

LQ45 Stock Recommendations with Fundamental Analysis Using the Simple Additive Weighting Method

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Abstract—Shares are a sign of ownership of a person or entity in a company or limited liability company. Shares are in the form of a piece of paper that explains that the paper's owner is the owner of the company that issued the securities. In the Indonesia Stock Exchange (IDX) there are several kinds of stock indices, one of which is LQ45. It is known that until 2020 there were 2.48 million investors in the capital market. However, it should be noted that of the large number of investors, 85% to 90% of investors experience failure or loss. This happens because investors do not have adequate skills and knowledge in investing in stocks. Therefore, a system is needed that can assist in determining the selection of LQ45 stocks, namely a decision support system (DSS). This system was built web-based using the Simple Additive Weighting (SAW) method to determine the order of the most recommended stocks in the garden. This study uses 45 stocks as alternative data and 5 selection criteria, namely Return on Assets (ROA), Price to price-to-earnings ratio (PER), Price to Book Value (PBV), Net Profit Margin (NPM), and Debt to Equity Ratio (DER). The implementation of the SAW method on the system produces a sequence of LQ45 stock recommendations, namely Adaro Energy Indonesia as the best alternative with the highest preference value of 0.925.

Keywords—Decision Support System (DSS), Stock, LQ45, Simple Additive Weighting (SAW), Investment

I. INTRODUCTION

In the current era, stock investment is not something foreign to the public. However, there are still many people who do not know the meaning of stock itself and the importance of stock investment today. Investment is the activity of investing capital in the form of money or other valuable assets into an institution or party (Waruwu & Nasution, 2020). Shares are a sign of ownership of a person or entity in a company or limited liability company. Shares are in the form of a piece of paper that explains that the owner of the paper is the owner of the company that issued the securities. Stock investments that are in great

demand by local and foreign communities today are investments listed by the Indonesia Stock Exchange (IDX). In the IDX there are several kinds of stock indices, one of which is LQ45 (Aulia, 2022). A stock index is a measurement of the price of a group of stocks. Generally, the calculation of a stock index is calculated from the price movement of a particular stock by calculating the average movement of the stocks in an index. In investing, the stock index is one of the important parameters for investors to see the movement in the stock market to be invested in because the movement in the stock index will show the weakening or strengthening of the stock index. These parameters are used by investors and financial managers to explain the prevailing market conditions and expected returns on a particular investment (Chusna, 2022). An investor is a person or company that invests capital into an institution in the hope of making a profit in the future. Before investors make an investment, investors will conduct an analysis to see the financial condition of a company using fundamental analysis in order to choose a company with good financial statements so as to benefit from the sale of shares and dividends in the future (Nuraini, 2022). Fundamental analysis is one of the measurement methods used by investors to determine the quality of stock value. This method is done by examining the economic and financial condition of the company. By knowing the condition of a company, investors can determine whether to invest in the company (Natalia, 2022). The development of the capital market is increasing. It is known that until 2020 there were 2.48 million investors in the capital market. Over the past five years, the number of stock investors has increased by 151%. However, it should be noted that of the large number of investors, 85% to 90% of investors experience failure or loss. This happens because investors do not have adequate skills and knowledge in investing in stocks. Such as knowing the company's financial statements with fundamental analysis (Tika, 2020).

A system is needed that makes it easier for investors to determine which stocks are worth investing in by calculating financial ratios. Decision Support System (DSS) is the right solution for analyzing and ranking

companies (Ramadiani, Heliza Rahmania Hatta, et al., 2019; Turban et al., 2005). The method that can be used in DSS for ranking alternatives is Simple Additive Weighting (SAW). The SAW method is often known as the weighted sum method which means finding the weighted sum of the ratings of each alternative on all criteria (Ramadiani et al., 2022). The total result obtained to get an alternative is by summing up all the results of the multiplication between the ratings compared on the criteria and the weight of each criterion (Ramadiani et al., 2018). Ratings on each criterion must have previously gone through the normalization process (Ramadiani et al., 2021, 2023). The advantage of this method is that the assessment is more precise because the ranking process is based on the criteria value of the predetermined preference weights (Hasan, 2023). Therefore, this research raises the title "LQ45 Stock Recommendations with Fundamental Analysis Using the Simple Additive Weighting Method" on the fundamental analysis of a company. It aims to help the public or investors in determining company shares that are worth buying.

