



Decision Support System for Determining Recipients of Fishing Boat Assistance using the Topsis Method

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Abstract

East Flores Regency is one of the regions in Indonesia that has great potential in the marine and fisheries sector. With most of its people relying on fishing activities, the provision of fishing boat assistance is one of the local government's priority programs to improve the welfare of coastal communities. The purpose of this research is to design and develop a Decision Support System (SPK) that can help the Fisheries and Maritime Affairs Office in determining prospective recipients of fishing boat assistance objectively and on target. The method used in this research is Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which is able to process multicriteria data such as income, age, number of dependents, and boat condition. This method was chosen for its superiority in ranking alternatives based on their proximity to positive and negative ideal solutions. The results show that the developed system is able to generate a ranking of beneficiaries based on the level of eligibility, thus accelerating the decision-making process and increasing transparency and accuracy in the selection of beneficiaries. The implementation of this system is expected to not only support operational efficiency, but also contribute to improving the welfare of traditional fishermen in the region

Keywords: Fisherman Boat Assistance, TOPSIS Method, Decision Support System

1. Introduction

East Flores Regency, located in East Nusa Tenggara Province, holds significant potential in the marine and fisheries sector. With a coastline stretching 2,064.65 km and coral reefs covering an area of 4,726.47 hectares, the region provides a natural habitat for economically valuable fish species such as tuna and skipjack. A large portion of the population, approximately 6,677 people, work as full-time fishermen [1].

To improve the welfare of coastal communities, the local government regularly distributes assistance in the form of fishing boats. However, the selection process for aid recipients often faces challenges regarding objectivity and targeting accuracy. This is due to the lack of a system capable of fairly and transparently evaluating recipients' eligibility based on predefined criteria [3][5].

A Decision Support System (DSS) serves as an effective solution to assist in complex decision-making processes. A DSS allows for multi-criteria data processing and supports systematic and objective evaluation of alternatives [2][6].

One of the widely used methods in DSS is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). This method works by identifying the alternative closest to the positive ideal solution and furthest from the negative ideal solution. TOPSIS is popular for its ability to provide clear and measurable results in the form of rankings [2][4].

TOPSIS has been widely implemented in various contexts, including the selection of social assistance recipients in Kutai Kartanegara, the selection of livestock housing locations, and decision-making in the fisheries sector. The results indicate that this method significantly improves efficiency and accuracy in the selection process [3][4][9].

This study aims to design and implement a DSS based on the TOPSIS method to assist the Fisheries and Marine Affairs Office of East Flores Regency in determining potential recipients of fishing boat assistance in a more efficient, accurate, and transparent manner. The evaluation criteria include income, age, number of dependents, and the condition of the fishing boat. With this system, the aid program is expected to be well-targeted and contribute to improving the welfare of coastal communities, particularly traditional fishermen in the region [6][7][10].

2. Methodology

The Waterfall method was used as the system development approach in this study due to its structured and sequential stages. This model consists of five phases: requirement analysis, design, implementation, verification, and maintenance. In the first phase, system requirements were gathered through interviews and observations at the Department of Marine and Fisheries of East Flores Regency. Next, system design was carried out, covering user interface and database structure. The implementation phase was conducted using PHP, MySQL, and

XAMPP. After the system was developed, verification was performed through functional testing to ensure alignment with the requirements. Finally, the tested system was maintained and adjusted based on user feedback.

The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method was used to perform calculations in the decision-making process for selecting recipients of fishing boat assistance. This method evaluates each alternative based on its proximity to the positive ideal solution (best) and its distance from the negative ideal solution (worst). The evaluation criteria include economic income, number of family dependents, fishing productivity, boat condition, and fishing experience. The steps in this method involve constructing a decision matrix, normalizing data, applying weights, determining ideal solutions, calculating the distance of alternatives from the ideal solutions, and calculating preference values. The final result is a ranking of eligibility for each alternative, which serves as the basis for objectively and accurately selecting aid recipients.

3. Result and Discussion

3.1. Analysis system

This system is designed to assist the Department of Fisheries and Marine Affairs of East Flores Regency in objectively, transparently, and accurately determining prospective recipients of fishing boat assistance. The system will eliminate subjectivity and accelerate the selection process by using the multi-criteria TOPSIS method.

3.2. Design

3.2.1. Use case diagram

The image below illustrates the interaction between the system interface and its users or actors, and shows the functions expected by the users or actors from the system. This use case is divided based on the system's capabilities. The actors who can access this system include the Admin, Division Head, and Fishermen.

1. Admin Use Case Diagram

This use case diagram illustrates the interaction between the Admin actor and the system in managing the selection process for recipients of fishing boat assistance. The Admin has full access to eight main functions: viewing the dashboard, managing applicant data, managing alternatives, managing criteria and weights, managing sub-criteria and scores, managing values, performing TOPSIS method calculations, and printing the final results. All of these functions are linked to the Login use case through <<include>> relationships, indicating that the login process is a prerequisite for accessing all system features. This diagram emphasizes that the Admin is the central actor responsible for the entire data management and decision-making process within the decision support system.

