear programming assisted by software QM for Windows V.5.2.

To solve the problem above, you can use the following steps:

Determine the decision variables of linear programming problems. The types of plastic sack products produced by PT Rajawali Tanjungsari Enjiniring are:

$$X_1 = Woven\ Bag\ (3700)$$
$$X_2 = Inner\ Bag\ (600)$$

In this study, the constraints of this research are used in the production activities of each Woven Bag and Inner Bag. The constraints can be written as follows:

$Polypropylene\ (PP) = 0.070\ X_1 \leq 1.276.296$
$Calsium\ (PO) = 0.020\ X_1 + 0.020\ x2 \leq 716.532$
$Pellet\ A\ (PP) = 0.020\ X_1 \leq 501.402$
$Polyethylene\ (PE) = 0.040\ X_2 \leq 537.825$
$Pellet\ MK\ (PE) = 0.020\ X_1 \leq 250.701$
$Woven\ Bag = 1\ X_1 \leq 21.300.000$
$Inner\ Bag = 1\ X_2 \leq 21.300.000$

In optimal production of 2 types of production based on the profit of each package can be determined by formulating

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the objective function model. The formulation of the objective function of the linear programming model is as follows:

$$Max\ Z = 3700\ X_1 + 600\ X_2$$

From the calculation of production optimization using Pom QM For Windows, the maximum profit is obtained, namely if PT Rajawali Tanjungsari Enjiniring produces Woven Bag products as much as 18,232,800 Lbr, and Inner Bag as much as 13,445,630 Lbr. The following table shows the results of the QM Pom calculation and the actual production results of PT Rajawali Tanjungsari Engineering:

Table 4: Optimal Production of Plastic Bags

			Units	Actual	Optimal	%
1	*Woven Bag*	x_1	Lbr	12.914.434	18.232.800	29
2	*Inner Bag*	x_2	Lbr	13.142.889	13.445.630	2

Source: Processed Data, 2021

Based on the results of the processing of the production optimization model, it shows that the production carried out by PT Rajawali Tanjungsari Engineering in real (actual) conditions is not optimal. This is indicated by the total production received in the actual condition is much different from the optimal condition.

b) Profit Optimization Rate for Plastic Sacks Production

Based on Table 4, the production of plastic sacks in the actual condition of PT Rajawali Tanjungsari Enjiniring is as many as 12,914,434 woven bags and 13,142,889 inner bags. Meanwhile, based on the results of production optimization processing using the QM For Windows V.5.2 program, the production level shows different levels of production, namely Woven Bag 18,232,800 Lbr, and Inner Bag 13,445,630 Lbr. The following table shows the results of the QM Pom calculation and the actual results of the production of PT Rajawali Tanjungsari Enjiniring:

Table 5: Optimal Advantages of Plastic Sacks

			Units	Actual	Optimal	Efficiency
1	*Woven Bag*	x_1	*Rp*	43.909.075.600	67.461.360.000	35%
2	*Inner Bag*	x_2	*Rp*	5.257.155.600	8.067.378.000	35%
	Total		***Rp***	**49.166.231.200**	**75.528.738.000**	**35%**

Source: Processed Data, 2021

When PT Rajawali Tanjungsari Engineering production is in accordance with optimal conditions, the profit that can be obtained under optimal conditions is Rp. 67.461.360.000,-. (Table 5) while the profit in the actual condition is Rp. 49,166,231,200,- (Table 5), the increase in profits obtained is Rp. 26,362,506,800, - with an efficiency percentage level of 35% from the initial conditions. This shows that the profit in actual conditions with optimal conditions is much different, but to increase its profits, PT Rajawali Tanjungsari Engineering must produce in accordance with optimal conditions.

c) Sensitivity Analysis

Sensitivity analysis is used to see how the value of the coefficient of the objective function and the value of the right-hand side of the constraint function change under optimal conditions without changing these conditions. At the end of the POM QM application for Windows, it is divided into two sensitivity analyzes: the analysis of the coefficients of the objective function and the analysis of the values to the right of the constraint function.