II. LITERATURE REVIEW

A. Stock Investment

Stock investment is the process by which an individual buys shares of a company, which means owning a small portion of ownership in that company. Owning shares entitles an investor to several benefits, including the right to share the company's profits in the form of dividends, the right to attend and vote at General Meetings of Shareholders (GMS), and the right to be involved in key decisions that affect the direction of the company. However, despite offering attractive potential returns, investing in stocks also comes with significant risks. Investors must be prepared to face fluctuations in stock prices that can be influenced by various factors, both internal to the company and overall market conditions. Therefore, in-depth and careful analysis is essential before deciding to buy stocks, as well as regular monitoring of company performance and market changes to ensure that the investment remains in line with the investor's financial objectives (Maulia, 2021).

B. LQ45 Stock Index

The LQ45 stock index is a stock index consisting of 45 selected stocks from leading companies on the IDX. The index is designed to represent the overall performance of the stock market on the IDX and is an important benchmark in measuring the performance of the Indonesian stock market (Ibnu, 2022).

The LQ45 stock index is one of the important indicators in measuring the performance of the Indonesian stock market for investors. The movement of stock prices incorporated in the LQ45 index can provide an overview of the state of the stock market as a whole (Aliya, 2023).

C. Fundamental Analysis

Fundamental analysis of stocks is a method that studies financial statements, economic factors, industries, and management to assess the intrinsic value of stocks. The

goal is to determine whether the stock price is in line with market value and financial statements. Investors analyze income statements, balance sheets, and cash flows, and consider factors such as market conditions, competition, regulation, and industry trends. In this study, the criteria used include Return on Assets (ROA), Price price-to-earnings ratio (PER), price-to-book value (PBV), Net Profit Margin (NPM), and Debt to debt-to-equity ratio (DER) (Stiawan, 2021).

D. Decision Support System

A Decision Support System (DSS) is part of a computer-based information system designed to assist decision-making in a company or organization (Ramadiani et al., 2020). DSS utilizes data, mathematical models, algorithms, and other information technology to help make better and more efficient decisions (Ramadiani, Rani, et al., 2019). In DSS data and information collected from various sources will be processed and analyzed to produce useful information for decision-making (Ramadiani et al., 2021). DSS also allows decision-makers to estimate the outcome of various possible scenarios, to choose the best option based on predetermined criteria (Wardhana, 2019).

E. Simple Additive Weighting (SAW)

The Simple Additive Weighting (SAW) method is used in decision support systems to select alternatives based on several criteria. This method assigns weights to each attribute, multiplies the attribute values by their weights, then adds them up. The alternative with the highest value is chosen as the best solution (Nofriansyah & Defit, 2017). The algorithm for solving this method is as follows:

- Step 1: First define the criteria - criteria that will be used as benchmarks problem-solving benchmarks.
- Step 2: Normalize each alternative value on each attribute by calculating performance rating value.
- Step 3: Calculating the preference weight value on each alternative.
- Step 4: Perform ranking (Ramadiani, Kurniawan, et al., 2019).

The formulas used in the SAW method are:

- a) Normalize each alternative (calculate the performance rating value) based on the type of criteria. The formula can be seen in Equation (1).

$$R_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max } i \ x_{ij}} & \text{If } j \text{ is the benefit} \\ \frac{\text{Min } i \ x_{ij}}{x_{ij}} & \text{If } j \text{ is the cost} \end{cases} \quad (1)$$

Description (1):

R_{ij} = performance rating value.

$\text{Max } i$ = the maximum value of each row and column.

$\text{Min } i$ = minimum value of each row and column.

x_{ij} = rows and columns of the matrix.

