

DECISION SUPPORT SYSTEM SELECTING MONEY MARKET MUTUAL FUND USING AHP METHOD

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Abstract: Money Market Mutual Funds are a short-term and low-risk investment vehicle suitable for novice investors. The large list of Money Market Mutual Funds for sale makes it difficult for novice investors to choose the best one. Therefore, in selecting Money Market Mutual Funds, a decision support system is needed by using the AHP (Analytical Hierarchical Process) method. Calculations using the AHP method can produce ratings that can be used as a reference in selecting Money Market Mutual Funds. The highest-ranking result in this study is Batavia Dana Kas Maxima.

Keywords: AHP; Decision Support System; Money Market Mutual Funds

Abstrak: Reksa Dana Pasar Uang adalah sarana investasi jangka pendek dan berisiko rendah yang cocok bagi investor pemula. Banyaknya daftar Reksa Dana Pasar Uang yang dijual membuat investor pemula kesulitan dalam memilih yang terbaik. Oleh sebab itu, diperlukan sistem pendukung keputusan dalam memilih Reksa Dana Pasar Uang dengan menggunakan metode AHP (*Analytical Hierarchy Process*). Perhitungan metode AHP dapat menghasilkan peringkat yang dapat dijadikan acuan dalam memilih Reksa Dana Pasar Uang. Hasil peringkat tertinggi pada penelitian ini adalah Reksa Dana Pasar Uang (RDPU) Batavia Dana Kas Maxima.

Kata kunci: AHP; Reksa Dana Pasar Uang; Sistem Pendukung Keputusan

INTRODUCTION

Investment is one way to increase future profits for companies and individuals. There are many types of investment with their respective levels of risk, Mutual Funds are one type of low risk investment[1]. Mutual Fund is a type of investment instrument in which investment funds are managed in a securities portfolio by an investment manager. Investors trust their funds to be managed by investment managers, so the reputation and expertise of investment managers are considered by investors in choosing a

good investment manager. Mutual Funds are designed for potential investors who want to invest but have limited investment knowledge and do not have time to analyze the market[2]. There are four types of Mutual Funds, namely[3]: Fixed Income Mutual Funds, Equity Mutual Funds, Money Market Mutual Funds and Mixed Mutual Funds.

Money Market Mutual Funds are types of financial products that are invested in deposits with maturities of less than one year, bonds, and Bank Indonesia Certificates. Money Market Mutual Funds have a small risk compared to oth-



er types of Mutual Funds because of their short period, so they are safe for novice investors even though they get small profits or returns compared to other types of Mutual Funds.[4], [5]. The large list of Money Market Mutual Funds in Indonesia makes novice investors confused in choosing and buying a good Money Market Mutual Funds. While there is no certainty that Money Market Mutual Funds that have performed well in the past will continue to do well in the future. Each type of mutual fund performs differently. It depends on how the performance of the investment manager is managed[6].

Decision support systems can help certain parties to make the right and fast decisions based on the alternatives that have been proposed[7]. The use of decision support systems for the selection of investment products has been discussed in several studies, using certain methods, decision support systems can provide the best investment alternative product choices[8], in this case are Money Market Mutual Funds Products.

The method used to choose the right Money Market Mutual Fund product is the AHP method. The AHP method can help investors prioritize and make optimal decisions through a decision support system. This method is suitable to be applied in this study because it can prioritize inventory. The application of AHP is based on experience and experts or users to determine the factors that influence the decision-making process[9].

The purpose of this research is to design a decision support system for choosing Money Market Mutual Funds using the AHP (Analytic Hierarchy Process) method so that it can help novice investors in choosing and deciding to buy the best Money Market Mutual Funds product.

