IMPLEMENTATION OF SMARTER METHOD FOR PROSPECTIVE STUDENT COUNCIL SELECTION SYSTEM SMK NEGERI 1 REMBANG

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Abstract— *One of the schools that has attempted to make the student council active and the primary platform for student development to encourage student activities at school is SMK Negeri 1 Rembang. OSIS administrators can execute numerous labor programs in both academic and non-academic domains. Participants must pass several selection processes to join the SMK Negeri 1 Rembang OSIS board. This student council board's election procedure still employs manual methods. The selection procedure may take longer and allow for subjective evaluations depending on the number of candidates and the criteria used. As a result, it is essential to develop a decision support system (SPK) that uses Rank Order Centroid (ROC) weighting and the Simple Multi-Attribute Rating Technique Exploiting Rank (SMARTER) method to help choose student council administrators. The SMARTER technique addressed disproportionality because the weights assigned do not provide a hierarchy or order of importance between the current criteria and their sub-criteria. Based on the computation of the final value of the standards and sub-criteria on each alternative, the system produces results in the form of the biggest to most minor order. Blackbox testing of this program demonstrates that it can operate and be used at SMK N 1 Rembang both in terms of functionality and outcomes from the system.*

Keywords: *Simple Multi-Attribute Rating Technique Exploiting Ranks; SMARTER, Rank Order Centroid (ROC); Decision Support System*

Abstrak— *SMK Negeri 1 Rembang adalah salah satu sekolah yang sudah mengusahakan keaktifan OSIS dan menjadikan OSIS sebagai wadah pembinaan kesiswaan yang utama untuk menunjang kegiatan-kegiatan siswa di sekolah. Pengurus OSIS bisa melakukan program kerja hingga puluhan program kerja baik dalam bidang akademik maupun non akademik. Untuk menjadi pengurus OSIS SMK Negeri 1 Rembang harus melalui beberapa tahapan seleksi. Proses penyeleksian pengurus OSIS ini masih menggunakan cara manual. Banyaknya pendaftar dan kriteria yang diterapkan dapat membuat proses pemilihan menjadi lebih lama dan memungkinkan penilaian yang bersifat subyektif. Oleh karena itu, perlu dibangun sebuah sistem pendukung keputusan (SPK) untuk membantu dalam menentukan pengurus OSIS dengan implementasi metode Simple Multi Attribute Rating Technique Exploiting Rank (SMARTER) dan menggunakan pembobotan Rank Order Centroid (ROC). Metode SMARTER dipilih untuk mengatasi ketidakproporsionalan karena bobot yang diberikan tidak memberikan jarak dan prioritas antar kriteria dan subkriteria yang ada. Hasil sistem berupa urutan terbesar hingga terkecil berdasarkan perhitungan nilai akhir dari kriteria dan sub kriteria pada setiap alternatif. Perangkat lunak ini diuji secara blackbox testing yang menunjukan sistem dapat berjalan dan digunakan dengan baik di SMK N 1 Rembang baik dari sisi fungsional maupun hasil dari sistem.*

Kata Kunci*: Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER), Rank Order Centroid (ROC), Sistem Pendukung Keputusan*

INTRODUCTION

The intra-school organization's (OSIS) administrators are the forerunners of future leaders. They must drive behavior change in their respective schools so that they become better (Ramaditya et al., 2020). OSIS aims to gather students' ideas, thoughts, talents, creativity, and interests into one of the containers within the school environment. OSIS will function effectively if it is supported by high activity from students. The only authorized forum in schools for accommodating and directing creativity through extracurricular activities that support the curriculum and those that are outside the curriculum is this intra-school structure. Students who are elected as administrators run and oversee the OSIS.

