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Application of Simplex Method with Exel Program (Solver) to Optimize Sales of Cabbage Chili

Abd. Kafi Al-Madani ¹, Irsadus Sholihah ²

¹ Universitas Islam Negeri Madura, Indonesia

Corresponding Author: Abd. Kafi Al-Madani, E-mail; abdkafialmadani@gmail.com

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ABSTRACT

In the world of trading, optimization problems include maximizing profits or minimizing costs, both of which can be solved using the simplex method. The purpose of this study is to maximize the profits of Mr. Sahri's cayenne pepper household production located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. This study was conducted at Mr. Sahri's house as the owner of the cayenne pepper household industry. The analysis carried out in this study is an analysis using the simplex method with the Microsoft Excel solver function. The instruments used are observation and interviews. The results of the study indicate that the optimal production amount of each product (small, medium, large cayenne pepper) in Mr. Sahri's cayenne pepper household production so as to obtain maximum profit.

Keywords: Excel, Optimization, Production

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INTRODUCTION

Every individual as a member of society must be able to survive, namely being able to maintain their existence in the community. Entrepreneurship is one of the choices in earning a living. Along with the development of the times, more and more companies are established and more and more competitors, both large companies and small businesses (home industries). Efforts and strategies are needed to gain profit. One of the home industries that started its business from the bottom is the cayenne pepper industry owned by Mr. Sahri, which is located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. In Sumber Anyar, there are several home industries, especially cayenne pepper production. The research was conducted at Mr. Sahri's place because only his place produces cayenne pepper in various sizes (small, medium, large). Other industrial places only produce one type of size (small chili only). With the existence

¹ Universitas Islam Negeri Madura, Indonesia

of several industries in the same village, it means that there are more competitors. Therefore, home industry owners must implement strategies to gain maximum profit. One way to maximize profits is to use linear programming with the simplex method.

The simplex method is one of the mathematical methods of operations research. According to Frederick S. Hillier & Gerald J. Lieberman, the general stages of an operations research study are:

- 1. Formulating the problem
- 2. Create a mathematical model that describes the core of the problem
- 3. Lowering a solution
- 4. Testing models and solutions
- 5. Determine controls over model completion
- 6. Running the solution

Linear programming is programming that concerns problems where the relationship between variables is linear (Rahmi and Mulia Suryani, 2018:32). In linear programming, two types of functions are known, namely:

- 1. The objective function, describes what the company wants to achieve using existing resources, usually expressed in Z notation.
- 2. The constraint function describes the constraints faced by the company in achieving these goals (Rahmi and Mulia Suryani, 2018:32).

The simplex method is a method that systematically starts from a feasible basic solution to another solution that is done repeatedly (iteration) with a limited number of repetitions, until finally an optimum basic solution is achieved (Ulfasari Rafflesia and Fanani Haryo Widodo, 2014:8). In using the simplex method to solve linear programming problems, the linear programming model must be changed into a general form called the "standard form". The characteristics of the standard form of the linear programming model are: a. All constraints are equations with negative right-hand sides b. All non-negative variables c. The objective function can be maximum or minimum (Sri Mulyono, 2017:29).

RESEARCH METHODOLOGY

This research is a type of Applied Research, namely research to collect information and help solve a problem in everyday life. The population in this study is small businesses in the field ofcayenne pepper production in Sumber Anyar village. The sample in this study was the cayenne pepper production business owned by Mr. Sahri in Sumber Anyar village. The sampling technique used in this study was purposive sampling, namely a sample determination technique with certain considerations. (Sugiyono, 2013:124) [7]. The research instruments used in this study were observation, interviews, and literature studies from articles relevant to the research theme.

