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# Developing the Application of Gold Price Forecasting Towards Rupiah by using Moving Average Method

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**Abstract:-** Fluctuating gold prices can result in losses in investments, thus it needs forecasting to reduce the risk of loss in making gold investment decisions. This research builds the application of gold price forecasting using moving average method. Moving average is a method of forecasting with the price of gold in the past. In this study, the moving averages used two different parameters, if the moving average value was above the gold price, it is likely the price will drop. If the moving average value is below the gold price, it is likely that the price will rise. The program implementation uses the Meta Quotes Language (MQL) programming language, which is located on Meta Trader 4 (MT4). System testing is done using backtest simulation on MT4. System test results obtained 99.85% accuracy level with absolute mean error (MAE) Rp. 7,672 or 1.56%. The results of system interface testing conducted using questionnaires acquired usability factors of 3.96, simplicity factor of 3.78 and interactivity factor of 3.78 from a scale of 1 to 5. From the first and second test results show that the system has been well implemented and easy to use.

**Keywords:-** Backtest Simulation, Gold, Moving Average, MQL, Forecasting Efisiensi.

## I. INTRODUCTION

The investment world and capital markets have always been an interesting topic in this globalization era. Investment is the planting of funds in the form of money or goods that will give more results later, so that by investing is expected to make money. Investments and capital markets have become part of the fundamental economy not only in developed countries, as well as developing countries such as Indonesia [1].

Investments have a broad meaning. Many think the most important investment is education. The principle is the same, with increasing knowledge and expertise, expected job search and greater income. The benefits will be felt in the future [2]. This research discusses investing in financial contexts. That is to get profit results in the form of material in the future.

Estimates of the gold price can be done with a number of methods such as Moving Average, Exponential Smoothing, Trend Projection, and chart analysis [4][5]. In this research will be done price forecast using moving average method. That is to calculate the average price movements over a certain period based on past data. The combination of two different parameters in moving averages can help produce a simple forecasting system, with high accuracy.

In order to make gold investment decisions should be considered towards the changes in gold prices that do not always rise. The lack of information obtained by the public regarding the change in gold prices can lead to mistakes in gold investment planning. Therefore, in order not to happen losses need to be done analysis of forecast gold price in the future in a certain period. It is therefore necessary a system that can perform historical data calculations affecting the future prices. So that with the system can serve as risk management and as consideration in decision making.

This research focuses on investing in physical assets in the form of gold. Gold is one of the precious metals of high value. Investing in gold will encourage investors to choose to invest gold from the capital market. Investing in gold delivers better results for the longer term and with better purchasing power, so the investment of gold becomes an effective solution considering the value of money that every year is affected by inflation [3].

There are four types of investment assets. Firstly, cash assets, i.e. investments in cash form are generally offered in the form of savings, deposits, or money markets. Secondly, fixed income, which is an investment that has the feature of providing fixed income for its investors. Generally offered in the form of bonds and fixed income funds. Thirdly, shares, namely investments in the form of proof of ownership of a company. Fourthly, physical assets, namely investments that are generally in the form of gold, gemstone, and property [2].

**II. METHODOLOGY**

*A. Data Collection*

Data collection activities are activities to obtain gold price data towards the rupiah which is later used to conduct system testing. The Data collected was the price of opening, closing, highest price, and lowest price in the period from January 2012 to December 2015.

Data collection was done by retrieving the data contained in the price history contained on the MT4 platform. Data is extracted from FBS company, PT. Aneka Tambang, and Rupiah exchange rate towards the US dollar. In order to retrieve data, a set of computers that have been installed with MT4 software are required. Such software can be downloaded from the FBS official website (<http://www.fbs.com/id/platforms>). The steps for retrieving data are as follows:

1. Download the MT4 platform at FBS Company by visiting the site <http://www.fbs.com/id/platforms>. Page view site looks at Figure 2.