METHOD

This study uses an observation technique, by collecting data from Bib-it.id securities to obtain a sample of data used as data in the AHP calculation. There are 5 samples of data from 5 securities used from 2018-2022. The AHP (Analytic Hierarchy Process) method measures and determines the proportional scale for discrete and continuous comparisons by breaking down complex multi-criteria problems into a hierarchy. Hierarchy is defined as a picture of complex problems in a multi-level structure, at the first level is a goal, then there are factor levels, criteria, sub-criteria and the final level is an alternative level so that the problem looks more systematic and structured[10]. On the criteria, the criteria are weighted using the AHP method formula based on the level of importance. There is a sequence of calculation steps that need to be considered in calculating AHP[10]:

1. Formulate the problem and determine the solution.
2. Create a hierarchy, starting with identifying the overall goal, identifying criteria, and alternatives.
3. Make a pairwise comparison matrix to compare the choices of decision-makers by evaluating the importance of one element to another. The assessment is carried out based on a comparison scale that aims to represent opinions or judgments, which are loaded into an analysis table such as table 1. After that, the paired comparison matrix is simplified into decimal form and adds up each column to get the \sum columns needed to calculate the consistency ratio later.
4. Normalize the pairwise comparison matrix, by multiplying the

row of elements by the column of elements like matrix multiplication. Then the results of the calculations are added up in each row to get the \sum_{row} .

5. Calculate the maximum eigenvector value obtained and perform consistency testing. If the results show inconsistent data, then the data collection on the matrix needs to be repeated.
6. Perform calculations for each level of the hierarchy by repeating steps 3, 4 and 5. In this study, calculations were made for alternatives.
7. Calculate the weight eigenvector of each element in the pairwise comparison matrix. The calculation is done by multiplying the eigenvector value of each alternative with the eigenvector value of the criteria.
8. Conducting hierarchical consistency testing. The consistency-

ratio must be less than 0.1 or 10% otherwise, the calculation must be recalculated. In calculating the consistency ratio, calculations are carried out to find the $\lambda_{maximum}$ or maximum eigenvector value, which is obtained from the sum of each column with the eigenvector. Then, calculate the Consistency Index (CI) based on formula (1).

$$CI = (\lambda_{maximum} - n) / (n - 1) \quad (1)$$

Then calculate the Consistency Ratio (CR) based on formula (2), IR or Random Index obtained from the table of values (quoted) as in table 2.

$$CR = CI / IR \quad (2)$$

Table 1. Pairwise Comparison Scale

Intensity of Interest	Description
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the other elements
7	One element is definitely more important than the other elements
9	One element is absolutely important than the other elements
2,4,6,8	The value between two adjacent elements

Table 2. Random Index Value

n	1,2	3	4	5	6	7	8	9	10	11	12	13	14	15
IR	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49	1,51	1,48	1,56	1,57	1,59

RESULT AND DISCUSSION

The selection of Money Market Mutual Funds is influenced by several important factors or criteria, including Bibit.id [11]: The reputation of the Investment Manager (criterion 1), Return (criterion 2), Risk (criterion 3), Managed Funds or AUM (Asset Under Management) (criterion 4), and Expense Ratio (criterion 5).

Based on the criteria that influenced the selection of Money Market Mutual Funds, five alternatives were taken, namely Batavia Dana Kas Maxima (Alt 1), Sucorinvest Money Market Fund (Alt 2), Bahana Dana Liquid (Alt 3), Eastspring Investment Cash Reserve Class A (Alt 4), TRIM Cash 2 (Alt 5).

Based on the criteria comparison matrix and the alternative comparison matrix, the number of elements is five so the Random Index (IR) value in this calculation is 1.12.

To perform AHP calculations, the criteria and alternative data samples were taken from Bibit.id on April 6, 2022[12] which is contained in table 3. Samples on all alternatives with the criteria of AUM and Expense Ratio were taken within 5 years (2018-2022). The data sample is used as a reference in making pairwise comparison matrices. The value of the data sample may vary depending on the condition of the Money Market Mutual Fund.