The research conducted uses primary data types and sources, meaning using data obtained directly based on the results of observations and interviews at the research site, namely at Mr. Sahri's house. The data collection technique used in this study is to conduct field research and library research. In field research, the author collects data needed and

related to the research through observation and interviews. Observations were conducted at Mr. Sahri's house as the owner of cayenne pepper production located in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency. Interviews were conducted directly with Mr. Sahri with the aim of obtaining data that will be resolved using the simplex method (solver function) in Excel. In library research, the author takes information related to the research theme through print and electronic media such as articles, and other relevant literature. The analysis technique used in this study is analysis using the simplex method with Microsoft Excel solver function. The simplex method has the advantage of being able to solve linear programming problems with two or more variables. The optimization problem to be solved in this study is to maximize profits (maximization) in the production of cayenne pepper at Mr. Sahri's place in Sumber Anyar Village, Larangan Tokol, Tlanakan District, Pamekasan Regency.

RESULTS AND DISCUSSION

From the data obtained through observation and interviews with the owner of the cayenne pepper home industry, Mr. Sahri, the following calculations can be made.

- 1. Sales Results Total sales = number of cayenne peppers x price per kg of cayenne peppers, so the following data is obtained:
- a. cayenne pepper with 1kg
- : 200 x IDR 500.00 = IDR 100,000.00
- b. cayenne pepper with 2 kg
- $: 50 \times Rp \ 2,500.00 = Rp \ 125,000.00$
- c. cayenne pepper with 3 kg
- : $40 \times Rp = 5,000.00 = Rp = 200,000.00 So$, the total sales result is: 1kg + 2kg + 3kg
- : Rp. 100,000.00 + Rp. 125,000.00 + Rp. 200,000.00 : Rp. 425,000.00
- 2. Production Costs

Production costs = production costs of cayenne pepper with 1 kg + production costs of cayenne pepper with 2kg + production cost of cayenne pepper with 3kg.

```
= Rp. 56,000.00 + Rp. 69,000.00 + Rp. 112,000.00
```