- c) Calculating the preference weight value for each alternative. The formula can be seen in Equation 2.

$$V_i = \sum_{j=1}^n w_j r_{ij} \quad (2)$$

Description (2):

V_i = preference weight value of each alternative

w_j = criterion weight value

R_{ij} = performance rating value

F. Black Box Testing

Black Box Testing is a type of software testing in which testing is done by examining the inputs and outputs of the software without having to know the details of the internal structure of the source code. The main purpose of Black Box Testing is to ensure that the software behaves in accordance with the specifications and meets the predefined functional requirements (Huda, 2022).

III. RESEARCH METHODS

A. Research Location

The location of this research is Balikpapan, East Kalimantan. Data processing was conducted at the Internet Application Laboratory, Faculty of Engineering, Mulawarman University.

B. Data and Equipment

Criteria data sourced from the Indonesia Stock Exchange obtained from interviews with Mr. Aldila Bandaro as PH Head of the East Kalimantan Branch IDX Office was used in this study. Details of the criteria data used can be seen in Table 1.

Table 1. Criteria Data

No	Code	Criteria	Weight	Type
1	C1	ROA	25%	Benefit
2	C2	PER	15%	Cost
3	C3	PBV	20%	Cost
4	C4	NPM	25%	Benefit
5	C5	DER	15%	Cost

Criteria data is used to process alternative data to get stock recommendation values.

C. Data Collecting and Processing

Alternative stock data was obtained from the Indonesia Stock Exchange (<https://www.idx.co.id>) and Ajaib Securities (<https://ajaib.co.id>), dated January 12, 2024 as shown in Table 2.

Table 2. Alternative Stock Data

Alternative	Company Name	Company Code
A1	Ace Hardware Indonesia	ACES
A2	Adaro Energy Indonesia	ADRO
A3	AKR Corporindo	AKRA
A4	Sumber Alfaria Trijaya	AMRT
...
A45	Unilever Indonesia	UNVR

By using alternative data from the Indonesia Stock Exchange and Ajaib Securities, alternative data is used for data processing using the Simple Additive Weighting method. Research data processing using a website mySaham.

IV. RESULTS AND DISCUSSION

A. Data Processing

The first step in making this decision support system is to process data by creating a database. This data processing aims to make the data easier to use for analysis in the system to help solve research problems. The database in this system is named mySaham, which consists of criteria, user, stock, and sub criteria tables.

B. Application of the SAW Method

This stage calculates the priority of alternative stock recommendations using the Simple Additive Weighting (SAW) method. The following are the steps of determining alternative priorities carried out by the SAW method, namely:

1. Formation of decision matrix

This step is carried out by making a decision matrix by taking the value of the criteria based on the initial data, so that a decision matrix is obtained which can be seen in Table 3.

Table 3. Stock Decision Matrix

Alternative	Company Code	C1	C2	C3	C4	C5
A1	ACES	2	3	2	2	1
A2	ADRO	3	2	1	3	1
A3	AKRA	2	3	2	2	2
A4	AMRT	2	3	3	2	2
...
A45	UNVR	3	3	3	2	2

2. Determination of Normalization Matrix

This step is done by normalizing the matrix using Equation (1) based on the type of criteria used, so that a normalized matrix (R) is obtained. The steps of matrix normalization are:

d) Normalization of Alternative Criteria C1

$$R_{i1} = \frac{x_{i1}}{\text{Max}\{1,2,3\}}$$

$$R_{11} = \frac{2}{3} = 0,66667 \quad R_{21} = \frac{3}{3} = 1$$

$$R_{31} = \frac{2}{3} = 0,66667 \quad R_{41} = \frac{2}{3} = 0,66667$$

$$\dots \quad R_{451} = \frac{3}{3} = 1$$

e) Normalization of Alternative Criteria C2

$$R_{i2} = \frac{\text{Min}\{1,2,3\}}{x_{i2}}$$

$$R_{12} = \frac{1}{3} = 0,33333 \quad R_{22} = \frac{1}{2} = 0,5$$

$$R_{32} = \frac{1}{3} = 0,33333 \quad R_{42} = \frac{1}{3} = 0,33333$$

$$\dots \quad R_{452} = \frac{1}{3} = 0,33333$$

f) Normalization of Alternative Criteria C3

$$R_{i3} = \frac{\text{Min}\{1,2,3\}}{x_{i3}}$$

$$R_{13} = \frac{1}{2} = 0,5 \quad R_{23} = \frac{1}{1} = 1$$

$$R_{33} = \frac{1}{2} = 0,5 \quad R_{43} = \frac{1}{3} = 0,33333$$

$$\dots \quad R_{453} = \frac{1}{3} = 0,33333$$

g) Normalization of Alternative Criteria C4

$$R_{i4} = \frac{X_{i4}}{\text{Max}\{1,2,3\}}$$

$$R_{14} = \frac{2}{3} = 0,66667 \quad R_{24} = \frac{3}{3} = 1$$

$$R_{34} = \frac{2}{3} = 0,66667 \quad R_{44} = \frac{2}{3} = 0,66667$$

$$\dots \quad R_{454} = \frac{2}{3} = 0,66667$$

h) Normalization of Alternative Criteria C5

$$R_{i5} = \frac{\text{Min}\{1,2,3\}}{X_{i5}}$$

$$R_{15} = \frac{1}{1} = 1 \quad R_{25} = \frac{1}{1} = 1$$

$$R_{35} = \frac{1}{2} = 0,5 \quad R_{45} = \frac{1}{2} = 0,5$$

$$\dots \quad R_{455} = \frac{1}{2} = 0,5$$

Determination of Preference Value

$$W = [0,25 \ 0,15 \ 0,20 \ 0,25 \ 0,15]$$

$$V_1 = (0,25 * 0,66667) + (0,15 * 0,33333) + (0,20 * 0,5) + (0,25 * 0,66667) + (0,15 * 1) = 0,63333$$

$$V_2 = (0,25 * 1) + (0,15 * 0,33333) + (0,20 * 1) + (0,25 * 1) + (0,15 * 1) = 0,925$$

$$V_3 = (0,25 * 0,66667) + (0,15 * 0,33333) + (0,20 * 0,5) + (0,25 * 0,66667) + (0,15 * 0,5) = 0,55833$$

$$V_4 = (0,25 * 0,66667) + (0,15 * 0,33333) + (0,20 * 0,33333) + (0,25 * 0,66667) + (0,15 * 0,5) = 0,525$$

$$\dots\dots\dots$$

$$V_{45} = (0,25 * 1) + (0,15 * 0,33333) + (0,20 * 0,33333) + (0,25 * 0,66667) + (0,15 * 0,5) = 0,60833$$

C. Application of Display

The display on this system is divided into two types of users, namely Admin as the system manager and Investor as the decision maker. Admin has the main role in managing and maintaining the system, ensuring data and features function properly, and making necessary configurations or updates. Meanwhile, Investors act as parties who use information in the system to make investment-related decisions. The following is an explanation of each page available in this system:

i) Admin Dashboard Page

Figure 1. shows, The admin dashboard page is a page that is accessed after a successful login validation process as an Admin. On this dashboard page, Admins can view important information, such as the total number of users registered in the system, the amount of stock data available and managed, and the number of admins who have access rights to manage data. On the left side of the page, there is a sidebar that contains various navigation menus that make it easier for Admins to access and manage various types of data, namely: Criteria, Sub criteria, Stocks, Recommendations, Users, Profiles, and Exit. These menus allow Admins to manage various data, such as viewing criteria and sub criteria data, as well as adding, changing,

or deleting stock and user data. Admins can select stocks for calculation through the Recommendations menu on the sidebar. In addition, Admins can also change profile information through the Profile menu, and can exit the system through the Exit menu after completing managing data.

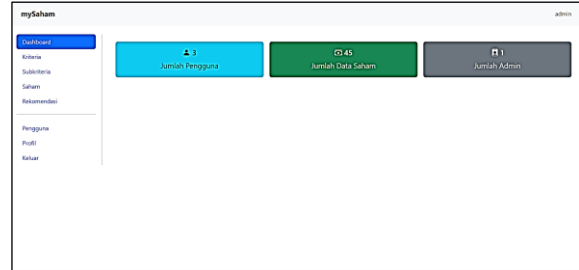


Figure. 1. Admin Dashboard Page

j) User Page

Figure 2. shows, the user page is a page used by Admin to manage user data that has been registered on the system. The user data page is displayed in the form of a table consisting of username, name, role and actions that can be performed by Admin.