Table 3. Money Market Mutual Fund Data Sample

	Reputation	Return	Risk	AUM(5Y)	Expense Ratio (5Y)
Alt 1	1	+25%	-0,03%	9.37T	1,27%
Alt 2	2	+36.51%	-0,04%	9.03T	1,10%
Alt 3	3	+27.05%	-0,07%	6.10T	1,01%
Alt 4	4	+22.25%	-0,11%	4.58T	0,29%
Alt 5	5	+27.59%	-0,07%	4.55T	1,03%

Criteria Comparison Matrix

Table 4. Simplification Criteria Comparison Matrix

	Criteria				
	Reputation	Return	Risk	AUM	Expense Ratio
Reputation	1,00	5,00	3,00	2,00	2,00
Return	0,20	1,00	2,00	0,25	0,50
Risk	0,33	0,50	1,00	0,33	2,00
AUM	0,50	4,00	3,00	1,00	3,00
Expense Ratio	0,50	2,00	0,50	0,33	1,00
Σ Column	2,53	12,50	9,50	3,92	8,50

Table 5. Normalization Criteria

	Criteria						Σ Row	Eigenvector
	Reputation	Return	Risk	AUM	Expense Ratio			
Reputation	5,00	23,50	23,00	6,92	18,50	76,92	0,3774742	
Return	1,44	5,00	5,60	1,73	6,15	19,93	0,0977834	
Risk	1,93	8,00	5,00	2,13	5,92	22,98	0,1127515	
AUM	4,30	18,00	17,00	5,00	15,00	59,30	0,2910191	
Expense Ratio	1,73	8,08	7,50	2,33	5,00	24,65	0,1209717	
						203,77	1	

Alternative Comparison Matrix

Table 6. Alternative Comparison Matrix 1 Simplification

	Alternative 1				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Alt 1	1,00	2,00	3,00	4,00	5,00
Alt 2	0,50	1,00	3,00	4,00	4,00
Alt 3	0,33	0,33	1,00	2,00	3,00
Alt 4	0,25	0,25	0,50	1,00	2,00
Alt 5	0,20	0,25	0,33	0,50	1,00
Σ Column	2,28	3,83	7,83	11,50	15,00

Table 7. Alternative Normalization 1

	Alternative 1					Σ Row	Eigenvector
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5		
Alt 1	5,00	7,25	15,67	24,50	35,00	87,42	0,4072732
Alt 2	3,80	5,00	10,83	18,00	27,50	65,13	0,3034554
Alt 3	1,93	2,58	5,00	8,7	13,00	30,68	0,1429533
Alt 4	1,19	1,67	3,17	5,00	7,75	18,78	0,0874725
Alt 5	0,76	1,14	2,27	3,47	5,00	12,63	0,0588456
						214,64	1

Table 8. Alternative Comparison Matrix 2 Simplification

	Alternative 2				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Alt 1	1,00	0,20	0,33	4,00	0,33
Alt 2	5,00	1,00	4,00	6,00	4,00
Alt 3	3,00	0,25	1,00	3,00	2,00
Alt 4	0,25	0,17	0,33	1,00	0,33
Alt 5	3,00	0,25	0,50	3,00	1,00
Σ Column	12,25	1,87	6,17	17,00	7,67

Table 9. Alternative Normalization 2

	Alternative 2					Σ Row	Eigenvector
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5		
Alt 1	5,00	1,23	2,97	11,20	3,47	23,87	0,0914169
Alt 2	35,50	5,00	13,67	56,00	19,67	129,83	0,4973028
Alt 3	14,00	2,10	5,00	25,50	7,00	53,60	0,205305
Alt 4	3,33	0,55	1,58	5,00	2,08	12,55	0,0480705
Alt 5	9,50	1,73	4,00	21,00	5,00	41,23	0,1579048
						261,08	1

Table 10. Alternative Comparison Matrix 3 Simplification

	Alternative 3				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Alt 1	1,00	2,00	4,00	6,00	4,00
Alt 2	0,50	1,00	3,00	5,00	3,00
Alt 3	0,25	0,33	1,00	4,00	2,00
Alt 4	0,17	0,20	0,25	1,00	0,25
Alt 5	0,25	0,33	0,50	4,00	1,00
Σ Column	2,17	3,87	8,75	20,00	10,25