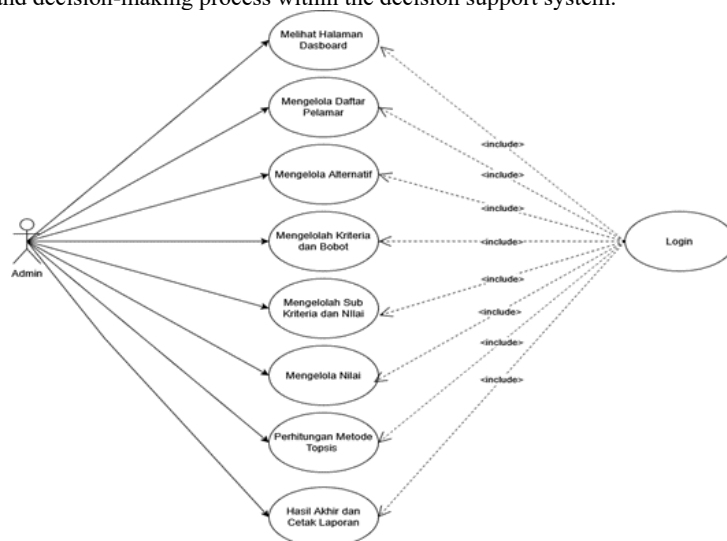


Fig. 1: Admin Use Case Diagram

2. Use Case Diagram of Division Head

This use case diagram illustrates the interaction between the Head of Division actor and the system in the context of verifying and reporting recipients of fishing boat assistance. The Head of Division has two main functions: viewing the dashboard and performing verification as well as printing the final selection report. Both functions have an <<include>> relationship with the Login use case, indicating that the login process must be completed before accessing these features. This diagram shows that the Head of Division plays an important role in the final stage of the selection process, namely validating and approving recipient data through verification and the generation of official reports.



Fig. 2: Use Case Diagram of Division Head

3. Use Case Diagram of Fisherman

This use case illustrates the interaction of a fisherman with the system to view the dashboard of the results of their submission. The process begins when the fisherman logs into the system, which is an important step so that they can access personal and relevant information. After successfully logging in, the fisherman can enter the feature to view the dashboard, where they will get a summary of the results of the submission that has been made.



Fig. 1: Use Case Diagram of Fisherman

3.2.2. Entity relation diagram

ERD (Entity-Relationship Diagram) is a diagram used to model the data structure in an information system by visually representing entities, attributes, and relationships between entities. An entity is an object or thing that holds data, an attribute is a characteristic of the entity, while a relationship shows the connection between two or more entities. ERD helps in designing databases in a structured way, simplifies understanding the data flow, and reduces errors in system implementation. With components such as entities, attributes, relationships, and cardinality, ERD becomes an important tool in the early stages of designing an information system..

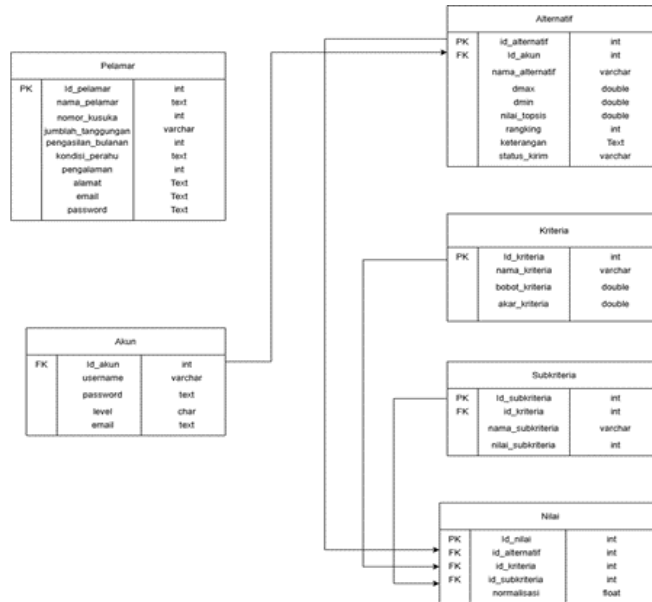


Fig. 2: Entity Relationship Diagram

3.3. System Implementation

The implementation of the decision support system for fishing boat assistance at the Fisheries and Marine Affairs Office of East Flores Regency is carried out through a web-based application designed to make the selection process more objective and measurable. This application enables officers to manage prospective recipients' data more efficiently, ensuring that every input can be processed quickly and accurately. By using this system, officers can avoid manual data-entry errors that often lead to inaccuracies in decision making. Moreover, the system also enhances accuracy, transparency, and accountability in the decision-making process. With a web-based platform, the aid selection process becomes more open, allowing all stakeholders to easily access the information they need. This not only reduces the potential for mistakes but also strengthens the integrity of the system, making the decisions taken more accountable to the community.

