Selection of Pencak Silat Athletes to Represent the Single Defense Arts Competition Using Multi Atribute Utility Theory

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Abstract*— Pencak Silat is one of the original martial arts from Indonesia. Besides being useful for protecting oneself from threats and introducing indigenous Indonesian culture, pencak silat is one of the martial arts sports that is often contested in sports championship events at the national and international levels. There are 3 categories in the pencak silat martial arts competition, one of which is the single art category. This study aims to enable the coaches of Pencak Silat achievements to determine which Pencak Silat athletes are eligible to participate in the Pencak Silat martial arts competition in the single art category, using a decision support system with the Multi Attribute Utility Theory (MAUT). The data collection was based on the results of interviews and data from the pencak silat athletes at the "Setia Hati Terate" Pecat Silat hermitage which was located on Jalan Abdul Wahab Syahrani Polder Air Hitam Samarinda, East Kalimantan.

Keywords*— pencak_silat; athlete; DSS; single_category, MAUT

I. INTRODUCTION

Pencak silat is one of the pearls of Indonesian cultural wealth. Pencak silat colleges are spread in almost all regions in Indonesia with various names and sects, including in the city of Samarinda. Pencak Silat has 3 categories namely; match singles, doubles and team categories. The competition category is a category that features two fighters from different angles. Both face each other using elements of defense and attack, namely: parrying or dodging or hitting or attacking the target and knocking down the opponent, using competitive techniques and tactics, stamina and fighting spirit, using rules by utilizing a wealth of techniques. Single category or single art is a category in which a fighter demonstrates his skills in the Baku [1-14]

Single Kick in a correct, precise, steady and full of spirit. The Doubles and Teams categories are categories that feature 2 and 3 fighters from the same team, demonstrating the skills and richness of their martial arts attack techniques.

The Single Art category is one of the most difficult categories to assess, because it requires higher accuracy than other categories. Therefore, it is necessary to determine the best athlete who is most suitable to participate in the single art category of martial arts competition at the provincial level,the Achievement Trustees of the "Setia Hati Terate" Brotherhood Padepokan Samarinda branch takes a long time and the selection is still using conventional methods. To help solve the problems above, a decision support system is needed as a tool to select pencak silat athletes who will take part in a single art category of martial arts competition. The decision support system uses the Multi Attribute UtilityTheory (MAUT) method for its assessment method [1-14].

The formulation of the problem in this study is how to build a system for selecting the best Pencak Silat athletes to represent in the single art category competition at the provincial and national levels, using the MAUT Method. The assessment criteria data were obtained from Pencak Silat coaches who used to assess and prepare athletes to compete. The criteria used for the selection of pencak silat athletes in the category of single martial arts are as follows: Body posture, Memorizing moves, Flexibility, Stamina, Mental, and Experience [1-14].

II. LITERATURE REVIEW

A. Pencak Silat

Pencak silat is an original martial art from Indonesia. Pencak is a beauty step movement by avoiding. Pencak can be competed as a means of achievement, while silat is an element of self-defense techniques to fend off, attack and lock that cannot be demonstrated in public. The Indonesian Pencak Silat Association (IPSI) is an Indonesian national organization that officially oversees Pencak Silat activities, including organizing matches and making policy rules and regulations. Pencak silat competitions were also held and participated in by several countries outside Asia, such as Luxembourg, France, England, Denmark, West Germany, Suriname, the United States, Australia, and New Zealand.

