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Selection of the Best EPL Players Using AHP, PROMETHEE, and TOPSIS Methods with a Pairwise Comparison Scale

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ABSTRACT

Every time players are assessed in terms of their performance on the field, players have the potential to compete for individual and team achievements in football, therefore a decision support system is made for the selection of the best premier league players in October 2020/2021. The 7 criteria for using the assessment include the number of goals, assists, kicks, wins, passes, fouls and plays time. In this study, there are three best player assessment methods, namely the Analytical Hierarchy Process (AHP) method, the Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE), and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The use of three methods in the assessment provides a good comparison of accuracy compared to one method alone and also aims to assess concretely and accurately so that the assessment runs fairly. The making of the premier league best player selection system is programmed with PHP and uses a MySQL database that is useful for storing player data and scores.

1. Introduction

Times are progressing together with technology that develops so rapidly. In today's sports, regulations and assessments use information systems and applications that provide speedy access to facilitate tasks such as data processing and decisions that can be taken more accurately, quickly and save time and money.

Decision Support System (DSS) plays an important role in a history of previous problems which will later be useful as a provider of answers to problems with a decision. DSS can be described as a system that is able to support analysis and decision modeling, is decision-oriented and is used in unusual times [8]. Decisions that are applied should be a form of taking that is based on an alternative to a problem so that it can be parsed into the process by a structured mechanism, aimed at minimizing the highest decision that is best chosen [7].

The Analitycal Hierarchy Process (AHP) method is a model for choosing the best decision developed by Thomas L. Saaty, a mathematician [9]. a functional Hierarchy to which human input is premier. The use of previously irregular hierarchies becomes fragmented in each of the structured and organized group placement objects. PROMETHEE is a method based on Multi Criteria Decision Making (MCDM), it can be seen that the usefulness of calculating a data into a sort which is explained in a multicriteria analysis, PROMETHEE supports the combination of two methods to clarify and sharpen the sorting of criteria and ease in structured calculations. This was chosen because it provides an accurate assessment and can determine the best premiere league player. Technique for Order Performance of Similarity to Ideal Solution (TOPSIS) is a method in decision support systems in a multicriteria analysis. The principle of this method is that the alternative can be selected the closest distance to the positive ideal solution and the negative ideal solution is selected from the farthest distance of an alternative. The advantage of using the TOPSIS method is its ease of understanding rational concepts [3].

In previous research conducted byI Made Dwi Putra Asana, I Gede Iwan Sudipa, I Made Angga Wijayad with the title "The employee appraisal decision support system at PT. Kupu-Kupu Taman Lestari using AHP and BARS method ". The system designed to improve the performance and quality of employees so that they are motivated to become competent employees for achievement is used the AHP method as a calculation used to obtain weight values based on employee criteria [10]. Furthermore, from research conducted by Gusrianty, Dwi Oktarina, Wahyu Joni Kurniawan, entitled "Decision support system with the PROMETHEE method to determine customer satisfaction from used motorcycle sales" which is calculated from a customer survey to evaluate and obtain customer satisfaction assessments using the PROMETHEE method which is efficient in ranking calculations because it has a function in defining changes in data. which produces a report on the ranking of each tribute [6]. For the third journal of research conducted by Muhamad Ibrohim, Maya

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Selvia Lauryn, Rodhiyallah Salma Nadziroh entitled "Decision support system for choosing the best food menu for patients with gastroesophageal reflux disease with the TOPSIS method". A system that aims to choose the best food because people with GERD are still confused in choosing the right food for them,

From each of the journals above that use the AHP-PROMETHE-TOPSIS method for the assessment of each of the discussion topics still using 1 method and there is no comparison, the researcher has an idea in selecting the best EPL player assessment sourced from the official EPL website to assess who The best players in October obtained 7 criteria data and 10 alternative players were taken. Of the three methods, the researchers made two pairwise comparisons, namely AHP-PROMETHEE and AHP-TOPSIS. Data from one AHP method calculation generates the criteria weight and the system from the PROMETHEE and TOPSIS methods will continue to calculate the best player ranking assessment.

2. Research methods

2.1 AHP Method -PROMETHEE

This research is divided into two comparisons, namely the comparison I AHP method with a combination of methodsPROMETHEE and comparison II of the AHP method with the combination of the TOPSIS method. For the initial step of research using the AHP method with a combination of the PROMETHEE method which is shown based on Figure 1 below:

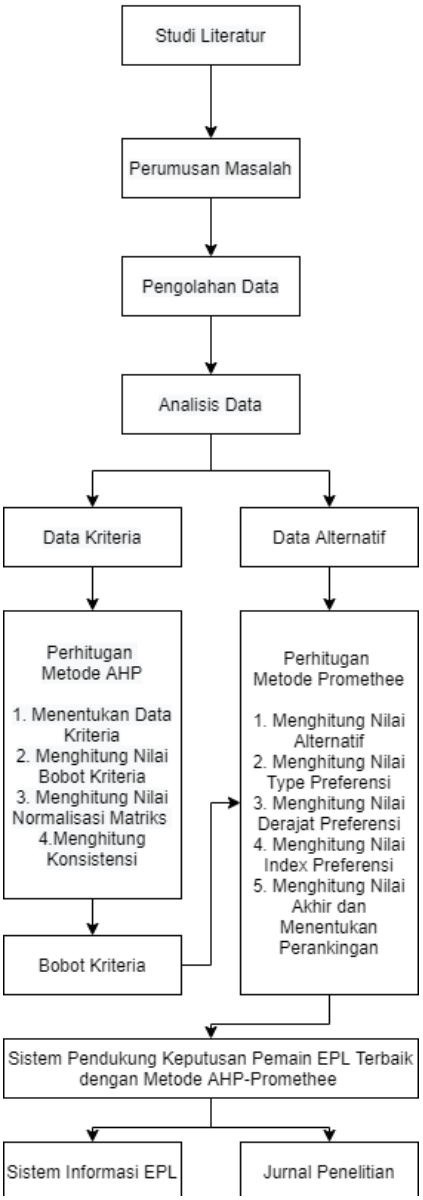

Fig 1. AHP Research Stages-PROMETHEE

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The following is an overview of the stages of research on the Best EPL Player using the AHP method.PROMETHEE. In the early stages of work, data research was carried out and data analysis sourced from the official website of the English Premiere League 2020/2021 update. Data collection will be used as criteria data and alternative data. The criteria data that will be calculated are 7 criteria and alternative data that will be made a sample of 10 players.

After the data process is completed, the analysis is then entered into the weight calculation formulation process using the AHP method which is a decision support model developed by Thomas L. Saaty,a mathematician, in which a functional hierarchy for the utilization of previously irregular hierarchies becomes divided on each object a structured and organized group placement [9]. After that the results of the weighted value will be entered into the ranking process which is calculated using the methodPROMETHEE. The AHP-PROMETHEE methodology is very good to use in determining the Best EPL Player. The first stages of the AHP Method are determining criteria and alternatives, then determining the pairwise comparison table or criteria comparison matrix by determining the scale of comparison shown based on table 1 below:

Table 1.
Matrix Comparison Scale

Level of Importance	Information
1	The two elements have an influence of equal importance
3	One element is slightly more important than the other element
5	One element is slightly more important than the other element
7	One element is absolutely more important than its counterpart
9	One element is absolutely more important than its partner element
2, 4, 6, 8	The values between two adjacent levels of importance

Pairwise comparisons between matrices can be done by comparing each criterion so that it is connected to a criterion weight table which will be used later to calculate the normalization of the matrix by dividing the elements of each criterion column by the number of criteria per column.

In the calculation of normalization there is a priority where the value is obtained from the average of each criterion row, then calculates the index from the matrix of order n which is shown based on the following formula:

$$CI = \frac{\lambda maks - n}{n-1} \quad (1)$$

Information :
CI = Consistency Index
$\lambda maks$ = The number of mean CM values
n = Number of Criteria

The eigenvalues are calculated based on the total consistency measure then averaged, then for the calculation of the Consistency Index (CI) it is calculated by the number of eigens in the less number of criteria values then divided by the number of criteria values under one, then to calculate the Consistency Ratio (CR) value calculated by dividing the Consistency Index value with the determined Ratio Index value as shown based on the formula:

$$CR = \frac{CI}{RI} \quad (2)$$

The Ratio Index value shown is based on the following table 2:

Table 2.
Ratio Index based on matrix order

Order Matrix	1	2	3	4	5	6	7	.	15
Ratio Index	0	0	0.58	0.9	1.12	1.24	1.32	..	1.59

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If the CR value is below 10%, it is considered consistency and can be continued, but if the CR value is above 10% which means inconsistency then the value of the criteria is still wrong or not balanced between one criterion and another.

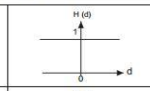
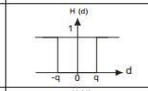
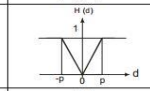
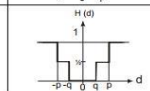
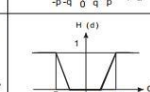
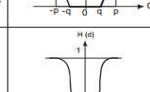
The PROMETHEE (Preference Ranking Organizational Method for Enrichment Evaluation) method is a method that can determine the usefulness of calculating a data into sorting which is described in a multicriteria analysis. The main problem is simplicity, clarity and stability. The assumption of the dominance of the criteria used in PROMETHEE is the use of value in the out-ranking relationship [6]. The next function of the Promethee method is to calculate the weight value that has been obtained from the AHP method calculation by entering an alternative value to become the main ingredient of the calculation which can produce a decision from the ranking results. The following are the calculation steps using the PROMETHEE method:

a. Determining the threshold value to determine the p and q values can be calculated using the veto formula as follows:

Preference (p) = vq (3)

b. Specifies the criteria preference type

Table 3.
Type of the criteria preference function

Tipe Preferensi Kriteria		Parameter
1. Kriteria Umum *(Usual Criterion)*		-
2. Kriteria Quasi *(Quasi Criterion)*		q
3. Kriteria Preferensi Linier *(Criterion with Linear Preference)*		p
4. Kriteria Level *(Level Criterion)*		q,p
5. Kriteria Dengan Preferensi Linier dan Area yang tidak berbeda *(Criterion with Linear Preference and Indefference Area)*		q,p
6. Kriteria Gaussian *(Gausian Criterion)*		σ

c. Multi criteria preference index value calculation

There are six criteria preference functions in the PROMETHEE method, although these functions do not always have an exact value, their use is of good value for decision making cases. In order to better describe different areas, the function of the difference in the criteria value between alternatives H (d) is used. which there is a direct relationship to the preference function P.

The calculation of leaving flow can be calculated using the formula:

Leaving Flow + (a) = $\emptyset \frac{1}{n-1} \sum_{x \epsilon A} {}_{\varphi}(a, x)$ (4)

Information :

${}_{\varphi}(a, x) =$ preference value a is better than value x

n = number of alternatives

$\sum$ alternative values from the preference table are summed horizontally.$x \epsilon A =$

Entering Flow calculations can be calculated using the formula:

$$\emptyset^{-}(a) = \frac{1}{n-1} \sum_{x \epsilon A} {}_{\varphi}(x, a) \quad (5)$$

Information :

${}_{\varphi}(x, a)$= preference value x is better than value a

n = number of alternatives

$\sum$ alternative values from the preference table are summed vertically.$x \epsilon A =$

Net Flow calculation can be calculated using the formula:

$$\emptyset(a) (6) + -\emptyset(a) - \emptyset(a)$$

Description =

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$\emptyset^+$ = Leaving flow
$\emptyset^-$ = Entering Flow
$\emptyset$= net flow

2.2 AHP-TOPSIS method

In the next comparison study, namely using the AHP-TOPSIS method. In this recruitment process the TOPSIS (Technique For Order Reference by Similarity to Ideal Solution) method is used.The principle of this method is that the alternative can be selected the closest distance to the positive ideal solution and the negative ideal solution is selected from the farthest distance of an alternative [2]. The flow of research stages for the Best EPL Player uses the AHP-TOPSIS method. In the early stages of work, data research was carried out and data analysis sourced from the official website of the English Premiere League 2020/2021 update. Data collection will be used as criteria data and alternative data. There are 7 criteria for calculating the criteria data, namely goals (C1), assists (C2), shot on target (C3), wins (C4), passes (C5), fouls (C6), and appearances (C7). While the alternative data that will be made a sample of 10 players. For the first step of research using the AHP-TOPSIS method, which can be seen in Figure 2, as follows:

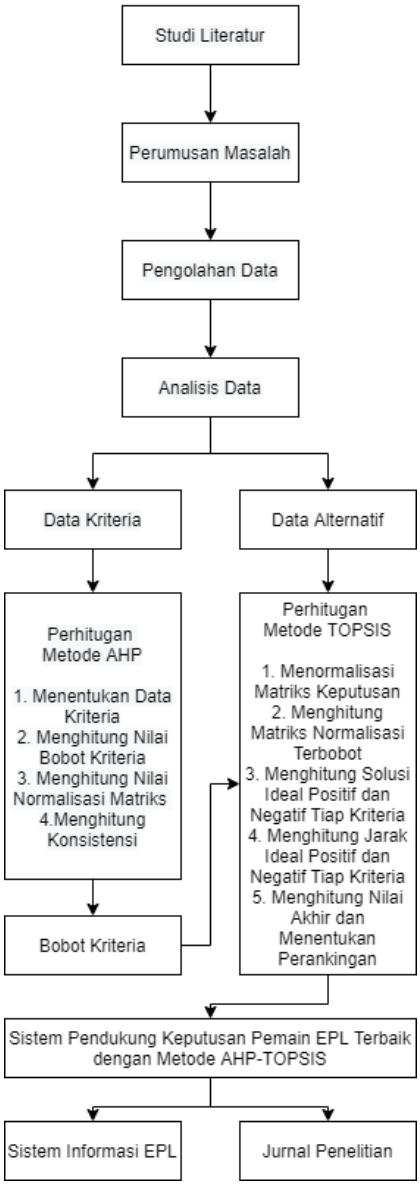

Fig 2. AHP-TOPSIS Research Stages

The second step after data processing and data analysis is to proceed to the calculation process using the AHP-TOPSIS method. The steps for calculating the AHP method are as follows:

a. Determines the pairwise comparison table that is obtained from the player criteria comparison data.

