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DECISION SUPPORT SYSTEM FOR FISH SEED SELECTION USING THE WEIGHT SUM MODEL (WSM) METHOD

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Abstract: Decision support systems (DSS) have become an important tool in various fields, including the selection of fish seeds. Selecting the right fish seeds is a crucial step in successful fish farming. In this context, the Weight Sum Model (WSM) method can be used as an approach in decision making. This research aims to develop a Decision Support System for selecting fish seeds using the Weight Sum Model (WSM) method. This method allows a systematic assessment of various criteria that are relevant in selecting fish seeds. The first step in this research is to identify the criteria that will be evaluated in selecting fish seeds. Each fish seed is assessed based on each criterion using the appropriate scale. In the WSM method, the values given to each criterion are multiplied by the weight of the corresponding criterion, and the results are added up for each fish seed. The fish seeds that have the highest number will be considered the best choice based on predetermined evaluation criteria. This Decision Support System can help fish farming farmers in making more informative and data-based decisions in selecting fish seeds that suit their needs.

Keywords: Decision Support Systems, Fish Seeds, Criteria, Weight Sum Model (WSM), Fish Cultivation.

Abstract: Sistem pendukung keputusan (SPK) telah menjadi alat penting dalam berbagai bidang, termasuk dalam pemilihan bibit ikan. Memilih bibit ikan yang tepat merupakan langkah krusial dalam budidaya ikan yang sukses. Dalam konteks ini, metode Weight Sum Model (WSM) dapat digunakan sebagai pendekatan dalam pengambilan keputusan. Penelitian ini bertujuan untuk mengembangkan Sistem Pendukung Keputusan untuk pemilihan bibit ikan menggunakan metode Weight Sum Model (WSM). Metode ini memungkinkan penilaian yang sistematis terhadap berbagai kriteria yang relevan dalam memilih bibit ikan. Langkah pertama dalam penelitian ini adalah mengidentifikasi kriteria-kriteria yang akan dievaluasi dalam pemilihan bibit ikan. Setiap bibit ikan dinilai berdasarkan setiap kriteria menggunakan skala yang sesuai. Dalam metode WSM, nilai-nilai diberikan pada setiap kriteria akan dikalikan dengan bobot kriteria terkait, dan hasilnya dijumlahkan untuk setiap bibit ikan. Bibit ikan yang memiliki jumlah tertinggi akan dianggap sebagai pilihan terbaik berdasarkan evaluasi kriteria yang telah ditentukan. Sistem Pendukung Keputusan ini dapat membantu para petani budidaya ikan dalam mengambil keputusan yang lebih informatif dan berdasarkan data dalam memilih bibit ikan yang sesuai dengan kebutuhan.

Kata kunci: Sistem Pendukung Keputusan, Bibit Ikan, Kriteria, Weight Sum Model (WSM), Budidaya Ikan.

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INTRODUCTION

In an increasingly advanced era like today, technology is progressing very rapidly. Especially in the field of information systems which is in line with the increasing need for information that is fast, accurate, well integrated and structured[1]. The application of information technology is widely used in processing power into accurate information. The development of information systems is very helpful in everyday life so that it can facilitate the delivery and receipt of information because each information system has a role to provide information to the user by processing existing data so as to produce detailed and accurate information.[2].

Fish seeds refer to individual fish that are used as an initial or initial stage in fish cultivation. Fish seeds can come from artificial sorting and hatching or from natural catches. Selection of good fish seeds is very important in aquaculture activities, because the right seeds will affect the growth, health and productivity of the fish being cultivated. However, the process of selecting fingerlings can be complicated because many factors must be considered, such as fish species, environmental conditions, source of seeds, and quality of seeds.[3].

The number of factors that must be considered in determining the selection of fish seeds requires a scientific approach to a decision support system. This system was built to make it easier for fishermen to make decisions by utilizing data, models and analytical methods. Providing appropriate and timely information to decision makers in order to make better and more informed decisions[4].

