Ittishal Educational Research Journal
January 2024, Vol. 5, No. 01, p. 28 - 40
http://journal.ittishal.net/index.php/ierj
https://doi.org/ 10.51425/ierj.v5i1.67

Simple additive weight method for determining promotion target for new student admission at STMIK Sinar Nusantara

Dziky Ridhwanullah[1], Budi Hartanto[2], Bayu Dwi Raharja[3]
[1]Sistem Informasi, STMIK Sinar Nusantara
[2]Informatika, STMIK Sinar Nusantara
[3]Sistem Informasi Akuntansi, STMIK Sinar Nusantara
Correspondence : dzikyr@sinus.ac.id, budihartanto@sinus.ac.id, bayudr@sinus.ac.id

ABSTRACT

Each university will hold PMB (New Student Admission) activities. Similar to STMIK Sinar Nusantara, which is one of private universities in Surakarta, these events are held annually to draw in individuals who wish to pursue higher education. This is a very significant activity for a private university, with a new improvement target each year. At a private university, the number of new students is crucial because it is the primary source of funding. Activities of New Student Admission (PMB) at STMIK Sinar Nusantara have shown a decreasing tendency for a number of years. Institutional development and instructional activities will be impacted by this. One of the reasons is the widespread adoption of promotional targets that lack a scholarly foundation. Therefore, a decision support system is required to solve this issue. This study aims to assist policy makers in selecting appropriate promotion targets. The technique in this research is Simple Additive Weighting (SAW). The school promotion targets derived from the school ranking order and cluster classification are the outcomes of this study. With a score of 0.96, SMKN 1 Bulukerto School got the highest preference computation score. SAW method-based decision support system has been successful in identifying the appropriate promotional targets. The results of this research can be used by policy makers organizing activities of new student admission in promoting STMIK Sinar Nusantara to increase the number of new students.

Keywords: Private College, New Student Admission, Decision Support System, Simple Additive Weighting

INTRODUCTION

STMIK Sinar Nusantara is one of Private Universities located in Surakarta, Central Java based on Minister Decree of National Education, Republic of Indonesia Number 173/D/0/2001 which at that time was the result of a transfer from AMIK Sinar Nusantara. This college has several computer education majors, namely accounting information systems, information systems, information engineering and informatics. Every year, universities will hold new student admission activities. STMIK Sinar Nusantara, Surakarta also carries out these activities in order to take people who want to continue their education to a higher level.

As a private college, new student admission activities are very important. Every year, they have different improvement targets. Its income from the number of new students in a private college is very serious because the main source of income is the number of new students obtained. Therefore, PTS tries to increase the number of students every year because it determines educational operations and future institutional development. Students at STMIK Sinar Nusantara mostly come from MA (Madrasah Aliyah/ Islamic Senior High School), SMA (Senior High School) and Vocational High School (Vocational Senior High School) graduates. It is known that currently the number of new students at STMIK Sinar Nusantara is experiencing a decreasing trend. Some of the problems that have been identified, one of which is promotional targets that are not based on research and are carried out massively.

Decision support systems can help bureaus of new students' admission to determine the right promotional targets. A decision support system is a system to support managerial decision makers in structured or semi-structured situations (Septilia et al., 2020). One method in a decision support system is to use SAW (Simple Additive Weighting). This method is one of MCDM (Multi Criteria Decision Making) methods (Yang et al., 2022) (Vafaei et al., 2021) (Dua, 2023). SAW is an algorithm that has a simple process and can be used in various fields of study (Taherdoost, 2023). This method was used in previous research to identify high-achieving pupils (Ramadhan & Nizam, 2021), promotion target (Sutrisno & Andriyani, 2021), selection of outstanding employees (Toresa et al., 2022), *lazismu* scholarship recipients (Yunia Pasa et al., 2022), determination of the best e-commerce (Ginting, 2020), new student admission (Hamsinar et al., 2021), determination of the business location (Wati, 2021), university

ranking (Irfan Ayhan, 2023), ethical performance of Islamic banks (Alhammadi et al., 2022), priority of learning methods (Ghassami et al., 2020), preferences for ecotourism impacts (Siolemba Patiro et al., 2023), vulnerability of land subsidence (Manafiazar et al., 2024), and career choice (Kulkarni & Gupta, 2022).