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b. Determining the normalization table by dividing each value from the column by the total column of the criteria concerned can use the formula:

$$\sum_{j=1}^{n} a_{ij}=1 \quad (1)$$

Information :
a = represents the pairwise comparison matrix
i = row in matrix a
j = column in matrix a.

c. add up the values of each matrix and divide by the number of priority elements to get the average value shown according to the formula:

$$w_i=\frac{1}{n}\sum_{j=1}^{n} a_{ij} \quad (2)$$

Information :
n = number of criteria
wi = average of the i-th row.

TOPSIS is used to select existing alternatives, where the chosen alternative must have the closest distance from the positive ideal solution and the furthest from the negative ideal solution. The steps in calculating the TOPSIS method are as follows [3]:

a. Create a table of alternative values and square them
b. Normalizing the decision matrix can be calculated using the formula:

$$rij=\frac{Xij}{\sum_{i}^{m} x_{ij}^2} \quad (3)$$

Information :
rij = normalization of the decision matrix
I = 1,2, ..., m
j = 1,2, ..., n,
xij = the weight of the jth criterion on the ith alternative, i the ith alternative and j the jth criterion.

c. Calculating the weighted normalization matrix can be calculated using the formula:

$$y_{ij}=w_j r_{ij} \quad (4)$$

Information :
i = 1, 2, ..., m
j = 1,2, ..., n,
wj = Priority weight
rij = derived from the normalized matrix value.

To get the weighted normalized matrix value is to multiply the normalized matrix value with the priority weight contained in the AHP calculation.

d. Determine the ideal solution positive and the ideal solution negative. Calculation data can be obtained from the maximum value and the minimum value of the weighted normalized matrix, each criterion must be determined for the benefit and cost assessment, positive ideal solution (A +) and negative ideal solution (A-) determined. To determine the ideal solution that can be calculated using the formula:

$$A^+=(y_1^+, y_{2,\cdots,}^+ y_n^+) \quad (5)$$

$$A^-=(y_1^-, y_{2,\cdots,}^- y_n^-) \quad (6)$$

e. Determine the distance between the value of each alternative with a matrix of positive ideal solutions and negative ideal solutions which can be calculated using the formula:

$$D_i^+=\sqrt{\sum_{i=1}^{n}(y_j^+-y_{ij})^2} \quad (7)$$

$$D_i^-=\sqrt{\sum_{j=1}^{n}(y_{ij}-y_j^+)^2} \quad (8)$$

Information :
Di + = column normalization decision matrix with positive ideal solutions.

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Di- = column normalization decision matrix with negative ideal solutions.

f. Calculating the final value and determining the ranking for each alternative, the preference value is obtained by dividing each positive ideal row by the column of each alternative plus the positive ideal row which can be calculated using the formula:

$$v_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (9)$$

Information :
Vi = Preference value
Di + = column normalization decision matrix with positive ideal solutions.
Di- = column normalization decision matrix with negative ideal solutions.

3. Results and Discussion

3.1 AHP-PROMETHEE method

In the initial process of the flowchart assessment of the best players using the AHP-PROMETHEE method, it begins by entering data on criteria and alternative players with real data sourced from the EPL update 2020/2021 website. Furthermore, the criteria data that have been input will be compared using the matrix comparison scale in Table 1. Next, the comparison value will be calculated for its normalization with the final process of determining the consistency value which cannot be above 0.1 will result in unstable data and must be repeated from the beginning. comparison matrix. Then the process of calculating alternative data by taking data samples from 10 alternative football players is calculated using the PROMETHEE method with the final result getting the ranking value of each alternative.

In Figure 3 below is a data flow or flowchart system from the use of the AHP-PROMETHEE method for selecting the best EPL players with a pairwise comparison scale.

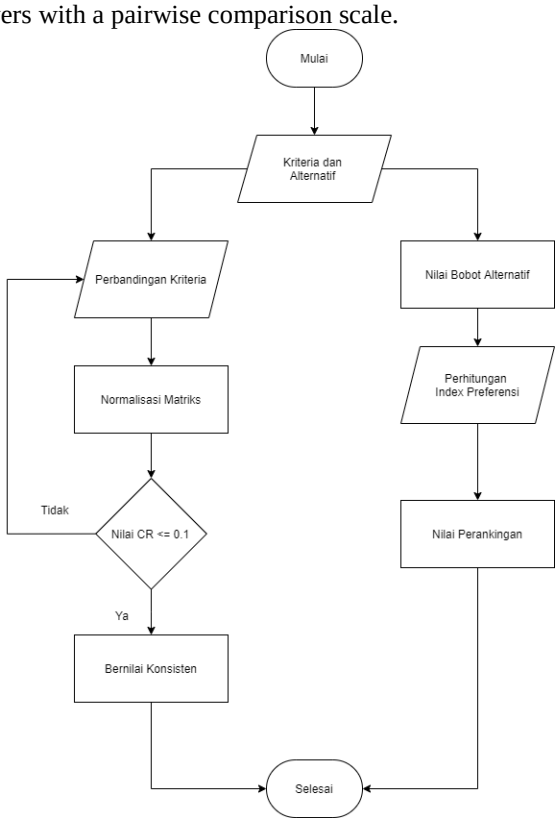

Fig 3. Flow chart selection of the best EPL players using the AHP-PROMETHEE method with a pairwise comparison scale