Many different types of characteristics must develop in students. One of them is responsibility, one of the many characteristics crucial for developing in students. Responsibility here is the attitude and actions of individuals to be

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able to carry out obligations and tasks that must be carried out on oneself, society, and the surrounding environment (Septiyaningrum & Listyaningsih, 2021). SMK Negeri 1 Rembang is one of the vocational high schools in Rembang Regency, Central Java Province. This school is a reference school in Rembang Regency with six competencies: Online Business and marketing, Software Engineering, Motorcycle Engineering and Business, and Community and Clinical Pharmacy (SMK Negeri 1 Rembang, 2023). The number of skill competencies is directly proportional to the number of classes opened for new students. So that it can add to the activities or work programs carried out by the OSIS board, the OSIS management of SMK Negeri 1 Rembang can carry out up to dozens of work programs in both academic and non-academic fields. It is not surprising that the student council committee is known by students and teachers at school because of their work in various activities. This will also affect new students interested in becoming OSIS administrators at SMK Negeri 1 Rembang. Until now, the stages for accepting OSIS administrators are still the same, namely the written test and interview test with the criteria determined by the committee. The process of selecting the OSIS administrators is still using the manual method. The many applicants and the requirements applied can shorten the selection process.

A decision support system can be an alternative solution to help the manager get the accurate result. Hence, this extends the decision-maker's capacity to process the information involved in making a decision (Marakas, 2003). DSS systems can also help identify, solve problems, and decide to find the best alternative (Syafrinal & Aldo, 2020). Decision support system application is nonroutine, as needed (Turban et al., 2005). Decision support systems can help decision-makers with data processed as relevant and necessary to make decisions about a problem more quickly and accurately (Angeline, 2018; Pami, 2017; Sofiah & Septiana, 2017).

Therefore, a decision support system is needed to assist the committee in selecting the OSIS board of SMK Negeri 1 Rembang. Many methods can be used in a decision-making system. Still, the authors will use the Simple Multi-Attribute Rating Technique Exploiting Rank (SMARTER) method in selecting student council administrators because this multi-attribute decision-making method supports decision-makers in choosing several alternatives. The SMARTER method is developing the SMART (Simple Multi-Attribute Rating Technique Exploiting Rank) method (Schramm & Morais, 2012). The development of this method is in the form of weighting criteria that will be used in determining the weight of each criterion based on ROC calculations (Schramm & Morais, 2012). In the SMARTER method, the decision maker gives the weighting directly so that the weighting procedure is considered disproportionate. To overcome this, Each weight must correctly reflect each criterion's distance and priority. The SMARTER method uses the ROC weighting equation (Danielson & Ekenberg, 2017). The advantage of the technique with calculations using ROC is the criteria weighting process so that the consistency of the distance between criteria can be maintained. The ROC technique will give weight to each bar by the ranking assessed based on the level (Schramm & Morais, 2012).

The reward is given to Education Personnel (Tendik) as a form of appreciation for performance in tertiary institutions. Giving rewards to Tendik must be based on proper and accurate performance appraisals. Decision-making, intuition, Attitude, Communication, and Discipline are the criteria used in this study with nine alternative data. Applying SMARTER and ROC concludes that alternative A4 has the highest performance rating with a final score of 0.6425 or a percentage value of 64.25% (Utomo & Purba, 2021). Other research from Mustafa about choosing the best whey protein. It uses the SMARTER method, and the test uses the Technology Acceptance Model (TAM) for usefulness (Mustofa et al., 2022). A study from Nasution about OSIS Chair Selection uses SMARTER and ROC for the system. With four criteria, this study indicates that 75% of OSIS coaches and members need a computerized decision-making system to determine the next OSIS chair candidate (Nasution & Nusa, 2022). Similar to research by Dinar about scholarship acceptance, it is necessary to create a decision support system by determining criteria and alternatives (Perdana et al., 2022).

Five criteria will be used: senior classmate poll, interview (consisting of aspects/sub-criteria of attitude, responsibility, discipline, manners, public speaking), written test, organizational experience, and other achievements.

The design of this Decision Support System application uses system design with UML (Unified Modeling Language). Not all diagrams will be used in this study. The diagram shown is a class diagram. Class diagrams describe the types of objects in the system and the relationships between them. Class diagrams also show the properties and operations of a class and the constraints contained in the object relationships. UML uses the term feature as a general term that includes the properties and operations of a class (Nugroho, 2005).