Table 11. Alternative Normalization 3

Alternative 3							
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Σ Row	Eigenvector
Alt 1	5,00	7,87	17,50	54,00	23,50	107,87	0,4293913
Alt 2	3,33	5,00	10,75	37,00	15,25	71,33	0,2839609
Alt 3	1,83	2,63	5,00	19,17	7,00	35,63	0,1418477
Alt 4	0,56	0,90	1,89	5,00	2,27	10,62	0,0422624
Alt 5	1,46	2,13	4,00	13,17	5,00	25,76	0,1025377
						251,21	1

Table 12. Alternative Comparison Matrix 4 Simplification

Alternative 4						
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	
Alt 1	1,00	2,00	4,00	5,00	5,00	
Alt 2	0,50	1,00	4,00	4,00	4,00	
Alt 3	0,25	0,25	1,00	3,00	3,00	
Alt 4	0,20	0,25	0,33	1,00	2,00	
Alt 5	0,20	0,25	0,33	0,50	1,00	
Σ Column	2,15	3,75	9,67	13,50	15,00	

Table 13. Alternative Normalization 4

Alternative 4							
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Σ Row	Eigenvector
Alt 1	5,00	7,50	19,33	32,50	40,00	104,33	0,4258503
Alt 2	3,60	5,00	12,67	24,50	30,50	76,27	0,3112925
Alt 3	1,83	2,50	5,00	9,75	14,25	33,33	0,1360204
Alt 4	1,01	1,48	3,13	5,00	7,00	17,63	0,0719388
Alt 5	0,71	1,11	2,63	4,00	5,00	13,45	0,054898
						245,00	1

Table 14. Alternative Comparison Matrix 5 Simplification

Alternative 5						
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	
Alt 1	1,00	0,50	0,33	0,20	0,33	
Alt 2	2,00	1,00	0,50	0,20	0,50	
Alt 3	3,00	2,00	1,00	0,25	2,00	
Alt 4	5,00	5,00	4,00	1,00	3,00	
Alt 5	3,00	2,00	0,50	0,33	1,00	
Σ Column	14,00	10,50	6,33	1,98	6,83	

Table 15. Alternative Normalization 5

Alternative 5							
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Σ Row	Eigenvector
Alt 1	5,00	3,33	1,88	0,69	2,18	13,09	0,0618019
Alt 2	8,00	5,00	2,72	1,09	3,27	20,08	0,094748
Alt 3	17,25	10,75	5,00	2,17	6,75	41,92	0,1978342
Alt 4	41,00	26,50	13,67	5,00	18,17	104,33	0,4924223
Alt 5	13,17	8,17	4,33	1,79	5,00	32,46	0,1531937
						211,88	1

Table 16. Comparison Matrix Consistency Ratio

Matrix	λ_{maximum}	CI	CR
Criteria	5,4177845	0,1044461	0,0932555
Alternative 1	5,1016048	0,0254012	0,0226796
Alternative 2	5,3420047	0,0855012	0,0763403
Alternative 3	5,1657572	0,0414393	0,0369994
Alternative 4	5,192432	0,048108	0,0429536
Alternative 5	5,1364912	0,0341228	0,0304668

Table 17. Alternative Rank

Eigenvector	Rank	Alternative
0,342496	1	Alternative 1 (Batavia Dana Kas Maxima)
0,297245	2	Alternative 2 (Sucorinvest Money Market Fund)
0,153547	3	Alternative 3 (Bahana Dana Likuid)
0,122989	4	Alternative 4 (Eastspring Investment Cash Reserve Kelas A)
0,083723	5	Alternative 5 (TRIM Kas 2)

CONCLUSION

The AHP method is proven to be able to assist in selecting the best Money Market Mutual Funds, based on important criteria and selected alternatives to support decision-making. The calculation results state that the best alternative in choosing Money Market Mutual Funds is Alternative 1, namely Batavia Dana Kas Maxima.

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