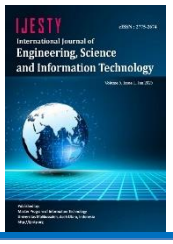
International Journal of Engineering, Science and Information Technology
Volume 5 No. 1 (2025) pp. 373-380
ISSN 2775-2674 (online)
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v5i1.754
Research Paper, Short Communication, Review, Technical Paper



Implementation of Complex Proportional Assessment Method in Determining Prioritization of Beneficiary Groups Fish Seeds in Lhokseumawe City

Putri Yesi Ramadhani*, Safwandi, Rini Meiyanti

Departement of Informatics, Faculty of Engineering, Universitas Malikussaleh, Aceh, Indonesia

**Corresponding author Email: putri.200170057@mhs.unimal.ac.id*

The manuscript was received on 18 May 2024, revised on 28 August 2024, and accepted on 12 January 2025, date of publication 22 January 2025

Abstract

The fisheries sector in Lhokseumawe City has an essential role in the regional economy, but the limited allocation of fish seed assistance requires an efficient and objective decision-making system (SPK). This research applies the Complex Proportional Assessment (COPRAS) method to prioritize groups of fish seed aid recipients. COPRAS was chosen because it can handle quantitative and qualitative criteria and produce a clear ranking of alternatives. The system evaluates criteria such as pond area, number of members, pond condition, and group age. The results showed that the Tani Mandiri group had the highest utility value = 1, while Tani Maju Berkah obtained the lowest value = 0.655. The COPRAS method effectively provided accurate and transparent recommendations in determining beneficiaries. Implementing this system is expected to help the Lhokseumawe City Marine, Fisheries, Agriculture, and Food Service Office in allocating fairer and more targeted assistance, as well as increasing the productivity of the fisheries sector in the area. This research also contributes to developing technology-based decision-making systems to support government policies.

Keywords: *COPRAS, Aquaculture, Beneficiary, Lhokseumawe City, Web Application.*

1. Introduction

The fisheries sector plays a vital role in the regional economy, but it faces challenges, particularly related to the dependence of fish farmer groups on government seed assistance. The demand for help continues to increase yearly, inversely proportional to the limited availability, thus requiring an efficient and fair allocation mechanism. For this reason, a technology-based decision support system (SDM) is needed to provide objective and transparent assessment results. One relevant approach is the Complex Proportional Assessment (COPRAS) method. This method handles quantitative and qualitative evaluation criteria by giving proportional weights and producing transparent and accountable alternative rankings. As expressed by [1], "COPRAS enables quick and effective determination of beneficiaries based on a proportional comparison between alternatives." COPRAS reduces subjectivity in judgment, thereby increasing the objectivity of decisions. This decision-making system (SDM) aims to assist in selecting the best course of action from a range of alternatives based on relevant criteria by reducing risk and ensuring the decision is by the objectives at hand. Previous research also applied different methods to select beneficiaries, which showed that "the SAW method used in the selection of fish seed beneficiaries can provide a clear and accountable ranking" [2]. With this background, this study aims to develop an SPK application that uses the COPRAS method in determining the priority of fish farmer groups entitled to receive fish seed assistance in Lhokseumawe City to assist the Department of Marine Affairs, Fisheries, Agriculture and Food in making more efficient and objective decisions. The Decision Making System (SPK) itself is a mechanism designed to assist individuals or organizations in making optimal decisions amid the various alternatives available and the various criteria that must be considered [3] [4].

2. Literatur Review

2.1. Decision Support System

A decision support system (SPK) is an information system designed to assist the decision-making process by utilizing data, mathematical models, and special analysis techniques to increase the accuracy and effectiveness of decisions [5]. SPK is a computer-based system that helps decision-making in various fields, with features tailored to meet the needs of specific sectors [6]. The application of SPK has been widespread in Indonesia, facilitating complex decision processes. Explain that SPK functions to process raw data into relevant information and can be applied in various scenarios such as selecting and allocating resources, including in education for college selection and determining scholarship recipients objectively and transparently [7]. The use of supporting technology in the decision-making process can help respond to changes in tourist behavior, where around 70% of tourist activities are now carried out through digital devices [8] [9] [10].