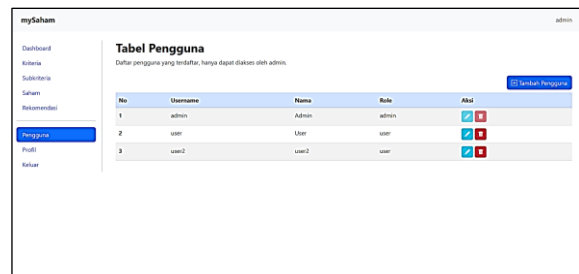


Figure. 2. User Page

Admin can press the “Add User” button in Figure 2. to add new user data which can be seen in Figure 3. Admin can fill in new user data such as name, username, role and password, then Admin can press the “Add” button to save the new user data.

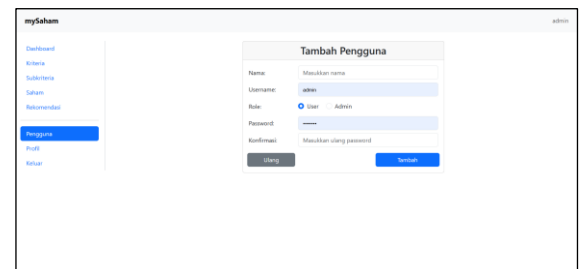


Figure. 3. Add User Page

Admin can press the light blue “pencil icon” button in Figure 2. to update user data, after which the input field will appear to have been filled in by the previous data which can be seen in Figure 4. Admins can press the “Edit” button to update user data.

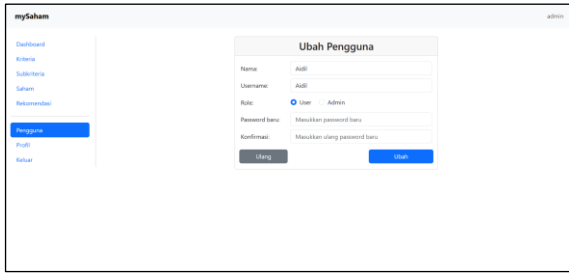


Figure. 4. Edit User Page



Figure. 7. Edit Stock Page

k) Stock Page

Figure. 5. shows, the stock page is a page used by investors to manage alternative data. The stock page is displayed in the form of a table consisting of alternative codes, company codes, company names and actions that investors can take for each alternative. Investors can only perform actions such as edit or delete data based on stock data that has been added by the Investor.

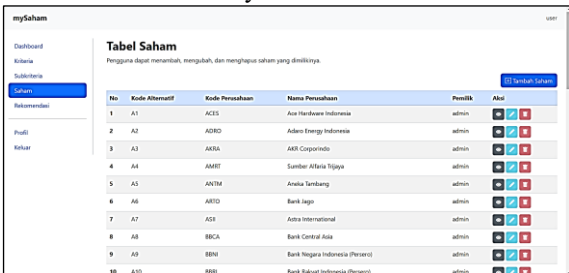


Figure. 5. Stock Page

Investors can press the “Add Stock” button in Figure. 5. to add new stock data which can be seen in Figure. 6. Investors can fill in alternatives, codes, names and criteria values, then Investors can press the “Add” button to save new alternative data.

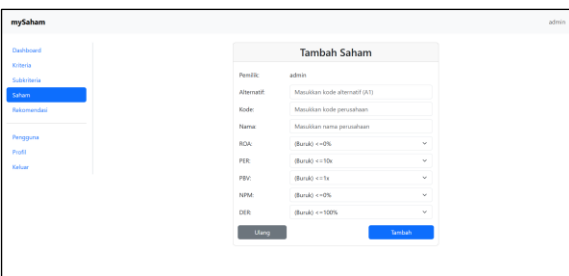


Figure. 6. Add Stock Page

Investors can press the light blue “pencil icon” button in Figure. 5. to update the stock data that has been added by the Investor, after which a form will appear to update the data which can be seen in the Figure. 7. Investors can press the “edit” button to update the stock data that has been added by the Investor.

l) Recommendation Page

Figure. 8. shows, The Investor recommendation page is a page used by investors to select several alternatives and see the results of recommendations given by the system. Investors can choose several types of alternatives first, then press the “Calculate Options” button.

