THE BEST PRESCHOOL RECOMMENDATION APPLICATION USING THE ELECTRE METHOD

Iqbal Kamil Siregar[1*], Wiwin Handoko[2]
[1]Computer Systems, Universitas Royal
[2]Information System, Universitas Royal
email : *iqbalkamilsiregar@royal.ac.id

Abstract: This research aims to build a recommendation system that can help parents determine the best Pendidikan Anak Usia Dini (PAUD) using the ELECTRE (Elimination and Choice Translating Reality) method. The electre method was chosen because of its ability to handle Multi-Criteria Decision Making (MCDM) problems, which allows evaluating alternatives based on various relevant criteria. This system is designed to identify and assess PAUD based on a number of important criteria, such as facilities, location, teacher-student ratio, curriculum, accreditation and reputation. Each criterion is given a weight according to its level of importance, which is determined based on parental preferences and applicable educational standards. Data is collected from various sources and processed using artificial intelligence techniques to ensure accuracy and relevance. The electre method is then used to evaluate and compare between PAUD. The research results show that the recommendation system developed is able to provide accurate and relevant PAUD recommendations, as well as increasing user satisfaction in the PAUD selection process. This research makes a significant contribution to the field of decision support systems and education, by showing the practical application of the electre method in determining the best PAUD. It is hoped that the results of this research can inspire the development of similar recommendation systems in other educational fields, as well as help in improving the quality of early childhood education through the use of advanced technology.

Keywords: artificial intelligence; electre method; multi-criteria decision making (mcdm); paud.

Abstrak: Penelitian ini bertujuan untuk membangun sistem rekomendasi yang dapat membantu orang tua dalam menentukan Pendidikan Anak Usia Dini (PAUD) terbaik dengan menggunakan metode ELECTRE (*Elimination and Choice Translating Reality*). Metode electre dipilih karena kemampuannya dalam menangani masalah *Multi-Criteria Decision Making* (MCDM), yang memungkinkan evaluasi alternatif berdasarkan berbagai kriteria yang relevan. Sistem ini dirancang untuk mengidentifikasi dan menilai PAUD berdasarkan sejumlah kriteria penting, seperti fasilitas, lokasi, rasio guru-murid, kurikulum, akreditasi dan reputasi. Setiap kriteria diberikan bobot sesuai dengan tingkat kepentingannya yang ditentukan berdasarkan preferensi orang tua dan standar pendidikan yang berlaku. Data dikumpulkan dari berbagai sumber dan diproses menggunakan teknik kecerdasan buatan untuk memastikan akurasi dan relevansi. Metode *electre* kemudian digunakan untuk melakukan evaluasi dan perbandingan antar PAUD. Hasil penelitian menunjukkan bahwa sistem rekomendasi yang dikembangkan mampu memberikan rekomendasi PAUD yang akurat dan relevan, serta meningkatkan kepuasan pengguna dalam proses pemilihan PAUD. Penelitian ini memberikan kontribusi signifikan pada bidang sistem pendukung keputusan dan pendidikan, dengan menunjukkan aplikasi praktis dari metode electre dalam penentuan PAUD terbaik. Diharapkan, hasil penelitian ini dapat menginspirasi pengembangan sistem rekomendasi serupa di bidang pendidikan lainnya, serta membantu dalam meningkatkan kualitas pendidikan anak usia dini melalui pemanfaatan teknologi canggih.

Kata kunci: kecerdasan buatan; metode electre; multi-criteria decision making (mcdm); paud.

INTRODUCTION

Development technology moment This has reach to very advanced and influential stage in a way significant in various aspect life humans [1] . A number of trends and innovation technology latest covers various field like intelligence artificial, computing cloud, Internet of Things (IoT), blockchain, and more Lots again [2] .

Aspect development technology one of them is information is intelligence Artificial (Artificial Intelligence/AI). Development technology in intelligence artificial (Artificial Intelligence/AI) has reach various significant achievement in a number of decade last [3] . Innovations This has expand AI capabilities , making it possible its implementation in various field, and improve quality as well as efficiency applications that use AI

Childhood Education (PAUD) has role crucial in form base development cognitive, emotional, and social child. [4]. With So, choose the right PAUD for child is decision crucial for parents. However, there are many PAUD options with various criteria and advantages create a selection process This become complex and demanding consideration ripe.

