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COMBINATION OF COCOSO AND SAW ALGORITHM TO DETERMINE USED MOTORCYCLES

Roni Dalimunthe[1], Rolly Yesputra[2*], Rohminatin[1]
[1]Information System, Sekolah Tinggi Manajemen Informatika dan Komputer Royal
[2]Computer System, Sekolah Tinggi Manajemen Informatika dan Komputer Royal
email: *ronidalimunthe729@gmail.com

Abstract: Used motorbikes are motorized vehicles that are used by many people in various cicles. For someone who is a prospective buyer of a used motorbike, before coming to the place of puchase they have several choices based on several criteria that have been determined according to the used motorbike they want to buy. A problem that often occurs for prospective buyers is the difficulty in determination which used motorbike is superior from several choices based on predetermined criteria. This results in potential buyers feeling confused in making their choice. The difficulty in determining used motorbikes is the reason this research was conducted. In this case, the decision support system will be used as a tool in providing superior used motorbike choices for potential buyers. The method offered in this research is to use a combination of the CoCoSo and SAW algorithms. The criteria for determination a used motorbike consist of 8 criteria namely mileage, price, brand, accessories, tire condition, body condition, engine condition and completeness of documents. In the results of this decision support system research, ranking results using a combination of CoCoSo and SAW methods show that the red Suzuki F1 alternative (A39) is ranked with the highest score.

Keywords: combined compromise solution; decision support system; simple additive weighting

Abstrak: Sepeda motor bekas merupakan kendaraan bermotor yang digunakan oleh sebagian banyak masyarakat dalam berbagai kalangan karena harganya yang relatif lebih murah. Bagi calon pembeli sepeda motor bekas, sebelum datang ke tempat pembelian mereka memiliki beberapa ketentuan pilihan yang berdasarkan pada beberapa kriteria yang telah ditentukan sesuai dengan sepeda motor bekas yang ingin dibeli. Permasalahan yang sering kali terjadi bagi calon pembeli ialah kesulitan dalam menentukan sepeda motor bekas mana yang unggul dari beberapa alternatif pilihan berdasarkan kriteria yang telah ditentukan sebelumnya. Hal ini mengakibatkan, calon pembeli merasa kebingungan dalam menentukan pilihannya. Kesulitan dalam penentuan sepeda motor bekas tersebut menjadi alasan penelitian ini dilakukan. Dalam hal ini sistem pendukung keputusan akan digunakan sebagai alat bantu dalam memberikan pilihan sepeda motor bekas yang unggul bagi calon pembeli. Metode yang ditawarkan dalam penelitian ini yaitu dengan menggunakan kombinasi algoritma CoCoSo dan SAW. Kriteria-kriteria dalam penentuan sepeda motor bekas terdiri dari 8 kriteria yaitu jarak tempuh, harga, merek, aksesoris, kondisi ban, kondisi body, kondisi mesin dan kelengkapan surat. Dalam hasil penelitian sistem pendukung keputusan ini, memberikan hasil perangkingan dengan kombinasi metode CoCoSo dan SAW menunjukkan bahwa alternatif Suzuki F1 merah (A39) adalah peringkat dengan nilai tertinggi.

Kata kunci : combined compromise solution; simple additive weighting; sistem pendukung keputusan

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INTRODUCTION

Motorbikes a powerful machines with two wheels, provide a thrilling mode of transportation [1]. This transportaion will make it easier to make daily trips such as work, school and others [2]. Motorbikes, typically procured through authorized dealerships, where they undergo meticulous inspection and quality assurance procedures [3].

The Kembar Motor dealership, renowned for its expertise in the trade of pre-owned motorbikes. Analysis reveals a conspicuous incongruity at the Kembar Motor dealership, as evidenced by the dissonance between potential buyers, estimated at approximately 42 individuals per month, and actual purchasers, a mere 8 per month. This incongruence underscores a deficiency in the dealership efficacy in furnishing suitable recommendations for used motorbikes, warranting a comprehensive investigation into potential factors impeding the conversion of prospective leads into confirmed sales.

Through meticulous problem analysis, offering recommendations to prospective buyers result in prolonged delays, particularly when faced with high influxes of potential customers, impeding optimal service provision by employees. With a decision support system therefore proposed to alleviate this challenge, facilitating tailored recommendations for the finest used motorbikes in accordance with the desired criteria of prospective buyers, thereby enhancing efficiency and customer satisfaction within the dealership setting.