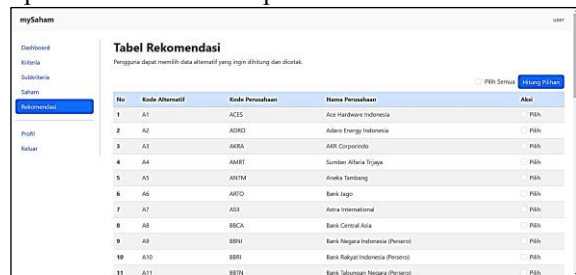


Figure. 8. Recommendation Page

Figure. 9. Shows, the results of the system calculation will appear after the Investor presses the “Calculate Options” button. The results of the system calculation are the priority order of the previously selected alternatives.

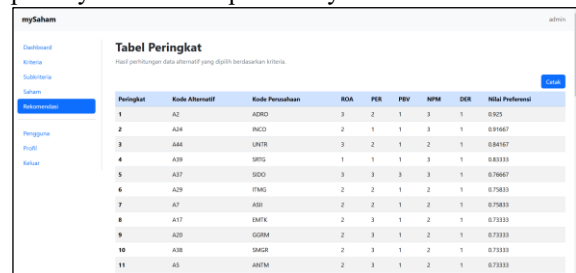


Figure. 9. Recommendation Result Page

D. Testing Results

System testing involved respondents, consisting of administrators and investors. This test focuses on observing the performance of the system, especially in terms of input and output functionality, to ensure that the system operates properly. Respondents were asked to fill out a questionnaire to report to the author if there are features that do not function properly. The results of black box testing can be seen in Table 4.

Table 4. Black Box Testing

#	Test Case	Expected Results	Testing Results
1	Login Button	Can validate username and password administrators	Successful
2	Dashboard Page	Can display the dashboard page	Successful
3	Criteria Page	Can display the criteria page	Successful
4	Stock Page	Can display the stock page	Successful
5	Add Alternative Button	Can add alternative stocks	Successful
6	Delete Button	Can remove stock alternatives	Successful
7	Edit Button	Can change stock alternatives	Successful
8	Sub criteria Page	Can display the sub criteria page	Successful
9	Recommendation Page	Can display ranking results	Successful
10	User Data Page	Can display the user data page	Successful
11	Delete Button	Can delete user data investors	Successful
12	Register Button	Can register an investor account	Successful
13	Home Page	Can display the investor's main page	Successful
14	Stock Page	Can display investor alternatives	Successful
15	Add Alternative Button	Can add alternative stocks	Successful
16	Delete Button	Can remove stock alternatives	Successful
17	Edit Button	Can change investors' stock alternatives	Successful
18	Profile Page	Can display profile	Successful
19	Edit Profile button	Can change account data	Successful
20	Recommendation Page	Can display the stocks to be selected	Successful
21	Calculate Button	Can display ranking results	Successful

V. CONCLUSION

A website-based decision support system that uses the Simple Additive Weighting (SAW) method is successfully used to determine the priority order of stock alternatives by calculating and comparing various relevant criteria using the black box testing method. This system makes it easier for investors to make more informed investment decisions by providing rankings based on predetermined preference weights, thus enabling more efficient and accurate identification of the best stocks.

The results of this study show that from the analyzed stock alternative data, alternative A2 obtained the highest preference value, which is 0.925, based on calculations using the Simple Additive Weighting (SAW) method. This preference value indicates that Alternative A2 is in the highest priority order compared to other alternatives, showing better potential to be considered as an investment option. This indicates that the stock meets the criteria used in the analysis, such as liquidity, market capitalization, and

financial performance, with superior performance among other alternatives.

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