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# Decision Support System for Plantation Land Recommendations in Mandailing Natal Regency Using The TOPSIS Method

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**ABSTRACT**

Plantations have great potential to be developed because they are a source of income for the community, farmers and PTPN in the area because Indonesia has the largest plantation land in the world. Mandailing Natal Regency is the district with the largest area in North Sumatra province, but Mandailing Natal has not been able to surpass crop production from plantation land in North Sumatra. The method for determining plantation land to produce good harvests is the TOPSIS algorithm for recommending plantation land. In this research, recommendations were made for plantation land with the aim of finding out what land is suitable in each subdistrict in Mandailing Natal Regency. The data method for this plantation land was taken at the Mandailing Natal Central Statistics Agency with the variables used, namely land area, area height, topography and rainfall. In implementing The decision support system using the TOPSIS algorithm on plantation land in Mandailing Natal Regency, the Recommendation results based on the type of plantation land in each sub-district are as follows: Rubber Plantation Land is highly recommended in Siabu District with a preference value of 0.56938682730811 and highly not recommended in Penyabungan District with preference value 0.33537499293319. Then, Palm Oil Plantation Land is highly recommended in Batang Natal sub-district with a preference value of 0.53467087652891 and not highly recommended in Tambangan sub-district with a preference value of 0.33181406496882. And the last one is Cocoa Farm which is highly recommended in Tambangan District with a preference value of 0.62855110465075 and highly not recommended in East Panyabungan District with a preference value of 0.25592982445435.

Keyword : Plantation; Recommendations; TOPSIS.



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## 1. INTRODUCTION

Plantations are an important sector in Indonesia's economy, playing a role in boosting economic growth, creating jobs, and meeting the public's needs for both food and non-food products. Indonesia has vast plantation potential with various types of crops such as oil palm, coffee, tea, rubber, and others. However, the conditions and characteristics of plantations in each region are very diverse and require different development strategies.

Mandailing Natal Regency is one of the areas in North Sumatra with significant plantation potential. In addition, Mandailing Natal Regency also produces other plantation commodities. However, it is often the case that plantations are established in areas that are not suitable for them, resulting in unsatisfactory yields. To avoid harm to the community from poor plantation results, the people need to know how to determine which crops are suitable for their area. Therefore, data mining using the TOPSIS algorithm is required to recommend plantation land in Mandailing Natal Regency (Agricultural Statistics, 2014).

Land recommendations for plantations in Mandailing Natal Regency are crucial for sustainable plantation management. Good recommendations can assist in decision-making for plantation management, including the development and improvement of production. Plantation area recommendations can also help address issues such as climate change, plant diseases, and natural disasters.

In the context of Mandailing Natal Regency, a Decision Support System that recommends plantation land using the TOPSIS method can help understand the characteristics and potential of plantation lands, as well as assist in developing better and more sustainable plantation development strategies. With effective and accurate plantation land recommendations, it is hoped that the productivity and quality of plantation yields, as well as the welfare of the people in Mandailing Natal Regency, can be improved.

**2. Research Stages**

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) is one of the methods in the MADM (Multi-Attribute Decision Making) decision model. The TOPSIS method uses the concept where the selected best alternative not only has the shortest distance from the positive ideal solution but also has the longest distance from the negative ideal solution. The concept is simple, easy to understand, computationally efficient, and has the ability to measure relative performance, making this method widely used in MADM models (Khomsatun et al., 2020). It should be noted that even though an alternative has the smallest distance from the positive ideal solution, it does not always mean that the alternative will have the largest distance from the negative ideal solution.

This concept is widely used in several MADM models to solve decision problems practically. This is because the concept is simple and easy to understand, computationally efficient, and has the ability to measure the relative performance of decision alternatives in a simple mathematical form (Wahyuni, 2017).

TOPSIS follows the steps as follows:

1. Construct the normalized decision matrix:
   The first step is to determine the normalized decision matrix using the following formula:
   $$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=j}^{m} {x_{ij}}^2}} \quad (1)$$
   Where : $x_{ij} = decision\ matrix$
   $r_{ij} = normalized\ matrix$
2. Construct the weighted normalized decision matrix:
   After constructing the normalized decision matrix, the next step is to determine the weighted normalized matrix, using the following formula:
   $$y_{ij} = w_i \cdot r_{ij} \quad (2)$$
   Where : $y_{ij} = weighted\ normalized\ matrix$
   $w_i = weighted\ vector\ from\ the\ data\ process$
   $r_{ij} = normalized\ matrix$
3. Determine the positive ideal solution matrix and the negative ideal solution matrix:
   After determining the weighted normalized matrix, the next step is to determine the positive and negative ideal solutions. The positive ideal solution $A^+$ and the negative ideal solution $A^-$ can be determined based on the normalized weighted matrix ($y_{ij}$), using the following formula:
   a. Positive Ideal Solution
      $$A^+ = ({y_1}^+, {y_2}^+, \dots, {y_n}^+) \quad (3)$$
   b. Negative Ideal Solution
      $$A^- = ({y_1}^-, {y_2}^-, \dots, {y_n}^-) \quad (4)$$
   Where : $y_j^+ = \begin{cases} \max y_{ij}, if\ j\ is\ a\ benefit\ attribute \\ \min y_{ij}, if\ j\ is\ a\ cost\ attribute \end{cases}$
   $y_j^- = \begin{cases} \min y_{ij}, if\ j\ is\ a\ benefit\ attribute \\ \max y_{ij}, if\ j\ is\ a\ cost\ attribute \end{cases}$
4. Determining the distance between the value of each alternative and the positive and negative ideal solution matrices.
   After determining the positive and negative ideal solutions, the next step is to determine the distance between the positive and negative ideal solutions using the following formula:
   a. Positive Distance
      $$D_i^+ = \sqrt{\sum ({y_i}^+ - {y_{ij}}^+)^2} \quad (5)$$
   b. Negative Distance
      $$D_i^- = \sqrt{\sum ({y_i}^- - {y_{ij}}^-)^2} \quad (6)$$
   Where : $D_i = distance\ to\ the\ ideal\ solution$
   $y_{ij} = value\ of\ the\ ideal\ solution$
   ${y_{ij}}^+ = value\ of\ the\ positive\ ideal\ solution$
   ${y_{ij}}^- = value\ of\ the\ negative\ ideal\ solution$
5. Determining the preference value for each alternative.
   After all the steps have been determined, the next step is to determine the preference value using the following formula:
   $$v_i = \frac{{D_i}^-}{{D_i}^- + {D_i}^+} \quad (7)$$

Where :$V_i = preference\ value$
$D_i^- = negative\ ideal\ distance$
$D_i^+ = positive\ ideal\ distance$

6. Determining the Rank.
After completing all the steps, the final step is to determine the rank from first to last based on the number of reference values.

The following is the system schema used in the TOPSIS method:

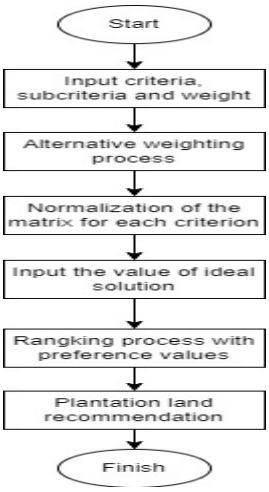


Fig 1. System Schema

The collected data set will be analyzed using the TOPSIS algorithm. The analysis will be performed using four attributes, namely Land Area, Elevation, Topography, and Rainfall in 2022. These attributes are initialized in the following table:

Table 1. Attribute Initialization

| Attribute | Initialization |
|---|---|
| Land Area | K1 |
| Elevation | K2 |
| Topography | K3 |
| Rainfall | K4 |

In this research, the alternatives provided are used, and these alternatives represent plantation land from the case study research. There are 4 criteria and data from the research results:

Table 2. Subcriteria Option for Land Area

| Land Area | Grade |
|---|---|
| 10-20 (Ha) | 1 |
| 21-30 (Ha) | 2 |
| 31-60 (Ha) | 3 |

Table 3. Selection of The Elevation Criteria

| Elevation | Grade |
|---|---|
| 0-300 (mdpl) | 1 |
| 200-600 (mdpl) | 2 |
| 600-1.300 (mdpl) | 3 |

Table 4. Selection of The Topography Criteria

| Topography | Grade |
|---|---|
| Hilly to mountainous | 1 |
| Wavy to hilly | 2 |
| Flat to hilly | 3 |
| Flat to wavy | 4 |

Table 5. Selection of The Rainfall Criteria

| Rainfall | Grade |
|---|---|
| 112-300 (mm) | 1 |
| 125-722 (mm) | 2 |
| 127-400 (mm) | 3 |
| 500-1481 (mm) | 4 |