The decision support system designed to make it easy to provide recommendations to potential buyers. There are several methods available in the support system, including Combined Compromise Solution and Simple Additive Weighting [4].

The SAW method, a decision-making technique, relies on assigning weights to various criteria and then evaluating alternatives based on these weighted criteria, due to its easy calculation algorithm [5]. The CoCoSo method a newly created method and has the advantage of completing calculations that have many cost criteria [6].

In previous research with the title "Decision Support System For Selecting Used Motorbikes Using The Simple Additive Weighting (SAW) Method", it was concluded that the saw method can help the marketing department in searching for used motorbikes which are grouped based on the conditions they want to choose [7].

The research "Selection Best Elementary Schools In Sei Dadap Using SAW Method" concludes that the SAW method effectively addresses simple but unstructured problems, particularly in aiding decision-making for optimal elementary school selection [8].

The study on "Motorcycle Choice Decision Support System Used with AHP and SAW Methods" suggests that employing a comparative analysis of the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) algorithms yields enhanced precision in decision outcomes [9]. And in another study with the title "Implementation Of The Cocoso Method In The Decision Support System For Selecting Hotels In Buleleng Regency", it was concluded that the CoCoSo method helps tourists in Buleleng Regency in providing the best hotel recommendations according

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to the criteria desired by the tourists [10].

The research into "Student Ranking Based on Learning Assessment Using the Simplified Piprecia Method and CoCoSo Method" concludes that the CoCoSo method exhibits compatibility for integration with other methods, suggesting its suitability for combined application in assessment contexts [11].

This research has the advantage of combine the SAW and CoCoSo methods, utilizing the advantages of SAW in determination the weight of criteria attributes and the advantages of CoCoSo in handling cost criteria, especially in the context of determination used motorbikes [12]. With this approach, a more holistic and effective framework for decision making regarding the purchase of a used motorbike is provided, helping consumers choose the option that best suits their preferences and financial limitations.

The existence of a system for determination used motorbikes at dealer Kembar Motor will help prospective buyers in determination used motorbikes according to the criteria they want [13]. The purpose of this research is to provide recommendation services to potential buyers.

METHOD

Data collection techniques in implementing the system are carried out in several steps consisting of:

Interview

To achieve comprehensive understanding regarding the identification of superior used motorbikes, an interview session was conducted with Mr. Irwan Yulianto, aged 43, proprietor of Kembar Motor dealership.

Study Literature

Look for literary sources that can be used as references in research, such as books, journals or other materials.

System Planning

Carrying out system design starts from where the system will run and builds a user interface.

System Implementation

At this stage, the system development process will be carried out based on the design that has been made.

Algorithm Combined Compromise Solution

Calculations using the CoCoSo method are as follows [11]: First, determine the criteria and assessment for each alternative. Then, weight value to each criterion. Create a normalized decision matrix from alternative assessments.

$$r_{ij}\ (\text{Benefit}) = \frac{Xij - \text{Min } X_{ij}}{\text{Max } Xij - \text{Min } X_{ij}} \quad (1)$$

$$r_{ij}\ (\text{Cost}) = \frac{\text{Max } Xij - X_{ij}}{\text{Max } Xij - \text{Min } X_{ij}} \quad (2)$$

Calculate the values of Si and Pi.

$$S_i = \sum_{j=1}^{n} (w_j * r_{ij}) \quad (3)$$

$$P_i = \sum_{j=1}^{n} (r_{ij})^{w_j} \quad (4)$$

Then, calculate the Kia, Kib and Kic values.

$$K_{ia} = \frac{P_i + S_i}{\sum_{i=1}^{m} (P_i + S_i)} \quad (5)$$

$$K_{ib} = \frac{S_i}{\text{Min } S_i} + \frac{P_i}{\text{Min } P_i} \quad (6)$$

$$K_{ic} = \frac{0{,}5(S_i) + (1\text{-}0{,}5) * (P_i)}{(0{,}5 * \text{Max } S_i + (1\text{-}0{,}5) * \text{Max } P_i)} \quad (7)$$

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Next, calculate the Ki value.

$$K_i=(K_{ia}K_{ib}K_{ic})^{\frac{1}{3}}+\frac{1}{3}(K_{ia}+K_{ib}+K_{ic}) \quad (8)$$

Algorithm Simple Additive Weighting

The calculations and processes for the SAW method are as follows [14]: **First,** determine the criteria and assessment for each alternative. **Then,** assign weight value. **Next,** normalize the decision matrix.

$$Rij\ (Benefit) = \frac{Xij}{Max\ Xij} \quad (9)$$

$$Rij\ (Cost) = \frac{Min\ Xij}{Xij} \quad (10)$$

Then, calculate the preference value. Lastly, determine the ranking where the greatest value is the best alternative choice.