2. Install the downloaded MT4 platform. After the download is complete, open the file named "Fbs4setup.exe" or "Fbs4setup". In the installation process, Internet network connection is required, because the file will be downloaded directly from the server of company FBS.
3. Create a demo account on the MT4 platform you have installed. The next process after the installation of the platform is to open a demo account to be able to perform data retrieval on MT4. After all the forms are filled, then select "Next" and a new window appears to select the server, after that select "Finish". If the demo account creation process is complete and no error occurs, it will exit the Price Chart Data window at this time.
4. Take the gold price data to the rupiah from January 2012 to January 2015. The next step is to do the data retrieval by selecting the view on gold towards the rupiah in the time range of January 2012 to January 2015. Figure 3.1 to show an example of a gold price chart towards the US dollar.



Fig 1:- Gold price charts towards US Dollar  
(Source: MT4 FBS)



Fig 2:- Gold price chart for Ten Years (Weekly)  
(Source: [www.antamgold.com](http://www.antamgold.com))

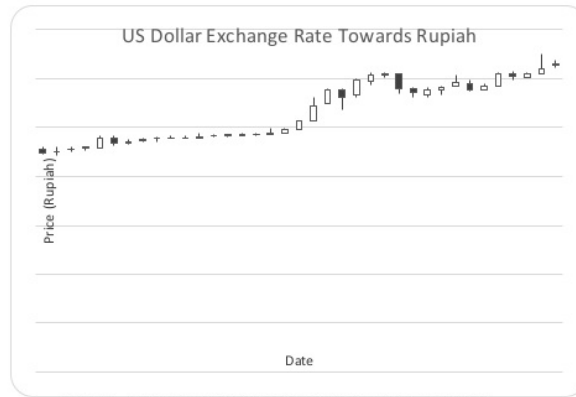


Fig 3:- US Dollar exchange rate towards Rupiah (Source: instaforex)

B. Application Building

At this stage explain the steps in building an upcoming trend forecasting application.