Based on those researches' background, this research applied a decision support system using Simple Additive Weighting (SAW) method to determine appropriate promotion targets based on school groupings (Public Senior High School (SMA)/ Vocational Senior High School(SMK)), namely school location, school reputation, number of alumni and school proximity. Therefore, these results can be used by new student admission bureau to provide policies for new student admission activities so that the amount of income from these activities can increase.

METHOD

This research is included as quantitative since Simple Additive Weighting (SAW) method was applied to calculate school promotion targets. Data collection and retrieval in this research were carried out by determining the promotion target area. The data collection and submission in this research was carried out by determining the promotion target area first. Data collection was then carried out by taking data from public senior high schools and vocational senior high schools in Indonesia Educational Statistics (Dapodik). The data collected is in the form of alternative data, criteria data and respective weights. The method steps in this research can be seen in Figure 1.

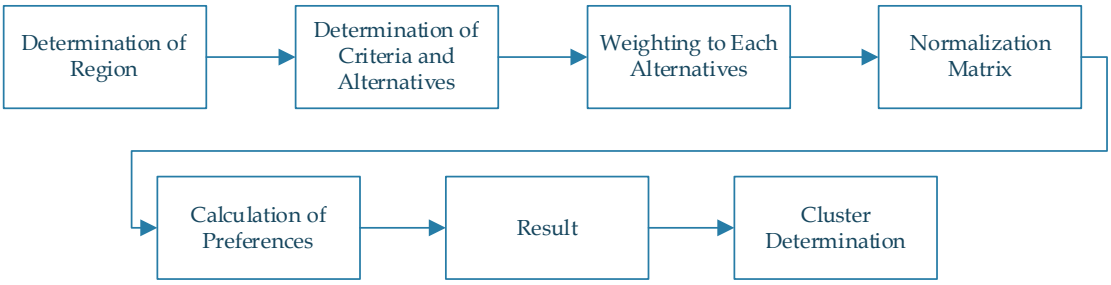

Figure 1 Research Method

Based on Figure 1, the research method are follows:

a. Determination of Region

   Determining the data for public senior high schools and vocational senior high schools covers the Surakarta residency area and school areas that have or have had

collaborations with universities.

b. Determination of Criteria and Alternatives

Determine the criteria that will be used as a reference (Ci). The criteria for determining the promotional target locations to be selected are based on the type and location of the school, the reputation of the school, the number of alumni and the proximity of the school. Meanwhile, the alternative is a list of high school and vocational schools.

c. Weighting to Each Alternatives

Weights are given on a rating scale of 1 to 5 and weights will be given a high value if the criterion is very important. Weight as the level of importance (W) where W = [W1, w2, w3,…wj].

d. Normalization Matrix

Formula of normalization matrix calculation

$$Rij = \begin{cases} \dfrac{X_{ij}}{max(x)_{ij}} & jika\ benefit \\ \dfrac{min(X)_{ij}}{X_{ij}} & jika\ cost \end{cases} \quad (1)$$

Rij	=	Normalized performance rating
Max Xij	=	The largest value of each criterion i
Min Xij	=	The smallest value of each criterion i
Xij	=	The attribute value of each criterion
Benefit	=	If the largest value is the best one
Cost	=	If the smallest value is the best one

e. Calculation of Preferences

$$V_i = \sum_{j=1}^{n} W_j R_{ij} \quad (2)$$

Vi	=	Ranking for each alternative
Wj	=	Ranking weight value (from each alternative)
Rij	=	Normalized performance rating value

f. Result

The results can be concluded from the largest value obtained from calculating the preferences for each alternative.

g. Cluster Determination

Grouping based on criterion variables will be analysed using SAW method. The results of the analysis will be used to determine promotional scheme priorities.

FINDINGS/RESULTS AND DISCUSSION

This section discusses research data analysis to clarify the discussion of data collection, criteria and alternatives, normalization, results and clusters.