In the development technology information, system recommendation has Lots implemented in various field For assist with the retrieval process decision. In context selection of PAUD, system recommendation can become effective tool For helping parents in determine the best suitable PAUD with needs and preferences they.

Electre method (Elimination and Choice Translating Reality) is one method Multi-Criteria Decision Making (MCDM) that can used For finish problem taking decision with Lots criteria[5].

This method Work with evaluate alternative based on criteria that have been determined , and then eliminate alternatives are lacking satisfying in a way gradually until obtained alternative best [6].

Parent often face various difficulty in choose the best PAUD (Early Childhood Education). For children they . A number of challenge main problem faced is Lack Information Trusted , Variety Existing PAUD options, limited time and resources, limited access to Quality and Concerned PAUD about Child Compatibility. Difficulties This make PAUD selection is a challenging process for parents, which is ultimately need help addition, like system recommendation based technology, for help they make more decisions appropriate .

Study This aim For build system recommendation determining the best PAUD use method electre. With integrate method This to in system recommendations, expected can give more results accurate and relevant in accordance with need user. Besides that For design and implement system possible recommendations helping parents in choose the best Early Childhood Education (PAUD). in accordance with needs and preferences they so that give accurate and appropriate results with various relevant criteria and ultimately can helping parents in take more decisions Good .

Study previously that had been discuss System Supporting Decisions on Determining the Best Early Childhood Education (PAUD). use AHP method is based on 6 criteria that is Accreditation, Facilities, Tuition Fees, Curriculum, Number of Teachers, Number of Students [7].

Implementation system recommendation based method electre expected can give contribution real in simplify the PAUD selection process for parents , in-

crease satisfaction users, and ultimately, supports development education child age early in Indonesia.

METHOD

System supporter decision Can used For help taking decision in structured situation nor No structured , because No There is no one knows method Certain For make decision [8].

System supporter decision is A based system computer consists from three interconnected components because, system language (way For give communication between users and components system supporter other decisions) [9].

According to the opinion of the experts above, yes concluded that system supporter decision is part from system information based capable computer finish problem in condition structured nor No structured.

The Electre's method start developed in Europe in the middle 1960s . [14]. This method introduced by Bernard Roy and his colleagues at the company SEMA consultant. The Electre Method is one method analysis multi- criteria decisions are used For choose action best from gathering existing actions through a selection process. As one of the MADM (Multi-Criteria Decision Making) method , method This known own excellent performance in analyze involving policies criteria qualitative. This method implemented in various field, incl business, development, design, and small hydropower. As for the steps in the Electre Method as following :

First Step Normalization Decision Matrix.

Every normalization from mark $r_{i,j}$ can done with formula :

$$r_{i,j} = \frac{x_{i,j}}{\sqrt{\sum_{i=1}^{m} x_{i,j}^2}} = \text{untuk i} =$$

$$1,2,3, \dots , m \text{ dan } j = 1,2,3, \dots n \qquad (1)$$

By $r_{i,j}$ is the normalization of the choice measurement of the ith alternative in relationship with criteria jth , $x_{i,j}$ is mark rating each answer respondents in rows and columns , are amount alternative , and is amount criteria . So that obtained matrix **R** results normalization as following :

$$\mathbf{R} = \begin{bmatrix} r_{1,1} & r_{1,2} & \cdots & r_{1,n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m,1} & r_{m,2} & \cdots & r_{m,n} \end{bmatrix} \qquad (2)$$

Second Step Weighting in Normalized Matrices .

After normalized, every column from matrix R is multiplied with weight $w_{i,j}$ specified by the manufacturer decision. So, the weighted normalize matrix is V=RW written as :

$$\mathbf{V} = \begin{bmatrix} v_{1,1} & v_{1,2} & \cdots & v_{1,n} \\ \vdots & \vdots & \ddots & \vdots \\ v_{m,1} & v_{m,2} & \cdots & v_{m,n} \end{bmatrix} \qquad (3)$$

Third step Determine Collection Concordance and Discordance Index.