MATERIALS AND METHODS

The SMARTER method is a multi-criteria decision-making method. This multi-criterion decision-making technique is based on the theory that each alternative consists of several criteria with values, each with a weight that describes how important it is compared to other criteria. The weighting in the SMARTER method uses a range between 0 and 1, making it easier to calculate and compare the value of each alternative (Edwards & Barron, 1994). The difference between the SMARTER method and the previous methods, namely SMART and SMARTS, lies in weighting. The criteria weighting in the three methods depends on the order of priority of the attributes, where the first order is occupied by attributes considered the most important. However, in the SMARTER method, the weighting calculation uses the Rank-Order Centroid (ROC) formula. For each step, summarize in the flowchart shown in Figure 1.

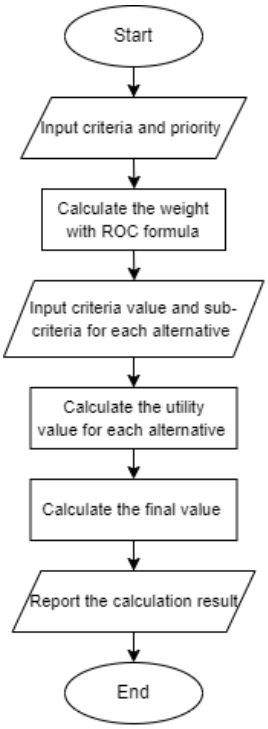

Figure 1. SMARTER Method Process

The completion steps of the SMARTER method are as follows.

1. Determine the criteria to be used. Table 1 shows all criteria determined by the SMK Negeri 1 Rembang student council. The written **test** is carried out using basic materials and academic potential. The aspects assessed in the **interview** are attitude, responsibility, discipline, manners, and public speaking. **Organizational experience** can be from official school organizations or outside of school. **Achievements** in this case are academic championship achievements and non-academic championships from the district to the provincial level.

Table 1. Criteria Data

Criteria	Range	Score
Senior classmate poll	1 - 6	1
	7 - 13	2
	14 - 20	3
	21 - 27	4
	28 - 32	5
Written test	1 - 20	1
	21 - 40	2
	41 - 60	3
	61 - 80	4
	81 - 100	5
Organizational experience	Yes	5
	No	0
Achievements	3rd place at district level	1
	2nd place at district level	2
	1st place at district level	3
	1st, 2nd, 3rd place at urban village level	4
	1st, 2nd, 3rd place at province level	5
Interview	1 - 20	1
	21 - 40	2
	41 - 60	3
	61 - 80	4
	81 - 100	5

2. Determine the sub-criteria of each predetermined criterion.
3. Determine the ranking/priority of each criterion and sub-criteria used.
4. Calculate the weight of each criterion and sub-criteria using the Rank-Order Centroid (ROC) formula.

$$Wk = \frac{1}{K} \sum_{i=k}^{K} \frac{1}{i} \quad \text{..... (1)}$$

Description:
W: Criterion weighting value
K: The Number of criteria
i: Alternative score

5. Calculating the utility value obtained from multiplying the weighting value of alternatives to the criteria multiplied by the weight of the criteria (Hermawan, 2005).
The formula for calculating utility is :

$$v(x) = \sum_{i=1}^{n} wi\ vi\ (x) \quad \text{..... (2)}$$

Description:

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Wi = The weight that affects the dimension i to the overall evaluation value
Vi = Evaluation object in dimension i
n = number of different value dimensions

6. The final value calculation is the utility value multiplied by the criterion weight value. This last result will determine the choice that will be selected. The absolute value is calculated using the formula:

$$n_1 = \sum_{j=1}^{k} nw_j \; u_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Description:
Wj = weight of the 1st criterion
Uij = Utility value of jth criterion for i-th student
ni = Final Score

RESULT AND DISCUSSION

The number of candidates is ten students with five criteria. Shown in table 2.

