



Article

Stock Saving Simulation Based on Historical Data Web-based

Mesakh Septiadi Simijaya¹, Aditiya Hermawan²

^{1,2}Buddhi Dharma University, Faculty of Science & Technology, Banten, Indonesia

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CORRESPONDENCE

E-mail :

mesakhsimijaya@gmail.com
aditiya.hermawan@ubd.ac.id

A B S T R A C T

This study aims to simulate the calculation of saving stocks based on historical data for the past 10 years for the period January 2010 - January 2020, because saving simulations based on historical data are still very rare, so a simulation application for saving stock calculations based on historical data is made that can help customers. investors in simulating the calculation of saving stocks so that it can be used as learning to determine how to save the right way that can produce a good return. This application is created using a waterfall model. From the application made, it is expected to know the good return results of the 10 issuers used in this study, and in making basic applications on user requirements obtained through several respondents through online questionnaires and processed with requirement elicitation techniques. With the application of a stock saving calculation simulation application, it is hoped that it can be a lesson for investors in saving stocks and can also be a lesson for potential investors and can also make it easier for investors to do calculations because the calculation process is computerized.

INTRODUCTION

Saving is not a new thing for humans, from an early age we as humans have learned to save, for example if we want to buy something but we don't have enough money to buy it then we will collect money within a certain period of time until it is sufficient to buy it. Saving is an activity to save money for needs that are needed at any time [1]. There are several types of savings, including conventional savings, term savings, and hajj savings, these types of savings are carried

out in the same way, namely by saving our money in the bank, but if inflation occurs, the value of our money will decrease. In addition to saving, there are other types of saving money, namely by investing, where the value of our money can survive with a return equal to inflation, but investment has the opportunity of profit or loss because investment is an activity of allocating or investing resources (resources) at this time (now), with the hope of getting a profit in the future (future) [2].

There are several investment products available, including investment in mutual funds, gold, debt securities (bonds), and stocks. This investment product is a product that is very easy to do, because there is already a platform that provides services to make this investment. In this study, it is more specific to discuss one investment product, namely stocks, because stocks are investment products that can provide a fairly good return at this time. Good stock investment returns encourage investment interest growth. Stocks have increased in recent years as can be seen in the data released in the 2nd edition of the KSEI News Bulletin released on September 21, 2020, the number of Single Investor Identification (SID) as of June 2020 reached 2,920. 373 SID, grew 43% in the same period last year (YoY) [3].

Stocks are investment products that can be purchased by saving (buying regularly), because by saving we can get the amount of money we want according to the amount of money we want without having to be without desire and by saving we can reduce price risk. which is volatile because we buy regularly and get the average price (High Price and Low Price).

Saving good stocks requires consistency in buying and requires the right time to buy stocks (Every Sunday, Every Month, beginning of the month or the end of the month), in order to get the maximum return later. For the realization of the right time in maximizing the realized return, it is necessary to analyze using historical data. Return is very important because it is used as a measure of the company's performance and sees the basis for returning expectations. Expected return is the return that is expected to be obtained by investors in the future [4]. Therefore knowing when is the right time to buy shares is important because it can increase realizability. To know this, we need a calculation pattern that we get from the historical data of the last few years. If we look for patterns manually, it will definitely take a very long time and be inefficient, therefore calculations will be made to make

it easier for investors to know when is the right time to save stocks that can generate good returns. Simulations can automatically use the help of information technology to perform calculations.

The process of calculating savings by involving historical data that requires sufficient assistance into computerized calculations to make it easier and faster to help investors who want to save shares. There are several types of platforms for making computerized calculations, one of which is based on a website that can be reached by anyone and anywhere through the internet network because active internet users in Indonesia based on data released by Hootsuite and We Are Social as of January 2020 have reached 175 .4 million [5], so that the process of simulating the calculation of the user's computerized history of data in the form of a web can be achieved by many people with the massive use of the internet. In addition to this, this web-based simulation is carried out to make it easier for investors to access this calculation simulation without the need for installation such as a mobile or desktop application, just simply enter one link and the simulation can be started immediately. This web-based simulation is designed using the waterfall design method. The waterfall model is a classical, systematic model, sequentially in building software [6]. This design method is used because the design is simple and easy to apply, because the design sequences are systematic, starting from the earliest stage, which is analyzing system requirements.