In fact, each group of people has structured their own style and techniques on the basis of the territory, the physical characteristics, the potential enemy and their need to fight to defend themselves and survive. Cimande is style that favors the conditioning of the body and that bases its fighting tactics on dodging the opponent’s blow to enter then hitting in a devastating way. It is typical of the styles of the Sunda ethnicity. The Cimande is the oldest and most recognized

style. Cikalong: as famous as Cimande, Cikalong is another style that has largely contributed to influencing many more "modern" Silat styles. This style owes its name to a city near Bandung and its peculiarity is to work mainly on the sensitivity of the arms and body, as well as on the use of joint levers, grips and open hand strikes. Cingrik is coming from the area of Jakarta, and it is quick and elusive techniques were born from the imitation of the movements of monkeys, animals common on the island. Sabahndar is the style comes from the village of the same name and brings together the Sunda and Minang cultures in its techniques and tradition. Setia Hati is a Minang-derived style known for thefluidity of it has kicks, effectively brought from both ground and standing position. Sera is the mother art from Bukti Negara that part of the styles practiced and safeguarded by the Naga Kuning Institute. Pencak Silat today is divided intofour main aspects: sports combat, self-defense, dance (culture and art) and mind and spirit (Fig. 1) [1-14].

Fig. 1. Pencak Silat as culture and art

The categories that are contested in each competition are the fighting category and the art category. The age groups that are competed in the competition are divided into three groups, namely the pre-teen age group, the adolescent age group, and the adult age group. The sparring category is a category of pencak silat competition that features two fighters from different camps. Both face each other using elements of defense and attack, namely parrying or dodging or hitting or attacking the target and bringing down the opponent. The art category is one of the pencak silat competitions which are contested by demonstrating their skills in standard moves correctly, precisely and steadily, full of soul, with bare hands and armed and subject to the provisions and regulations that apply in this category. The art category has three categories, namely single category, double category, and team category [1- 14].

B. Athlete

An athlete or sportsman is someone who is proficient in sports and other forms of physical exercise. Athletes can be referred to as sportsmen, especially those who participate in competitions or competitions (strength, agility, and speed). In certain sports, athletes must have higher than average physical abilities. Often this word is used to refer specifically to athletic participants. So that athletes can be interpreted as individuals who are unique and have their own talents, then have patterns of behavior and personality and have a background in life that specifically affects them [1-7].

C. Pencak Silat Competition Category

There are 4 categories in the pencak silat competition:

1) Competition Category

The match category shows 2 people from two different angles (red and blue) that attack each other to win. The attack definitely uses the rules that exist in pencak silat and the rules that have been set by the competition committee. In the competition category, there are class divisions that are separated according to age and weight. So that there will not be a big enough gap in the competition [1][7-8].

2) Single Category

This category only features a fighter who performs a single artistic move. The element of beauty can be felt in the single category because the fighter must make steady and correct movements according to the standards and must comply with the rules that have been set (Fig. 2).

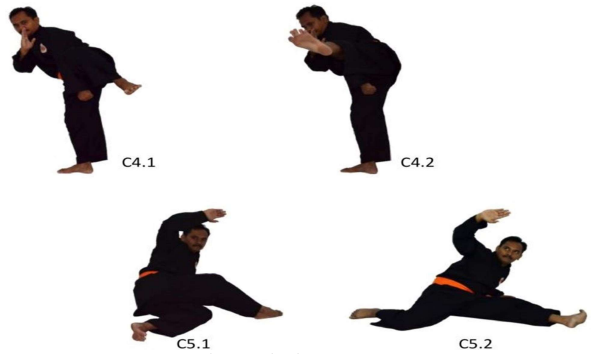

Fig. 2. Single Category

3) Double Category

The doubles category is similar to the sparring category in that there are 2 fighters, but those competing in this category are from the same team. They demonstrate proficiency in attack-defense techniques. Their movements are shown in a planned, effective, aesthetic, steady and logical way in a series of movements. At the beginning 2 fighters from the same team started the movement with their bare hands followed by weapons.

4) Team Category

This category is carried out by 3 fighters from the same team. They perform standard moves at the same time. These three fighters performed their movements steadily, full of soul and compact with their bare hands (Fig. 3) .