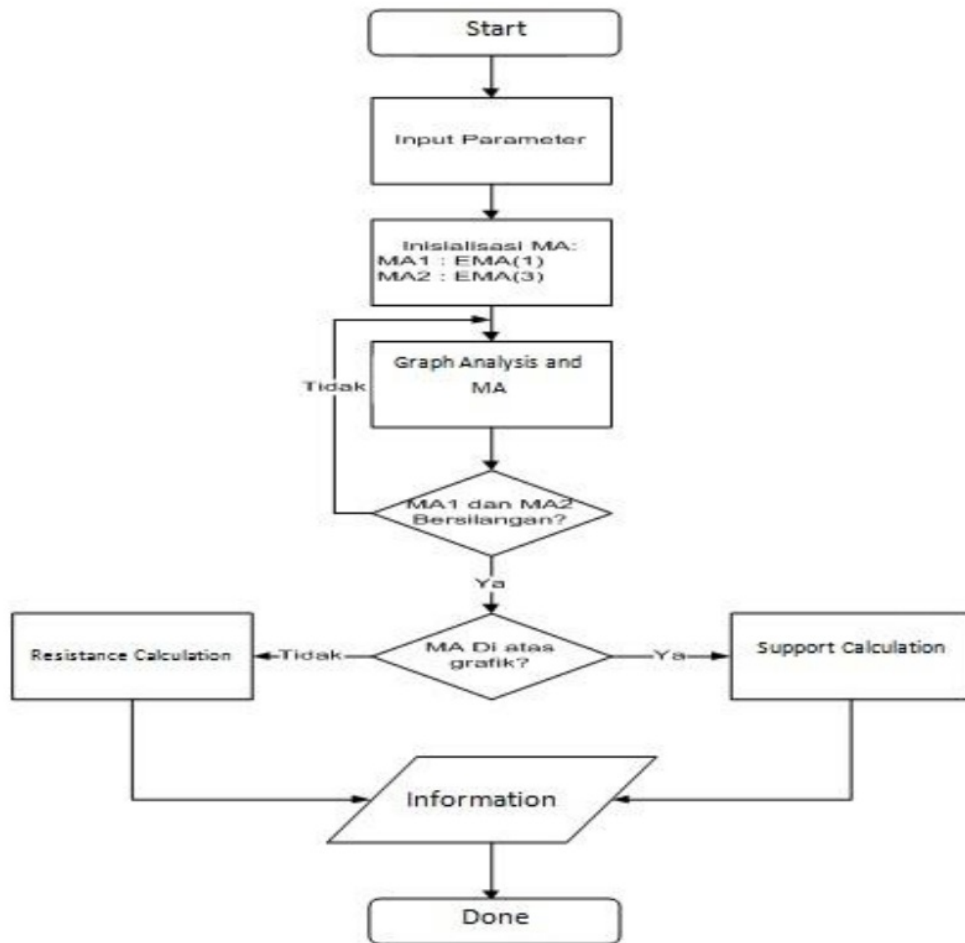


Fig 4:- Flow Chart Algoritma Program

Figure 4 is an algorithm of forecasting program to be built. The *moving average* used are *Exponential Moving Average* with period MA1 1 period, MA2 3 period. Each period is used to calculate as needed, i.e. a MA1 period of 1 representing historical data over the past month, and a MA2 of 3 representing historical data over the past two

months. From the algorithm described when the program starts by setting the parameters in conducting the system test, the program will perform the *Moving Average* analysis based on the price data available. Figure 12 is an algorithm for calculating *support* and *resistan*.

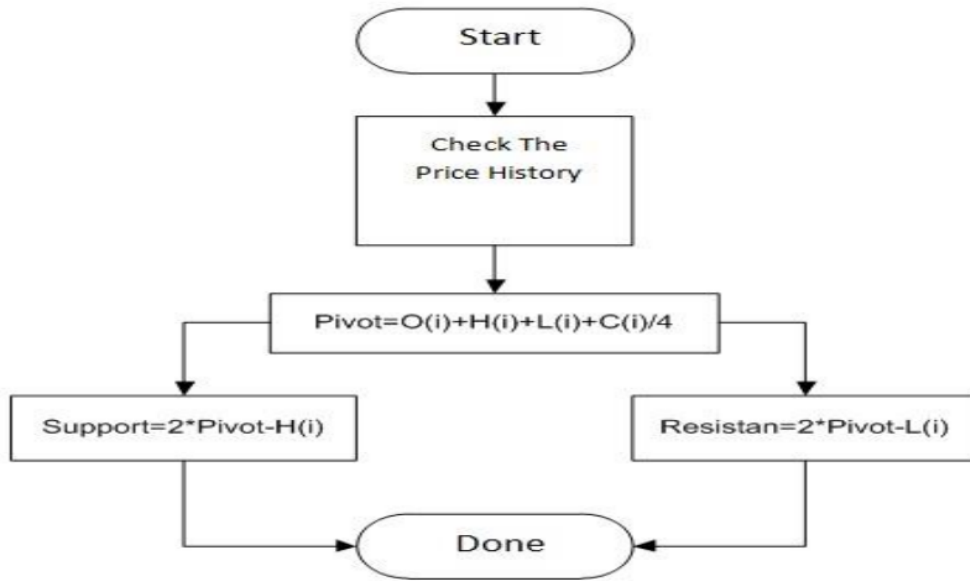


Fig .5:- Counting Algorithms for *Support* and *Resistan*

Figure.12 is an algorithm to calculate the value of *support* and *resistant*. The value of *support* or *resistance* will be calculated if the conclusion of the possibility formed from the *moving average* has been obtained. By collecting the past price history of several periods, the value of the *pivot* is derived, i.e. the middle value of future price movements. If the price moves up, then as a high-size price is the resistance and if the price moves down as the lowest value size is support.