In this research, the Weight Sum Model (WSM) is used as an approach in decision making. WSM is a popular method in Decision Support Systems (DSS) because it is relatively simple and easy to understand[5]. This method combines and assigns weight to each relevant factor in the selection of fish seeds, then adds up these weights to obtain a final value that describes the degree of suitability of each alternative fish seed.[6].

A decision support system is an interactive information system that provides information, modeling, and data manipulation that is used to assist decision making in semi-structured and unstructured situations where no one is sure how they should make a decision.[7].

The decision support system is part of a computer-based information system including the knowledge system used to support decision making[8].The decision support system (Decision Support System) only helps in making decisions in dealing with quite complex problems and is a second opinion in decision making, and does not mean replacing the manager's duties.[9].

The aim of the research to be carried out is to develop a computer system that can help fishery business owners or fish farmers in choosing fish seeds that best suit their needs.[10]. This system will analyze various factors relevant to selecting fish seeds, such as water quality, temperature, type of feed, and the quality of the fish seeds themselves. By using the WSM method, the system will provide recommendations about the most optimal fish seeds based on the weight assigned to each factor.

It is hoped that this research can help improve efficiency and effectiveness in selecting fish seeds, so that the results of fish farming can be improved. In addition, this decision support system can also reduce the level of uncertainty and risk in decision making, because it is based

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on a more detailed and objective analysis.

METHODS

In this research, researchers used the WSM method. The WSM method is a very popular method and is widely applied to help decision makers in making decisions. Method (WSM) is one of the simplest and easiest to understand implementation methods[11]. The WSM method is a general model that is used for different applications such as robotics, processors and others, this method is often used in single-dimensional problems.[12]. The flowchart of this research can be seen in Image 1.

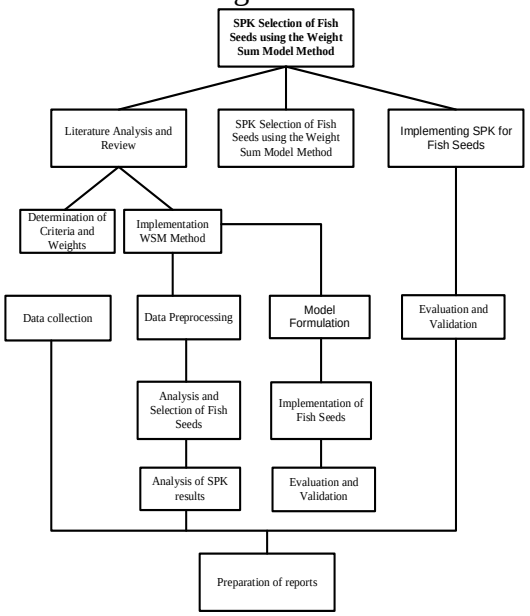

Image 1. Research Flow Diagram

The research diagram above illustrates the steps that will be carried out in SPK research on fish seed selection using the Weight Sum Model (WSM) Method.

1. The initial stage involved a needs and criteria analysis, during which the relevant criteria for fingerling selection were determined. Then, the SPK design was carried out using the WSM method, which involved model development and the formulation of criteria weights.
2. Furthermore, data collection was carried out using various data collection techniques, such as questionnaires, interviews, or field observations. The collected data is analyzed to obtain the information needed in developing the SPK.
3. After that, the SPK is implemented, and the evaluation and validation stage is carried out to test the system performance and ensure the accuracy and effectiveness of the recommendations produced.
4. Finally, an analysis of the results and recommendations is carried out, where the data that has been analyzed is used to produce recommendations for selecting appropriate fish seeds based on the weight of the criteria that have been determined.