1. Sensitivity Analysis of the Coefficient of Change of the Objective Function

Sensitivity analysis to find out how many values or how many changes is still allowed so as not to change the results of the best product combination. From this analysis, the maximum and minimum change values can still be tolerated, so that the results of the optimal state do not change. Based on the calculation results under optimal conditions, it is known that there is a limit if later PT Rajawali Tanjungsari Engineering. The following limits the change in the value of the Woven Bag and Inner Bag objective functions with some scenario assumptions as follows:

Table 6: Scenarios of Changes in the Coefficient of Objective Function

			Units	Initial Constraints	Preliminary Results	Scenario 1 Limit Increase	Scenario 1 Results	Scenario 2 Lowering the Limit	Scenario 2 Results
1	Woven Bag	x_1	Rp/Ribuan	3700	67.461.360	3800	69.284.640	3600	65.638.080
2	Inner Bag	x_2	Rp/Ribuan	600	8.067.378	700	9.411.941	500	6.722.815

Source: Processed Data, 2021

Based on Table 6, it can be seen that from Scenario 1 the increase in the limit can affect the optimal result, which if increasing the limit of the objective function will result in a greater result than the previous optimal result. Meanwhile, in scenario 2, it can be seen that lowering the limit of the objective function will result in a decrease in the result from the previous optimal result. So the sensitivity analysis of changes to the goal value can be accepted because in each scenario, optimal results are still obtained from the initial condition values.

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2. Analysis of the Sensitivity of the Range of Changes to the Value of the Right Section of the Constraint Function

The value sensitivity analysis on the right hand side of the constraint function aims to ensure that the threshold range on the right side of the constraint function can be increased or decreased without changing the optimal solution. Based on the findings above, we can see that the sensitivity analysis shows how much we can increase or decrease the limit of production resources while maintaining optimal solution conditions if there is a limit if later PT Rajawali Tanjungsari Engineering. The following limits the changes in the value of the right-hand side of the Woven Bag and Inner Bag constraint functions with some scenario assumptions as follows:

Table 7: Scenarios of Changes to the Value of the Right Section of the Constraint Function

No	Description	Availability Beginning	Units	Scenario 1 10% increase	Scenario 2 10% reduction
1	Raw Material				
	Polypropylene (PP)	1.276.296	Kg	1.403.925	1.160.269
	Calsium (PO)	716.532	Kg	788.185	651.392
	Pellet A (PP)	501.402	Kg	551.542	455.820
	Polyethylene (PP)	537.825	Kg	591.607	488.931
	Pellet Mk (PE)	322.695	Kg	354.964	293.359
2	Production Limit				
	Woven Bag / *Inner Bag*	21.300.000	Lbr	21.300.000	21.300.000
3	*WB Results*	18.232.800	Lbr	20.056.090	16.575.270
	IB Results	13.445.630	Lbr	14.790.180	12.223.300
	Total Sales	75.528.738.000	Rp	83.081.630.000	68.662.480.000

Source: Processed Data, 2021

Based on Table 7, it can be seen that from Scenario 1, a 10% increase in the value of the right-hand side of the constraint function can affect the optimal result if increasing the value of the right-hand side of the constraint function will affect the result greater than the previous optimal result. Meanwhile, in scenario 2, a 10% decrease in the value of the right-hand side of the constraint function can be seen that if the value of the right-hand side of the constraint function is decreased, the result will decrease from the previous optimal result. So the sensitivity analysis of changes to the value of the right hand side of the constraint function can be accepted because in each scenario, optimal results are still obtained from the initial condition values.

d) Company Policy

Based on Table 3, the level of optimization of the production capacity of plastic bags and 4 levels of optimization of the profit of the production of plastic sacks are very good. So on the actual condition of PT Rajawali Tanjungsari Enjiniring can provide policies in research as follows:

1. Companies can conduct training to human resources as an element of the production process to improve performance in the production process.
2. The company can plan the supply of raw materials so as not to hamper the production process which results in the optimal level of production decreasing.
3. The company can set quality standards so as to reduce the impact of the company's products resulting in the optimal level of production decreasing.
4. The company can make / pour in the Standard Operating Procedure in the production process so that it can be sustainable and a good work scheduling system in order to optimize the production process.