Table 2. Criteria, Sub-criteria, Priority, and Weight

C	P	W	S-C	P	W
K1	1	0.456667	-	-	-
K2	2	0.256667	SK1	1	0.456667
			SK2	2	0.256667
			SK3	3	0.156667
			SK4	4	0.09
			SK5	5	0.04
K3	3	0.156667	-	-	-
K4	4	0.09	-	-	-
K5	5	0.04	-	-	-

C is Criteria, P is Priority, W is Weight, and S-C is Sub-Criteria. K1 is the Senior classmate poll, K2 is an Interview, K3 is a Written test, K4 is Organizational experience, and K5 is Achievements.

Table 3. Alternatives Value Data (K1, K3, K4, K5)

Candidate	K1	K3	K4	K5
D1	5	4	5	3
D2	2	3	0	0
D3	3	4	5	3
D4	4	4	5	0
D5	4	5	0	0
D6	5	4	5	3
D7	4	4	5	0
D8	3	4	0	3
D9	5	4	5	0
D10	4	4	0	0

Table 3 shows ten candidates with their value data in K1 (Senior classmate poll), K3 (Written test), K4 (Organizational experience), and K5 (Achievements) criteria. The ten candidates are the names of the students who applied for OSIS participants. This data is data that has been changed according to the value parameters of each criterion.

Table 4. Alternatives Value Data (K2)

Cand.	K2				
	SK1	SK2	SK3	SK4	SK5
D1	5	5	5	5	5
D2	4	4	4	4	4
D3	4	5	5	4	4
D4	5	5	5	5	4
D5	5	5	4	5	5
D6	5	5	5	5	5
D7	5	5	5	5	5
D8	3	4	4	4	4
D9	4	5	5	4	4
D10	5	4	4	4	4

Table 4 shows ten candidates' value data in K2 (Interview) criteria. This data is placed separately because the Interview criterion has five sub-criteria.

After giving the value of each criterion, the next step is to calculate the utility value using formula 2.

Table 5. Utility Value (K1, K3, K4, K5)

Candidate	K1	K3	K4	K5
D1	2.283	0.626	0.45	0.12
D2	0.913	0.47	0	0
D3	1.37	0.626	0.45	0.12
D4	1.826	0.626	0.45	0
D5	1.826	0.783	0	0
D6	2.283	0.626	0.45	0
D7	1.826	0.626	0.45	0.12
D8	1.37	0.626	0	0
D9	2.283	0.626	0.45	0
D10	1.826	0.626	0	0

The value of utility for K1 (Senior classmate poll), K3 (Written test), K4 (Organizational experience), and K5 (Achievements) criteria for every candidate is shown in Table 5. The score comes from a calculation using 2nd formula described in the results and discussion chapter.

Table 6. Utility Value (K2)

Cand.	K2					Sum of SK
	SK1	SK2	SK3	SK4	SK5	
D1	2.283	1.283	0.783	0.45	0.2	5
D2	1.826	1.026	0.626	0.36	0.16	4
D3	1.826	1.283	0.783	0.36	0.16	4.41
D4	2.283	1.283	0.783	0.45	0.16	4.96
D5	2.283	1.283	0.626	0.45	0.2	4.84
D6	2.283	1.283	0.783	0.45	0.2	5
D7	2.283	1.283	0.783	0.45	0.2	5
D8	1.37	1.026	0.626	0.36	0.16	3.54
D9	1.826	1.283	0.783	0.36	0.16	4.41
D10	2.283	1.026	0.626	0.36	0.16	4.46

The value of utility for K2 (Interview) for every candidate is shown in Table 6. The score comes from a calculation using 2nd formula described in the results and discussion chapter. This data is placed separately because the Interview criterion has five sub-criteria.

The next step is to calculate the total value for each criterion.