The following is a flowchart of the Weighted Sum Model (WSM) method as follows:

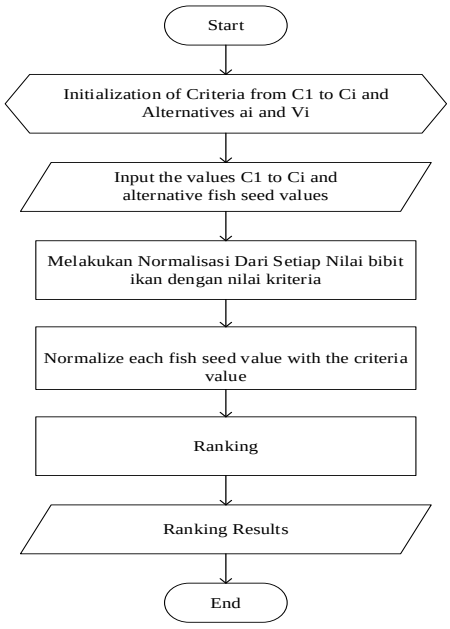

Image 2. WSM Method Flowchart

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RESULTS AND DISCUSSION

The Weighted Sum Model method is a very general method, and is widely applied to help decision makers in making decisions. WSM is one of the simplest and easiest to understand methods of implementation. Is part of the MCDM (Multi-Criteria Decision Making) method in evaluating the value of each alternative.

$$A_j^{wsm-score} = \sum_{j=1}^{n} w_j^{xij} \qquad (1)$$

Information:
N : number of criteria
W_A : weight of each criterion
a_{ij} : matrix value x

The process of analyzing data is where the data is in the form of criteria

used as an assessment of the selection of superior seeds in seawater fish ponds. The method used to analyze this data is to apply the weighted product method to produce information in the form of rankings against the criteria for the data managed earlier.

Some of the criteria and sub-criteria that influence the determination of freshwater fish farming are as follows: grouper, red snapper, milkfish, tuna and gourami. Alternative Data Alternative data is very important data in decision support systems. The following is a list of alternatives to choose from. Alternatives and criteria can be seen in the following table:

To carry out a calculation analysis of each alternative and the criteria given, a weighting scale is needed for each criterion, the following scale is used:

Table 1. List of Alternatives

No	Alternative	Sub Criteria	Information
1	Growth Rate	C1	Daily Growth Rate
		C2	Total length
		C3	Standard Length
		C4	Morphological Changes
		C5	Feed Conversion Factor
		C6	Survival Rate
2	Nutrient content	C1	Protein Content
		C2	Fat Content
		C3	Vitamin content
		C4	Water Content
		C5	Micronutrient Content
3	Fish Prices	C1	Seed Quality
		C2	Types and species
		C3	Seeding rate
		C4	Health and certification
		C5	Environmental Suitability
4	Fish Harvesting Period	C1	Weight
		C2	Quality
		C3	Maturity Level
		C4	Population density level
		C5	Growth rate
		C6	Feed efficiency
		C7	Water quality
		C8	Market Demand
5	Fish Health	C1	Survival rate
		C2	Physical appearance
		C3	Growth rate
		C4	Dietary habit
		C5	General health level
		C6	stress level
		C7	Water cleanliness
		C8	Symptoms of Disease
		C9	Pool Cleanliness
		C10	Vaccination or medication
6	Easy Seeds to Get	C1	Market availability
		C2	Purchase accessibility
		C3	Affordable prices
		C4	Seed Quality
		C5	Seed size and age
		C6	Guarantee and after-sales service
		C7	Stock availability throughout the year
		C8	Type of payment

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Table 2. Weighting Scale

Criteria	Scale	Weight
Growth Rate	Very good	5
	Good	4
	Pretty good	3
	Not good	2
	Very Not Good	1
Nutrient content	Very good	5
	Good	4
	Pretty good	3
	Not good	2
	Very Not Good	1
Fish Prices	0 - 1000	1
	1050 - 2000	2
	2050 - 3000	3
	3050 - 4000	4
	4050 - 5000	5
Harvest Time	0 – 4 Months	5
	5 – 9 Months	4
	10 – 13 Months	3
	14 – 17 Months	2
	20 – 23 Months	1
Fish Health	Very good	5
	Good	4
	Pretty good	3
	Not good	2
	Very Not Good	1
Seeds are easy to get	Very easy	5
	Easy	4
	Quite easy	3
	Less Easy	2
	Not easy	1

Table 3. Criteria Weight (Quisoner questions and answers with initial weight)