C. Testing

System testing is the final stage in this study. Once the program is completed to test whether the program created can provide accurate forecasts so that investors do not feel lost after using the program. System testing was done by means of *Backtest Simulation* program that has been made run on computer with past data collected on point 3.1. The testing of the system was also done towards nine people who have different work and education background to measure *usability* factors, *simplicity* factors, and *interactifity* factors.

III. RESULT AND DISCUSSION

A. Voltage and Back EMF Constant

Forecasting is said to be successful if it produces the right solution in reading the situation in the future based on data in the past. System testing was done with *backtest simulation* using price data over the last ten years.

In testing the forecasting system there are several results of the simulation. Based on the resulting simulation data, the forecast price and actual price will be analyzed to assess forecasting accuracy. Table 1 shows the results of simulating monthly forecasting.

From the simulation results of the program and the calculation result obtained an average absolute error value of 7672 Rupiah or 1.56% of the average gold price and the percentage of the forecasting accuracy of 99.85%. Figure 6 is a comparison graph between forecasting results and actual prices.

No.	Tanggal	Harga Emas (Rupiah/Gram)		Yt-Ft	POA
		Ramalan (Ft)	Aktual (Yt)		
1	01/01/2012	478452	496875	18423	96,29%
2	01/02/2012	508748	512000	3252	99,36%
3	01/03/2012	513569	505250	8319	98,38%
4	01/04/2012	496357	498500	2143	99,57%
5	01/05/2012	498377	491875	6502	98,70%
6	01/06/2012	484611	488125	3514	99,28%
7	01/07/2012	500060	490375	9685	98,06%
8	01/08/2012	498644	500750	2106	99,58%
9	01/09/2012	513892	533250	19358	96,37%
10	01/10/2012	538614	543375	4761	99,12%
11	01/11/2012	540253	540875	622	99,89%
12	01/12/2012	531853	543250	11397	97,90%
13	01/01/2013	522830	542125	19295	96,44%
14	01/02/2013	513864	522000	8136	98,44%
15	01/03/2013	503377	504500	1123	99,78%
16	01/04/2013	496334	482500	13834	97,21%
17	01/05/2013	472363	457500	14863	96,85%
18	01/06/2013	439145	422500	16645	96,21%
19	01/07/2013	420675	425750	5075	98,81%
20	01/08/2013	477218	478625	1407	99,71%
21	01/09/2013	505571	501750	3821	99,24%
22	01/10/2013	491734	484000	7734	98,43%
23	01/11/2013	490944	480000	10944	97,77%
24	01/12/2013	491876	480375	11501	97,66%
25	01/01/2014	478157	484875	6718	98,61%
26	01/02/2014	484274	493000	8726	98,23%
27	01/03/2014	480960	489500	8540	98,26%
28	01/04/2014	487514	480125	7389	98,48%
29	01/05/2014	486003	479625	6378	98,69%
30	01/06/2014	487345	487625	280	99,94%
31	01/07/2014	496665	493125	3540	99,29%
32	01/08/2014	490006	489250	756	99,85%
33	01/09/2014	497202	479750	17452	96,49%
34	01/10/2014	489363	475375	13988	97,14%
35	01/11/2014	468546	469375	829	99,82%
36	01/12/2014	471732	474625	2893	99,39%
37	01/01/2015	The Average 491659	489750	1909	99,61%
Rata-rata		<b>492940,19</b>	<b>492219,59</b>	<b>7671,84</b>	<b>99,85%</b>