1. Login Page

The login form serves as the initial page for authenticating users before they can access the system. On this form, users are prompted to enter their registered Email and Password. If the entered credentials are valid, the user is granted access to the system and can use the available features according to their access rights.

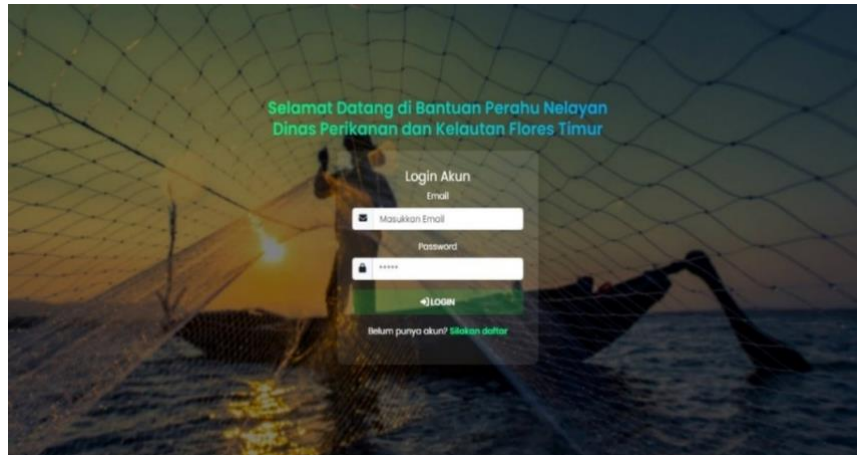


Fig. 5: Login Page

2. Admin Home Page

The Admin Home Page in this decision support system serves as the welcome screen for users. This page provides a brief explanation of the system's purpose, which is to assist in the objective and transparent selection process for fishing boat assistance using the TOPSIS method.

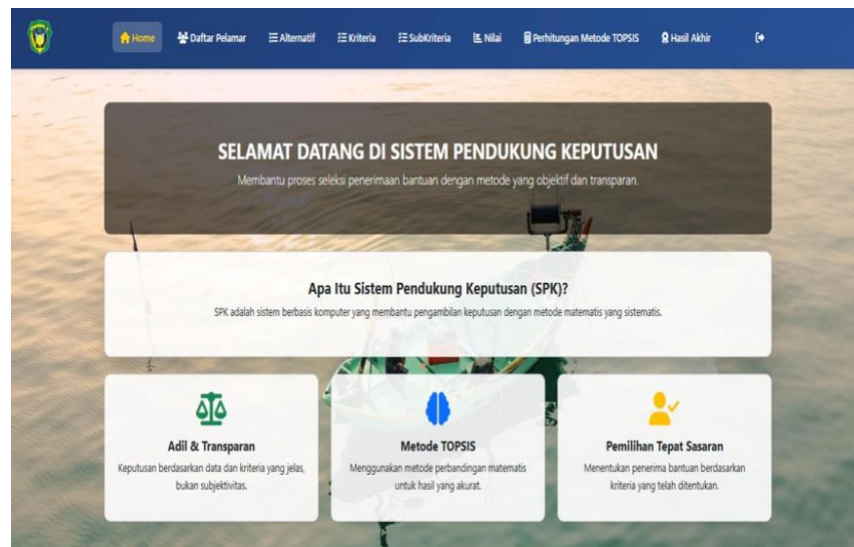


Fig. 3: Admin Home Page

3. Applicant List Page

This page displays the applicant data in a table format, including name, Kusuka number, dependents, income, boat condition, experience, address, and email. There is a "Download Data" button to download the applicant data.