## 3. RESULTS AND DISCUSSION

Plantations in Mandailing Natal Regency are one of the main sources of income for the local community. Mandailing Natal Regency has a climate that is very suitable for agriculture and plantations, making it one of the main producers of agricultural and plantation commodities in North Sumatra. The area of Mandailing Natal is 4,372.86 $km^2$, consisting of 30,749 hectares of rice fields, 363,439.14 hectares of non-rice agricultural land, and 43,286 hectares of non-agricultural land. Agriculture is the driving force behind the economic development of Mandailing Natal Regency, as reflected in the composition of the Gross Regional Domestic Product (GRDP) in 2021, where the agricultural, forestry, and fisheries sectors contributed the largest share of 51.34 percent to the economy of Mandailing Natal. Generally, plantation companies have their own processing units, so the products marketed are already in the form of processed goods. Processed products are primary productions that have been processed into finished or semi-finished goods, thereby increasing their economic value (BPS, 2021).

Oil palm plantations in Mandailing Natal are spread across several subdistricts. These plantations are generally managed by large companies that employ many workers. The management of oil palm plantations in Mandailing Natal is carried out intensively with proper irrigation systems to ensure that the oil palm plants grow optimally. In addition to being a source of income for the companies, oil palm plantations also provide significant economic benefits to the local community. Jobs in the oil palm plantations can absorb a large workforce and provide stable income for workers. Oil palm plantations in Mandailing Natal are an important sector for the region's economy. However, their management must still consider environmental and social aspects to ensure that they provide sustainable benefits to the community and the surrounding environment.

Mandailing Natal Regency has a climate that is very suitable for rubber cultivation, making it one of the main rubber producers in North Sumatra. Rubber plantations in Mandailing Natal are generally managed by smallholder farmers who own rubber plantations of varying sizes. These smallholder farmers often collaborate with rubber agents or factories to supply their harvests. Generally, rubber farmers in Mandailing Natal manage their plantations in a traditional manner. The process of creating planting holes, applying fertilizer, and planting rubber seedlings is still done manually. Once the rubber seedlings are planted, maintenance tasks such as pruning, weed clearing, and irrigation are also done manually by the farmers. During the harvest season, rubber is collected by tapping the latex from the trees and collecting it in containers. The latex is then processed into raw rubber material, which is ready to be sold to rubber processing factories.

Although rubber plantations in Mandailing Natal provide significant economic benefits for farmers and the surrounding area, their management also raises some social issues. Common issues include the low selling price of rubber, which affects the welfare of farmers, and the lack of knowledge and technology, which leads to low productivity in the rubber plantations. To address these issues, the government and relevant parties have taken various measures, such as providing assistance and training on technology for rubber farmers, opening new market access, and establishing modern and efficient rubber production centers. Overall, rubber plantations remain an important sector for the regional economy in Mandailing Natal. However, their management needs to be continuously improved to enhance the welfare of rubber farmers and ensure that the surrounding environment is preserved.

The recommendation for plantation land using the TOPSIS algorithm has been successfully carried out, categorizing the land into three types of plantations: cocoa, oil palm, and rubber. The following is the data from each district that will be used in the calculation.

Table 6. Data by Distric

| Number | Distric | Land area (Ha) | Elevation (mdpl) | Topography | Rainfall (mm) |
|---|---|---|---|---|---|
| 1 | Kotanopan | 1 | 2 | 1 | 3 |
| 2 | Pakantan | 3 | 3 | 1 | 3 |
| 3 | Bukit Malintang | 3 | 2 | 3 | 4 |
| 4 | Batahan | 1 | 1 | 4 | 2 |
| 5 | Sinunukan | 1 | 1 | 4 | 2 |
| 6 | Batang Natal | 3 | 3 | 2 | 2 |
| 7 | Lingga Bayu | 3 | 3 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Ranto Baek | 3 | 3 | 2 | 2 |
| 9 | Ulu Pungkut | 1 | 2 | 1 | 3 |
| 10 | Tambangan | 1 | 1 | 1 | 3 |
| 11 | Lembah Sorik Marapi | 2 | 2 | 1 | 3 |
| 12 | Puncak Sorik Marapi | 3 | 3 | 1 | 3 |
| 13 | Muara Sipongi | 2 | 3 | 1 | 3 |
| 14 | Payabungan | 2 | 3 | 3 | 1 |
| 15 | Payabungan Selatan | 2 | 3 | 1 | 1 |
| 16 | Payabungan Barat | 2 | 1 | 3 | 1 |
| 17 | Payabungan Utara | 2 | 1 | 3 | 1 |
| 18 | Payabungan Timur | 3 | 2 | 1 | 1 |
| 19 | Huta Bargot | 2 | 2 | 3 | 1 |
| 20 | Natal | 1 | 1 | 4 | 4 |
| 21 | Muara Batang Gadis | 2 | 2 | 4 | 4 |
| 22 | Siabu | 2 | 2 | 2 | 4 |
| 23 | Naga Juang | 3 | 2 | 3 | 4 |
| | Weight | 0,2 | 0,3 | 0,3 | 0,2 |