Fig. 3. Team Category

D. The Multi Attribute Utility Theory (MAUT) Method

The Multi Attribute Utility Theory method is a scheme in which the final evaluation, v(x), of an object x is defined as a weight that is summed with a value relevant to its dimension value. The expression commonly used to refer to it is utility value. The Multi Attribute Utility Theory method is used to change from several interests into a numeric value with a scale of 0-1 with 0 representing the worst choice and 1 being the best. This allows direct comparison of various sizes. The end result is a ranking order of alternative evaluations that describes the choices of the decision makers. Alternative evaluation is obtained by normalizing alternative weights with equation 1 [15-25]:

$$U_{(x)} = \frac{x - x_i^-}{x_i^+ - x_i^-} \quad \text{..... (1)}$$

Where U(x) is the normalized alternative weight, xi is the alternative weight, x - is the worst (minimum) weight of the the criterion, x + is the best (maximum) weight of the criterion. Calculation attribute normalization utility is based on Equation 2,

$$V_{(x)} = \sum_{i=1}^{n} w_j . x_{ij} \quad \text{..... .. (2)}$$

Where V(x) is the overall value of the alternative choice of a sub-criteria, Wj is the weight of the criteria, xij is the value of the alternative choice of a sub-criteria, i is the alternative choice, j sub-criteria, n the number of research samples.

III. RESEARCH METHOD

A. Data Collection

Data collection methods were carried out by means of literature review, observation and direct interviews with trainers, to obtain data on athletes to be selected and other supporting information about Pencak Silat athletes. Interviews were conducted on Mrs. Sri Murni, M.Sc. as the head of the Samarinda branch of Performance Development. The resource person is tasked with fosteringt pencak silat athletes who will take part in the Samarinda branch of the pencak silat competition.

This research was conducted at the Padepokan Pencak Silat Brotherhood of the Heart of Terate, Samarinda branch, having its address at Jalan Abdul Wahab Syahrani Polder Air Hitam Samarinda, East Kalimantan. The time for the research to be carried out is approximately 6 months, starting from January 13 to July 13, 2021.

B. Data analysis

The data obtained are criteria data as material for determining athletes who are eligible to take part in the pencak silat competition in the form of numerical values and scores in the form of narratives. The value in the form of a narrative will be converted into a number according to the results of an interview with Mrs. Sri Murni as anachievement coach at the Faithful Heart Terate BrotherhoodPencak Silat Padepokan. In this research method, there are weights and criteria needed to determine the process ofselecting the best athletes who will take part in the pencak silat competition in the single art category. This study has 6 criteria, namely, body posture, memorization of moves, flexibility, stamina, mentality and experience. These 6 criteria can be seen in Table I.

TABLE I. 6 CRITERIA AND WEIGHTING

No	Criteria	Weight
1	Posture	10
2	Memorize kick	20
3	Dexterity	20
4	Stamina	10
5	Mental	25
6	Experience	15

The criteria for selecting the best athlete to take part in the martial arts competition in the first single art category is body posture, which is given a weight of 10. In the single category pencak silat, the body posture criterion does not affect the assessment because the single art emphasizes the beauty of movement. The criteria for memorizing moves are given a weight of 20, enough to affect the assessment because athletes must be ready to memorize 100 moves in 3minutes and there should be nothing wrong. Then the Flexibility criterion is that the assessment of the beauty of the movement of the moves is as important as the memorization of the moves, it is given a weight of 20. The Stamina criterion is given a weight of 10 because in the single art category, athletes require not large enough energy.Furthermore, the Mental criteria are given a weight of 25, themost influential in the assessment because mentality can affect the athlete's focus, memorizing movements and even movements can become stiff. Experience criteria are given aweight of 15, enough to influence the assessment because athletes who have experience are already familiar with the state of martial arts [1-5], [15].

Body posture criteria use height and weight data which are calculated into a BMI (Body Mass Index) calculation. If the BMI calculation shows a result less than 18.5 or greater than or equal to 30 then it is worth 1. If the BMI calculation shows a result greater than or equal to 23 or less than 30, then it is worth 2. If the BMI calculation shows a result greater than or equal to 18.5 or less than 23, then it is worth 3.The greater the resulting value, the more proportional the athlete's body is (Table II).