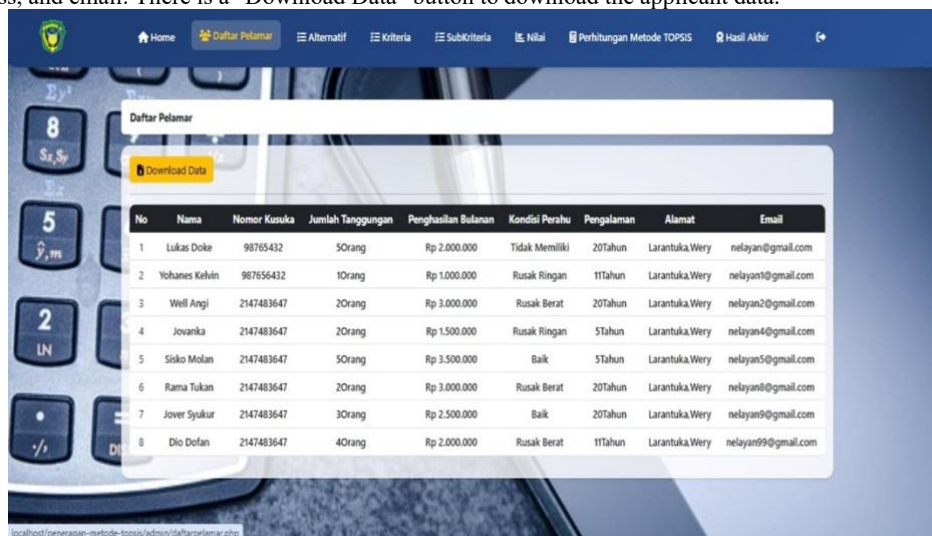


Fig. 7: Applicant List Page

4. Alternatives Page

The Alternatives Page displays the data of prospective aid recipients in a table format. This table shows the serial number, alternative name, and options to edit or delete the data. Additionally, there is a feature to add new data for including new applicants into the system.

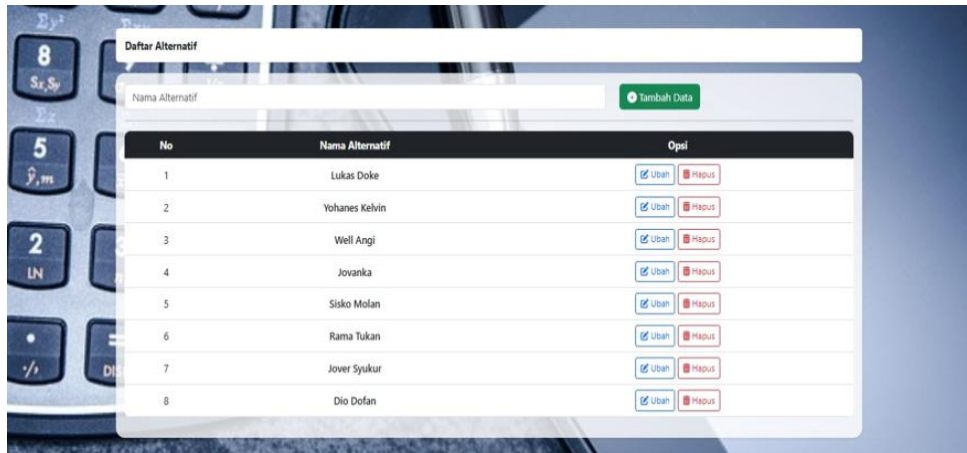


Fig. 8: Alternatives Page

5. Edit Alternative Page

The Edit Alternative Page is used to modify the data of the prospective aid recipient (fisherman) already registered in the system. On this page, there is an input field to change the desired fisherman's name. Two action buttons are available: the "Cancel" button to cancel the changes and return to the previous page, and the "Update" button to save the changes to the system..



Fig. 9: Edit Alternative Page

6. Criteria Page

The Criteria Page is used to manage the list of evaluation criteria in the aid selection process. Each criterion is displayed alongside its weight in a table. On this page, the admin can add new criteria, edit existing criteria, or delete criteria that are no longer needed..

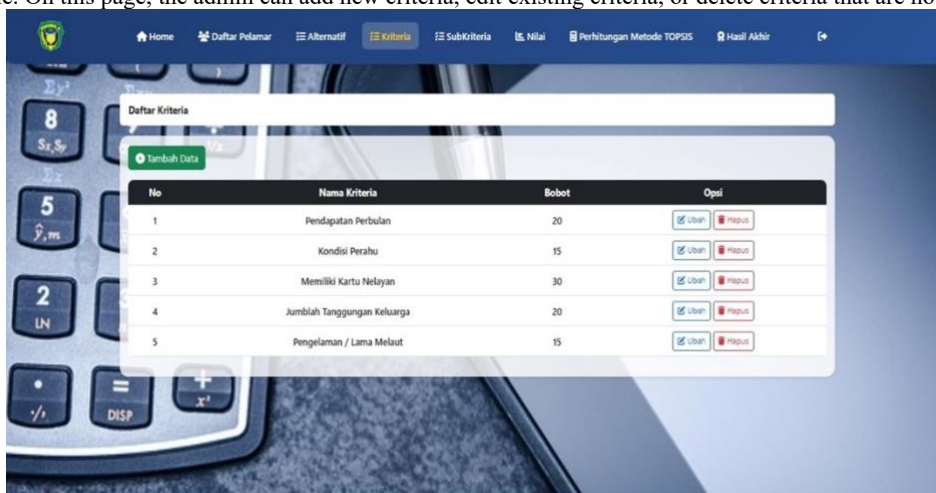


Fig. 10: Criteria Page

7. Add Criteria Page

This page is used to add a new criterion to the evaluation system. The admin is prompted to enter the criterion name and its weight. Once the fields are completed, the admin can click the green Save button to store the criterion or click the red Cancel button to abort the process.