I. LITERATURES REVIEW

a. Stock Price

The stock price is the price in the real market, and the price is very easy to determine because it is the stock price when the market is in progress and when the

market closes, so the market price is the closing price [7].

b. Related Research

Some previous studies that are used as references in making simulation applications, for simulations of saving stocks using historical data are considered as new research, so the research that is used as a reference is more towards simulation.

The calculation of advances and payments in this industry was still using the conventional method, namely using a calculator, so that in the calculation process errors could occur and it took time to calculate credit payments because employees had to calculate and rewrite credit payment details on paper to be given to consumers. The purpose of this research is to create an Android-based credit down payment calculation application which is expected to make it easier for consumers to carry out calculations and share complete data with consumers about the details of calculating motorcycle credit purchases and share analyzes over the optimal credit limits that can be submitted. System development design using use case diagrams, activity diagrams, and class diagrams. Create calculation formulas in simulations using calculations that have been approved by the industry. The conclusion of this research is to create an android application that can help operational activities at PT Tunas Motor Pratama so that it does not take up employee performance time and provides good service to consumers [8].

To achieve normal family finances, financial planning is needed. Where the plan is made to be able to control and evaluate income and expenses as a reference in the next period. The purpose of this research is to make financial planning applications so that financial planning becomes easier.

Application development will be tried on the android platform. The Family Financial Planning application will record assets, debts, income and expenses, then carry out a comparison process is to equate the amount of cash added to savings after that compared to regular expenses as a cash dimension, equate the amount of installments with income to determine the percentage of installment payments, the amount money saved with income to determine the percentage saved. The application design uses UML procedures, UML procedures will visually describe the software engineering process, starting from user interaction to the process of actions that occur in the system/soft feature that is being engineered. Based on research that has been tried, it can be concluded that this Family Financial Planning Application is very helpful for managing and recognizing family financial stability which is made with a simple and easy-to-understand interface. The financial planner's accuracy in filling out the cash flow will be very helpful in identifying his future financial situation [9].

From previous research, simulation-based applications state that simulation can help simplify the calculation process but does not use historical data as a reference for simulation results. Historical data is a summary of the development of individual stock prices from issuers/companies whose shares are traded [10]. In this study, the calculation of savings stocks uses historical data to see the returns obtained because in stock savings there are price fluctuations every day then a simulation is applied to the website to represent information on a number of pages that have related topics on the internet network [11].

II. METHODS

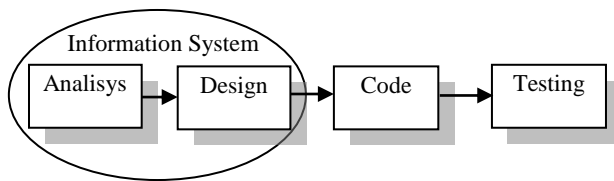


Figure 1. Waterfall Diagrams [12]

The method used in this research is the method with waterfall design model, with the following steps :

- a. **System Requirements Analysis**
In this stage, the analysis needed by the web is carried out, namely the user can simulate stock calculations, the web performs a calculation simulation based on historical data for the past 10 years stored in the database, so that the user can find out the results of the calculation of how many returns the user gets in a certain period of time.
- b. **Design**
At this stage, the design is carried out by making a flowchart design. Designing databases and tables using MySQL. Design the web interface with the Bootstrap framework.
- c. **Code**
In this stage, the program code is created using the PHP programming language with the Laravel framework.
- d. **Testing**
At this stage, the application is tested using the black box testing method, whether the application is running well or is it still having problems. By testing, improvements can be made if the application still has problems and it can also be ensured that the application can run as it should.