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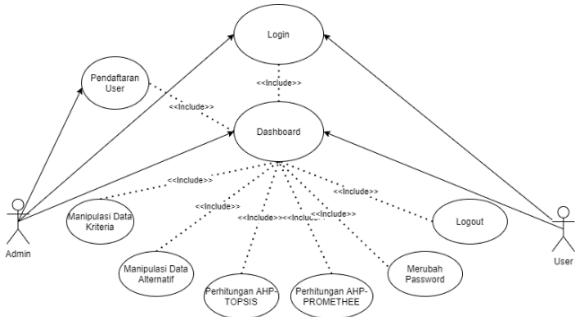

Fig 4. Usecaseselection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale

Here are the usecase stages from selection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale,As the admin of this application, all access rights can be run, and as a user there are functions that are locked or cannot be accessed by the user, namely creating new user data, so the user can only access the criteria, alternatives, and calculation functions using AHP-PROMETHE-TOPSIS.

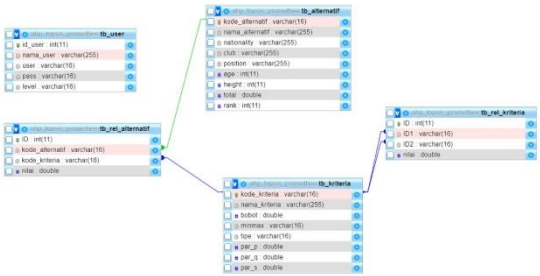

Fig 5. Data baseselection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale

3.2 Calculation of the Analytical Hierarchy Process Method

There are 7 criteria used in calculating the selection of the best EPL players with a paired comparison scale, including the following:

a) Goals
The highest value of the goals criteria data (C1) will be prioritized in the assessment

b) Assist
The highest value from the assist criteria data (C2) will be prioritized in the assessment

c) Shot on Target
The highest value of the shot on target (C3) criteria data will be prioritized in the assessment.

d) Wins
The highest score of the wins (C4) criteria will be prioritized in the assessment.

e) Passes
The highest value of the data passes (C5) criteria will be prioritized in the assessment

f) Fouls
The lowest value of the fouls criterion data (C6) will be prioritized in the assessment

g) Appearances
The highest value of the appearances criteria data (C7) will be prioritized in the assessment

The criteria data used in this study are described in table 4 below:

Table 4.
Criteria data

Code	Criteria
C1	Goals
C2	Assist
C3	Shot On Target
C4	Wins
C5	Passess
C6	Fouls
C7	Appearances

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Alternative data used in this study are described in table 5 below:

Table 5.
Alternative data

Code	Alternative
A1	Son Heung-Min
A2	Jamie Vardy
A3	Patrick Bamford
A4	Harry Kane
A5	Dominic Calvert-Lewin
A6	Mohamed Salah
A7	Wilfried Zaha
A8	Sadio Mane
A9	Danny Ings
A10	Raul Jimenez

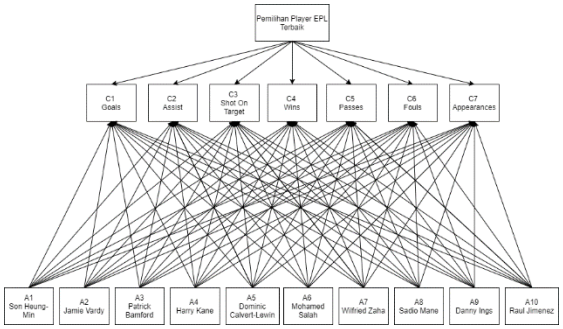

Fig 6. Hierarchical Structure selection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale

Hierarchical structure selection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale, connect between each criterion element with each alternative element.