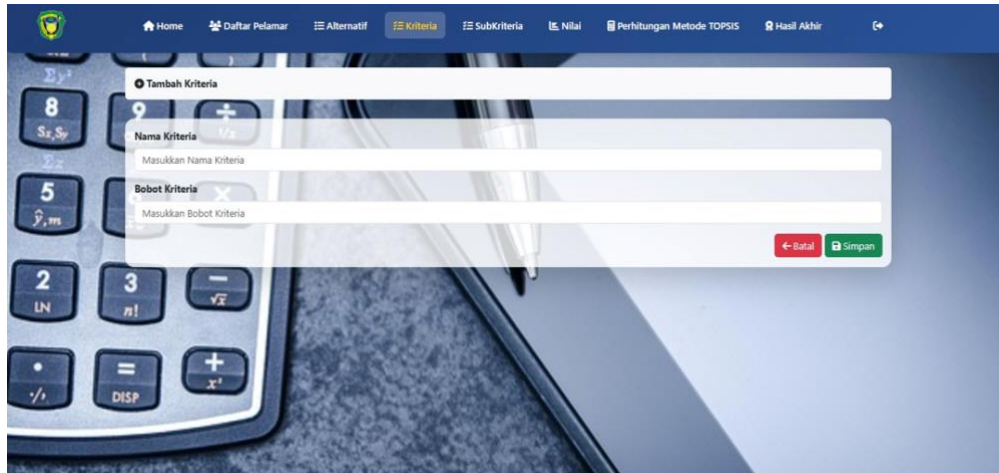


Fig. 11: Add Criteria Page

8. Edit Criteria Page

The Edit Criteria Page is used to modify the name and weight of criteria that are already registered in the system. On this page, there is an input field to change the desired criterion name and weight. Two action buttons are available: the **Cancel** button to cancel the changes and return to the previous page, and the **Update** button to save the changes to the system..

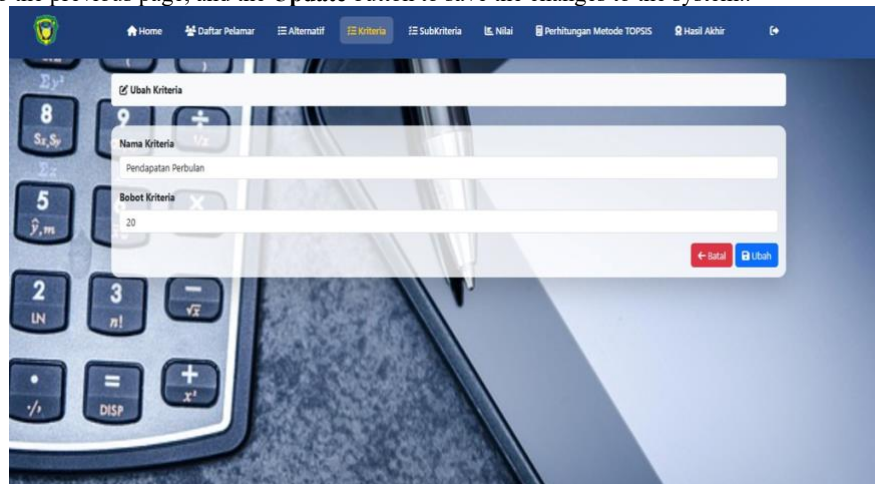


Fig. 12: Edit Criteria Page

9. Sub-criteria Page

This page is used to manage the sub-criteria for each main criterion, such as monthly income, boat condition, possession of a fisherman's card, number of family dependents, and experience or years of fishing. Next to each criterion, there is a Sub-Criteria button that can be clicked to view or manage the sub-criteria.