Table 1 :-Monthly Forecasting Simulation Results



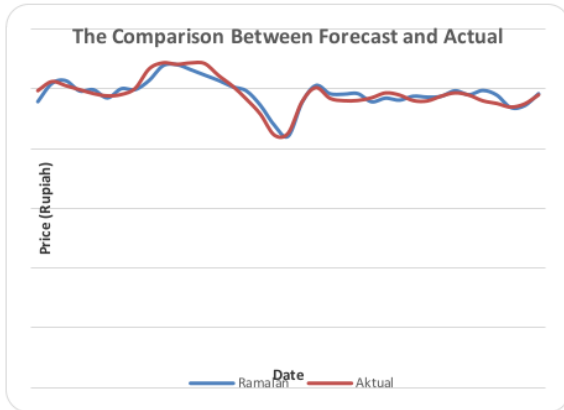


Fig 6:- Gold Price estimation Chart

**DISCUSSION**

The results of the research obtained from the analysis and simulation of the program that has been done. In this subchapter will be discussed the implementation process or program creation and explanation of some *source codes* and data analysis.

**1. Running Meta Editor.**

Meta Editor is an editor and compiler for the MQL4 programming language. In order to run the Meta Editor Select the existing Meta Editor icon in the MT4 *toolbar*.

It will open a Meta Editor window as seen in Figure 7. Through Meta Editor, you can create the program (*coding*), and compile the program. Click the *New* icon on the Meta Editor *toolbar* to create a *new* program.

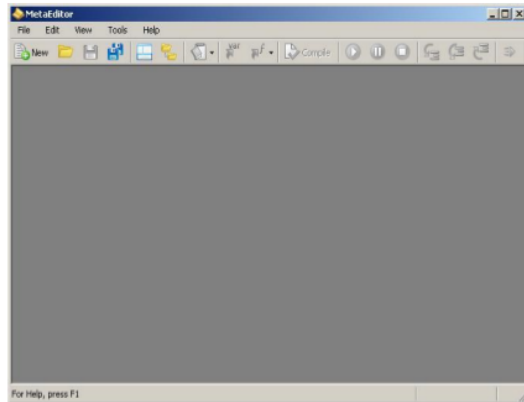


Fig 7:- Meta Editor

Once the new icon on the Meta Editor *toolbar* is clicked it will appear in the MQL *Wizard* window. In this window will appear some options of the type of program to be created. In this research, a program will be made on the *Custom Indicator*, as shown in Figure 8



Fig 8:- MQL Wizard

After the *custom indicator* is selected then click *Next* until the next window appears.

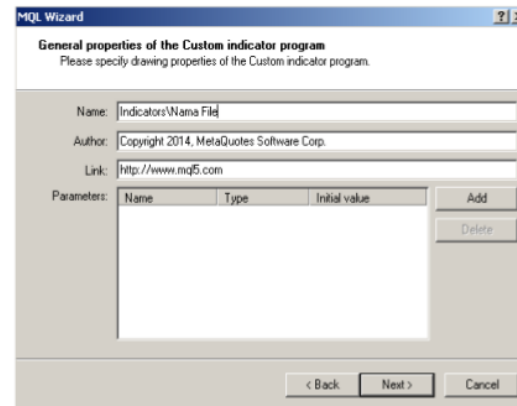


Fig 9:- MQL Wizard *properties*

The *properties window* in this MQL *Wizard* is useful for naming the program *file* to be created. Then click *Next* until the text editor appears to generate the program code.

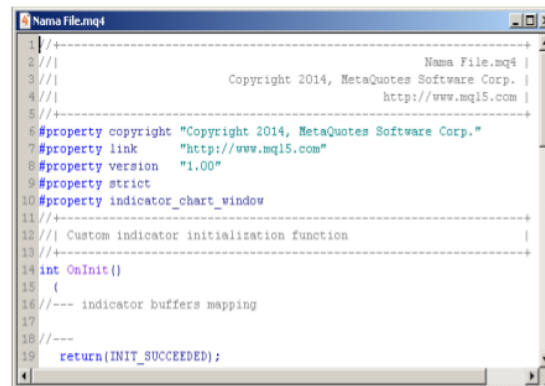


Fig 10:- Text editor to create a program

After the text editor appears, the programming process can be done according to the algorithm of Figure 3.5 in part three.