= Rp. 237,000.00

Profit = total sales – total production costs

= Rp. 425,000.00 - Rp. 237,000.00

= Rp. 188,000.00

Mr. Sahri's cayenne pepperin one production produces 200kg of small cayenne pepper, 50kg of medium cayenne pepper and 40kg of large cayenne pepper. Based on the amount of cayenne pepper production, the cost for each packing is as follows:

```
small cayenne pepper =Rp56,000.00/200 = Rp. 280.00
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medium sized cayenne pepper =Rp. 69,000.00 /50 = Rp1,380.00

large cayenne pepper =Rp112,000.00/40 = Rp2,800.00

 ΔZ The increase in profit per kg of cayenne pepper is as follows:

Small cayenne pepper = Rp. 500.00 - Rp. 280.00

= Rp. 220.00

Large cayenne pepper = Rp. 5,000.00 - Rp. 2,800.00

= Rp. 2,200.00

The total amount of time needed to produce cayenne pepper is as follows: 1.) small cayenne pepper: 2 months

2.) medium sized cayenne pepper : 3 months

3.) Large cayenne pepper: 4 months +

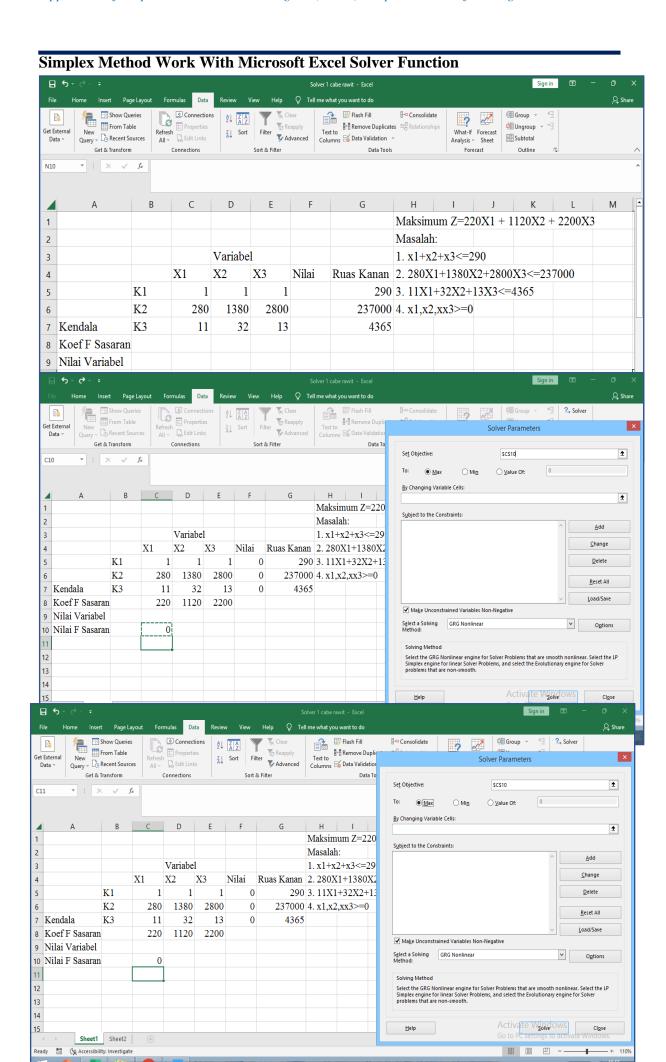
Total: 8 months

If the data for the calculation is all known, then the next step is to enter the data into the linear programming table to solve the problem. The linear programming table is as follows.

Table 1.1 Linear Program Table

	Size				
Part Small Size Medium Size Large Size Capacity					
(X1)(X2)(X3))	Activity			
Many Units Cayenne peppe	l er	1	1		290
Production cos Cayenne peppe	st 280	1380	2800		237,000
Time	2 months	3 months	4 months		8 months
ΔZ					
Addition		profit each	2201.120	2,200	Cayenne
pepper					

The mathematical model used to solve the linear programming problem is as follows. Objective function: Maximize Z=220x1+1,120x2+2,200x3 Constraint function: $x1+x2+x3 \le 290\ 280x1+1,380x2+2,800x3 \le 237,000\ 11x1+32.4x2+13, 12x3 \le 4,365\ x1,\ x2,\ x3 \ge 0$



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Columns Data Validation Show Queries Clear Reapply 1 ? Solver ? A↓ Z A A Z ₫≣ Ungroup T Advanced Get & Transform Connections Sort & Filter Data Tools Forecast Outline Analyze G5 Maksimum Z=220X1 + 1120X2 + 2200X3 2 Masalah: 3 Variabel 1.2 Add Constraint × X2 X1 X3 Nilai Ruas Kanan 2. K1 290 3. <u>+</u> ∨ =\$G\$5 237000 4.2 K2 280 1380 2800 0 7 Kendala K3 11 32 13 4365 <u>A</u>dd <u>O</u>K <u>C</u>ancel Koef F Sasaran 220 1120 2200 9 Nilai Variabel 10 Nilai F Sasaran 12 13 14

Figure 3. Select max, according to the objective function

B Show Querie A Z A Z Clear ? Solver ? From Table Reapply ₫≣ Ungroup Z Sort Filter Advanced New Query V Co Recent Source Columns S Data Validation E Subtotal Get & Transform Connections Sort & Filter Data Tools Outline Analyze H I J K L M N O Maksimum Z=220X1 + 1120X2 + 2200X3 Masalah: 2 3 1. 2 Add Constraint X1 X2 Nilai 4 X3 Ruas Kanan 2. K1 0 290 3. Cell Reference: 5 1 **1** <= ∨ =\$G\$7 **1** SFS5 K2 280 1380 2800 237000 4.2 0 4365 7 Kendala 11 13 32 8 Koef F Sasaran 220 1120 2200 9 Nilai Variabel 10 Nilai F Sasaran 0 11 12 13 Q Sha Show Queries Flash Fill Group ~ Connections 8-0 Consolidate A↓ Z A A Z Ø Unaroup × From Table Remove Duplicates Relationship Refresh Sort Filter Adv New Query - Co Recent Sources Solver Parameters Get & Transform Sort & Filter Connections Analyze Ť Set Objective SCS10 ○ Mi<u>n</u> ○ <u>V</u>alue Of: By Changing Variable Cells: Q Ť SCS9:SES9 Subject to the Constraints: \$F\$5<= \$G\$5 ∆dd Variabel \$F\$6<=\$G\$6 X1 X2 X3 Nilai Ruas K Change \$F\$7<=\$F\$7 <u>D</u>elete K2 280 1380 2800 0 23 Reset All Kendala K3 32 0 11 13 Koef F Sasaran 220 1120 2200 Load/Save ✓ Make Unconstrained Variables Non-Negative Nilai Variabel Select a Solving Nilai F Sasaran 0 Options Reapply