III. ANALYSIS AND DESIGN

3.1 System Requirements Analysis

a. General Description

In this research, historical data from several companies listed on the Indonesia Stock Exchange (IDX) are needed. As for the companies used as many as 10 companies listed on the

Composite Stock Price Index (IHSG), including:

1. Bank Central Asia Tbk (BBCA)
2. Bank Rakyat Indonesia (Persero) Tbk (BRI)
3. HM Sampoerna (Persero) Tbk (HMSP)
4. Bank Mandiri (Persero) Tbk (BMRI)
5. Astra Internasional Tbk (ASII)
6. Bank Negara Indonesia (Persero) Tbk (BBNI)
7. Unilever Indonesia Tbk (UNVR)
8. Indofood CBP Sukses Makmur Tbk (ICBP)
9. Barito Pacific Tbk (BRPT)
10. Semen Indonesia (Persero) Tbk (SMGR)

From the ten companies, daily historical data was taken for 10 years for the period January 2010 – January 2020, historical data taken is historical data on close prices. Close price is the last price for trading shares on that day, because the price for one day in the trading process is changing. Therefore, in this study, the close price was taken as a simulation. Historical data is used in this study because historical data is data that has happened before, so it can be said in this study the calculations are obtained based on previous experience. In the calculation if there is a stock exchange holiday date, the calculation will be accumulated to the next date when the exchange is active again, for example if the market is closed on Saturday and Sunday, the savings will be accumulated on Monday

b. User Requirement

user requirements are distributed to 24 users who are familiar with stock trading with various backgrounds, then the results of user requirements are processed in 3 stages. stage 1 summarizes all the results of the request, Stage 2 is processed by separating based on the level of importance (Mandatory, Desired, Not

Important) and stage 3 is divided into Operational and Economic) types of feasibility (Technical,

Table 1. User Requirement

Title: Stock Saving Simulation Based on Historical Data Web-based	
Functional	
No	User Needs
1	Can enter the amount of regular savings
2	Can determine the length of time to save
3	Can choose a weekly or monthly saving routine
4	Can choose available company
5	Can count without have to login
6	Displays the simulation results of the increase/decrease in share value in %
7	Show general knowledge about stocks
8	Can compare the simulation results of one company with another
9	Can compare the company simulation results with the available index
Non Functional	
No	User Needs
1	The website displayed is easy to understand, understandable, attractive appearance, simple, easy to access, and light
2	Complete data displayed
3	Easy-to-understand calculation results
4	Displaying calculations in tabular form
5	Displaying calculations in graphical form
6	There is a chart of stock

3.2 Design

a. Calculation Method

Stock historical data can be downloaded at finance.yahoo.com and id.investing.com, in this study used data was downloaded on these sites.

Table 2. Dataset Example

Date	Close
2010-02-01	755
2010-02-02	755
2010-02-03	755
2010-02-04	740
2010-02-05	725
2010-02-08	710
2010-02-09	725
2010-02-10	715
2010-02-11	730
2010-02-12	755

The dataset is then entered into the database, to calculate the monthly saving period, the data will be grouped by date starting from 1-31, while for the regular weekly saving period, the data will be grouped by day, namely, Monday, Tuesday, Wednesday, Thursday, Friday. If there is an empty date which means the exchange is on holiday, the savings will be accumulated to the next date. For example, the calculation if you save regularly on a weekly basis and the amount of regular savings is IDR 100,000 is :

Table 3. Example of Stock Sheet

Date	Close	Savings	Stocks Sheet
2010-02-01	755	100000	132.45
2010-02-02	755	100000	132.45
2010-02-03	755	100000	132.45
2010-02-04	740	100000	135.14
2010-02-05	725	100000	137.93
2010-02-08	710	300000	422.54
2010-02-09	725	100000	137.93
2010-02-10	715	100000	139.86
2010-02-11	730	100000	136.99
2010-02-12	755	100000	132.45

Source : Self-processed data

Savings of IDR 100,000 is divided by the close price every day to produce shares obtained.