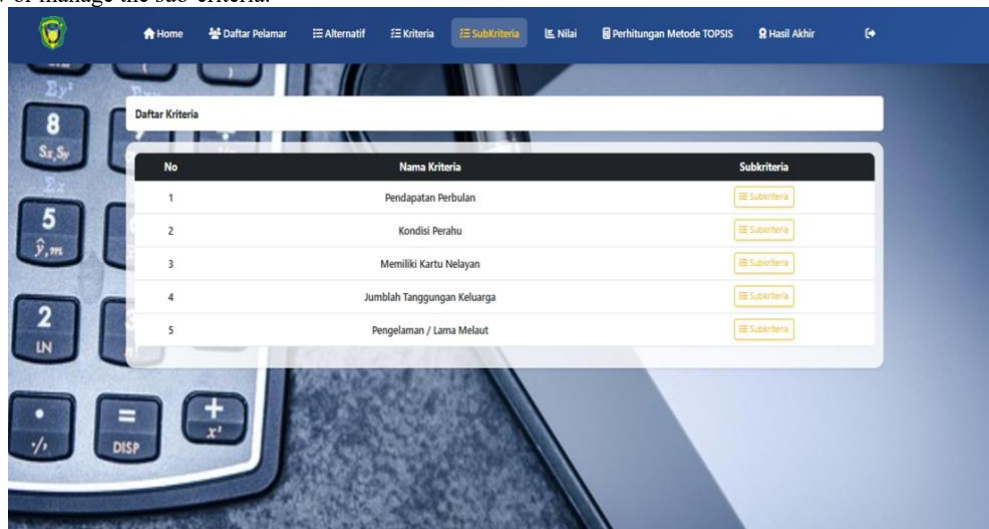
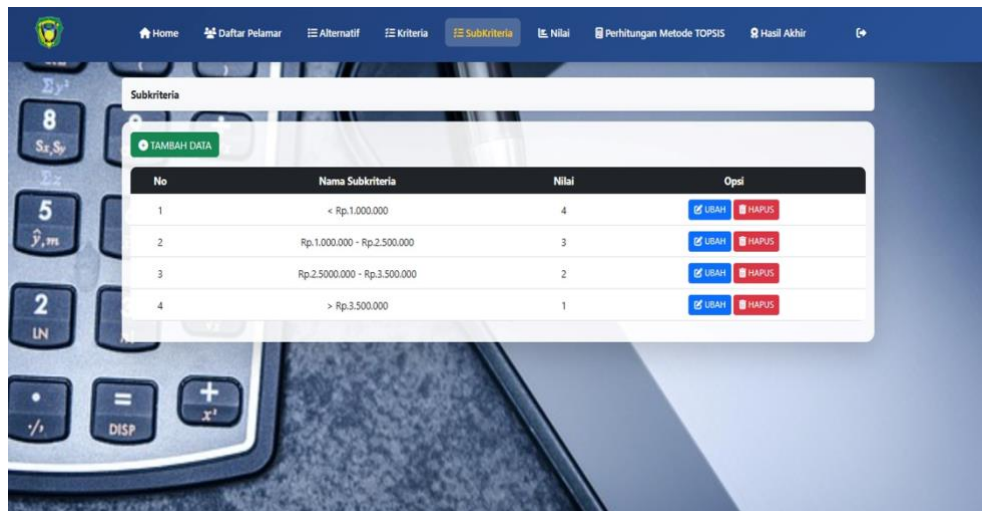


Fig. 13: Sub-criteria Page

10. Sub-Criteria List Page

This page displays the list of sub-criteria for one of the main criteria previously selected. There is an Add Data button at the top to add a new sub-criterion, while the Edit and Delete buttons on each row are used to modify or remove existing sub-criteria. This page is essential for managing the evaluation categories in more detail.

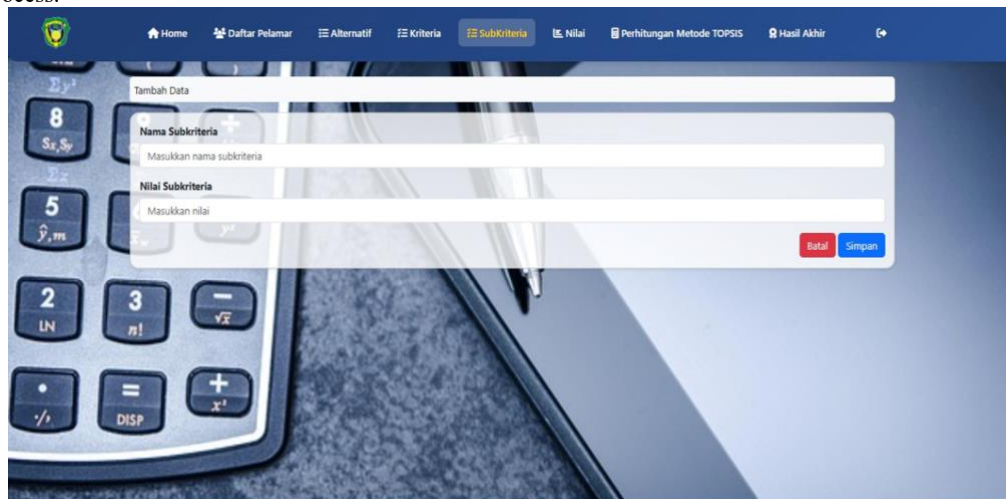


No	Nama Subkriteria	Nilai	Ops
1	< Rp.1.000.000	4	<input type="checkbox"/> UBAH <input type="checkbox"/> HAPUS
2	Rp.1.000.000 - Rp.2.500.000	3	<input type="checkbox"/> UBAH <input type="checkbox"/> HAPUS
3	Rp.2.500.000 - Rp.3.500.000	2	<input type="checkbox"/> UBAH <input type="checkbox"/> HAPUS
4	> Rp.3.500.000	1	<input type="checkbox"/> UBAH <input type="checkbox"/> HAPUS

Fig. 14: Sub-Criteria List Page

11. Add Sub-Criteria Data Page

This page is used to add a new sub-criterion to the evaluation system. The admin is prompted to enter the sub-criterion name and its value. Once the fields are completed, the admin can click the blue Save button to store the sub-criterion, or click the red Cancel button to abort the process.