The final result of the ideal solution for the rubber plantation is as follows:

Table 7. The Preference Value of The Rubber Plantation

| Distric | Value | Ranking |
|---|---|---|
| Siabu | 0.56938682730811 | 1 |
| Lembah Sorik Marapi | 0.562357948894 | 2 |
| Tambangan | 0.56175943623131 | 3 |
| Bukit Malintang | 0.55544108297678 | 4 |
| Naga Juang | 0.55544108297678 | 5 |
| Kotanopan | 0.53744446250792 | 6 |
| Ulu Pungkut | 0.53744446250792 | 7 |
| Pakantan | 0.51065684291359 | 8 |
| Puncak Sorik Marapi | 0.51065684291359 | 9 |
| Muara Sipongi | 0.51022253844963 | 10 |
| Muara Batang Gadis | 0.50440288626509 | 11 |
| Natal | 0.48190444992693 | 12 |
| Batang Natal | 0.4377233768058 | 13 |
| Lingga Bayu | 0.4377233768058 | 14 |
| Ranto Baek | 0.4377233768058 | 15 |
| Payabungan Timur | 0.41459532382605 | 16 |
| Batahan | 0.37302178979839 | 17 |
| Sinunukan | 0.37302178979839 | 18 |
| Payabungan Barat | 0.36500573405374 | 19 |
| Payabungan Utara | 0.36500573405374 | 20 |
| Payabungan Selatan | 0.36346913658877 | 21 |
| Huta Bargot | 0.35207310508025 | 22 |
| Panyabugan | 0.33537499293319 | 23 |

From the calculation, we can determine that the area highly recommended is Siabu district, while the area not recommended is Payabugan district for rubber plantation. The final result of the ideal solution for the oil palm plantation is as follows:

Table 8. The Preference Value of The Oil Palm Plantation

| Distric | Value | Ranking |
|---|---|---|
| Batang Natal | 0.53467087652891 | 1 |
| Lingga Bayu | 0.53467087652891 | 2 |
| Ranto Baek | 0.53467087652891 | 3 |
| Payabungan Timur | 0.53465365229525 | 4 |
| Huta Bargot | 0.5168613898434 | 5 |
| Panyabugan | 0.50266042948436 | 6 |
| Payabungan Barat | 0.50168345455916 | 7 |
| Payabungan Utara | 0.50168345455916 | 8 |
| Payabungan Selatan | 0.48866190830181 | 9 |
| Pakantan | 0.4750449890252 | 10 |
| Puncak Sorik Marapi | 0.4750449890252 | 11 |
| Bukit Malintang | 0.46278273759928 | 12 |
| Naga Juang | 0.46278273759928 | 13 |
| Muara Sipongi | 0.42941964760573 | 14 |
| Lembah Sorik Marapi | 0.42801801835755 | 15 |
| Muara Batang Gadis | 0.41660326776286 | 16 |
| Batahan | 0.41060883445268 | 17 |
| Sinunukan | 0.41060883445268 | 18 |
| Siabu | 0.39609742209913 | 19 |

| | | |
|---|---|---|
| Natal | 0.36519193188955 | 20 |
| Kotanopan | 0.35812012822587 | 21 |
| Ulu Pungkut | 0.35812012822587 | 22 |
| Tambangan | 0.33181406496882 | 23 |

From the calculation, we can determine that the area highly recommended is Batang Natal district, while the area not recommended is Tambangan district for oil palm plantation. The final result of the ideal solution for the cocoa plantation is as follows:

Table 9. The Preference Value of The Cocoa Plantation

| Distric | Value | Ranking |
|---|---|---|
| Tambangan | 0.62855110465075 | 1 |
| Siabu | 0.62322981566 | 2 |
| Kotanopan | 0.62187907090507 | 3 |
| Ulu Pungkut | 0.62187907090507 | 4 |
| Natal | 0.57912238180828 | 5 |
| Lembah Sorik Marapi | 0.5768513625647 | 6 |
| Muara Batang Gadis | 0.57150665614346 | 7 |
| Bukit Malintang | 0.56384724704411 | 8 |
| Naga Juang | 0.56384724704411 | 9 |
| Muara Sipongi | 0.53362843402673 | 10 |
| Pakantan | 0.47706367108479 | 11 |
| Puncak Sorik Marapi | 0.47706367108479 | 12 |
| Batahan | 0.42406994061151 | 13 |
| Sinunukan | 0.42406994061151 | 14 |
| Batang Natal | 0.36873077076193 | 15 |
| Lingga Bayu | 0.36873077076193 | 16 |
| Ranto Baek | 0.36873077076193 | 17 |
| Payabugan | 0.32144373987322 | 18 |
| Huta Bargot | 0.32049790893688 | 19 |
| Payabugan Selatan | 0.31970147322884 | 20 |
| Payabugan Barat | 0.31964042463454 | 21 |
| Payabugan Utara | 0.31964042463454 | 22 |
| Payabugan Timur | 0.25592982445435 | 23 |

From the calculation above, we can determine that the area highly recommended is Tambangan district, while the area not recommended is Payabugan Timur district for cocoa plantation.

The preference results for each land in every subdistrict are as follows:

Table 10. The Recommendation Results from Each District

| Distric | Rubber Preference result | Oil Palm Preference result | Cocoa Preference result | Ranking |
|---|---|---|---|---|
| Tambangan | 0.5693868273 | 0.628551104 | 0.62855110465 | Cocoa |
| Siabu | 0.5623579488 | 0.623229815 | 0.62322981566 | Rubber |
| Kotanopan | 0.5617594362 | 0.6218790709 | 0.62187907090 | Cocoa |
| Ulu Pungkut | 0.5554410829 | 0.6218790709 | 0.62187907090 | Cocoa |
| Natal | 0.5554410829 | 0.579122381 | 0.57912238180 | Cocoa |
| Lembah Sorik Marapi | 0.5374444625 | 0.576851362 | 0.57685136256 | Oil Palm |
| Muara Batang Gadis | 0.53744446250 | 0.5715066561 | 0.57150665614 | Oil Palm |
| Bukit Malintang | 0.51065684291 | 0.5638472470 | 0.56384724704 | Oil Palm |
| Naga Juang | 0.51065684291 | 0.5638472470 | 0.56384724704 | Cocoa |
| Muara Sipongi | 0.51022253844 | 0.5336284340 | 0.53362843402 | Cocoa |
| Pakantan | 0.50440288626 | 0.4770636710 | 0.47706367108 | Cocoa |
| Puncak Sorik Marapi | 0.48190444992 | 0.4770636710 | 0.47706367108 | Rubber |
| Batahan | 0.43772337680 | 0.4240699406 | 0.42406994061 | Cocoa |
| Sinunukan | 0.43772337680 | 0.4240699406 | 0.42406994061 | Oil Palm |
| Batang Natal | 0.43772337680 | 0.3687307707 | 0.36873077076 | Oil Palm |
| Lingga Bayu | 0.41459532382 | 0.3687307707 | 0.36873077076 | Oil Palm |
| Ranto Baek | 0.37302178979 | 0.3687307707 | 0.36873077076 | Oil Palm |
| Payabugan | 0.37302178979 | 0.3214437398 | 0.32144373987 | Oil Palm |
| Huta Bargot | 0.36500573405 | 0.3204979089 | 0.32049790893 | Oil Palm |
| Payabugan Selatan | 0.36500573405 | 0.3197014732 | 0.31970147322 | Cocoa |
| Payabugan Barat | 0.36346913658 | 0.3196404246 | 0.31964042463 | Cocoa |
| Payabugan Utara | 0.3520731050 | 0.31964042463 | 0.31964042463 | Cocoa |
| Payabugan Timur | 0.3353749929 | 0.25592982445 | 0.25592982445 | Cocoa |

## 4. CONCLUSION

In its application, the Decision Support System using the TOPSIS algorithm for plantation land in Mandailing Natal Regency yielded the following recommendations based on the type of plantation land in each district:

1. Rubber plantation land is highly recommended in Siabu District with a preference value of 0.56938682730811.
2. Oil palm plantation land is highly recommended in Batang Natal District with a preference value of 0.53467087652891.
3. Lastly, cocoa plantation land is highly recommended in Tambangan District with a preference value of 0.62855110465075.