Every partner from alternatives k and l (k,l =1,2,3,…, m and k ≠ 1) set of J criteria shared into two sets part , ie concordance and discordance. A criteria in a alternative including concordance if :

$$C_{k,1} = \{j, v_{k,j} \geq, \} \text{ untuk } j = 1,2,3, \dots n \qquad (4)$$

On the contrary, complementary from set part concordance is set disordance , that is if :

$$D_{k,1} = \{j, v_{k,j} \geq, \} \text{ untuk } j = 1,2,3, \dots n \qquad (5)$$

Fourth Step Counting Matrix Concordance And Discordance.

Count matrix concordance, For determine mark from elements in the matrix concordance is with add up weights included in the set concordance , literally the mathematics is as following :

$$C_{k,l} = \sum_{j \in c_{k,l}} w_j \qquad (6)$$

Count matrix discordance, For determine mark from elements in the matrix discordance is with share maximum difference included criteria to in set part discordance with maximum difference mark all over existing criteria , in fact the mathematics is as following :

$$C = \begin{bmatrix} - & C_{1,2} & C_{1,3} & C_{1,n} \\ \vdots & - & \vdots & \vdots \\ C_{1,2} & C_{1,2} & C_{1,2} & - \end{bmatrix} \qquad (7)$$

Fifth Step Determine Matrix dominant Concordance and Discordance.

Count Dominant matrix concordance.
Matrix F as matrix dominant concordance can built with help mark threshold , ie with compare loyal mark element matrix concordance with mark threshold.

$$C_{k,l} \geq C \qquad (8)$$

With mark threshold (C) is :

$$C = \frac{\sum_{k=1}^{m} \sum_{l=1}^{m} C_{k,l}}{m(m-1)} \qquad (9)$$

So that element matrix F is determined as following :

Dsada
$$f_{k,l} = 1, \text{jika } C_{k,l} \geq c \text{ dan } f_{k,l} \, 0 \text{ jika } c_{k,l} < c \quad (10)$$

Count Matrix Dominant Discordance.

Matrix G as matrix dominant discordance can built with help mark threshold d :

$$d = \frac{\sum_{k=1}^{m} \sum_{l=1}^{m} d_{k,l}}{m(m-1)} \qquad (11)$$

Elements matrix G is determined :

$$g_{k,l} = 0 \text{ jika } d_{k,l} d \text{ dan} g_{k,l} \, 1 \text{ jika } d_{k,l} < d \quad (12)$$

Sixth Step Determine Aggregate Dominance Matrix .

Matrix E as aggregate dominance matrix is every matrix the elements is multiplication between element matrix F with element the corresponding matrix G, respectively mathematical can stated as following :

$$e_{k,l} = f_{k,l} \cdot g_{k,l} \qquad (13)$$

The Seventh or Final Step Election Less Favorable Alternative .

Matrix E gives order choice from every alternative, ie when $e_{k,l} = 1$ then alternative A is a better alternative than A1. So, the row in matrix E that has $e_{k,l} = 1$ the fewest numbers can be eliminated. Thus, the best alternative is the alternative that dominates the other alternatives.

Understanding PAUD (Early Childhood Education)

Childhood Education (PAUD) is effort targeted coaching to child since born until age six year with give stimulation education For support growth and development physique as well as the child's mental state, so they Ready enter level more education tall [10]. PAUD includes all over service purposeful education For develop all over aspect development children, incl aspect physical, emotional, social and cognitive .