1. Data Collection

At this section, this research data were from public senior high schools and vocational senior high schools in Surakarta residency covering Surakarta, Sukoharjo, Wonogiri, Karanganyar, Sragen, Boyolali and Klaten as well as additional areas of Pacitan, Ponorogo, and Ngawi regency. Alternative data was obtained with a total of data reaching 644 schools. The example data can be seen in Table 1.

Table 1 Example of School Data

Region Type	Region	School Data
City	Surakarta	SMAN 1 Surakarta
City	Surakarta	SMAN 2 Surakarta
City	Surakarta	SMAN 4 Surakarta
Regency	Boyolali	SMKN 1 Boyolali
Regency	Boyolali	SMKN 1 Banyudono
Regency	Boyolali	SMKN 1 Mojosongo

2. Determination of Alternative Weights

a. School Location

The location of school more or less determines their culture whether they continue to college or not. The more they move towards urban areas, the more their culture will be towards continuing their studies, where one of the main factors is economic conditions. Therefore, a school location rubric can be determined which can be seen in Table 2.

Table 2 School Location

No.	School and Location	Weight Value
1.	State High School in city	1
2.	State High School in regency	
3.	Private High School in city	
4.	Private High School in regency	2
5.	State High School in sub-district	

6.	State Vocational High School in city	
7.	Private Vocational High School in city	3
8.	Private High School in sub-district	
9.	State Vocational High School in regency	4
10.	Private Vocational High School in regency	
11.	State Vocational High School in sub-district	5
12.	Private Vocational High School in sub-district	

b. School Reputation

School reputation is seen from new student admission of Senior High Schools in 2023 (PPBD SMA/SMK 2023) on achievement lines for state schools and accreditation for private schools. The lowest average score on the achievement track is an indicator of a school's reputation. The higher the average lowest score, the more the school has a high reputation or is called a favorite. Therefore, a school reputation rubric can be determined, which can be seen in Table 3 to Table 4.

Table 3 Reputation of Public Schools

No.	Lowest Average of Achievement Track in PPDB SMA/SMK	Value
1.	91-100	1
2.	81-90	2
3.	71-80	3
4.	61-70	4
5.	Kurang dari 60	5

Table 3 Reputation of Private Schools

No.	School Accreditations	Value
1.	A / City	1
2.	A / Regency	2
3.	B	3
4.	C	4
5.	Not Accredited	5

c. Number of School Alumni

The number of school alumni who register with STMIK Sinar Nusantara is an indication that alumni at the school are already familiar with STMIK Sinar Nusantara. Alumni can also become promotional agents for the school. Therefore, a rubric for the number of school alumni in these 4 years can be determined according to active students which can be seen in Table 5.

Table 5 Number of Alumni

No.	Number of School Alumni	Value
1.	0	1
2.	1-3	2
3.	4-7	3
4.	8-10	4
5.	> 10	5

d. School Proximity

The closer the school to STMIK Sinar Nusantara, the easier it will be to carry out promotions. Therefore, a school proximity rubric can be determined which can be seen in Table 6.

Table 6 School Proximity

No.	**School Proximity**	**Value**
1.	There are never any joint activities and they are not linear	1
2.	Vocational School has a Linear Department	2
3.	Previous year's Promotion Target	3
4.	Collaboration with Field Work Practice	4
5.	Partnership Program (Tridharma PT) and Affiliated Collaboration	5

e. Value Conversion

Alternative value conversion was applied by entering criteria values on a scale of 1 to 5. Table 7 is an example of the results of converting alternative values according to the predetermined rubric.

Table 7 Alternatives

Alternatives	C1	C2	C3	C4
SMAN 1 Surakarta	1	4	2	3
SMAN 2 Surakarta	1	4	2	3
SMAN 4 Surakarta	1	4	2	3
SMKN 1 Boyolali	2	5	3	3
SMKN 1 Banyudono	5	5	1	3
SMKN 1 Mojosongo	5	5	1	1

3. SAW Method

a. Criteria Weight

The criteria consist of the school and location, the school's reputation, the number of school alumni who are pursuing further education and the proximity of the school to the institution. In Table 8, it can be seen that C1 has a weight of 30%, C2 35%, C3 10%

and C4 25%. The decision to assign weights in this study is based on the level of importance (W) of each criterion in which W=[W1,W2,W3,W4].

