The Goal Programming Method: Minimizing Expenses and Maximizing Assets for Optimizing the Financial Statements of Bank Syariah Indonesia

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ABSTRACT

Every company, including banks, prepares financial reports as a source of information regarding a company's performance and financial position. Economic reports have five essential elements: assets, liabilities, equity, income, and expenses. Each bank has several goals; to achieve the goal, a method is needed that can solve problems with several objectives. This study aims to apply the Goal Programming (GP) method to solve several financial goals simultaneously and analyze solutions to optimize financial reports at Bank Syariah Indonesia (BSI). Goal Programming is a multi-objective optimization technique that allows decision-makers to balance conflicting goals by prioritizing deviations from predetermined targets. This study uses GP to model BSI's financial constraints and objectives: maximizing assets, minimizing liabilities, maximizing equity, maximizing income, and minimizing expenses. The solution for the GP model is calculated using Lingo software. So far, BSI has never used the Goal Programming Method to optimize financial statements, offering a new analytical framework for the bank's decision-making process. The study results show that Bank BSI's financial reports for 2019 to 2022 have been optimal by implementing the GP method and the assistance of Lingo software. This is indicated by all deviations being successfully minimized and achieving the target. The minimized expenses are IDR 68.012.380 million, and the maximized assets are IDR 1.018.471.648 million.

Keywords: Bank, Financial Statements, Goal Programming, Optimum

Introduction

Financial statements are reports that conclude a company's performance and financial position. These reports provide information related to the performance, position, and changes in the financial status of a company. The information presented benefits users and economic decision-makers (Basriati et al., 2021). Financial statement analysis activities are carried out after the preparation of financial statements. Bank financial statement analysis is conducted for several purposes. Through this analysis, a company's strengths and weaknesses can be identified. With a better understanding of these strengths and weaknesses, the company can design improved policies for future periods and ensure the effectiveness of its financial statements (Yunitasari & Yuliani, 2017).

A financial statement has five critical components: assets, liabilities, equity, income, and expenses. These components are essential elements of financial statements with the potential to affect the economic condition of the company (Haikal et al., 2022). Every bank aims to achieve specific objectives. To achieve

all these objectives, problem-solving techniques related to multiple goals are required (Hanggara, 2019). Therefore, an approach is needed to address situations where various goals must be achieved.

One method applicable to solving such problems is the goal programming method. This method is used to find solutions in situations involving multiple objectives, either with or without assigning priorities (Nisa et al, 2019). *Goal programming* is a multi-criteria decision-making method that aims to optimize several objectives by minimizing the deviations between the achieved results and the expected targets for each goal (Sugianto, 2020). In goal programming, additional objectives are treated as constraints (goal constraints), and deviation variables are incorporated into these constraints (Taha, 2017; Rao, 2009). The fundamental principle of goal programming is to set goals expressed numerically and formulate objective functions for each goal, subsequently finding a solution that minimizes the deviation values of the objective functions relative to each goal. There are two types of goal programming. The first is non-preemptive goal programming, where all objectives have the same priority level. The second is preemptive goal programming, where a hierarchical priority order for each aim is established (Hillier & Lieberman, 2015; McAllister et al., 2012).

The goal programming method has been widely utilized in research to address problems in various fields, including production optimization, as demonstrated by (Titilias et al., 2018; Hakimah et al., 2020; Kabosu & Kartiko, 2020; Sugianto, 2020; Hasanah et al., 2020; Safitri et al., 2021; Sofiyanto et al., 2021; Simanjuntak & Nasution, 2022; Devani, 2023; Junaidi et al., 2023; Nilamsari et al., 2023; Pradjaningsih, et al., 2023; Pradjaningsih, et al., 2024; Pradjaningsih, et al., 2024; Umama et al., 2024). Applications in scheduling were investigated by (Lesmana & Herdyati, 2019; Zuhanda et al., 2022; Pradjaningsih, et al., 2023; Priharyanti et al., 2023). Studies on its application in financial statements include research by (Yunitasari & Yuliani, 2017; Basriati et al., 2021; Haikal et al., 2022).