Criteria Code	Criterion Name	Weight
K1	Growth Rate	**5**
K2	Nutrient content	**3**
K3	Prices of Fish Seeds	**4**
K4	Harvest Time	**4**
K5	Fish Health	**5**
K6	Seeds are easy to get	**5**

Table 4. Fish Seed Data Conversion

Alternative Code	Criteria					
	Growth Rate	Nutrient content	Prices of Fish Seeds	Harvest Time	Fish Health	Easy to Get Seeds
BI1	4	4	4	4	5	4
BI2	4	4	5	4	5	4
BI3	5	5	4	5	5	5
BI4	5	4	3	5	5	5
BI5	4	4	4	5	4	3

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Based on the initial weight table that has been determined for each criterion, the decision maker gives the weight preferences are w = [5 3 4 4 5 5] where W= (W1,W2,W3,W4,W5). Correction of Weight Value Correction of the initial weight value will be corrected by:

Growth Rate $W_J = \frac{WJ}{\sum WJ}$

Fixed Weight for Growth Rate Value:

$$W1 = \frac{5}{5+3+4+4+5+5} = \frac{5}{26} = 0{,}192$$

Weight Improvement for Nutritional Content Value:

$$W2 = \frac{3}{5+3+4+4+5+5} = \frac{3}{26} = 0{,}115$$

Weight Improvement for Fish Seed Price Value:

$$W3 = \frac{4}{5+3+4+4+5+5} = \frac{4}{26} = 0{,}153$$

Improvement of the weight of the harvest period value

$$W4 = \frac{4}{5+3+4+4+5+5} = \frac{4}{26} = 0{,}153$$

Fish Health Weight Improvement

$$W5 = \frac{5}{5+3+4+4+5+5} = \frac{5}{26} = 0{,}192$$

Fish Health Weight Improvement

$$W6 = \frac{5}{5+3+4+4+5+5} = \frac{5}{26} = 0{,}192$$

From the weighting process above, the final weights are obtained as follows:

Table 5 . Change in Weight Value

Criteria Code	Criterion Name	Weight
K1	Growth Rate	0.192
K2	Nutrient content	0.115
K3	Fish Prices	0.153
K4	Harvest Time	0.153
K5	Fish Health	0.192
K6	Seeds are easy to get	0.192
	Amount	1

Calculate the WSM-Score value with the formula:

$$A_j^{wsm-score} = \sum_{j=1}^{n} w_j^{xij}$$

BI1=(0.192*4)+(0.115*4)+(0.153*4)+(0.153*4)+(0.192*4)+(0.192*5)= 8.224

BI2 = (0.192 * 4) + (0.115*4)+(0.153 * 5)+(0.153 * 4) + (0.192*5)+(0.192 *5) = 9.416

BI3 = (0.192 * 5) + (0.115*5)+(0.153 * 4)+(0.153 * 5) + (0.192*5)+(0.192 *5) = 9.8

BI4 = (0.192 *5) + (0.115* 4)+(0.153 * 3)+(0.153 * 5) + (0.192*50.192 * 5) = 9.416

BI5 = (0.192 * 4) + (0.115*4)+(0.153 * 4)+(0.153 * 5) + (0.192*4)+(0.192 *3) = 7.224

From the results of calculations carried out based on the Weighted Sum Model (WSM) method, the values of the following alternatives are obtained:

Table 6. Ranking Based on Preference Value.

Alternative Code	Alternative	Preference Value	Information
BI3	Milkfish	9,8	Rank 1
BI4	Tuna	9,416	Rank 2
BI2	Red Snapper	8,416	Rank 3
BI1	grouper	8,224	Rank 4
B14	Gourami	7,224	Rank 5

From the table above, data is obtained that the B13 (Milkfish) sample is the type of fish seed that has the largest WSM index value, namely 9.8, which ranks first, so that in research using the WSM method, it can be used as material in making decisions about cultivating fish seeds.

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CONCLUSION

Validation of the weight sum model (WSM) method can provide more accurate selection results in drawing conclusions about the effectiveness of the WSM model in selecting fish fry. The application of the WSM method can contribute to increasing productivity in aquaculture businesses. The WSM method shows that the WSM-based decision support system is successful in increasing fish seed selection.