2.2. Characteristics of Decision Support Systems

Characteristics of Decision Support Systems According to [11], Decision support systems also have several characteristics. The characteristics of the decision support system are as follows:

1. Support decision-making for structured, semi-structured, and unstructured problems.
2. Provides personal output at various levels of the organization.
3. Supports all decision-making stages, from intelligence design to selection.
4. Has a human-machine interface, with user control over decisions.
5. Uses relevant mathematical and statistical models.

2.3. Complex Proportional Assessment (COPRAS)

The Complex Proportional Assessment (COPRAS) method is an effective multi-criteria decision-making technique for handling complex problems by considering the relative weights of various interrelated criteria. COPRAS helps in uncertain situations, where the available information is incomplete, to produce a comprehensive solution[12]. The COPRAS method is one of the techniques used in decision support systems, as applied in previous studies. This system is designed to support decision-making in semi-structured and unstructured situations. The COPRAS method can also consider positive criteria that provide benefits and negative criteria that are detrimental by conducting separate evaluations. Negative criteria that are detrimental to conducting separate assessments [13].

According to Ahmad [14], COPRAS follows a systematic step: identifying relevant factors and assigning weights based on their importance, then calculating alternative performance scores to make rational decisions. COPRAS measures the direct relationship between alternatives by considering the importance of each criterion [15]. The main stages in COPRAS include:

1. Initial Decision Matrix: Create a matrix containing each alternative's assessment value against predetermined criteria.

$$x = [x_{ij}]_{m*n} = \begin{pmatrix} x_{11} & x_{12} & x_{13} & x_{1n} \\ x_{21} & x_{22} & x_{23} & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & x_{m3} & x_{mn} \end{pmatrix} \quad \text{.....(1)}$$

2. Matrix Normalization: Uses an equation to normalize the values in the decision matrix.

$$\boldsymbol{R = m[r_{ij}]_{m*n} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}} \quad \text{..... (2)}$$

3. Weight Calculation: Multiplying the normalized values by the criteria weights to produce a weighted performance score.

$$\boldsymbol{D = [Y_{ij}]_{m*n} = rij * wj, i = 1, \dots, m, j = 1, \dots, n} \quad \text{..... (3)}$$

$$\boldsymbol{\sum_{i=1}^{m} Y_{ij} = W_j} \quad \text{..... (4)}$$

4. Weight Calculation: Multiplying the normalized values by the criteria weights to produce a weighted performance score:

$$\boldsymbol{S_{+i} = \sum_{j=1}^{n} y + ij} \quad \text{..... (5)}$$

$$\boldsymbol{S_{-i} = \sum_{j=1}^{n} y - ij} \quad \text{..... (6)}$$

5. Determination of Relative Importance: Calculates the Qi value to determine the priority of each alternative:

$$Q_i = S_{+1} + \frac{S_{-min} * \sum_{i=1}^{m} S_{-i}}{S_{-i} * \sum_{i=1}^{m} (s - \min / S_{-i})} \quad i = 1, \dots, m \qquad (7)$$

6. Quantitative Utility Calculation (Ui): Calculates the utility value for each alternative, which is normalized between 0% and 100%, indicating how high the preference for the alternative is:

$$U_i = \left[\frac{Q_i}{Q_{max}}\right] \text{x } 100 \qquad (8)$$

2.4. Priority

The concept of priority refers to what takes precedence or priority in a series of actions. Prioritizing means choosing the more important thing to do. Every human being's daily activities do not escape the word priority [16]. Prioritization is the key to life. Each activity has a different weight, so setting priorities is essential [17].

2.5. Fish Farming

Fish farming utilizes surrounding resources to achieve collective group goals [18]. Increased investment in the aquaculture sector is expected to spur regional economic growth, especially in rural areas [19]. Fish farming is one of the main contributors to the provision of fish for the community, apart from the catch in nature. The rapid development of fish farming activities in various countries allows people to meet their animal protein needs from fish [20].