RESULTS AND DISCUSSION

The Electre method is used For determine action best from bunch existing options through a selection process. As one of the MADM (Multi-Criteria Decision Making) method, method This known own performance tall in analyze involving policies criteria qualitative. This method implemented in various field like business, development and design and hydropower small. In completion use method electre must need criteria certain For determine the alternative would be selected. It has appropriate and good criteria in the best PAUD recommendation process. As for the criteria as following :

Table 1. Criteria

Criteria	Code
Facility	C1
Location	C2
Teacher-Student Ratio	C3
Curriculum	C4
Accreditation	C5
Reputation	C6

Weight value the sorted based on scale interest factors that have been determined will given mark weighting:

Table 2. Weight Values Criteria

Factor	Value Weight
Facility	4
Location	3
Teacher-Student Ratio	5
Curriculum	3
Accreditation	2
Reputation	1

In determining criteria done weighting from every criteria, weighting the between is as following :

Table 3. Weight Values Preference

Fuzzy Sets	Value Weight
Very Low (SR)	1
Low (R)	2
Enough (C)	3
Height (T)	4
Very High (ST)	5

Implementation Interface

For implementation method Electre For recommendation selection of the best PAUD, which is implemented to in the Visual Basic programming language is as following :

Main Utama

The following displays the Main Menu form. This form functions to control all menus in the system, such as alternative menus, criteria menus, calculation menus to results reports and ranking reports.
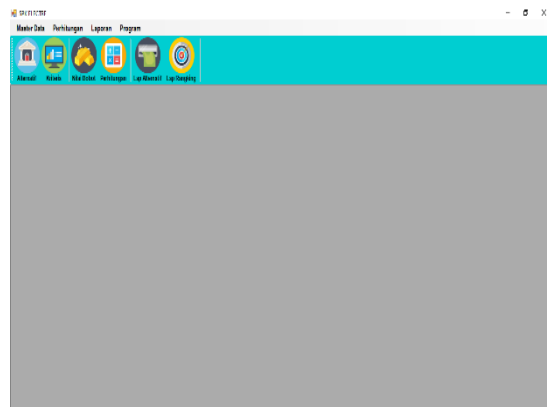

Image 1. Display Main Menu Form

Alternative form

Each data has an alternative code, in this form we adjust the alternative code by inputting it into the system. This form can be deleted, added according to data needs
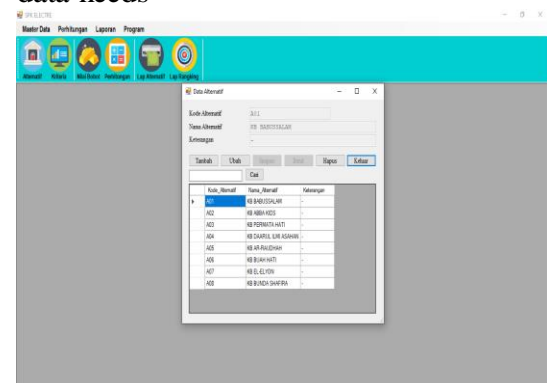

Image 2. Display Alternative Form

Criteria Form

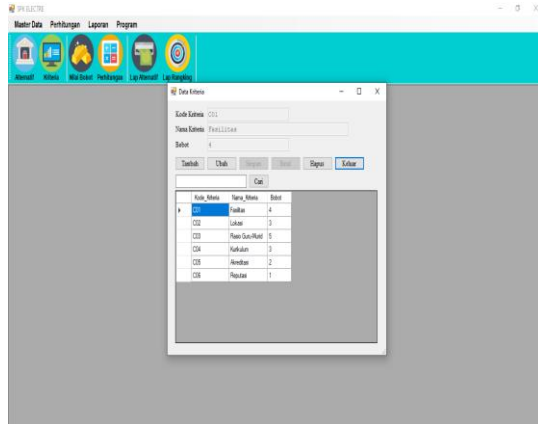The following is a display of the Criteria form.

Image 3. Display Criteria Form

Appearance Alternative Value Form

Display of the alternative value form that has been input.

Image 4. Display Alternative Value Form

Appearance value form alternative give Admin rights For manage value data alternatives obtained. Every one candidate alternative assessed on this form. Evaluation done based on criteria that have been determined previously.