## REFERENCES

Abidin, N. A. S. Z., Avila, R. D., Hermatyar, A., & Rismayani, R. (2022). Comparison of K-Means and K-Medoids Algorithms for Grouping Cocoa Production Areas. In JUTISI (Jurnal Teknik Informatika dan Sistem Informasi). 8(2), 383-391. https://doi.org/10.28932/jutisi.v8i2.4897

Fadlisyah, F., Rosnita, L., & Pane, M. W. A. (2023). Decision Support System in Determining High School Student Specialization Using MOORA Method. In JICS (Journal of Informatics and Computer Science), 9(1), 65-70. https://doi.org/10.33143/jics.v9i1.2945

Fajriana, F. (2021). Analysis of the K-Medoids Algorithm in The Capture Fisheries Production Clustering System of North Aceh Regency. In JEPIN (Jurnal Edukasi dan Penelitian Informatika), 7(2), 263–269. https://dx.doi.org/10.26418/jp.v7i2.47795

Harahap, L. M., Fuadi, W., Rosnita, L., Darnila, E., & Meiyanti, R. (2022). Clustering of Featured Vegetables Using The K-Means Algorithm. In JUTISI (Jurnal Teknik Informatika dan Sistem Informasi), 8(3), 567-579. https://doi.org/10.28932/jutisi.v8i3.5277

Karlina, L., & Nurdiawan, O. (2023). Application of K-Medoids in Classifying The Distribution of Critical Land in West Java Based on District/City. In JATI (Jurnal Mahasiswa Teknik Informatika), 7(1), 527–532. https://doi.org/10.36040/jati.v7i1.6348

Khomsatun, K., Ikhsan, D., Ali, M., & Kursini, K. (2020). Decision Support System for Selecting Planting Areas in Wonosobo Regency Using K-Means Clustering and TOPSIS. In Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI), 9(1), 55. https://doi.org/10.23887/janapati.v9i1.23073

Marlina, D., Lina, N., Fernando, A., & Ramadhan, A. (2018). Implementation of K-Medoids and K-Means Algorithm for Grouping of Defect in Children. In Jurnal CoreIT: Jurnal Hasil Penelitian Ilmu Komputer dan Teknologi Informasi. 4(2), 64. https://doi.org/10.24014/coreit.v4i2.4498

Maulida, R. (2018). Application of Data Mining in Grouping Tourist Visits to Top Tourist Attractions in DKI Jakarta Province Using K-Means. In JISKA (Jurnal Informatika Sunan Kalijaga). 2(3), 167. https://doi.org/10.14421/jiska.2018.23-06

Mubarok, A., Suherman, H. D., Ramdhani, Y., Topiq, S. (2019). Decision Support System for Credit Granting Feasibility Using The TOPSIS Method. In Jurnal Informatika. 6(1), 37-46. https://doi.org/10.31311/ji.v6i1.4739

Risawandi, R., Rosnita, L., & Putra, R. K. (2023). Decision Support System for Predicting The Graduation of Informatics Students Using the SAW Method. In Journal of Informatics and Computer Science (JICS). 9(1), 58–64. https://doi.org/10.33143/jics.v9i1.2944

Rosnita, L., Yunizar, Z., & Ananda, E. F. (2024). Implementation of Data Mining in Determining Drug Purchase Patterns Using the Apriori Method. In Journal Serambi Engineering (JSE). 9(3), 9459-9466. https://doi.org/10.32672/jse.v9i3.1679

Sadli, M., Fajriana, F., Fuadi, W., Ermatita, E. & Pahendra, I. (2018). Application of The K-Nearest Neighbors Model in Classifying Electricity Demand for Each Area in Lhokseumawe City. In Jurnal ECOTIPE. 5(2), 11-18. https://doi.org/10.33019/ecotipe.v5i2.64668

Sulistyawati, A. A. D., & Sadikin, M. (2021). Application of the K-Medoids Algorithm to Determine Customer Segmentation. In Sistemasi, 10(3), 516. https://doi.org/10.32520/stmsi.v10i3.1332

Wahyuni, E. G. (2017). Decision Support System for Employee Recruitment Using The TOPSIS Method. In Jurnal Sains, Teknologi Industri, 14(1), 108–116.

Wira, B., Budianto, A. E., & Wiguna, A. S. (2019). Implementation of K-Medoids Clustering Method to Identify Study Program Selection Patterns of New Students in 2018 at Kanjuruhan University Malang. In RAINSTEK : Jurnal Terapan Sains & Teknologi, 1(3), 53–68. https://doi.org/10.21067/jtst.v1i3.304