Although the application of GP in financial optimization has been widespread, its application in Islamic banking—especially for BSI—is still under-explored. Previous studies have focused on conventional banks or non-financial sectors (e.g., production and scheduling), so there are still gaps in the problem. Furthermore, although BSI's publicly available financial statements, no previous study systematically optimized its multi-objective financial goals (assets, liabilities, equity, revenues, and expenses) using GP. This study fills the gap by introducing GP as a new tool for BSI's financial decision-making and demonstrating actionable optimization results through Lingo software. The urgency of this study is underscored by BSI's rapid growth as the most prominent Islamic bank in Indonesia, which requires an advanced analytical framework to achieve its set targets.

Based on the issues outlined, the goal programming method will be applied to identify and analyze solutions to financial statement optimization problems at BSI. Goal Programming is a multi-objective

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optimization technique that allows decision-makers to balance conflicting goals by prioritizing deviations from predetermined targets. This study uses GP to model BSI's financial constraints and objectives: maximizing assets, minimizing liabilities, maximizing equity, maximizing income, and minimizing expenses. The case study uses annual financial statement data from BSI, Jember Branch, the largest Islamic bank in Indonesia. So far, BSI has never used the Goal Programming Method to optimize financial statements, offering a new analytical framework for the bank's decision-making process. The goal programming model will be solved using Lingo software. Lingo is a tool designed to address various operational research problems, including linear, non-linear, and integer optimization models, quickly, easily, and efficiently. Lingo software provides a comprehensive integration package with an easy-to-understand interface (Gupta & Ali, 2021).

Methods

This study collects data through observation, interviews and website to provide an accurate picture of the conditions that are occurring. The study results are analyzed systematically to find patterns or relationships that can be used for decision-making or further research. The preparatory phase begins with a literature review, which is done by collecting and studying various sources of information related to solutions for the research problem. The subsequent steps in this research are as follows:

1. **Data Collection**: The data used in this research is secondary data obtained from the Annual Reports of Bank BSI, Jember Branch, for the years 2019 and 2022, which are publicly available on the website: https://ir.bankbsi.co.id/. The data collected includes assets, liabilities, equity, income, and expenses. The research data is presented in Table 1.

Table 1. Research Data

| Data | Financial Statement Values (IDR Million/Year) | | | | Target |
	2019	2020	2021	2022	
Assets	205.297.027	239.581.524	265.289.081	305.727.438	1.015.895.120
Liabilities	44.006.843	66.040.361	61.886.476	73.655.791	245.589.471
Equity	19.068.945	21.743.145	25.013.934	33.505.610	99.322.634
Income	158.426.702	169.316.662	196.181.144	217.638.365	741.562.873
Expenses	16.205.463	17.518.644	17.792.473	19.072.328	70.588.908

2. **Construction of the Mathematical Model**: The fundamental accounting equation is a process that equates an organization's assets and liabilities. Total assets are calculated as liabilities, equity, and income minus expenses. Based on this equation, reports on assets, liabilities, equity, revenue, and costs are assigned equal priority (Haikal et al., 2022). Thus, a uniform coefficient of one is applied, indicating that assets, liabilities, equity, income, and expenses are prioritized equally. Accordingly, the appropriate goal programming model is non-preemptive goal programming.

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Steps for mathematical model formation and data processing using the goal programming method:

    a. Determination of decision variables

    b. Definition of objectives to be achieved

    c. Determination of goal constraints

    d. Determination and formulation of the objective functions

3. **Calculation Using Lingo Software:** The calculation is conducted using Lingo software by inputting the decision variables, objective functions, and goal constraints. The results obtained from using Lingo software include the deviation magnitude from the formulated goal constraints.

4. **Result Analysis and Conclusion**: The mathematical model developed using goal programming and processed with Lingo software is then used to evaluate whether the formulated objectives have been achieved through optimization results. The conclusions of the results analysis address the research objectives and provide recommendations for further research.