3. Research Methods

This research takes data on groups of recipients of fish seed assistance at the Office of Marine Affairs, Fisheries, Agriculture, and Food in Lhokseumawe City. This place was taken because it has aspects that support the need for data that supports the system's needs that will be designed so that this research runs well. Research on implementing the Complex Proportional Assessment (COPRAS) Method to determine the priority of fish seed beneficiary groups will be completed within 3 (3) months until completion. The research steps are as follows:

1. Observation
   A technique or method of data collection. This study conducted a direct review at the Lhokseumawe City Marine, Fisheries, Agriculture, and Food Service Office (DKPPP). Furthermore, an analysis of the problems faced by observing the process of determining the acceptance of fish seed assistance is carried out.
2. Data Processing
   Data processing is converting, analyzing, and interpreting raw data into information that can be used to make decisions. Data processing will use various statistical methods and software such as Google Sheets and Excel.
3. System Design
   System design determines a system's specifications, architecture, components, modules, and interfaces to meet specific needs and objectives. System design plays a vital role because this is where the representation of the system is built into a system workflow or scheme.
4. System Testing
   The system testing stage evaluates the software or system to determine whether it functions correctly by the specified requirements or specifications. The goal is to find errors or defects in the software or system and ensure they are fixed before the product is released.

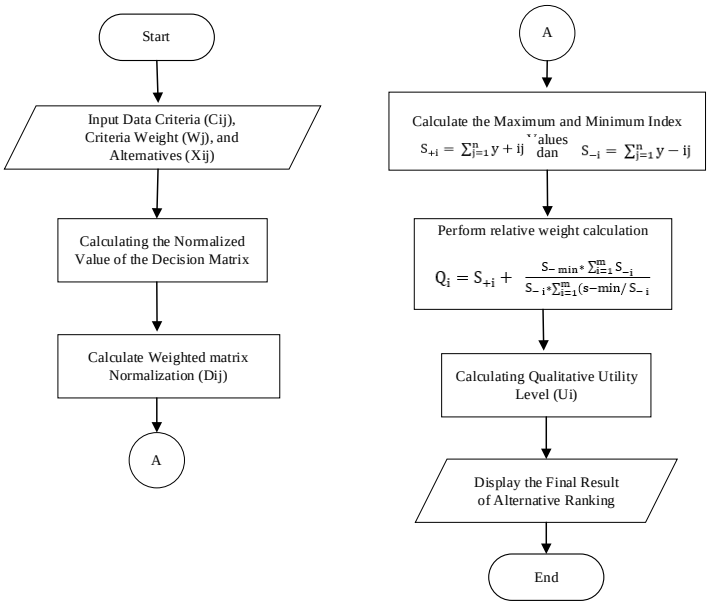


Fig 1. System Schematic

4. Results and Discussion

The data used by this researcher is data from the beginning of 2022 to 2024 obtained from the Department of Marine Affairs, Fisheries, Agriculture, and Food in Lhokseumawe City.

4.1. Cultivator Group Data

The criteria used in the COPRAS method are the number of members, land area, SKU, e-Kusuka, types of plants to be cultivated, economic conditions, and types of cultivation. Only the first word in a title must be capitalized, and the other word should be in small case.