IV. CONCLUSION

Based on the results of research using linear programming and with the help of QM for Windows V.5.2 software, it can be concluded as follows:

- Based on the results of the analysis with linear programming, the optimization of production at PT Rajawali Tanjungsari Enjiniring is to produce Woven Bags of 18,232,800 Lbr with a percentage level of 29% from the actual condition, and Inner Bag 13,445,630 Lbr with a percentage rate of 2% from the actual condition.
- Based on the results of profit optimization calculations at PT Rajawali Tanjungsari Engineering production in accordance with optimal conditions, the gross profit that can be obtained under optimal conditions is Rp. 75,528,738,000,-. While the profit in the actual condition is Rp. 49,166,231,200, - then the increase in profits is Rp. 26.362506800,- with an efficiency level of 35% of the actual results.
- Based on the results of optimization calculations on the company, then in the condition of PT Rajawali Tanjungsari Enjiniring can apply policies so that the company can be optimal and get the following benefits:
  1. The companies can conduct training to human resources as an element of the production process to improve performance in the production process.
  2. The company can plan the supply of raw materials so as not to hamper the production process which results in the optimal level of production decreasing.
  3. The company can set quality standards so as to reduce the impact of the company's products resulting in the optimal level of production decreasing.
  4. The company can make / pour in the Standard Operating Procedure in the production process so that it can be sustainable and a good work

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scheduling system in order to optimize the production process.

REFERENCES

[1] Adhi Prasnowo, M., Purwanto, R., Sugiarto, A., Heru Romadhon, A., Rokhmawan, T., Aulia, V., Vira Zwagery, R., Fitriana Afriza, E., Kunto Aribowo, E., Kurniawan, Rianita, D., Hadi Saputra, D., Mangiring Parulian Simarmata, H., Gienardy, M., Yusuf, A., Ratnadewi, Febrianty, Setyowati, N., Muktamar, Z., … Winarni, S. (2019). Designing odoo's enterprise resource planning (ERP) in micro, small and medium enterprises (MSMEs). *Journal of Physics: Conference Series*, *1175*(1). https://doi.org/10.1088/1742-6596/1175/1/012202

[2] Adtria, K. V., & Rarasati, N. (2021). Analisis Sensitivitas dalam Optimalisasi Produksi Makaroni Iko Menggunakan Linear Programming. *Jurnal Matematika Dan Pendidikan Matematika*, *3*(2), 174–182.

[3] Agnia, G., Herwanto, D., Hoerunisa, I., Nugraha, B., & Sari, R. P. (2021). Optimize the Time and Network on the Distribution of Tempe Industry by Using the Approach of the Assignment and Networking. *Jurnal Serambi Engineering*, *6*(2). https://doi.org/10.32672/jse.v6i2.2863

[4] Ahmad, F. (2020). Penentuan Metode Peramalan Pada Produksi Part New Granada Bowl ST Di PT. X. *Jurnal Integrasi Sistem Industri*, *7*(1), 31–39.

[5] Aini, N., Sinurat, S., & Hutabarat, S. A. (2018). Penerapan Metode Simple Moving Average Untuk Memprediksi Hasil Laba Laundry Karpet Pada CV . Homecare. *Jurnal Riset Komputer (JURIKOM)*, *5*(2), 167–175.

[6] Aprilyanti, S. (2019). Optimasi Keuntungan Produksi Pada Industri Kayu PT . Indopal Harapan Murni Menggunakan Linear. *Jurnal Penelitian Dan Aplikasi Sistem & Teknik Industri (PASTI)*, *13*(1), 1–8.

[7] Baharudin, S., & Noordin, N. (2018). A Linear Programming Approach to Optimize Natural Rubber Production. *Journal of Computing Research and Innovation*, *2*(1), 50–55. https://doi.org/10.24191/jcrinn.v2i1.30

[8] Durmuş, B., İŞÇİ GÜNERİ, Ö., & İNCEKIRIK, A. (2019). Comparison of Classic and Greedy Heuristic Algorithm Results in Integer Programming: Knapsack Problems. *Mugla Journal of Science and Technology*. https://doi.org/10.22531/muglajsci.469475

[9] Fattah, M., Susadiana, S., & Sofiati, D. (2021). Optimization of Pangasius Catfish Production in Pagersari Village, Tulungagung Regency. *Journal of Aquaculture and Fish Health*, *10*(1), 85. https://doi.org/10.20473/jafh.v10i1.20876

[10] Firdaus, A. (2016). ANALISIS MODEL ANTRIAN PADA PELAYANAN PELANGGAN (STUDI KASUS PENGISIAN BAHAN BAKAR PADA SPBU KOTA JAMBI) Analysis Of The Queueing Models On Customer Service (a Case Study of Refueling at Gas Stations of The City of Jambi). *J-Mas*, *1*(1), 83–97.