Appearance Form Calculation

The calculation form from the implementation method Electre, from the calculation form this is us too Already Can see the total of calculations that have been made carried out by the application, below This appearance :

Image 5. Display Form Calculation

Appearance Calculation Results

The calculation results from applying the Electre method for selecting the best PAUD. From the results of the calculation, the one ranked first is KB BAUSSALAM, here is what it looks like:

Image 6. Display of results Calculation

CONCLUSION

Several important conclusions that can be drawn from this research are that the Electre method has proven to be effective in dealing with Multi-Criteria Decision Making (MCDM) problems as a whole, the ELECTRE method makes a

650

major contribution in facilitating the complex decision-making process in selecting the best PAUD. A systematic and data-based approach, it is possible for the system to carry out a comprehensive evaluation of various PAUD alternatives based on relevant criteria, namely facilities, location, teacher-student ratio, curriculum, accreditation and reputation. The recommendation system developed is able to increase user satisfaction, especially parents, in the PAUD selection process.

By providing structured information and in-depth analysis, parents can make more informed and informed decisions. This marks a step forward in the use of technology to support the educational process from an early age. Thus, this research is not only successful in developing the best PAUD recommendation system, but also opens up opportunities for wider applications of electret methods and artificial intelligence technology in various aspects of education. It is hoped that the results of this research can help improve the quality of early childhood education and provide sustainable benefits for society.

BIBLIOGRAPHY

[1] M. Mukhsin, "Peranan teknologi informasi dan komunikasi menerapkan sistem informasi desa dalam publikasi informasi desa di era globalisasi," *Teknokom*, vol. 3, no. 1, pp. 7–15, 2020.

[2] A. M. A. Saputra, L. P. I. Kharisma, A. A. Rizal, M. I. Burhan, and N. W. Purnawati, *TEKNOLOGI INFORMASI: Peranan TI dalam berbagai bidang*. PT. Sonpedia Publishing Indonesia, 2023.

[3] E. S. W. Taruklimbong and H. Sihotang, "Peluang dan Tantangan Penggunaan AI (Artificial Intelligence) dalam Pembelajaran Kimia," *J. Pendidik. Tambusai*, vol. 7, no. 3, pp. 26745–26757, 2023.

[4] A. Susanto, *Pendidikan anak usia dini: Konsep dan teori*. Bumi Aksara, 2021.

[5] F. Mada, R. Resmawan, and A. R. Nuha, "Sistem Pendukung Keputusan Menggunakan Metode Electre Dan Metode Topsis Pada Kasus Pemilihan Bakal Calon Ketua Umum Ukm Oikumene," *J. Ris. dan Apl. Mat.*, vol. 7, no. 1, pp. 33–48, 2023.

[6] R. Simarmata, R. W. Sembiring, R. Dewi, A. Wanto, and E. Desiana, "Penentuan Masyarakat Penerima Bantuan Perbaikan Rumah di Kecamatan Siantar Barat Menggunakan Metode ELECTRE," *J. Comput. Syst. Informatics*, vol. 1, no. 2, pp. 68–75, 2020.

[7] N. Sari, M. Maryaningsih, and J. Fredricka, "Application of AHP Method in The Decision Support System for Determining the Best Early Childhood Education (PAUD) by Education Office of Bengkulu City," *J. Komputer, Inf. dan Teknol.*, vol. 1, no. 2, pp. 379–386, 2021, doi: 10.53697/jkomitek.v1i2.293.

[8] D. A. Prameswari and A. Hadi, "Sistem Pendukung Keputusan Penilaian Kinerja Karyawan Pada Diskominfo Di Kabupaten Nganjuk Berbasis Web," *J. Ilm. Teknol. Inf. Asia*, vol. 17, no. 2, pp. 147–156, 2023.

[9] S. Marwati, R. D. T. Wulandari, L. Marsella, and D. Hartanti, "Sistem

Pendukung Keputusan Pemilihan Penerima Bonus Karyawan Di 'RJ Mart' Menggunakan Metode Weighted Product (WP)," in *Prosiding Seminar Nasional Teknologi Informasi dan Bisnis*, 2022, pp. 381–389.

[10] S. Wasis, "Pentingnya Penerapan Merdeka Belajar Pada Pendidikan Anak Usia Dini (Paud)," *Pedagog. J. Ilm. Ilmu Pendidik.*, vol. 9, no. 2, pp. 36–41, 2022.