Table 1. Cultivator Group Data

No	Name	Number Of Members	Land Area	SKU	E-Kusuka	Land Type	Economic Conditions	Cultivation Type
1	Pasi Jaya	10 persons	60 m²	There's	None	Right of use	Good	Brackish Water Fish (milkfish)
2	Pokdakan Rahmat Beuhase	6 persons	334 m²	None	None	Rent	Good	Brackishwater Fish (Vaname Shrimp)
3	Usaha Jaya	10 persons	5.600 m²	There's	None	Right of use	Enough	Local consumption of fish (tilapia)
4	Sandi Piranha Makmur	30 persons	32 m²	There's	None	Personal	Good	Ornamental Fish or Specialty Farming
5	Ade Berata	10 persons	171 m²	There's	None	Personal	Enough	Local Consumption Fish (Snapper)
6	Bagi sare	10 persons	4.000 m²	There's	None	Right of use	Enough	Featured Freshwater Fish (Catfish)
7	Bijeeh Puteh	10 persons	224 m²	There's	There's	Right of use	Good	Featured Freshwater Fish (Gurame)
8	Junaidi	1 person	5.600 m²	There's	None	Personal	Good	Brackish Water Fish (milkfish)
…	…	…	…	…	…	…	…	…
110	Sejahtera Abadi	12 persons	2.000 m²	There's	None	Rent	Good	Ornamental Fish or Specialty Farming

4.2. Determine The Criteria

The following table determines the criteria used

Table 2. Determines The Criteria

Criteria Description		
Criteria Name	**Criteria Type**	**Value Weight**
e-Kusuka	BENEFIT	0,20
economic conditions	BENEFIT	0,18
Number of Members	BENEFIT	0,15

Land Area	BENEFIT	0,15
SKU	BENEFIT	0,12
land type	COST.	0,10
Cultivation Type	COST	0,10

4.3. Decision Matrix

The following is the decision matrix table:

Table 3. Decision Matrix

No.	Name	C1	C2	C3	C4	C5	C6	C7
1	A1	4	5	2	1	5	3	3
2	A2	4	5	2	1	4	4	3
3	A3	4	4	2	4	5	3	2
4	A4	4	5	4	1	5	5	1
5	A5	4	4	2	1	5	5	2
6	A6	4	4	2	3	5	3	4
7	A7	5	5	2	1	5	3	4
8	A8	4	5	1	4	5	5	3
…	…	…	…	…	…	…	…	…
110	A110	4	5	3	3	5	4	1
	Nmax	5	5	4	5	5	5	4

4.4. matrix normalization

The following is a table of matrix normalization results

Table 4. Matrix Normalization

No.	Name	C1	C2	C3	C4	C5	C6	C7
1	A1	0,8	1	0,5	0,2	1	0,6	0,75
2	A2	0,8	1	0,5	0,2	0,8	0,8	0,75
3	A3	0,8	0,8	0,5	0,8	1	0,6	0,5
4	A4	0,8	1	1	0,2	1	1	0,25
5	A5	0,8	0,8	0,5	0,2	1	1	0,5
6	A6	0,8	0,8	0,5	0,6	1	0,6	1
7	A7	1	1	0,5	0,2	1	0,6	1
8	A8	0,8	1	0,25	0,8	1	1	0,75
…	…	…	…	…	…	…	…	…
110	A110	0,8	1	0,75	0,6	1	0,8	0,25
	Totally	92,6	109	56,75	61,2	106,6	85,4	70,5

4.5. decision matrix normalization

The following is a table of decision matrix normalization results

Table 5. Decision Matrix Normalization

No.	Name	C1	C2	C3	C4	C5	C6	C7
1	A1	0,00864	0,009	0,009	0,0033	0,009	0,007	0,011
2	A2	0,00864	0,009	0,009	0,0033	0,008	0,009	0,011
3	A3	0,00864	0,007	0,009	0,0131	0,009	0,007	0,007
4	A4	0,00864	0,009	0,018	0,0033	0,009	0,012	0,004
5	A5	0,00864	0,007	0,009	0,0033	0,009	0,012	0,007

6	A6	0,00864	0,007	0,009	0,0098	0,009	0,007	0,014
7	A7	0,0108	0,009	0,009	0,0033	0,009	0,007	0,014
8	A8	0,00864	0,009	0,004	0,0131	0,009	0,012	0,011
…	…	…	…	…	…	…	…	…
110	A110	0,00864	0,009	0,013	0,0098	0,009	0,009	0,004
		Benefit	Benefit	Benefit	Benefit	Benefit	Cost	Cost
	Weight	0,20	0,18	0,15	0,15	0,12	0,10	0,10