TABLE II. POSTURE CRITERIA SCALE

No	Body Posture	Weight Value
1	<18,5 atau >=30	1
2	>= 23 atau < 30	2
3	>= 18,5 atau < 23	3

The criterion of memorizing moves is an important criterion, because in a single-art category martial arts competition showing movements in moves, the total moves to be displayed are 100 movements, the more movements that are remembered, the greater the score generated, the greater the score obtained by the athlete.The more likely the athlete is to take part in a single art category of martial arts competition. The flexibility criteria scale is assessed subjectively based on the opinionof the achievement coach from the Setia Hati Terate Brotherhood hermitage (Tabel III).

TABLE III. THE CRITERIA FOR MEMORIZING MOVES

No	Memorization Kick	Weight Value
1	1 >= 90 moves 5	5
2	2 >= 70 moves 4	4
3	3 >= 50 moves 3	3
4	4 >= 40 moves 2	2
5	5 < 40 moves 1	1

The stamina criterion scale is assessed based on how long the athlete can run, the longer the athlete runs, the greater the score obtained (Tabel IV).

TABLE IV. STAMINA CRITERIA SCALE

No	Stamina	Value Weight
1	>= 30 minutes	5
2	>= 20 minutes	4
3	>= 10 minutes	3
4	>= 5 minutes	2
5	> 5 minutes	1

Performance coaches make subjective judgments based on their mentality as they perform movements and when they speak (Tabel V).

TABLE V. MENTAL CRITERIA SCALE

No	Mental	Value Weight
1	Very Strong	5
2	Strong	4
3	Normal	3
4	Weak	2
5	Very Weak	1

Athletes who have experience in the field of martial arts will be able to adapt easily, the longer the experience accumulated, the higher their score on this experience criteria scale (Table VI).

TABLE VI. EXPERIENCE CRITERIA SCALE

No	Experience	Value Weight
1	>= 3 years	4
2	>= 2 years	3
3	>= 1 years	2
4	> 1 years	1

IV. RESEARCH RESULTS

There were 15 participants who took part in the selection of athletes. 3 athletes who will represent as participants in the martial arts competition in the single art category. They are:

1) A1 = Abdul Gofar Rosidi
2) A2 = Agung Hartono
3) A3 = Alfian Ahkam
4) A4 = Anggun Vitianessa
5) A5 = Dio Enggar Mahendra
6) A6 = Fiki Priadi
7) A7 = Meggy Dewantara
8) A8 = Mohammad Iwan Nurhuda
9) A9 = Muhammad Feriansyah
10) A10 = Muhammad Zainal Arifin
11) A11 = Nurkani Hadi
12) A12 = Rachmasari Dwi Astuti
13) A13 = Sigit Sumarsono
14) A14 = Wiwin Kasmawati
15) A15 = Yossi Andre Melodi.

A. Data Input Form

The data input form is a form for inputting student data. The data input form contains alternatives and criteria for selecting a single martial arts athlete. Under the criteria, there is a save button which functions to save the input of alternative data, the delete form filling button functions to delete the entered data has not been saved and the delete data button functions to delete data that has been saved. The display of the data input form can be seen in Fig. 4.

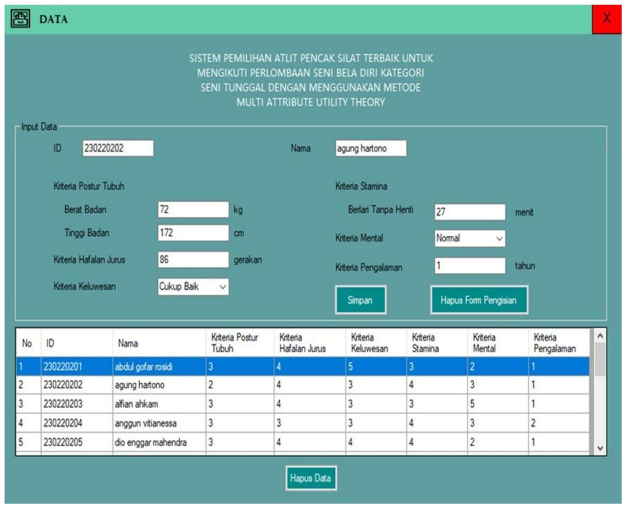

Fig. 4. Data Entry Form

There are 6 criteria that are used as a reference in determining the decision-making process in determining the best athlete to take part in a single art competition (Tabel VII and Tabel VIII), namely:

1) Posture (C1)

2) Memorizing moves (C2)

3) Dexterity (C3)

4) Stamina (C4)

5) Mental (C5)

6) Experience (C6)

TABLE VII. SUITABILITY RATING OF EACH ALTERNATIVE AND CRITERIA

Alternatif	C1	C2	C3	C4	C5	C6
A1	3	4	5	3	2	1
A2	2	4	3	4	3	1
A3	3	4	3	3	5	1
A4	3	3	3	4	3	2
A5	3	4	4	4	2	1
A6	3	3	4	4	5	3
A7	3	4	5	2	3	1
A8	2	5	4	5	5	3
A9	2	3	4	3	5	2
A10	3	5	2	4	3	3
A11	1	4	5	1	3	2
A12	3	4	3	4	4	1
A13	2	4	5	3	2	2
A14	3	4	3	3	3	2
A15	3	4	4	4	3	1

TABLE VIII. VALUE WEIGHT (W) CRITERIA

No	Criteria	Weight
1	C 1	10
2	C 2	20
3	C3	20
4	C 4	10
5	C 5	25
6	C 6	15

B. *Data Calculation*

The data calculation form is a page that provides the MAUT count button which functions to calculate alternative values that will determine which athlete is most worthy of participating in a single art category of martial arts competition, there are several tables in the data calculation form, namely: data table, normalized data table, normalized data table that has been multiplied by the weight of the criteria, the athlete data SPK calculation table and the athlete data SPK calculation ranking table [15-31]. In addition to tables, in this form there is also a combo box to determine the number of alternatives the best data to be printed and theprint button which is useful for printing the best alternative data rankings in the form of a report. The display of the data calculation form can be seen in Fig. 5.

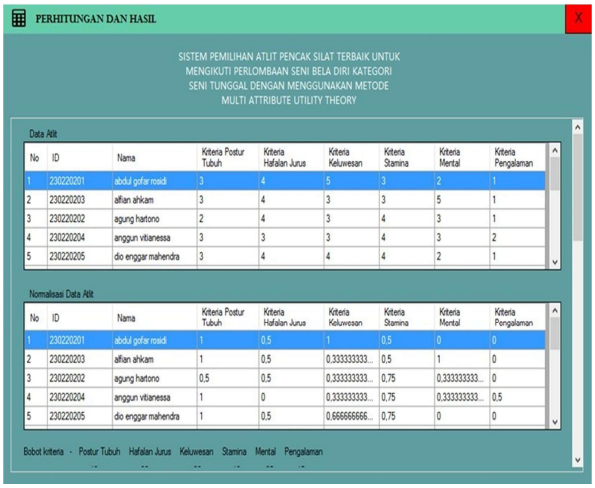

Fig. 5. Calculation and Result form

The next stage is to normalize alternative data on each criterion (Table IX).

TABLE IX. NORMALIZATION RESULTS

Alternatif	C1	C2	C3	C4	C5	C6
A1	1	0,5	1	0,5	0	0
A2	0,5	0,5	0,33	0,75	0,33	0
A3	1	0,5	0,33	0,5	1	0
A4	1	0	0,33	0,75	0,33	0,5
A5	1	0,5	0,66	0,75	0	0
A6	1	0	0,66	0,75	1	1
A7	1	0,5	1	0,25	0,33	0
A8	0,5	1	0,66	1	1	1
A9	0,5	0	0,66	0,5	1	0,5
A10	1	1	0	0,75	0,33	1
A11	0	0,5	1	0	0,33	0,5
A12	1	0,5	0,33	0,75	0,66	0
A13	0,5	0,5	1	0,5	0	0,5
A14	1	0,5	0,33	0,5	0,33	0,5
A15	1	0,5	0,66	0,75	0,33	0