Tambah Data

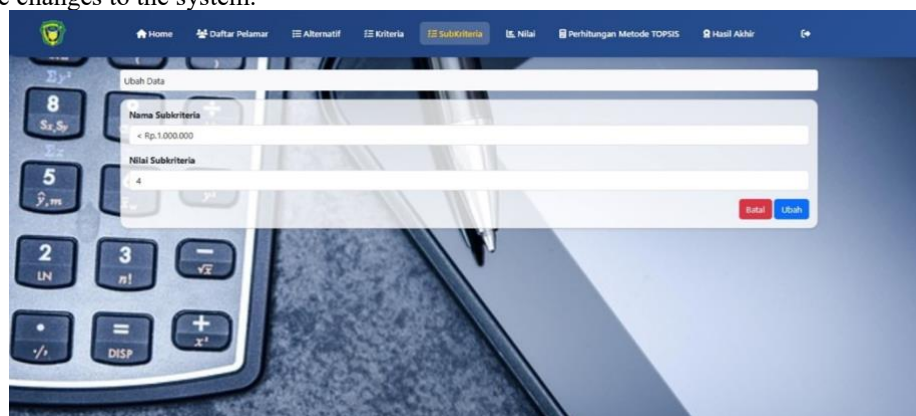
Nama Subkriteria
Masukkan nama subkriteria

Nilai Subkriteria
Masukkan nilai

Fig. 15: Add Sub-Criteria Data Page

12. Edit Sub-Criteria Data Page

The Edit Sub-Criteria Data Page is used to modify the name and value of sub-criteria already registered in the system. Two action buttons are provided: the Cancel button to discard changes and return to the previous page, and the Update button to save the changes to the system.



Ubah Data

Nama Subkriteria
< Rp.1.000.000

Nilai Subkriteria
4

Fig. 16: Edit Sub-Criteria Data Page

13. Score Page

This page displays the score of each fisherman based on the predefined criteria, where the scores will be used in the calculation process to determine the best selection. Data can be added, edited, or deleted using the available buttons.

No	Nama Nelayan	Pendapatan Perbulan	Kondisi Perahu	Memiliki Kartu Nelayan	Jumlah Tanggungan Keluarga	Pengalaman / Lama Melaut	Opsi
1	Lukas Doke	3	4	4	4	4	Ubah Hapus
2	Yohanes Kelvin	4	2	4	2	3	Ubah Hapus
3	Well Angi	2	3	4	2	4	Ubah Hapus
4	Jovanka	3	2	4	2	2	Ubah Hapus
5	Sisko Molan	2	1	4	4	1	Ubah Hapus

Fig. 17: Score Page

14. Add Score Page

This page is used to add new score data for each fisherman. The user is prompted to select the fisherman's name from the list of available alternatives, then enter scores for each criterion. Each criterion is filled by selecting the appropriate sub-criteria along with its predefined automatic value. Once all criteria are completed, the data can be saved by clicking the Save button or canceled using the Cancel button.

Fig. 18: Add Score Page

15. TOPSIS Method Calculation Page

This page displays the calculation process using the TOPSIS method to determine the ranking of fishermen based on several criteria. The first section presents the decision values, which are the original data for each criterion. All of this data is then used to identify the positive and negative ideal solutions, ultimately resulting in the final ranking of the fishermen.

No	Nama Nelayan	Pendapatan Perbulan	Kondisi Perahu	Memiliki Kartu Nelayan	Jumlah Tanggungan Keluarga	Pengalaman / Lama Melaut
1	Lukas Doke	Rp.1.000.000 - Rp.2.500.000	Tidak Memiliki Perahu	Memiliki Kartu Nelayan	> 4 Orang	> 20 Tahun
2	Yohanes Kelvin	< Rp.1.000.000	Memiliki perahu (Rusak Ringan)	Memiliki Kartu Nelayan	2 - 1 Orang	11 - 20 Tahun
3	Well Angi	Rp.2.500.000 - Rp.3.500.000	Memiliki perahu (Rusak Parah)	Memiliki Kartu Nelayan	2 - 1 Orang	> 20 Tahun
4	Jovanka	Rp.1.000.000 - Rp.2.500.000	Memiliki perahu (Rusak Ringan)	Memiliki Kartu Nelayan	2 - 1 Orang	5 - 10 Tahun
5	Sisko Molan	Rp.2.500.000 - Rp.3.500.000	Memiliki Perahu(Baik)	Memiliki Kartu Nelayan	> 4 Orang	< 5 Tahun
6	Rama Tukan	Rp.2.500.000 - Rp.3.500.000	Memiliki perahu (Rusak Parah)	Memiliki Kartu Nelayan	2 - 1 Orang	> 20 Tahun
7	Jover Syukur	Rp.2.500.000 - Rp.3.500.000	Memiliki Perahu(Baik)	Memiliki Kartu Nelayan	4 - 3 Orang	> 20 Tahun
8	Dio Dofan	Rp.1.000.000 - Rp.2.500.000	Memiliki perahu (Rusak Parah)	Memiliki Kartu Nelayan	4 - 3 Orang	11 - 20 Tahun