4.6. Normalization of Weighted matrices

The following is a table of the results of the Normalization of Weighted Matrix

Table 6. Normalization Of Weighted Matrix

No.	Name	C1	C2	C3	C4	C5	C6	C7
1	A1	0,00173	0,00165	0,00132	0,00049	0,00113	0,0007	0,00106
2	A2	0,00173	0,00165	0,00132	0,00049	0,0009	0,00094	0,00106
3	A3	0,00173	0,00132	0,00132	0,00196	0,00113	0,0007	0,00071
4	A4	0,00173	0,00165	0,00264	0,00049	0,00113	0,00117	0,00035
5	A5	0,00173	0,00132	0,00132	0,00049	0,00113	0,00117	0,00071
6	A6	0,00173	0,00132	0,00132	0,00147	0,00113	0,0007	0,00142
7	A7	0,00216	0,00165	0,00132	0,00049	0,00113	0,0007	0,00142
8	A8	0,00173	0,00165	0,00066	0,00196	0,00113	0,00117	0,00106
…	…	…	…	…	…	…	…	…
110	A110	0,00173	0,00165	0,00198	0,00147	0,00113	0,00094	0,00035
		Benefit	Benefit	Benefit	Benefit	Benefit	Cost	Cost
	Weight	0,20	0,18	0,15	0,15	0,12	0,10	0,10

4.7. Determining the Maximum and Minimum Values of the Index

The following is a table of the results of Determining the Maximum and Minimum Values of The Index.

Table 7. Determining the Maximum and Minimum Values of the Index

No.	Alternative	S+i	S-i
1	A1	0,006317	0,001766
2	A2	0,006092	0,002001
3	A3	0,007457	0,001412
4	A4	0,007638	0,001526
5	A5	0,005986	0,00188
6	A6	0,006967	0,002121
7	A7	0,006749	0,002121
8	A8	0,007127	0,002235
…	…	…	…
110	A110	0,007958	0,001291
		$\sum_{i=1}^{m} S - i$	0.20

4.8. Relative Weight

The following is a table of Relative Weight Results.

Table 8. Relative Weight

No.	Name	$1/S-i$	$S\_i * \sum_{i=1}^{m} S-i$	$\frac{\sum_{i=1}^{m} S-i}{S\_i * \sum_{i=1}^{m} S-i}$	$S+_i \frac{\sum_{i=1}^{m} S-i}{S\_i * \sum_{i=1}^{m} S-i}$
1	A1	566,1213	112,6762	0,001775	0,008092
2	A2	499,8506	127,6149	0,001567	0,007659
3	A3	708,3176	90,0562	0,002221	0,009678
4	A4	655,4927	97,31367	0,002055	0,009694
5	A5	531,864	119,9337	0,001668	0,007654
6	A6	471,4722	135,2962	0,001478	0,008445
7	A7	471,4722	135,2962	0,001478	0,008227
8	A8	447,4693	142,5537	0,001403	0,008529
…	…	…	…	…	…
110	A110	774,3666	82,37494	0,002428	0,010386
	$\sum_{i=1}^{m} 1/S-i$	63788,4		Qmax	0,011414

4.9. Qualitative Utility Value

The following is a table of results for qualitative ultility value.

Table 9. Qualitative Ultility Value

No	Name	Ui	Rank
1	A1	0,708937522	99
2	A2	0,671007904	106
3	A3	0,847904461	29
4	A4	0,849275352	28
5	A5	0,670590798	108
6	A6	0,739896111	89
7	A7	0,720783271	93
8	A8	0,747292428	86
…	…	…	…
110	A110	0,909930715	9