RESULT AND DISCUSSION

The criteria employed originate from structured interviews conducted. The criteria data can be seen in th table 1.

Table 1. Weight Criteria

Criteria	Detail	
	Type	Weight
Mileage	Cost	0,1
Price	Cost	0,15
Brand	Benefit	0,11
Tire Condition	Benefit	0,15
Form	Benefit	0,18
Engine	Benefit	0,16
License	Benefit	0,15

Each sub-criterion weight value is derived from meticulous observations and meticulously documented in table 2.

Table 2. Sub Criteria

Name	Detail	
	Sub Criteria	Weight
Mileage	< 50K Km	1
	50K – 100K Km	2
	100K – 150K Km	3
	150K – 200K Km	4
	> 200K Km	5
Price	< 5 Million	1
	6 - 10 Million	2
	11 - 15 Million	3
	16 - 20 Million	4
	> 20 Million	5
Brand	Yamaha	1
	Suzuki	2
	Honda	4
Form	Good	2
	Very Good	3
License	Nothing	1
	1 Document	2
	Complete	4

Next step, assessment of alternatives conducted. The results of alternatives assessment can be seen in the table 3.

Table 3. Alternative Assessment

A	Criteria						
	C1	C2	C3	C4	C5	C6	C7
A1	4	1	1	3	2	2	2
A2	4	1	1	3	2	2	2
A3	4	1	1	3	2	2	2
A4	4	1	1	3	2	2	2
A5	3	2	4	3	2	2	2
A6	3	2	4	3	2	2	2
A7	4	2	4	3	2	2	2
A8	3	2	4	3	2	2	2
...	...	...	...	...	...	...	...
A63	3	4	3	3	2	2	1

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Combined Compromise Solution

The stages carried out in solving using the CoCoSo method are the first to determine the normalized matrix. By normalizing the matrix, one establishes a consistent reference frame for subsequent analytical operations. The method that will be used in this research is qualitative methods. Data will be processed in the form of numbers.

The initial stage carried out in carrying out calculations using a combination of the CoCoSo and SAW methods is determine the weight of each criterion. In this case, the criteria that will be used are mileage, price, brand, accessories, motorcycles condition and completeness of documents. The criteria employed originate from structured interviews conducted. The normalized matrix CoCoSo method results are displayed in table 4.

Table 4. CoCoSo Normalized Matrix

Alternative	The Criterias						
	C1	C2	C3	C4	C5	C6	C7
A1	0,25	1	0	1	0,5	0,5	0,33
A2	0,25	1	0	1	0,5	0,5	0,33
A3	0,25	1	0	1	0,5	0,5	0,33
A4	0,25	1	0	1	0,5	0,5	0,33
A5	0,5	0,75	1	1	0,5	0,5	0,33
A6	0,5	0,75	1	1	0,5	0,5	0,33
A7	0,25	0,75	1	1	0,5	0,5	0,33
A8	0,5	0,75	1	1	0,5	0,5	0,33
...	...	...	...	...	...	...	...
A63	3	4	3	1	3	2	2

Then, determination the Si and Pi values. Si represents the positive value of ideal solution, whereas Pi denotes the negative value of the ideal solution.

Table 5. Si and Pi Values

alternatif	Si and Pi Values	
	Si	Pi
A1	0,545	5,496
A2	0,545	5,496
A3	0,545	5,496
A4	0,545	5,496
A5	0,643	6,517
A6	0,643	6,517
A7	0,618	6,454
A8	0,643	6,517
...	...	...
A63	0,481	5,479

The next process, determines the maximum and minimum Si and Pi.

Table 6. Max Min Si and Pi

Si and Pi	Max and Min Values	
	Max	Min
Si	0,87917	0,28333
Pi	8,58281	3,59932

Next step, involves the relative weight, denoted as Ki.