Results and Discussion

This section presents the research results using the steps outlined in the methodology. In addition to presenting the research findings, discussions about the results obtained are also elaborated. Based on the financial statement data of Bank BSI obtained from the official Bank BSI website and presented in Table 1, a goal programming model was constructed using the data and solved using Lingo software. The variables used in this study are as follows:

x_1 : financial statement value in 2019

x_2 : financial statement value in 2020

x_3 : financial statement value in 2021

x_4 : financial statement value in 2022

d_i^+ : positive deviation from the ith goal or target

d_i^- : negative deviation from the ith goal or target

The programming model in this research is as in equations (1) and (2).

$$Min \ Z = \ d_1^- + d_2^+ + d_3^- + d_4^- + d_5^+ \qquad (1)$$

Subject to

$$\begin{cases} 205.297.027x_1 \ \ + 239.581.524x_2 + \ 265.289.081x_3 + \ 305.727.438x_4 + d_1^+ - d_1^- = 1.015.895.070 \\ 44.006.843x_1 \ + 66.040.361x_2 \ + 61.886.476x_3 + \ \ 73.655.791x_4 + d_2^+ - d_2^- = 245.589.471 \\ 19.068.945x_1 \ + 21.743.145x_2 \ + 25.013.934x_3 \ + \ 33.505.610x_4 + d_3^+ - d_3^- = 99.322.634 \\ 158.426.702x_1 \ \ + 169.316.662x_2 + 196.181.144x_3 \ + 217.638.365x_4 + d_4^+ - d_4^- = 741.562.873 \\ 16.205.463x_1 \ \ + 17.518.644x_2 \ + 17.792.473x_3 \ + \ 19.072.328x_4 + d_5^+ - d_5^- = \ 70.588.908 \end{cases} \quad (2)$$

After constructing the goal programming model, the next step is to simulate the program using Lingo software. The goal programming model is written in the available worksheet. Since goal programming minimizes the objective function, the syntax used in Lingo begins with Min. Negative deviations are denoted with 1, and positive ones with 2. For instance, d_1^- is written as $d11$, and d_1^+ is written $d12$, and so on. The End command follows the definition of the objective function and constraints. Figure 1 illustrates the goal programming model written in Lingo.
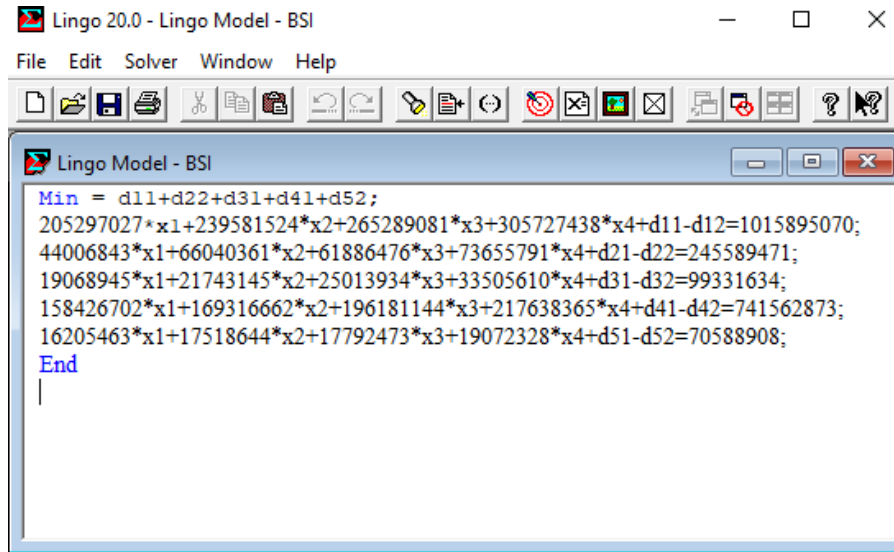