Table 3 Weight

Criteria ID	Criteria	Weight	Weight Percentage
C1	School Location	0,3	30%
C2	School Reputation	0,35	35%
C3	Number of School Alumni	0,1	10%
C4	School Proximity	0,25	25%
Total of Weight Percentage			100%

b. Normalization

In normalization, there was a decision matrix formed from table 7 value conversion from each alternative in criteria. The X value of each alternative (Ai) for each predetermined criterion (Cj), namely; i=1,2….m and j=1,2…n. The following is an example of the calculation of alternatives for SMAN 1 Surakarta and SMAN 2 Boyolali with criteria C1.

r1 = 1/maxC1 = 1/5 = 0,2

r4 = 2/maxC1 = 2/5 = 0,4

maxC1 is the maximum value for all alternatives in the 1st criterion (C1), namely 5. Examples of matrix normalization calculation results based on cases with several school samples can be seen in Table 9.

Table 4 Normalization

No.	Region	School Name	C1	C2	C3	C4
1	Surakarta	SMAN 1 Surakarta	0,2	0,8	0,4	0,6
2	Surakarta	SMAN 2 Surakarta	0,2	0,8	0,4	0,6
3	Surakarta	SMAN 4 Surakarta	0,2	0,8	0,4	0,6
4	Boyolali	SMKN 1 Boyolali	0,4	1	0,6	0,6
5	Boyolali	SMKN 1 Banyudono	1	1	0,2	0,6
6	Boyolali	SMKN 1 Mojosongo	1	1	0,2	0,2

c. Calculating Preference Values

Next, after you have finished creating the normalized matrix, you can calculate the preference value for each existing alternative. The results of this value are a reference as a ranking value. The following is a calculation to find the preference value. Some alternative examples are SMAN 1 Surakarta and SMKN 1 Boyolali.

A1 = 0,2*0,3 + 0,8*0,35 + 0,4*0,1 + 0,6*0,25

= 0,06 + 0,28 + 0,04 + 0,15
= 0,53

A4 = 0,4*0,3+1*0,35+0,6*0,1+0,6*0,1
= 0,12+0,35+0,06+0,15
=0,68

In this calculation, each criterion possessed by an alternative will be multiplied by the weight of each criterion and added up. The results of example calculations for sample respondents can be seen in Table 10.

Table 10 Preference Values

No.	School Name	C1	C2	C3	C4	$\sum Cn$
1	SMAN 1 Surakarta	0,06	0,28	0,04	0,15	0,53
2	SMAN 2 Surakarta	0,06	0,28	0,04	0,15	0,53
3	SMAN 4 Surakarta	0,06	0,28	0,04	0,15	0,53
4	SMKN 1 Boyolali	0,12	0,35	0,06	0,15	0,68
5	SMKN 1 Banyudono	0,3	0,35	0,02	0,15	0,82
6	SMKN 1 Mojosongo	0,3	0,35	0,02	0,05	0,72

d. Result

Based on the conclusion, the largest value was obtained from calculating the preferences for each alternative, the data for 644 schools, both Public Senior High School (SMA) and Private Senior High School (SMK), obtained the ranking results according to Simple Additive Weighting (SAW) method calculation. Examples of ranking results can be seen in Table 11.

Table 11 Ranking Results

No	**Region**	**School Name**	$\sum Cn$
1	Wonogiri	SMKN 1 Bulukerto	0,96
2	Sukoharjo	SMKN 1 Sukoharjo	0,93
3	Pacitan	SMK N 1 Donorojo	0,92
4	Klaten	SMKN 1 Pedan	0,86
5	Sukoharjo	SMKN 4 Sukoharjo	0,86
6	Karanganyar	SMKN 2 Karanganyar	0,85
7	Klaten	SMKN 1 Tulung	0,84
8	Wonogiri	SMKN 1 Pracimantoro	0,84
9	Wonogiri	SMKN 1 Kismantoro	0,84
10	Sukoharjo	SMKN 6 Sukoharjo	0,84

e. Cluster Determination

In this research, 3 clusters were determined in accordance with bureau policy of new college student admission. This cluster determination is based on the results of the previous ranking and then based on these results three clusters will be determined. Each cluster has the same number, namely 161. The results of this cluster have high, medium and low chances, which means the chance that students will continue their tertiary education at STMIK Sinar Nusantara. Examples of cluster results can be seen in Table 11.