[11] Frimpong, F. O., & Owusu, A. (2015). Allocation of Classroom Space Using Linear Programming (A Case Study : Premier Nurses Training College , Kumasi). *Journal of Economics and Sustainable Development*, *6*(2), 12–20.

[12] Hamali, S., Nurfanka, A. G. R., Firdausi, A. M., & Setiawati, M. S. (2020). Evaluation of the delayed fiber optical installation project on pre-sales division at PT XYZ. *IOP Conference Series: Earth and Environmental Science*, *452*(1). https://doi.org/10.1088/1755-1315/452/1/012081

[13] Heizer, J., Render, B., & Munson, C. (2017). *Operations Management (Sustainability and Supply Chain Management)*.

[14] Hermanto, N., Hermaliani, E. H., & Sutinah, E. (2017). Vogell's Aproximation Method Dalam Optimalisasi Biaya Transportasi Pengiriman Koran pada PT Arah Medialog Pembangunan. *Jurnal Teknik Komputer AMIK BSI (JTK)*, *III*(1), 30–36.

[15] Hiswati, M. E., & Wicaksono, L. N. (2017). Implementasi Metode Simplek Untuk Mengetahui Optimasi Produksi Gerabah (Studi Kasus: Sentra Kerajinan Kasongan Bantul Daerah Istimewa Yogyakarta). *JISKA (Jurnal Informatika Sunan Kalijaga)*, *2*(2), 71. https://doi.org/10.14421/jiska.2017.22-02

[16] Ima Ratnasari, D. D. R. (2018). PENGALOKASIAN PRODUK PADA MESIN STRIPPING DENGAN MENGGUNAKAN ASSIGNMENT METHOD DI PT KIMIA FARMA TBK PLANT BANDUNG. *Jurnal Teknovasi*, *05*(02), 26–29.

[17] Ishak, A., & Nababan, P. (2020). The fuzzy goal programming approach to production planning of intermediate gear spare parts: a case study. *Jurnal Sistem Dan Manajemen Industri*, *4*(2), 137–143. https://doi.org/10.30656/jsmi.v4i2.2143

[18] Khlil, S., Al-Khazraji, H., & Alabacy, Z. (2020). Solving Assembly Production Line Balancing Problem Using Greedy Heuristic Method. *IOP Conference Series: Materials Science and Engineering*, *745*(1). https://doi.org/10.1088/1757-899X/745/1/012068

[19] Koltai, T., & Tatay, V. (2011). A practical approach to sensitivity analysis in linear programming under degeneracy for management decision making. *International Journal of Production Economics*,

ISSN (online): 2581-3048
Volume 6, Issue 8, pp 15-24, August-2022
https://doi.org/10.47001/IRJIET/2022.608003

131(1), 392–398. https://doi.org/10.1016/j.ijpe.2010.04.037

[20] Kurniawan, M. F., Madelan, S., Saluy, A. B., Buana, U. M., Buana, U. M., & Buana, U. M. (2021). EFFICIENCY ANALYSIS OF EXCAVATOR NUT INVENTORY USING ECONOMIC ORDER QUANTITY METHOD AT PT . ABCDE BEKASI-JAWA. *Jurnal Dinasti*, *2*(3), 265–276.

[21] Lestari, F., Anwar, U., Nugraha, N., & Azwar, B. (2017). Forecasting demand in blood supply chain (case study on blood transfusion unit). *Lecture Notes in Engineering and Computer Science*, *2230*, 764–767.

[22] Lina, T. N., Marlissa, B. S., Rumetna, M. S., & Lopulalan, J. E. (2020). Penerapan Metode Simpleks Untuk Meningkatkan Keuntungan Produksi. *JURIKOM (Jurnal Riset Komputer)*, *7*(3), 459. https://doi.org/10.30865/jurikom.v7i3.2204

[23] Lina, T. N., Rumetna, M. S., Pangaribuan, E. A. W., Permana, M., Mambrasar, Y., Martvie, N., Magdalena, M., Tambayong, H., Kaliele, J., & Tangmerun, D. (2021). Premium Dan Pertalite Menggunakan Metode Maximization of Profit on Premium and Pertalite Businesses Using Simplex Methods and Pom-Qm. *Elektro Luceat*, *7*(1), 1–9.

[24] Listiani, D. P., Putri, S. N. D., & Annisa, V. (2021). Implementasi Integer Programming dalam Mengoptimalkan Produksi Kopi Susu (Studi Kasus : Kopi Rekan). *Bulletin of Applied Industrial Engineering Theory*, *2*(2), 81–84.