Figure 1. Writing The Goal Programming Model

Next, click *Solver* or press Ctrl + U, and the *Lingo Solver Status* window will appear, as shown in Figure 2, displaying the optimization status.
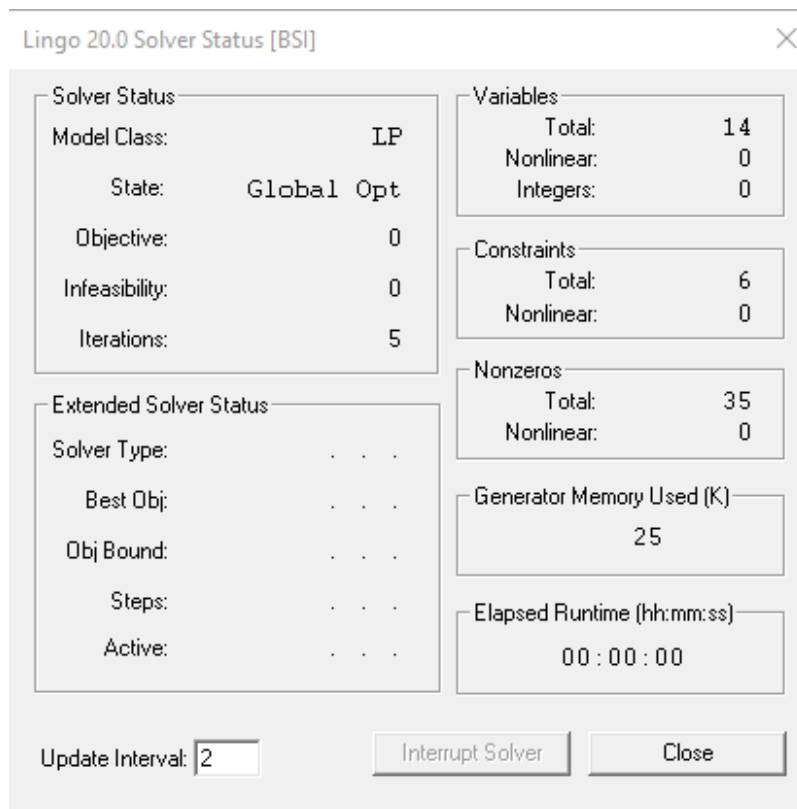
Figure 2. Solution Status

At the end of the process, the optimization results will be shown. These results can be observed in Figure 3.

```
Variable            Value         Reduced Cost
    D11          0.000000             1.000000
    D22          0.000000             1.000000
    D31          0.000000             1.000000
    D41          0.000000             1.000000
    D52          0.000000             1.000000
     X1          0.000000             0.000000
     X2          0.6008485            0.000000
     X3          2.358172             0.000000
     X4          0.8141960            0.000000
    D12          2576528.             0.000000
    D21          0.000000             0.000000
    D32          0.000000             0.000000
    D42          0.000000             0.000000
    D51          2576528.             0.000000

    Row     Slack or Surplus        Dual Price
     1          0.000000            -1.000000
     2          0.000000             0.000000
     3          0.000000             0.000000
     4          0.000000             0.000000
     5          0.000000             0.000000
     6          0.000000             0.000000
```
Figure 3. Optimal Solution Resolution

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Based on the output from Lingo software, the optimal solution was achieved in the 5th iteration when $c_j - z_j$ had a non-negative value, with the results presented in Table 2 as follows:

Table 2. *Recapitulation of Optimal Solution Results*

	Constraint (i)	Target	d_i^-	d_i^+	Description
Maximize assets	1	1.015.895.120	0	2.576.528	Achieved
Minimize liabilities	2	245.589.471	0	0	Achieved
Maximize equity	3	99.322.634	0	0	Achieved
Maximize income	4	741.562.873	0	0	Achieved
Minimize expenses	5	70.588.908	2.576.528	0	Achieved

The results from Lingo show that the optimal solution has a value of 0, indicating that the solution is fully optimized. The slack or surplus values for assets, liabilities, equity, income, and expenses are all 0, demonstrating that the constraints exceed the requirements for an optimal solution. Table 2 highlights the efforts to achieve all objectives through their constituent elements while obtaining the following optimal solution combination:

1. The target to maximize assets is achieved because there is no negative deviation from the total asset value over the 4 years, i.e., $d_1^- = 0$. The positive deviation d_1^+ is 2.576.528, meaning total assets can be increased by IDR 2,576,528 million annually. Thus, assets can be maximized from IDR 1.015.895.120 million to IDR 1.018.471.648 million.

2. The target to minimize liabilities is achieved because there is no positive deviation from the total liabilities over the 4 years, i.e., $d_2^+ = 0$. The negative deviation $d_2^- = 0$, indicating no changes, which remains IDR 245.589.471 million for the 4 years.

3. The target to maximize equity is achieved because there is no negative deviation from the total equity over the 4 years, i.e., $d_3^- = 0$. The positive deviation $d_3^+ = 0$, indicating no changes, which remains IDR 99.322.634 million for the 4 years.