## 2. Introduction of variables.

Variables are used in the program as placeholders of temporary values. The value of variables are arbitrary. The introduction of variables seen in Figure 11.

```
12 double Sekarang, Open1, Open2, High1, High2, Low1, Low2, Close1
13     ,Close2, EMA1, EMA3, Pivot, Support, Resistan, Harga
14     ,EMA1a,EMA3a;
15
16 string Posisi,Tren;
```

Fig 11:- Introduction of Variables

There are two types of data used in the built programming. That is *double* and *string*. *Double* is used to store the data in the form of a real number. *String* used to accommodate data of letters and other characters.

## 3. Function of moving average.

Before the implementation of *moving average* into the program, define the *moving average* first and the parameters to be used. It is necessary to facilitate the function call to be built. The *moving average* function can be seen on Figure 12.

```
18 void MovingAverage()
19 {
20     EMA3=iMA(Symbol(),PERIOD_MN1,3,0,MODE_LWMA,PRICE_CLOSE,1);
21     EMA1=iMA(Symbol(),PERIOD_MN1,1,0,MODE_LWMA,PRICE_CLOSE,1);
22     EMA1a=iMA(Symbol(),PERIOD_MN1,1,0,MODE_LWMA,PRICE_CLOSE,2);
23     EMA3a=iMA(Symbol(),PERIOD_MN1,3,0,MODE_LWMA,PRICE_CLOSE,2);
24 }
```

Fig 12:- Function of Moving Average

Based on the program part in Figure 12, the parameters used in the EMA1 are using a one month period, with the *moving average* period of one, the *moving average* mode used is LWMA and applied to the closing of the price.

The parameters of the EMA3 is the period of one month, with a period of *moving average* of 3, the *moving average* mode used is LWMA applied to the closing of the price.

## 4. Function to calculate pivot point.

*Pivot point* is used to calculate the average price balance in the last three months. *Pivot point* are used as reference of price target movement, by utilizing *pivot point* can be calculated *support* and *resistan*.

```
26 void PivotPoint()
27 {
28     Open1=iOpen(Symbol(),PERIOD_MN1,1);
29     High1=iHigh(Symbol(),PERIOD_MN1,1);
30     Low1=iLow(Symbol(),PERIOD_MN1,1);
31     Close1=iClose(Symbol(),PERIOD_MN1,1);
32     Open2=iOpen(Symbol(),PERIOD_MN1,2);
33     High2=iHigh(Symbol(),PERIOD_MN1,2);
34     Low2=iLow(Symbol(),PERIOD_MN1,2);
35     Close2=iClose(Symbol(),PERIOD_MN1,2);
36     Pivot=(Open1+Open2+High1+High2+Low1+Low2+Close1+Close2)/8;
37     Support=((2*Pivot)-((Open1+Open2)/2))/31.1;
38     Resistan=((2*Pivot)-((Low1+Low2)/2))/31.1;
39 }
```

Fig 13:- Function of pivot point

The code snippets above are the functions of the *pivot point* is the middle or average value of the past period.

## 5. Function of current gold price.

```
41 void HargaSekarang()
42 {
43     PivotPoint();
44     Sekarang=iClose(Symbol(),PERIOD_MN1,0);
45     if(Sekarang>Pivot)
46     {
47         Posisi="Di atas";
48     }
49     else if(Sekarang<Pivot)
50     {
51         Posisi="Di bawah";
52     }
53 }
```

Fig 14:- Current gold price trends

To know the current position and price of gold can be done using a program like the Figure above. *Pivot point* price as a reference in current gold price movements.

## 6. Main function.

```
201 int OnCalculate(const int rates_total,
202               const int prev_calculated,
203               const datetime &time[],
204               const double &open[],
205               const double &high[],
206               const double &low[],
207               const double &close[],
208               const long &tick_volume[],
209               const long &volume[],
210               const int &spread[])
```

Fig 15:- Main function program

The above program fragments are the main functions of the program being created. Without this function, the program will not be able to run.