Tabel 5 Cluster

No.	Cluster	Region	School Name
1	1	Wonogiri	SMKN 1 Bulukerto
2		Sukoharjo	SMKN 1 Sukoharjo
3		Pacitan	SMK Negeri 1 Donorojo
…		…	…
161		Sragen	SMKS Muhammadiyah 1 Sragen
162	2	Sragen	SMAN 1 Sambungmacan
163		Ponorogo	SMKS Hudatulmuna 2 Ponorogo
164		Surakarta	SMKN 6 Surakarta
…		…	…
322		Klaten	SMKS Muhammadiyah 3 North of Klaten
323	3	Klaten	SMKS Kristen 5 Klaten
324		Klaten	SMKS Muhammadiyah 4 Central Klaten
325		Klaten	SMKS Muhammadiyah 1 Prambanan
…		…	…
483		Karanganyar	SMAN Mojogedang

CONCLUSIONS

The research findings indicated that promotional targets for high school and vocational schools in designated areas can be set using a decision support system that applies SAW (Simple Additive Weighting) method. Based on the preference values of 644 school data, the promotion target priorities were successfully ranked by SAW's computations, and 483 schools were selected to be used as PMB promotion targets in 2024. Three clusters were created out of these targets. Every cluster has distinct goals for promotion. SMKN 1 Bulukerto is the first cluster with the highest preference value, at 0.96. SMAN 1 Sambungmacan is the second cluster with a preference value of 0.64, while SMAS Kristen 1 Klaten is the third cluster with a preference value of 0.56. PMB bureau stakeholders can thus use this to decide which promotions to run based on the clusters

that have been developed.

ACKNOWLEDGMENTS

The author would like to thank STMIK Sinar Nusantara Surakarta and New Student Admissions Committee division for providing permission to conduct research.

REFERENCES

Alhammadi, S., Alotaibi, K. O., & Hakam, D. F. (2022). Analysing Islamic banking ethical performance from Maqāṣid al-Sharīʻah perspective: evidence from Indonesia. *Journal of Sustainable Finance and Investment*, *12*(4), 1171–1193. https://doi.org/10.1080/20430795.2020.1848179

Dua, T. Van. (2023). *Combination Of Design Of Experiments And Simple Additive Weighting Methods: A New Method For Rapid Multi-Criteria*. *1*, 120–133. https://doi.org/10.21303/2461-4262.2023.002733

Ghassami, F., Yousefi, E., & Salehi, E. (2020). Prioritizing the teaching methods of ESD using an integrated fuzzy entropy–SAW algorithm (case study: technical and vocational schools). *Applied Environmental Education and Communication*, *19*(2), 205–220. https://doi.org/10.1080/1533015X.2019.1581113

Ginting, J. V. B. (2020). Penerapan Sistem Pendukung Keputusan Dalam Menentukan e-Commerce Terbaik Dengan Menggunakan Metode SAW. *Jurnal Media Informatika Budidarma*, *4*(1), 225. https://doi.org/10.30865/mib.v4i1.1986

Hamsinar, H., Musadat, F., & Eka Intansari, W. O. (2021). Penerapan Metode Simple Additive Weighting (Saw) Pada Sistem Pendukung Keputusan Penerimaan Siswa Baru. *Jurnal Informatika*, *10*(1), 36. https://doi.org/10.55340/jiu.v10i1.526

Irfan Ayhan, A. Ö. (2023). A practical framework for ranking universities by their competitive advantages: a mixed methods study on foundation universities in Turkey. *The TQM Journa*, *35*. https://doi.org/https://doi.org/10.1108/TQM-08-2022-0246