A1=(10*1)+(20*0,5)+(20*1)+(10*0,5)+(25*0)+(15*0) = 45

A2=(10*0,5)+(20*0,5)+(20*0,333)+(10*0,75)+(25*0,333)+(15*0) = 37,5

A3=(10*1)+(20*0,5)+(20*0,333)+(10*0,5)+(25*1)+(15*0) = 56,7

A4=(10*1)+(20*0)+(20*0,333)+(10*0,75)+(25*0,333)+(15*0,5) = 40,0

A5=(10*1)+(20*0,5)+(20*0,667)+(10*0,75)+(25*0)+(15*0) = 40,8

A6=(10*1)+(20*0)+(20*0,667)+(10*0,75)+(25*1)+(15*1) = 70,8

A7=(10*1)+(20*0,5)+(20*1)+(10*0,25)+(25*0,333)+(15*0) = 50,8

A8=(10*0,5)+(20*1)+(20*0,667)+(10*1)+(25*1)+(15*1) = 88,3

A9=(10*0,5)+(20*0)+(20*0,667)+(10*0,5)+(25*1)+(15*0,5) =55,8

A10=(10*1)+(20*1)+(20*0)+(10*0,75)+(25*0,333)+(15*1) = 60,8

A11=(10*0)+(20*0,5)+(20*1)+(10*0)+(25*0,333)+(15*0,5) = 45,8

A12=(10*1)+(20*0,5)+(20*0,333)+(10*0,75)+(25*0,667)+(15*0) =50,8

A13=(10*0,5)+(20*0,5)+(20*1)+(10*0,5)+(25*0)+(15*0,5) =47,

A14=(10*1)+(20*0,5)+(20*0,333)+(10*0,5)+(25*0,333)+(15*0,5) =47,5

A15=(10*1)+(20*0,5)+(20*0,667)+(10*0,75)+(25*0,333)+(15*0) =49,2

Based on the assessment of each athlete who has entered the system, the ranking results are obtained using the MAUT method [15-31]. The display of the data ranking result can be seen in Fig. 6.

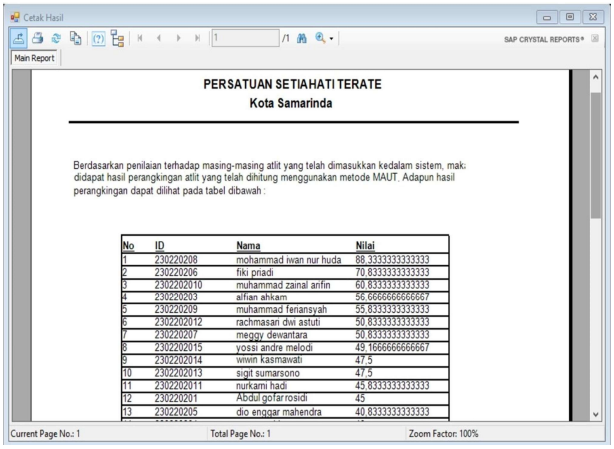

Fig. 6. Ranking Results on System

So that ranking can be done as the last step with the 3 best values at A8 = 88.3, A6 = 70.8, A10 = 60.8 So the recommendations obtained with the best ranking are:

Best 1 = Mohammad iwan nurhuda with a score of 88.3

Best 2 = Fiki Priadi with a score of 70.8

Best 3 = Muhammad zainal arifin with a score of 60.8.

V. CONCLUSION

The results of the research that have been carried out, several conclusions can be drawn, including: This research has produced a decision support system for selecting the best athlete at the Padepokan Pencak Silat Hati Terate Samarinda branch by using the Multi-Attribute Utility Theory Method. This system is expected to make it easier for achievement coaches to determine their best athlete, obtaining the highest ranking value according to the predetermined category. Of the 15 athletes who took part in the selection, finally 3 athletes were chosen who were entitled to represent the hermitage to participate in the martial arts competition, pencak silat in the single art category.

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