## 7. Call of formation functions

```
65 MovingAverage();
66 PivotPoint();
67 HargaSekarang();
```

Fig 16:- Call of formation function

All previously created form functions must be invoked in the main function, because otherwise the program does not work.

## 8. Displays the results on the screen.

```
91 Comment("TUGAS AKHIR\n");
92     ,"INDRA GUNAWAN\m11055102469\n";
93     ,"Rata-rata bulan lalu : ",Pivot
94     ," \nHarga Saat ini:",Sekarang," \n\n";
95     ,"Pergerakan saat ini berada ",Posisi," Harga rata-rata bulan lalu\n";
96     ,"Kemungkinan tren harga akan ",Tren," \n";
97     ,"Pada posisi : ",Harga," \n");
98     return(rates_total);
```

Fig 17:- Command to displays on the screen



As an interface and information for users, the result of forecasting is displayed on the screen, so users will be helped to obtain the information. To display information on the screen, you can use the command as in the Figure above. Once all the programming stages have been completed, it is necessary to compile the program to find out if an error occurred or not to the program that has been created. To compile, click the *compile* icon in the *toolbar*. If there is no error, it will appear information as in Figure 18.

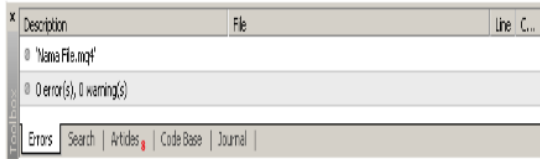


Fig 18:- Compile process

If the program does not have an *error* so the program is successfully created and can be used. To be able to use the program you have created, go to the MT4 *platform* and click the *indicator* icon on the *toolbar*.

Then there will appear several indicators, then select custom, and select "Source Code".

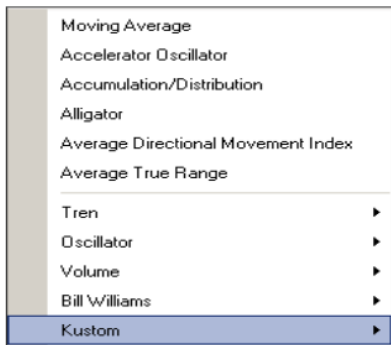


Fig 19:- Indicators

➤ *System Interface Testing*

System testing was conducted to 33 respondents for assessment of the system. The response from the user is poured out in the questionnaire after they use this forecasting system. There are three important factors in testing the system interface, i.e. the *usability* factor is determined by the question No: 1, 3, 4, 5, 7, the *simplicity* factor determined by the Question No: 1, 2, 9, 10, and the *interactivity* factor determined by question No: 6, 8. Results system testing is available on Table 4.2.

Question Number	Factors		
	<i>Usability</i>	<i>Simplicity</i>	<i>Interactivity</i>
1	3.78	3.78	
2		3.89	
3	4.44		
4	3.44		
5	4.00		
6			4.00
7	4.44		
8			3.56
9		4.00	
10		3.56	
Total	4.02	3.81	3.78

Table 2:- Respondent's Response results

Based on table 2 It appears that the lowest value is 3.44 and the highest value 4.44 from the rating scale of 1 to 5 points. The end result indicates that the average respondent is satisfied with this gold price forecasting system interface.

**IV. CONCLUSION**

From the test results of the system that has been done, the conclusions can be given as follows: This research has managed to create a gold price forecasting system application to estimate the price of gold in the future using the moving average method. System test results conducted using backtest simulation shows this forecasting system has an accuracy of 99.85% with an absolute average error of 7,672 Rupiah or 1.56%. While the evaluation results gained from a brief survey among users shows user satisfaction in terms of usability, simplicity, and interactivity.

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