Fig. 19: TOPSIS Method Calculation Page

16. Final Results Page

This page displays the calculation process using the TOPSIS method to determine the ranking of fishermen based on several criteria. The first section shows the decision values, which consist of the original data for each criterion. All of this data is then used to determine the positive and negative ideal solutions, leading to the final ranking of the fishermen.

No	Nama Nelayan	Keterangan	Status	Aksi
1	Lukas Dike	Diterima	Dikirim	Sudah Dikirim
2	Dio Dofan	Belum Diproses	Belum Dikirim	✔ Kirim
3	Well Angi	Belum Diproses	Belum Dikirim	✔ Kirim
4	Rama Tukan	Belum Diproses	Belum Dikirim	✔ Kirim
5	Yohanes Kelvin	Belum Diproses	Belum Dikirim	✔ Kirim
6	Jover Syukur	Belum Diproses	Belum Dikirim	✔ Kirim
7	Sisko Molan	Belum Diproses	Belum Dikirim	✔ Kirim
8	Jovanka	Belum Diproses	Belum Dikirim	✔ Kirim

Fig. 20: Final Results Page

17. Division Head Result Verification Page

This page is used by the division head to verify the TOPSIS calculation results. The table displays the names of the fishermen, their TOPSIS scores, rankings, status descriptions (Accepted, Rejected, or Not Yet Processed), and action buttons **Approve** or **Reject** to decide the final outcome. The Division Head can also download all data using the **Download Data** button at the top of the page.

No	Nama Nelayan	Nilai TOPSIS	RANGKING	KETERANGAN	AKSI
1	Lukas Dike	0.1499	1	Diterima	Sudah Diproses
2	Dio Dofan	0.1033	2	Belum Diproses	Sudah Diproses
3	Well Angi	0.0972	3	Belum Diproses	✔ Setuju ✖ Tidak
4	Rama Tukan	0.0972	4	Belum Diproses	✔ Setuju ✖ Tidak
5	Yohanes Kelvin	0.0960	5	Belum Diproses	✔ Setuju ✖ Tidak
6	Jover Syukur	0.0905	6	Belum Diproses	✔ Setuju ✖ Tidak
7	Sisko Molan	0.0860	7	Belum Diproses	✔ Setuju ✖ Tidak
8	Jovanka	0.0591	8	Belum Diproses	✔ Setuju ✖ Tidak

Fig. 21: Division Head Result Verification Page

18. Fisherman Home Page

This page serves as the homepage of the Fishing Boat Assistance System, providing information about the boat assistance program for fishermen in East Flores Regency. Fishermen are welcomed and given a brief explanation of the program, along with a "View Application Status" button. When this button is clicked, fishermen can immediately see whether their application has been accepted or reject.

Selamat Datang diSistem Bantuan Perahu Nelayan

Bantuan Perahu untuk Nelayan

Program ini dirancang untuk membantu nelayan meningkatkan produktivitas mereka dalam melaut. Setiap penerima bantuan akan mendapatkan perahu lengkap dengan perlengkapan dasar yang dibutuhkan.

Pastikan Anda telah mengajukan permohonan dan pantau status pengajuan Anda secara berkala. Jika belum mendaftar, segera lakukan pendaftaran untuk mendapatkan bantuan.

[→ Lihat Status Pengajuan](#)

Alamat Kantor
 Jl. Contoh No. 123, Kabupaten Flores Timur, Nusa Tenggara Timur
 (0380) 12345678
 info@spkbantuan.com

Fig. 22: Fisherman Home Page

4. Conclusion

This study produced a Decision Support System (DSS) based on the TOPSIS method that is capable of assisting the Department of Fisheries and Marine Affairs of East Flores Regency in objectively, efficiently, and accurately determining prospective recipients of fishing boat assistance. By taking into account multivariate criteria such as income, number of dependents, age, and boat condition, the system generates a ranking of candidates based on their proximity to the ideal solution. The implementation of TOPSIS in this system has been shown to enhance the transparency and accuracy of the selection process, while reducing subjectivity in decision-making. Thus, the system not only supports the operational efficiency of the agency but also contributes to improving the welfare of coastal communities through more precisely targeted aid distribution.

Acknowledgement

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