4.10. Chart

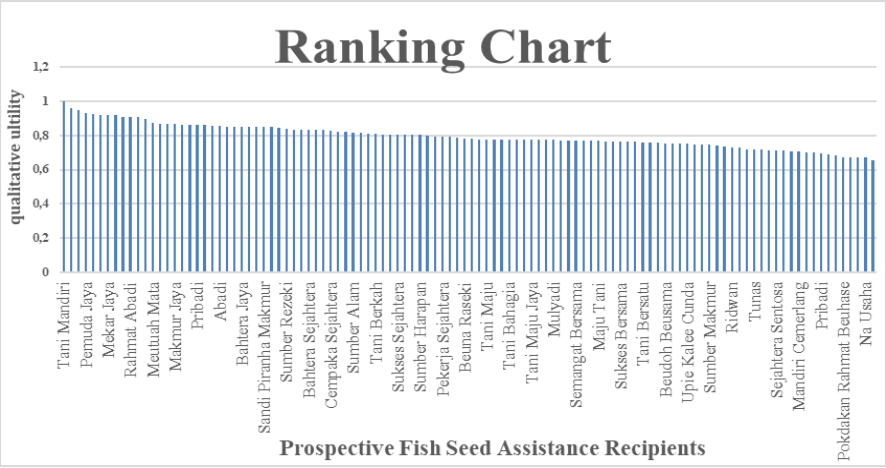


Fig 2. Ranking Chart

5. Conclusion

Based on the study's results, the Complex Proportional Assessment (COPRAS) method proved to be effective and efficient in evaluating and prioritizing groups of fish seed beneficiaries in Lhokseumawe City. This method can provide accurate recommendations through structured calculation stages. From the analysis, the Tani Mandiri group (A88) became the best alternative with a quantitative utility value of 1, followed by Usaha Jaya (A45) with a value of 0.9576. At the same time, Tani Maju Berkah (A81) was the lowest alternative, with a value of 0.6551. However, the application of the COPRAS method is weak when several alternatives have similar utility values, reducing the ability of this method to provide clear prioritization and potentially resulting in unfair decisions. This finding suggests that although COPRAS has advantages in supporting decision-making, its use requires more attention when dealing with situations with similarly valued alternatives.