$$\text{Stocks Sheet} = \frac{\text{Savings}}{\text{Close}}$$

Then the data is grouped by day so as to produce :

Table 4. Example of Data Grouping

Day	Savings Amount	Sum of Stocks Sheet
Monday	200000	273.295
Tuesday	200000	270.38
Wednesday	200000	272.31
Thursday	200000	272.12
Friday	200000	270.38

Source : Self-processed data

Then after the data is reached, the percentage obtained is calculated :

Table 5. Example of Calculation of Profit Saving Stocks

Day	Savings Amount	Sum of Stocks Sheet	Total Equity	Profit
Monday	200000	273.295	206338.0282	103.17%
Tuesday	200000	270.38	204137.931	102.07%
Wednesday	200000	272.31	205594.4056	102.80%
Thursday	200000	272.12	205451.6846	102.73%
Friday	200000	270.38	204137.931	102.07%

Source : Self-processed data

Total equity is the total stocks ownership that we have in a company. Total equity is obtained from the number of stocks multiplied by the price in the latest data. The percentage of profit is obtained from total equity divided by the amount of savings, for more details, it can be seen from the formula:

$$\text{Total equity} = \text{Stocks sheet} \times \text{Close on latest data}$$

$$\text{Profit} = \left(\frac{\text{Total equity}}{\text{Saving Amount}} \right) \times 100 \%$$

b. Flowchart

Here is the application flowchart :

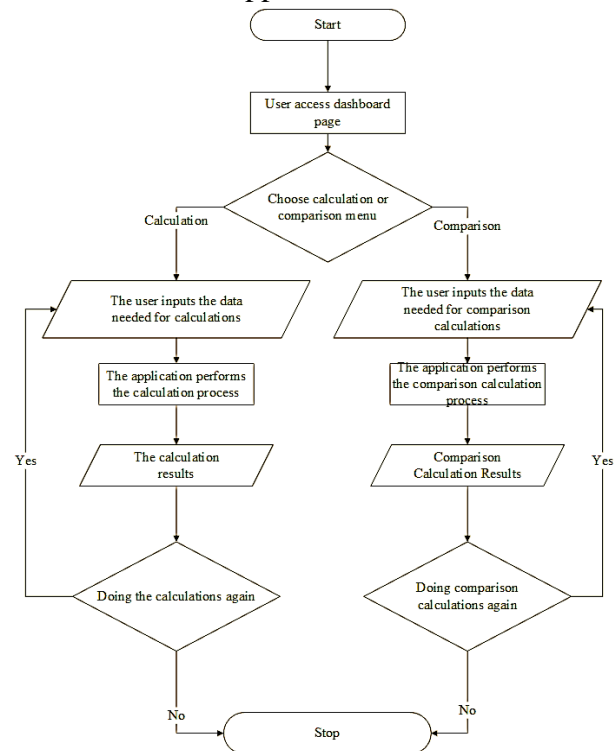


Figure 2. Application Flowchart

IV. IMPLEMENTATION AND TESTING

A. Implementation

Dashboard Page contains daily stock price charts, and there is a choice of simulation

types, namely ordinary calculations, comparisons and own data calculations.

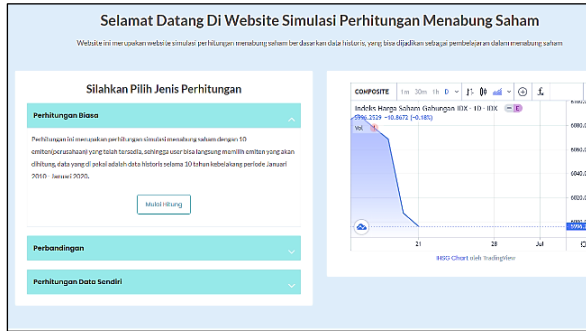


Figure 3. Dashboard Page

To use the simulation, the user is able to input data and perform calculations, starting from selecting issuers, entering the amount of regular savings, choosing the length of time for saving from 1-10 years, and choosing a weekly or monthly saving routine on the simulation page.