Table 7. Calculation of Kia Kib and Kic

A	Calculation		
	Kia	Kib	Kic
A1	0,0156	3,4104	0,7812
A2	0,0156	3,4104	0,7812
A3	0,0156	3,4104	0,7812
A4	0,0156	3,4104	0,7812
A5	0,0184	4,0308	0,9258
A6	0,0184	4,0308	0,9258
A7	0,0182	3,9272	0,9145
A8	0,0184	4,0308	0,9258
...	...	...	...
A63	0,0154	3,1844	0,7707

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Finally, calculations on Ki result. Can be seen in table 8.

Table 8. Ki Calculation

A	Calculation	
	Ki	Rank
A1	1,74851	38
A2	1,74851	39
A3	1,74851	40
A4	1,74851	41
A5	2,06814	17
A6	2,06814	18
A7	2,02289	21
A8	2,06814	19
...	...	...
A63	1,65876	46

Simple Additive Weighting

The steps taken in solving using the SAW method are determination the normalized matrix first.

Table 9. SAW Normalized

A	Criteria						
	C1	C2	C3	C4	C5	C6	C7
A1	4	1	1	3	2	2	2
A2	4	1	1	3	2	2	2
A3	4	1	1	3	2	2	2
A4	4	1	1	3	2	2	2
A5	3	2	4	3	2	2	2
A6	3	2	4	3	2	2	2
A7	4	2	4	3	2	2	2
A8	3	2	4	3	2	2	2
...	...	...	...	...	...	...	...
A63	3	4	3	3	2	2	1

Table 10. Preference Values

A	Preference	
	Vi	Rank
A1	0,65417	31
A2	0,65417	32
A3	0,65417	33
A4	0,65417	34
A5	0,67	26
A6	0,67	27
A7	0,66167	30
...	...	...
A63	0,57	52

In order to make it easier for users to calculate used motorbikes using the CoCoSo and SAW methods, implement the system in application form. Admin can add, change and delete data needed for calculations.

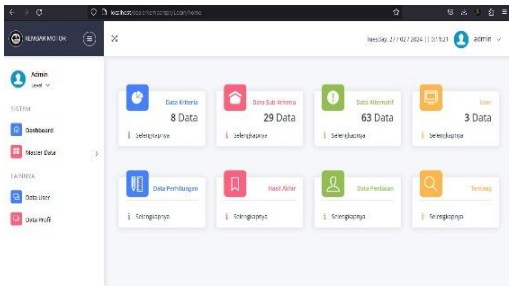

Image 1. Menu Dashboard Admin

The potential buyers will be able to access the dashboard page for users.

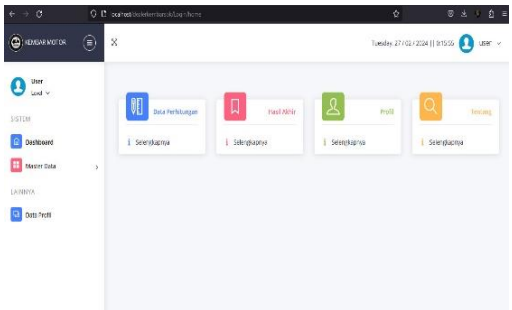

Image 2. Menu Dashboard Users

When the admin has filled in alternative data, criteria, sub-criteria and

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carried out alternative assessments, the admin can carry out calculations according to the desired combination.

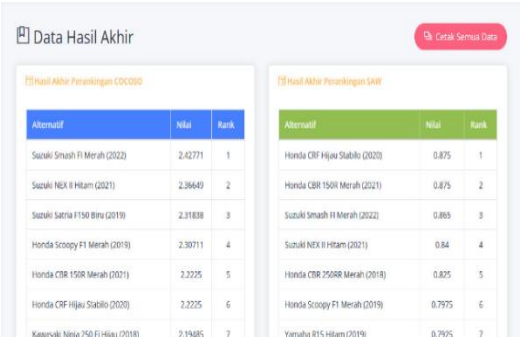

Image 3. Rank Result

In the results of this application, ranking results using a combination of CoCoSo and SAW methods show that the red Suzuki F1 alternative (A39) is ranked with the highest score. with recommendations for used motorbikes that meet the criteria of prospective buyers through this calculation system, making it easier for them to make decisions to buy the desired used motorbike with adequate specifications.

CONCLUSION

Use combination of the CoCoSo and SAW methods to providing recommendations for determination used motorbikes at dealer Kembar Motor is quite helpful for prospective used motorbike buyers. By having a ranking order for used motorbikes, service will be able to improve, so that it can improve and provide positive results for dealers. The results of the calculations carried out provide a positive GAP, which shows that potential buyers are satisfied with using this service.

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