[25] Marit, I. Y., Nursanti, E., & Vitasari, P. (2020). Analysis of time acceleration using Critical Path Method (CPM) to increase motorcycle maintenance in authorized service station. *IOP Conference Series: Materials Science and Engineering*, *885*(1). https://doi.org/10.1088/1757-899X/885/1/012059

[26] Masayu Anisah, A.N. Afandi, Sabilal Rasyad, Evelina, T. R. (2017). APLIKASI LINEAR PROGRAMMING PADA SISTIM OPTIMASI SALURAN TRANSMISI. *Jurnal Ampere*, *2*, 31–38.

[27] Md Zain, N. J., & Wan Shahidan, W. N. (2018). Maximization of Palm Fruit Planted Area Using a Goal Programming Approach. *Journal of Computing Research and Innovation*, *3*(3), 46–51. https://doi.org/10.24191/jcrinn.v3i3.71

[28] Ngantung, M., Jan, A. H., Peramalan, A., Obat, P., Ngantung, M., & Jan, A. H. (2019). Analisis Peramalan Permintaan Obat Antibiotik Pada Apotik Edelweis Tatelu. *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi*, *7*(4), 4859–4867. https://doi.org/10.35794/emba.v7i4.25439

[29] Prakoso, I. A., Kusnadi, K., & Nugraha, B. (2021). Peramalan Penjualan Produk Dengan Metode Regresi Linear Dan Aplikasi POM-QM di PT XYZ. *Widya Teknik*, *20*(1), 17–20. http://journal.wima.ac.id/index.php/teknik/article/view/3158

[30] Purnama, E., Sugiyono, S., & Badawi Saluy, A. (2021). Optimization of Project Colocation At Pt. Xyz Using Pert and Cpm Methods Based on Pom-Qm for Windows Application. *Dinasti International Journal of Education Management And Social Science*, *3*(2), 166–187. https://doi.org/10.31933/dijemss.v3i2.1040

[31] Ratnaningsih, W., Asmara, S., Rahmawati, W., Haryanto, A., & Novita, D. D. (2018). Optimalisasi Pengelolaan Usaha Laboratorium Lapang Terpadu Fakultas Pertanian Universitas Lampung Menggunakan Metode Linear Programming. *Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering)*, *7*(1), 25. https://doi.org/10.23960/jtep-l.v7i1.25-34

[32] Riswan, R. (2018). Penentuan Jarak Minimum dalam Suatu Jaringan Listrik dengan Algoritma Prim dan QM for Windows (Studi Kasus Pada Perumahan Nelayan di Kota Palopo). *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *6*(1), 77–88. https://doi.org/10.24256/jpmipa.v6i1.460

[33] Rumetna, M. S. (2019). Mengoptimalilasi Keterbatasan Sumber Daya Untuk Memaksimalkan Keuntungan Penjualan Es Kelapa Muda Menggunakan Metode Simpleks Dan Software Pom-Qm. *Journal of Dedication to Papua Community*, *2*(2), 136–149. https://doi.org/10.34124/jpkm.v2i2.45

[34] Rumetna, M. S. (2021). Optimasi Jumlah Produksi Roti Menggunakan Program Linear Dan Software Pom-Qm. *Computer Based Information System Journal*, *9*(1), 42–49. https://doi.org/10.33884/cbis.v9i1.3645

[35] Rumetna, M. S., & Lina, T. N. (2021). Forecasting Number of Covid-19 Positive Patients in Sorong City Using the Moving Average and Exponential Smoothing Methods. *The IJICS (International Journal of Informatics and Computer Science)*, *5*(1), 37–43. https://doi.org/10.30865/ijics.v5i1.2908

[36] Rumetna, M. S., Lina, T. N., Cahya, S. D., Liwe, B. M., & Kosriyah, M. (2020). Menghitung Keuntungan Maksimal Dari Penjualan Roti Abon Gulung Dengan Menggunakan Metode Simpleks Dan Software Pom-Qm. *Jurnal Jendela Ilmu*, *1*(1), 6–12. https://doi.org/10.34124/ji.v1i1.49

[37] Rumetna, M. S., Lina, T. N., Rustam, M. Y., Sitaniapessy, S. F., Soulisa, D. I., Sihombing, D. S., Kareth, S., & Kadiwaru, Y. (2020). Optimalisasi Penjualan Noken Kulit Kayu Menggunakan Metode Simpleks Dan Software Pom-Qm. *Computer Based Information System Journal*, *8*(2), 37–45. https://doi.org/10.33884/cbis.v8i2.1954