References

[1] S. J. Ritonga *et al.*, “Implementasi Metode COPRAS (Complex Proportional Assessment) Untuk Menentukan Penerima Bantuan Pupuk Kelapa Sawit,” vol. 2, no. 2, pp. 44–49, 2022.
[2] N. Nelis, S. M. Febriani, and ..., “Sistem Penunjang Keputusan Pemilihan Kelompok Penerima Bantuan Benih Ikan di Balai Benih Ikan Sukamaju Menggunakan Metode SAW,” *Semin. Nas. …*, pp. 335–340, 2022.
[3] J. Sapitri, Y. Vitriani, E. Haerani, and F. Kurnia, “Sistem Pendukung Keputusan untuk Rekomendasi Pemilihan Guru Terbaik Menggunakan Metode Simple Additive Weighting,” *Indones. J. Innov. Multidisipliner Res.*, vol. 2, no. 2, pp. 312–330, 2024, doi: 10.69693/ijim.v2i2.139.
[4] Z. Soares Lopes, F. Kurniawan, and J. Tistogondo, "Case Study of Public-Private Partnership on Infrastruc-ture Projects of Tibar Bay Port in Timor-Leste," *Int. J. Eng. Sci. Inf. Technol.*, vol. 1, no. 3, 2021, doi: 10.52088/ijesty.v1i3.79.
[5] F. N. et al Jeperson Hutahaean, *Sistem Pendukung Keputusan*, vol. MESRAN., R, no. March. 2023.
[6] N. Rahma, Y. Amrozi, N. Diana Fahma Salsabila, and M. H. Miqdad G, “Telaah Kajian Pustaka Pemodelan Sistem Pendukung Keputusan Pada Usaha Mikro Kecil Dan Menengah,” *J. Simantec*, vol. 11, no. 2, pp. 185–190, 2023, doi: 10.21107/simantec.v11i2.9725.
[7] L. R. Mara Wahyu Alamsyah Pane, Fadlisyah, “SISTEM PENDUKUNG KEPUTUSAN DALAM MENENTUKAN PEMINATAN SISWA SMA MENGGUNAKAN METODE MOORA,” vol. 9, no. 1, pp. 65–70, 2023.
[8] P. L. Parameswari, I. Astuti, and W. W. Ariestya, “Implementasi Metode Ahp Pada Sistem Pendukung Keputusan Pariwisata Jawa Timur,” *J. Teknoinfo*, vol. 16, no. 1, p. 40, 2022, doi: 10.33365/jti.v16i1.1401.
[9] B. Dwi Cahyono and D. Sulastri, "Development Of Electrical Installation Learning Me-dia With Delphi Language," *Int. J. Eng. Sci. Inf. Technol.*, vol. 1, no. 3, 2021, doi: 10.52088/ijesty.v1i3.81.
[10] D. Abdullah, C. I. Erliana, and M. Fikry, "Data Envelopment Analysis with Lower Bound on Input to Measure Efficiency Performance of Department in Universitas Malikussaleh," *Int. J. Artif. Intell. Res.*, vol. 4, no. 1, 2020, doi: 10.29099/ijair.v4i1.164.
[11] S. Darpi Nurhayati, “Sistem Pendukung Keputusan Pendeteksi Kerusakan Komputer Pada Universitas Al-Khairiyah,” *J-Tekin*, vol. 1, no. 1, pp. 24–30, 2022.
[12] P. Citra, “Penerapan Metode Complex Proportional Assessment (COPRAS) Pada Penilaian Kelayakan Produk,” vol. 1, no. 4, pp. 150–158, 2023.
[13] D. Setiawan, “Implementasi Sistem Pendukung Keputusan Penentuan Siswa Terbaik Dengan Metode Complex Proportional Assessment (COPRAS),” vol. 1, no. 3, pp. 85–96, 2024.
[14] A. Haris, H. Nugroho, P. S. Informatika, F. Komunikasi, D. A. N. Informatika, and U. M. Surakarta, “SISTEM INFORMASI BUKU KENANGAN,” 2022.
[15] Y. Laia, I. G. I. Sudipa, D. S. Putra, P. Rosyani, and R. Aryanti, “Sistem Pendukung Keputusan Penilaian Kinerja Tenaga Honorer Menerapkan Metode Weighted Product (WP) dan Complex Proportional Assessment (COPRAS) dengan Kombinasi Pembobotan Rank Order Centroid (ROC),” vol. 2, no. 1, 2023.
[16] S. K. Qolbi, “PERSPEKTIF AGAMA ISLAM MANAGEMENT OF THE PRIORITY SCALE OF HUMAN LIFE IN THE ISLAMIC PERSPECTIVE Satria Kharimul Qolbi Sutrisno PENDAHULUAN Dalam KBBI Offline 1 . 2 ., kata ‘ prioritas ’ merupakan hal yang didahulukan atau diutamakan , sedangkan “ memprio,” vol. 7, no. 2, pp. 197–210, 2021, doi: 10.36701/nukhbah.v7i2.357.PENDAHULUAN.
[17] H. Aisha, D. S. Rusdianto, and A. P. Kharisma, “Pengembangan Aplikasi Penentuan Prioritas Kebutuhan Perangkat Lunak dengan Metode Value Oriented Prioritization (VOP),” vol. 3, no. 9, pp. 9314–9320, 2019.
[18] P. L. G. Cahyo Saparinto, “Cahyo Saparinto, Panduan Lengkap Gurami . (Jakarta: Swadaya, 2008), 3. 18," pp. 18–26, 2019.
[19] O. Lepa, S. Kulla, E. Yuliana, and E. Supriyono, “ANALISIS KUALITAS AIR DAN KUALITAS LINGKUNGAN UNTUK BUDIDAYA IKAN DI DANAU LAIMADAT , NUSA TENGGARA TIMUR ANALYSIS OF WATER QUALITY AND ENVIRONMENTAL QUALITY FOR,” vol. 1, no. 3, pp. 135–144, 2020.
[20] S. W. dan A. M. Gitarama, “AMONIA PADA SISTEM BUDIDAYA IKAN,” *J. Ilm. Indones.*, vol. 5, pp. 112–125, 2020.