The calculation of weighting criteria used by AHP is based on data from the English league website which is shown based on table 6 below:

Table 6.
Criteria weighted value

CODE	C1	C2	C3	C4	C5	C6	C7
C1	1	1	4	1	3	5	2
C2	1	1	3	0.5	2	3	0.5
C3	0.25	0.33	1	0.33	2	3	0.33
C4	1	2	3	1	3	3	1
C5	0.33	0.5	0.5	0.33	1	2	1
C6	0.2	0.33	0.33	0.33	0.5	1	0.5
C7	0.5	2	3	1	1	2	1
Total Criteria (∑)	4.28	7.16	14.8	4.5	12.5	19	6.33

Steps in filling in the elements of the matrix in table 5. namely:

a. Elements a [i, j] = 1, where i = rows 1,2,3,… n and j = columns 1,2,3,… n. for this research n was 7.
b. The upper triangular matrix element as input
c. Lower triangular matrix element

The value of the normalization of the criteria matrix can be seen in table 7 made by calculating the element value per criteria column divided by the number of matrix columns and can be seen with the formula below:

$$NM = \frac{\text{Nilai elemen per kolom kriteria}}{\text{Jumlah kolom matriks}} \qquad (10)$$

Information :
NM = Normalized Matrix
Hkm = Number of Matrix Columns

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><= Comparison
C1 = Goals
C2 = Assist
C3 = Shot On Target
C4 = Wins
C5 = Passess
C6 = Fouls
C7 = Appearances

Table 7.
Matrix normalization calculation value

Code	C1	C2	C3	C4	C5	C6	C7	Priority	CM
C1	0.2335	0.1395	0.2697	0.2222	0.24	0.2632	0.3158	0.2405	7,5165
C2	0.2335	0.1395	0.2022	0.1111	0.16	0.1579	0.0789	0.1547	7,595
C3	0.0584	0.0465	0.0674	0.0741	0.16	0.1579	0.0526	0.0881	7,4006
C4	0.2335	0.2791	0.2022	0.2222	0.24	0.1579	0.1579	0.2133	7,5273
C5	0.0778	0.0698	0.0337	0.0741	0.08	0.1053	0.1579	0.0855	7.3406
C6	0.0467	0.0465	0.0225	0.0741	0.04	0.0526	0.0789	0.0516	7.3157
C7	0.1167	0.2791	0.2022	0.2222	0.08	0.1053	0.1579	0.1662	7,5951

Calculating priority by adding the row value taken from the normalized value so that it becomes averaged and divided by each criterion. Meanwhile, the method of calculating Consistency Measure is by means of each line of the criteria weight multiplied by the priority column and divided by the priority table per criteria.

How to calculate the value of the Consistency Index (CI), namely lamda max minus n, namely the number of criteria of 7 divided by n minus 1 means 7 minus 1 can be seen by the formula below:

$$CI = \frac{\lambda max - n}{n-1} \quad (11)$$

Information
n = Number of Criteria

$$\frac{7{,}470-7}{7-1} = 0.078$$

How to calculate the Consistency Ratio (CR) value, namely the Consistency Index (CI) value divided by the value of the ratio index table provisions according to the criteria obtained from the criteria as many as 7, which is 1.32 which can be seen with the formula below:

$$CR = \frac{CI}{RI} \quad (12)$$

Informations
CR = Consistency Ratio
CI = Consistency Index
RI = Ratio Index

$$CR = \frac{0.078}{1.32} = 0.059 \text{ (Konsisten)} \quad (13)$$

The CR value is consistency if it is below or equal to 0.1, it means that the criteria weighting process is valid and can proceed to the next calculation, namely by using the PROMETHEE method, but if the CR value exceeds 0.1 then the criteria weighting process is considered inconsistent and the criteria weight comparison process must be repeated. The results of the above calculations can be shown based on Figure 7 below.

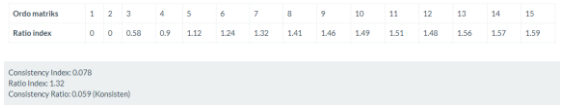

Fig 7. Check Results of Criteria Weight Consistency

3.3 PROMETHEE Method Calculation

a. The first step in calculating PROMETHEE in assessing the best EPL player is by determining alternative data such as alternative name, nationality, club, position, age, and the last is height.

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No	Kode	Nama Alternatif	Nationality	Club	Position	Age	Height
1	A001	Son Heung-Min	South Korea	Tottenham Hotspur	Forward	28	183
2	A002	Jamie Vardy	England	Leicester City	Forward	33	179
3	A003	Patrick Bamford	England	Leeds United	Forward	27	185
4	A004	Harry Kane	England	Tottenham Hotspur	Forward	27	188
5	A005	Dominic Calvert-Lewin	England	Everton	Forward	23	187
6	A006	Mohamed Salah	Egypt	Liverpool	Forward	28	175
7	A007	Wilfried Zaha	Cote Divoire	Crystal Palace	Forward	27	180
8	A008	Sadio Mane	Senegal	Liverpool	Forward	28	175
9	A009	Danny Ings	England	Southampton	Forward	28	178
10	A010	Raul Jimenez	Mexico	Wolverhampton Wonderers	Forward	29	190

Fig 8. Alternative application data

b. Determine alternative values taken from the EPL official website data and make a weight assessment as shown in table 8 below:

Table 8.
Alternative weight values

Weight	Information
4	Very good
3	Good
2	Enough
1	Less

1) Goals
   Entering the weight of the goals, including:
   a) Goals worth 5-7 are well worth 4
   b) Goals worth 3-4 are well worth 3
   c) Goals worth 2 are enough for 2
   d) Goals worth 1 are less than 1
2) Assist
   Input weight for the assist value, among others:
   a) An assist worth 5-7 is very good at 4
   b) An assist worth 3-4 is well worth a 3
   c) An assist with a value of 2 is sufficient for a 2
   d) An assist with a value of 1 is less than 1
3) Shot on Target
   The input of the shot on target value includes:
   a) Shot on Target worth 7-12 is very good at 4
   b) Shot on Target is worth 3-6 is good for 3
   c) Shot on targets worth 1-2 are enough for 2
   d) Shot on Target is worth 0 less than 1
4) Wins
   Entering the weight of the wins, among others:
   a) A coin is worth 4 very well worth 4
   b) Wins worth 3 are worth 3
   c) A coin worth 2 is enough for a 2
   d) Wins are worth 1 less than 1
5) Passes
   Input passes weight, including:
   a) Passes worth 100-200 are very well worth 4
   b) Passes worth 50-99 are well worth 3
   c) Passes worth 26-49 are quite a 2
   d) Passes worth 0-25 are less than 1
6) Fouls
   Inputting the weight of the fouls value includes:
   a) fouls worth 1 are very well worth 4
   b) fouls worth 2 are worth 3
   c) 3-5 fouls are worth 2
   d) fouls worth 6 are less than 1
7) Appearances
   Inputting the appearances value, among others:
   a) fouls worth 4-5 are very well worth 4

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b) fouls worth 3 are worth 3
c) 2 fouls are worth 2
d) fouls are worth 1 less than 1

Kode	Nama Alternatif	Goals	Assist	Shot on Target	Wins	Passes	Fouls	Appearences
A001	Son Heung-Min	4	2	4	3	3	4	4
A002	Jamie Vardy	4	1	3	3	2	1	4
A003	Patrick Bamford	3	2	3	3	2	1	4
A004	Harry Kane	3	4	4	3	3	4	4
A005	Dominic Calvert-Lewin	4	1	4	3	3	2	4
A006	Mohamed Salah	4	1	4	3	4	3	4
A007	Wilfried Zaha	3	1	2	3	3	1	4
A008	Sadio Mane	3	1	3	3	4	2	3
A009	Danny Ings	3	1	3	3	3	2	4
A010	Raul Jimenez	2	1	3	3	4	4	4

Fig 9. Give each alternative a weight value

c. Determine 2 different types, namely minimization and maximization. The maximization value means the largest value that will be made the highest assessment while the minimization value means the smallest value that will be made the highest assessment.

Kode	Nama Kriteria	Bobot	Min Max	Tipe Preferensi	Q	P	S
C01	Goals	0.2405	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0
C02	Assist	0.1547	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0
C03	Shot on Target	0.0881	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0
C04	Wins	0.2133	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0
C05	Passes	0.0855	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0
C06	Fouls	0.0516	Minimasi	Tipe Linier (Linear Criterion atau V-Shape)	7	1	0
C07	Appearences	0.1662	Maksimasi	Tipe Linier (Linear Criterion atau V-Shape)	1	7	0

Fig 10. Determine the criteria for minimization, maximization, and type of preference

d. Furthermore, determining the type of preference as the best and most suitable type on the target topic is based on the data. The preference type used is the Linear type (Linear Criterion or V-Shape, which means this type uses a predetermined trend value and is above 0.
e. Leaving Flow, Entering Flow, and Net Flow calculations and the ranking of the best player scores are shown in Figure 11.

Perbandingan Alternatif

Alternatif	Son Heung-Min	Jamie Vardy	Patrick Bamford	Harry Kane	Dominic Calvert-Lewin	Mohamed Salah	Wilfried Zaha	Sadio Mane	Danny Ings	Raul Jimenez	Jumlah	Leaving
Son Heung-Min	0	0.3284	0.4142	0.2405	0.1547	0.1547	0.3953	0.4834	0.4834	0.2429	2.8976	0.322
Jamie Vardy	0	0	0.2405	0.2405	-0.0516	0	0.3287	0.1889	0.1889	0	1.136	0.1262
Patrick Bamford	0	0.1547	0	0	0.1031	0.1547	0.2429	0.1031	0.1031	0.3953	1.257	0.1397
Harry Kane	0	0.1736	0.1736	0	0	0	0	0.0881	0.0881	0.3287	0.8522	0.0947
Dominic Calvert-Lewin	0	0.1736	0.4142	0.2405	0	-0.0516	0.2405	0.3287	0.3287	0.0881	1.7628	0.1959
Mohamed Salah	0.0339	0.0881	0.3287	0.2744	0.0855	0	0.3261	0.3287	0.4142	0.0365	1.916	0.2129
Wilfried Zaha	0	0.0855	0.0855	0	-0.0516	0	0	-0.0516	-0.0516	0.2405	0.2567	0.0285
Sadio Mane	-0.0807	-0.1662	-0.1662	-0.0807	-0.0807	-0.2178	0.0074	0	-0.0807	0.0743	-0.7913	-0.0879
Danny Ings	0	0.0855	0.0855	0	0	-0.0516	0.0881	0	0	0.2405	0.4481	0.0498
Raul Jimenez	0.0855	0	0	0.0855	0.0855	0	0.1736	0	0.0855	0	0.5156	0.0573
Jumlah	0.0387	0.9233	1.576	1.0009	0.2449	-0.0116	1.8026	1.4693	1.5596	1.6469		
Entering	0.0043	0.1026	0.1751	0.1112	0.0272	-0.0013	0.2003	0.1633	0.1733	0.183		