Kulkarni, K., & Gupta, P. (2022). *A Study on Graduate Students ' Decision-Making in Selecting Career Avenues*. *4*, 42–46. https://doi.org/10.54741/mjar.2.4.7

Manafiazar, A., Khamehchiyan, M., Nadiri, A. A., & Sharifikia, M. (2024). Learning simple additive weighting parameters for subsidence vulnerability indices in Tehran plain (Iran) by artificial intelligence methods. *European Journal of Environmental and Civil Engineering*, *28*(1), 108–127. https://doi.org/10.1080/19648189.2023.2205914

Ramadhan, M. R., & Nizam, M. K. (2021). Penerapan Metode SAW (Simple Additive Weighting) Dalam Pemilihan Siswa-Siswi Berprestasi Pada Sekolah SMK Swasta Mustafa. *TIN Terapan Informatika …*, *1*(9), 459–471. https://ejurnal.seminar-id.com/index.php/tin/article/view/655

Septilia, H. A., Parjito, P., & Styawati, S. (2020). Sistem Pendukung Keputusan Pemberian Dana Bantuan Menggunakan Metode Ahp. *Jurnal Teknologi Dan Sistem Informasi*, *1*(2), 34–41. https://doi.org/10.33365/jtsi.v1i2.369

Siolemba Patiro, S. P., Hendarto, K. A., Parmono, V. R., Wibowo, L. R., Suka, A. P., Abdurakhman, A., Pramusita, A., Al Hasan, R., Yumantoko, Y., Nandini, R., Susila, I. W. W., Desmiwati, D., Wisudayati, T. A., Njurumana, G. N., Yuniati, D., Pratama, Y. S. A., & Yatma, T. D. N. (2023). Analyzing residents' preferences to ecotourism impacts using simple additive weighting: The case of Mount Rinjani National Park, Indonesia.

Forest Science and Technology, *20*(1), 25–37. https://doi.org/10.1080/21580103.2023.2284282

Sutrisno, B. T., & Andriyani, W. (2021). Penerapan Madm Dengan Metode Saw Untuk Menentukan Target Promosi Berdasarkan Asal Jurusan Di Sekolah. *Simetris: Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer*, *11*(2), 480–492. https://doi.org/10.24176/simet.v11i2.4784

Taherdoost, H. (2023). Analysis of Simple Additive Weighting Method (SAW) as a MultiAttribute Decision-Making Technique: A Step-by-Step Guide. *Journal of Management Science & Engineering Research*, *6*(1), 21–24. https://doi.org/10.30564/jmser.v6i1.5400

Toresa, D., Ahmad Zamsuri, Yogi Yunefri, & Nurfika Sari. (2022). Penerapan Metode Saw Dalam Pemilihan Pegawai Berprestasi Berdasarkan Evaluasi Kinerja Berbasis Kepada Sistem Pendukung Keputusan. *SATIN - Sains Dan Teknologi Informasi*, *8*(1), 92–105. https://doi.org/10.33372/stn.v8i1.770

Vafaei, N., Ribeiro, R. A., & Camarinha-Matos, L. M. (2021). Assessing Normalization Techniques for Simple Additive Weighting Method. *Procedia Computer Science*, *199*, 1229–1236. https://doi.org/10.1016/j.procs.2022.01.156

Wati, E. F. (2021). Penerapan Metode SAW Dalam Menentukan Lokasi Usaha (Embun Fajar Wati) |241 Universitas Bina Sarana Informatika Jl. *Jurnal Sains Komputer & Informatika (J-SAKTI*, *5*(1), 21231170.

Yang, W. C., Ri, J. B., Yang, J. Y., & Kim, J. S. (2022). Materials selection criteria weighting method using analytic hierarchy process (AHP) with simplest questionnaire and modifying method of inconsistent pairwise comparison matrix. *Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications*, *236*(1), 69–85. https://doi.org/10.1177/14644207211039912

Yunia Pasa, I., Wachid Adi Prasetya, N., & Hafsarah Maharrani, R. (2022). Penerapan Metode SAW Pada Penentuan Penerima Beasiswa Lazizmu. *Jurnal Intek*, *5*(1), 81–89.