4. The target to maximize income is achieved because there is no negative deviation from the total revenue over the 4 years, i.e., $d_4^- = 0$. The positive deviation $d_4^+ = 0$, indicating no changes, which remains IDR 741.562.873 million for the 4 years.

5. The target to minimize expenses is achieved because there is no positive deviation from the total costs over the 4 years, i.e., $d_5^+ = 0$. The negative deviation d_5^- is 2.576.528; expenses can be reduced by IDR 2.576.528 million annually. Thus, costs can be minimized from IDR 70.588.908 million to IDR 68.012.380 million.

Based on the deviation value, the Z-value obtained is 0, which indicates that the goal of minimizing Z has been achieved. Total assets can be increased by IDR 2.576.528 million, and total expenses can be reduced

by IDR 2.576.528 million. The increase in total assets and the decrease in total costs will impact the increase in profits obtained by Bank BSI so that management can issue policies to increase targets in the following year. A graphical visualization of the target is shown in Figure 4.
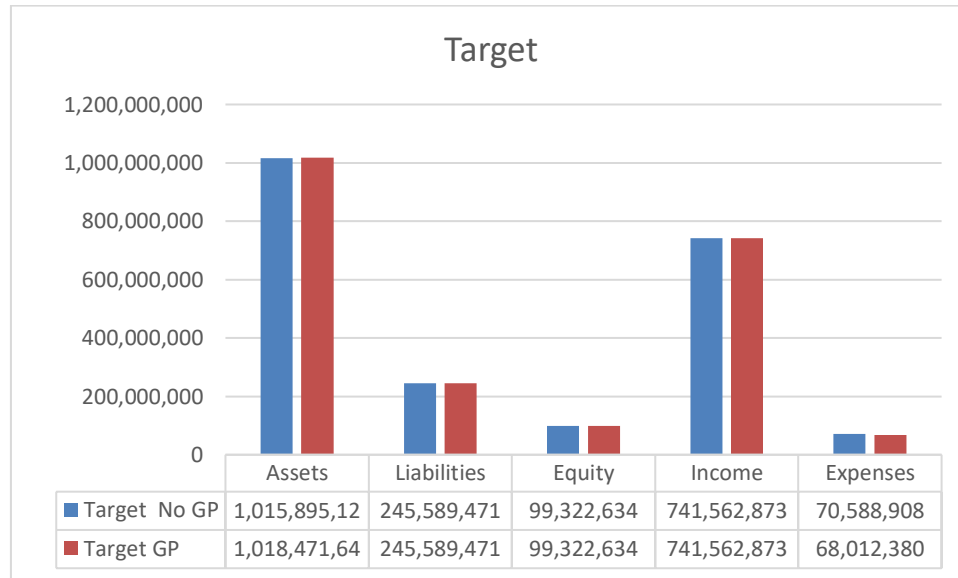

Target	Assets	Liabilities	Equity	Income	Expenses
■ Target No GP	1,015,895,12	245,589,471	99,322,634	741,562,873	70,588,908
■ Target GP	1,018,471,64	245,589,471	99,322,634	741,562,873	68,012,380

Figure 4. A Graphical of The Target

Conclusion

The financial reports of BSI can be optimized by applying the goal programming method. The optimization of BSI's financial statements, with the objective function minimizing, resulted in a zero value, indicating that all deviations were successfully minimized and the targets achieved. Based on the optimization results obtained using Lingo software, it can be concluded that the financial statements of BSI for the period 2019 to 2022 have been optimized, with expenses minimized to IDR 68.012.380 million and assets maximized to IDR 1.018.471.648 million.

Suggestions for further research are expanding time frames & variables or combining GP with machine learning for real-time financial optimization and adaptive target setting. Meanwhile, wider industry applications offer a scalable framework for financial institutions in developing countries to enhance stability and growth. The methodology and results of this study provide a replicable model for financial optimization with implications for academia and industry.

Acknowledgement

assistance, this research was able to run smoothly. We also appreciate the invaluable guidance and contributions from the researchers and staff involved, especially our colleagues at the Keris-Dimas Mathematical Optimization and Computations (MOCo), Department of Mathematics, who have provided valuable insights and suggestions throughout the research process.

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