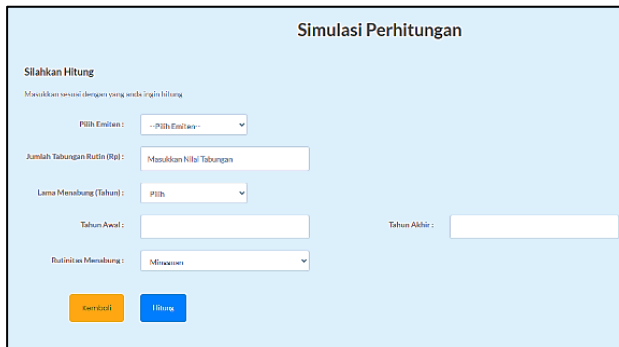


Figure 4. Calculation Simulation Page

After doing the calculations, the results of the calculations can be seen in the form of tables and graphs.

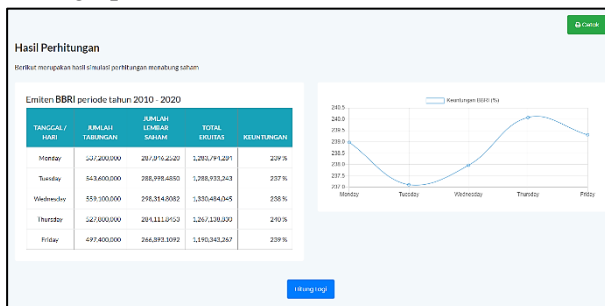


Figure 5. Result of Calculation Simulation Page

Users can also perform simulations to compare between stocks or with the Index to

see which stocks provide better returns within a certain period of time.

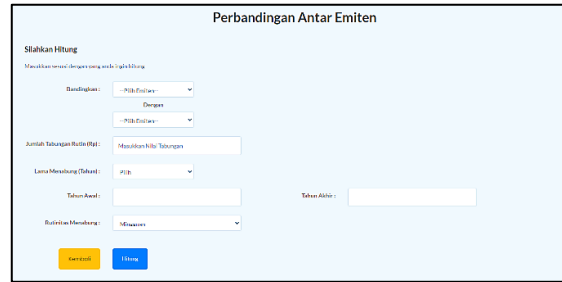


Figure 6. Comparison between Company Page

This page is the result page of the comparison calculation between issuers with their weekly savings routine, the results are in the form of tables and graphs.

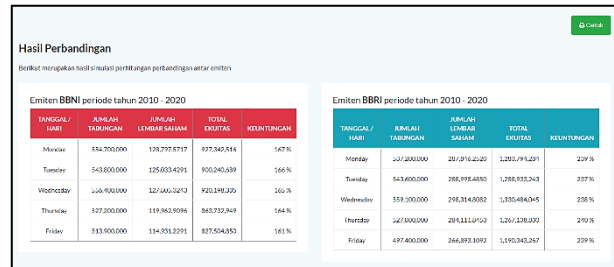


Figure 7. Result of Comparison between Company Page

In addition to the data that has been provided, users can also upload their own data for calculations, namely entering the amount of routine savings and choosing a weekly or monthly saving routine.

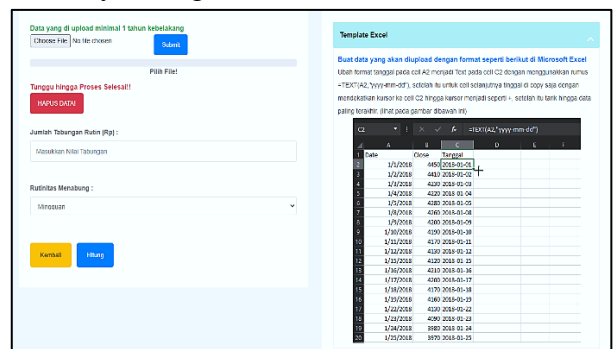


Figure 8. Own Data Calculation Page

On this web, users can choose companies that are already available users can simulate savings calculations and compare calculations between companies, companies with stock indexes. In conducting a