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Columns From Text/CSV Recent Sources Group - * Data Analysis ? 📈 A Z A From Web Existing Connections Ungroup - -2 Solver Data - From Table/Range Edit Links E Subtotal Analysis · Sheet Get & Transform Data Solver Results 5-0-Solver found a solution. All Constraints and : X ✓ fr optimality conditions are satisfied. C D ■ Keep Solver Solution O Restore Original Values Variabel X1 X2 X3 Return to Solver Parameters Dialog Outline Reports K1 1380 2800 k2 280 11 32 Kendala K3 13 Koef F Sasaran 1120 2200 220 Nilai Variabel 0 127.5607 21.77365 Nilai F Sasaran 190770 Solver found a solution. All Constraints and optimality conditions are satisfied. When the GRIG engine is used, Solver has found at least a local optimal solution. When Simplex LP is used, this means Solver has found a global optimal solution.

Figure 6. Enter the value cells and the right side of constraint 2.

Figure 9. The last step, click OK.

CONCLUSION

Based on calculations using the simplex method with Microsoft Excel Solver function, the results obtained that without changing the allocation of production capital, the application of the simplex method can maximize the profit of Mr. Sahri's cayenne pepper home industry. The results of calculations using the simplex method show the optimal solution, namely Z = Rp190,770.00, with x2 = 127.5607 (rounded to 128) and x3 = 21.77365 (rounded to 22). Medium-sized cayenne pepper is produced as much as 128 kg, and large-sized cayenne pepper is produced as much as 22 kg, so the maximum profit obtained is Rp190,770.00. Overall, it can be concluded that to maximize profits in optimizing production results can be done through the application of linear programming simplex method with Microsoft Excel Solver function. This can help determine the amount of optimum production that can be achieved to achieve maximum profit.

REFERENCES

Hiller, SF & Lieberman, GJ 1990. Introduction To Operations Research. (Gunawan, E & Mulia, AW). Jakarta: Erlangga

Mulyono, S. 2017. Operations Research: Jakarta: Media Discourse Partners

Nitisusastro, M. 2010. Entrepreneurship & Small Business Management. Bandung: Alfabeta

Nurmayanti, L. 2021. Implementation of Linear Programming Simplex Method in Home Industry. Journal of Management. Vol. 13 (3), 431-438

Rahmi, MD 2018. Linear Program. Yogyakarta: Deepublish.

Samsuriah. 2020. Simplex Method in Linear Programming with Solver Function in Excel. Progres (Professional Journal in Integrity, Knowledge, and Skill), 12(1), 2-7

Sugiyono. 2013. Research Methods. Bandung: Alfabeta

Ulfasari Rafflesia, SM 2014. Linear Programming. Bengkulu: Publishing Agency of the Faculty of Agriculture UNIB

Saryoko, A. (2016). Simplex method in optimizing production results. Informatics for Educators and Profesional, 1(1), 3144869

Warman, A., Rois, T., & Kuningan, U. (2021). Determination of bread product combinations using the simplex method to maximize profits (case study on IKMZ & J Cookies). Tirtayasa Ekonomika, 16(1), 133-144.

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