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BIBLIOGRAPHY

[1] M. Zulpan Batubara, M. Irwan, and P. Nasution, "Online Information System for Social Fund Management at the North Sumatra Orphanage," *J. Technol. And Sis. inf. Business-JTEKSIS*, vol. 5, no. 3, p. 164, 2023, [Online]. Available: http://jurnal.unidha.ac.id/index.php/jteksishttps://doi.org/10.47233/jteksis.v5i3.819.

[2] L. Hernando, "Financial Information System Design in Savings and Loans Cooperative Units," *J. Technol. And Sis. Inf. Business*, vol. 2, no. 1, pp. 22–32, 2020, doi: 10.47233/jteksis.v2i1.84.

[3] S. Hudaidah, Q. Hasani, and MW Yusup, *Community Empowerment Through Development of Catfish Cultivation*. 2017.

[4] Ramadina Pertiwi, Natalia Silalahi, and Fince Tinus Waruwu, "Decision Support System in Determining the Best Workshop Head Using the AHP and WSM Methods," *Bull. Comput. sci. Res.*, vol. 2, no. 1, pp. 1–5, 2021, doi: 10.47065/bulletincsr.v2i1.122.

[5] S. Supiyandi *et al.*, "Implementation of the Weighted Sum Model Method in Determining Used Car Selection," SENASHTEK Pros. Monday. Nas. Sauce. Humanities and Technology., pp. 106–111, 2022.

[6] R. Zulkarnain and T. Susilowati, "Decision Support System for Selecting Quality Catfish Seeds Using the Saw Method (Simple Additive Weighting) in Wates Village," *Department of Information Systems, STMIK Pringsewulampung*, vol. 5, no. 1, pp. 434–441, 2017.

[7] WP Sari, A. Setiawan, and MI Saepulhaq, "Implementation of the Weighted Sum Model Method in Decision Support Systems Using the Rational Unified Process (Rup)," *Narrative J. Nas. Research, App. and Tech. inform.*, vol. 2, no. 1, pp. 50–54, 2020, doi: 10.53580/naratif.v2i1.83.

[8] A. Ramadhan and S. Supatman, "Decision Support System for Supplier Selection at PT. Avo Innovation Technology With the Simple Addivite Weighting (SAW) Method," *J. Technol. And Sis. Inf. Business*, vol. 4, no.

2, pp. 256–267, 2022, doi: 10.47233/jteksis.v4i1.484.

[9] L. Hernando, "Client Server-Based Decision Support System for Accepting New Employees," *JURTEKSI (Journal of Information Technology and Systems)*, vol. 6, no. 3, pp. 239–246, 2020, [Online]. Available: https://jurnal.stmikroyal.ac.id/index.php/jurteksi/article/download/671/412.

[10] Ade Suhara, "Cultivation Techniques for Raising and Selecting Patin Fish Seeds (Case Study on the Large Land of Mekar Mulya Village, Teluk Jambe Barat District, Karawang Regency)," *J. Buana Pengabdi.*, vol. 1, no. 2, pp. 1–8, 2019, doi: 10.36805/jurnalbuanapengabdian.v1i2.1066.

[11] R. Irwansyah and Mesran, "Decision Support System for Selecting the Best Vocational School Students in Medan City Using the Weighted Sum Model Method," *J.Inf. syst. Res.*, vol. 3, no. 3, pp. 155–158, 2022, doi: 10.47065/josh.v3i3.1432.

[12] J. Fredricka and L. Elfianty, "Decision Support System for Vocational School Selection with the Weighted Product and Weighted Sum Model Methods," *J.Tek. inform. Unika St. Thomas*, vol. 05, no. 02, pp. 186–192, 2020, [Online]. Available: http://download.garuda.kemdikbud.go.id/article.php?article=2582107%5C&val=24271%5C&title=Vocational School Selection Decision Support System using the Weighted Product Method and Weighted SUM Model.