calculation simulation, the user only selects an available company, enters the nominal savings that will be regularly saved, chooses the length of time to save (minimum 1 year and a maximum of 10 years), and chooses a weekly or monthly saving routine. The calculation results produce a percentage of the profit which is presented in the form of tables and graphs, if you choose a weekly routine the results are on the profit percentage from Monday - Friday, if you choose a monthly routine then the result will be the profit percentage on 1 – 31. Users can download the table of calculation results in the form of a pdf file.

B. Testing

In testing this calculation, the selected savings period is for 10 years for the period January 2010 - January 2020, and a comparison is made with the lump sum method of buying shares. The amount of savings calculated is regular savings of

IDR 100,000 every month, and lump sum purchases of IDR 12,000,000. Here are the results of the resulting calculation :

Table 6. Stocks Calculation Testing

Stocks	Profit (%)	
	Saving	Lumpsum
ASII	94%	179.89%
BBCA	290%	641.58%
BBNI	168%	381.66%
BBRI	247%	571.79%
BMRI	165%	311.81%
BRPT	2252%	1003.85%
HMSP	106%	525.66%
ICBP	246%	619.05%
SMGR	109%	157.24%
UNVR	143%	359.73%

Source : Self-processed data

In this web trial, several questions were made regarding the assessment of web test results by users, the following are the questions asked :

Table 7. Research Questionnaire

No.	Rating Element	VG	G	F	P	VP
1.	This application can help in simulating the calculation of saving stocks					
2.	This application can help in determining the right time to save stocks					
3.	This application can make it easier to find out the estimated stock return obtained					
4.	This application displays calculation results that are easy to understand					
5.	This application can display a graph of the calculation results that are easy for the user to understand					
6.	This application can calculate the data uploaded by the user					
7.	Aspects of the overall appearance of the User Interface					
8.	Aspects of user convenience in using the application					
9.	Speed in carrying out the calculation					

	process					
10.	The application can print a table of calculation results					

Questionnaires above has five rating scale that is VG (Very Good), G (Good), F (Fair), P (Poor), VP (Very Poor). 25 users were randomly selected with various educational backgrounds, occupations and how long they have been familiar with stock investing. From the results of the user's answers, the data is processed for each question using a scale such as the following:

Table 8. Value Rating

Rating	Value
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

Tabel 9. Questionnaire Results

Rating Element	Result
Q1	110
Q2	108
Q3	107
Q4	110
Q5	113
Q6	109
Q7	103
Q8	118
Q9	116
Q10	110
Total	1.104

from the results of the answers of 25 users the level of user satisfaction is $(1.104 / (25 * 5)) * 100\% = 88.32\%$.

V. CONCLUSION

Based on the making of a simulation application for the calculation of saving shares using historical stock data that has been

created and described in this study, this research can help investors in choosing the right time to save stocks where the calculation results show the percentage of profits obtained based on the routine amount of savings saved on a weekly or monthly basis. This research can assist investors in predicting the results of stock returns obtained by looking at the calculation results indicated by the percentage of profits based on the amount of regular savings saved over a certain period of time, in this study limited to 1-10 years. This calculation simulation application is made web-based, making it easier for investors to access this application, as evidenced by the results of the questionnaire which states that the user satisfaction level is 88.32% from the expected 100%, this percentage is on the Very Good scale.

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BIOGRAPHY

Mesakh Septiadi Simijaya, Graduated in Informatics Engineering Study Program from Buddhi Dharma University in 2021, currently an employee as IT Staff at PT. Catur Sentosa Adiprana (Div P&G).

Aditiya Hermawan, Graduated in the Informatics Engineering Study Program (S1) in 2010, continued his Masters in Computer Science in 2011 and graduated in 2013. He is currently a Lecturer Informatics Engineering Study Program in Buddhi Dharma University.