Table 7. Total Value

Cand.	K1	K2	K3	K4	K5	TV
D1	2.28	1.28	0.63	0.45	0.12	4.762
D2	0.91	1.03	0.47	0	0	2.41
D3	1.37	1.13	0.63	0.45	0.12	3.699
D4	1.83	1.27	0.63	0.45	0	4.176
D5	1.83	1.24	0.78	0	0	3.853
D6	2.28	1.28	0.63	0.45	0	4.643
D7	1.83	1.28	0.63	0.45	0.12	4.306
D8	1.37	0.91	0.63	0	0	2.906
D9	2.28	1.13	0.63	0.45	0	4.492
D10	1.83	1.14	0.63	0	0	3.597

Table 7 shows the total value of all criteria (K1 for Senior classmate poll, K2 for Interview, K3 for Written test, K4 for Organizational experience, and K5 for Achievements) for every candidate. The score comes from a calculation using 3rd formula described in the results and discussion chapter.

The final step is to determine the ranking of the absolute value.

Table 8. Ranking Result

Cand.	K1	K2	K3	K4	K5	TV
D1	2.28	1.28	0.63	0.45	0.12	4.762
D6	2.28	1.28	0.63	0.45	0	4.643
D9	2.28	1.13	0.63	0.45	0	4.492
D7	1.83	1.28	0.63	0.45	0.12	4.306
D4	1.83	1.27	0.63	0.45	0	4.176
D5	1.83	1.24	0.78	0	0	3.853
D3	1.37	1.13	0.63	0.45	0.12	3.699
D10	1.83	1.14	0.63	0	0	3.597
D8	1.37	0.91	0.63	0	0	2.906
D2	0.91	1.03	0.47	0	0	2.41

Based on Table 8, alternative D1 gets a predicate as the best prospective student council with a 4,762 total value. All full scores are ranked and sorted. The one with the most significant score becomes the best candidate.

Class Diagram

This decision support system is web-based, and the class diagram design is shown in Figure 2. The class diagrams are Siswa, Criteria, Valuation, Sub-Criteria, and User.

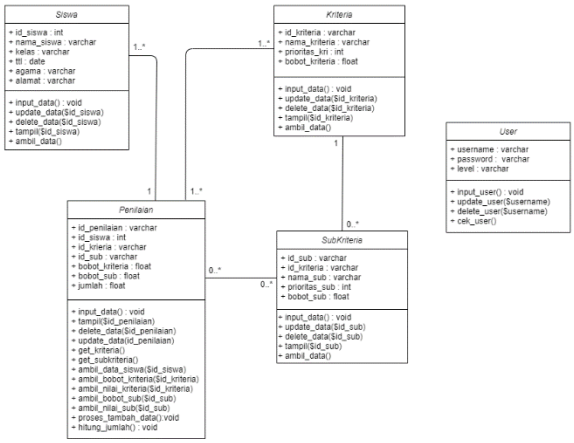

Figure 2. Class Diagram

Figure 3 shows the ranking result interface. It comes from the calculation of input criteria and alternatives in the system. The system will calculate with the input formula of SMARTER and ROC.

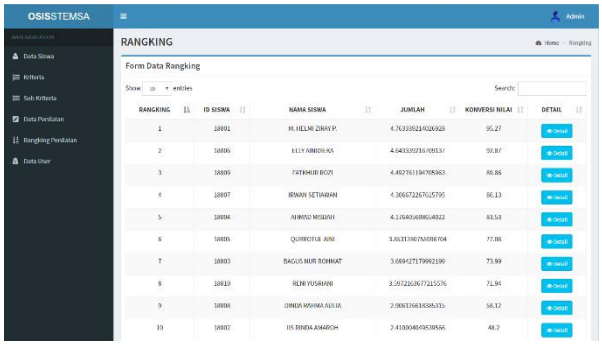

Figure 3. Ranking Result Interface

The best prospective student council with a 4,762 total value is shown in Figure 3.

CONCLUSION

The Simple Multi-Attribute Rating Technique Exploiting the Rank (SMARTER) method can be applied or implemented for a decision support system for selecting Candidates for OSIS Management at SMK Negeri 1 Rembang. The SMARTER method has several stages, namely determining the criteria and sub-criteria used, determining the priority of each criterion and sub-criteria, calculating the weight of each using the ROC formula, calculating utility, and calculating the final value. Based on the calculation, alternative D1 gets a predicate as the best prospective student council with 4,762 total values.

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