ISSN (online): 2581-3048
Volume 6, Issue 8, pp 15-24, August-2022
https://doi.org/10.47001/IRJIET/2022.608003

[38] Rumetna, M. S., Lina, T. N., Simarmata, L., Parabang, L., Joseph, A., & Batfin, Y. (2019). Pemanfaatan POM-QM Untuk Menghitung Keuntungan Maksimum UKM Aneka Cipta Rasa (ACR) Menggunakan Metode Simpleks. *Geotik*, 12–22.

[39] Rumetna, M. S., Otniel, O., Litaay, F., Sibarani, C., Tahrin, R., Lina, T. N., & Pakpahan, R. R. (2020). Optimasi Pendapatan Pembuatan Spanduk dan Baliho Menggunakan Metode Simpleks (Studi Kasus: Usaha Percetakan Shiau Printing). *JURIKOM (Jurnal Riset Komputer)*, *7*(2), 278. https://doi.org/10.30865/jurikom.v7i2.1922

[40] Ryan Swastiputro Adinugroho, & Madelan, S. (2021). Optimization of Cafe and Salon Development Project Management With Pert and Cpm Methods At Pt Dtd. *Dinasti International Journal of Management Science*, *3*(1), 188–201. https://doi.org/10.31933/dijms.v3i1.919

[41] Salim, A., & Santoso, I. B. (2018). Optimasi Produksi Beton Ready Mix Dengan Metode Linear Programming. *JMTS: Jurnal Mitra Teknik Sipil*, *1*(1), 65. https://doi.org/10.24912/jmts.v1i1.2243

[42] Setiawati, K., & Tenriajeng, A. T. (2021). OPTIMASI BIAYA OPERASIONAL MRT JAKARTA FASE I MENGGUNAKAN METODE VOGEL APPROXIMATION DENGAN SOFTWARE POM-QM FOR WINDOWS transportasi dihitung secara manual kemudian di input kedalam program VAM . Menurut (Putra , 2018) Metode VAM (Vogel Approximation M. *Jurnal Teras*, *11*(2), 451–462.

[43] Shafii, N. H. B., Alias, R., & Radzuan, N. (2018). Least Cost Diet for Children Two to Three Years in Malaysia Using Linear Programming Approach. *Journal of Computing Research and Innovation*, *3*(4), 25–30. https://doi.org/10.24191/jcrinn.v3i4.91

[44] Sholih Nugroho Hadi, Akhmad Hamdan, A. S. (2019). OPTIMASI FORMULASI PAKAN SAPI POTONG DENGAN MENGGUNAKAN LINEAR PROGRAMMING MODEL. *Pengembangan Penyuluhan Peternakan*, *16*(30), 1–9.

[45] Simegn, D. T. (2019). Optimizing water productivity using deficit irrigation, the case of koga irrigation project, Ethiopia. *Journal of Agriculture and Environment for International Development*, *113*(2), 197–209. https://doi.org/10.12895/jaeid.20192.1048

[46] Subiyanto, A. F., Aurachman, R., & I, M. D. (2018). Optimization In Develop The LTE Site Planning Jabodetabek Region Using Linear Programming Method In Pycharm And POM-QM Software , Case Study PT . XYZ. *International Journal Of Science, Engineering, And Information Technology*, *2*(2), 60–64.

[47] Suparjo. (2021). Optimalisasi Biaya Peng iriman Menggunakan Metode NWC , Least Cost dan VAM Dengan Software POM-QM Pada Bagian Logistic PT Gotrans Logistic International. *Scientifict Journal of Industrial Engineering*, *2*(1), 92–98. http://jim.unindra.ac.id/index.php/sijie/article/view/114

[48] Tjusila, A. K., & Gozali, L. (2021). Implementation of project management to develop the AHA.002 project with PERT method, Gantt chart and QM for windows v5 software at PT. Matahari Megah. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, *July*, 2659–2668.

[49] Wang, P., Wang, C., Hu, Y., Varga, L., & Wang, W. (2018). Power generation expansion optimization model considering multi-scenario electricity demand constraints: A case study of zhejiang province, China. *Energies*, *11*(6). https://doi.org/10.3390/en11061498

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