Fig 11. Entering flow and Leaving Flow calculations

The leaving flow calculation is obtained by calculating the number of alternative preference index line values for the number of alternative values and less than 1 which is shown based on the formula below:

Leaving Flow + (a) = $\emptyset \frac{1}{n-1} \sum_{x \epsilon A} \varphi(a, x)$

$=\frac{1}{10-1}(2.8976) = 0.322$
$=\frac{1}{10-1}(1.916) = 0.2129$
$=\frac{1}{10-1}(1.7628) = 0.1959$
$=\frac{1}{10-1}(1.136) = 0.1262$
$=\frac{1}{10-1}(0.8522) = 0.0947$
$=\frac{1}{10-1}(1.257) = 0.1397$
$=\frac{1}{10-1}(0.4481) = 0.0498$
$=\frac{1}{10-1}(0.5156) = 0.0573$
$=\frac{1}{10-1}(0.2567) = 0.0285$
$=\frac{1}{10-1}(-0.7913) = -0.0879$

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The calculation of entering flow is obtained by calculating the number of alternative preference index column values for the number of alternative values and less than 1 which can be seen in the formula below:

Entering Flow - (a) $=\emptyset \frac{1}{n-1} \sum_{x \epsilon A} \varphi(x, a)$

$=\frac{1}{10-1}(0.0387) = 0.0043$

$=\frac{1}{10-1}(-0.0116) = -0.0013$

$=\frac{1}{10-1}(0.2449) = 0.0272$

$=\frac{1}{10-1}(0.9233) \ = 0.1026$

$=\frac{1}{10-1}(1.0009) = 0.1112$

$=\frac{1}{10-1}(1.576) = 0.1751$

$=\frac{1}{10-1}(1.5596) = 0.1733$

$=\frac{1}{10-1}(1.6469) = 0.183$

$=\frac{1}{10-1}(1.8026) = 0.2003$

$=\frac{1}{10-1}(1.4693) = 0.1633$

Hasil Akhir

Rank	Kode	Nama	Leaving Flow	Entering Flow	Net Flow
1	A001	Son Heung-Min	0.322	0.0043	0.3177
2	A006	Mohamed Salah	0.2129	-0.0013	0.2142
3	A005	Dominic Calvert-Lewin	0.1959	0.0272	0.1686
4	A002	Jamie Vardy	0.1262	0.1026	0.0236
5	A004	Harry Kane	0.0947	0.1112	-0.0165
6	A003	Patrick Bamford	0.1397	0.1751	-0.0354
7	A009	Danny Ings	0.0498	0.1733	-0.1235
8	A010	Raul Jimenez	0.0573	0.183	-0.1257
9	A007	Wilfried Zaha	0.0285	0.2003	-0.1718
10	A008	Sadio Mane	-0.0879	0.1633	-0.2512

Alternatif produk terbaik adalah **Son Heung-Min** dengan total: **0.3177**

Fig 12. The results of the leaving flow calculation, entering flow, net flow

The net flow calculation is obtained by calculating the leafing flow value less than the entering flow value which can be seen in the formula below:

$NetFlow\emptyset(\mathrm{a}) = + \text{-}\emptyset(\mathrm{a}) - \emptyset(\mathrm{a})$

0.322- 0.0043= 0.3177 (A1 = Son Heung-Min)
0.2129- -0.0013= 0.2142 (A2 = Mohamed Salah)
0.1959- 0.0272= 0.1686 (A3 = Dominic Calvert-Lewin)
0.1262- 0.1026= 0.0236 (A4 = Jamie Vardy)
0.0947- 0.1112= -0.0165 (A5 = Harry Kane)
0.1397- 0.1751= -0.0354 (A6 = Patrick Bamford)
0.0498- 0.1733= -0.1235 (A7 = Danny Ings)
0.0573- 0.183= -0.1257 (A8 = Raul Jimenez)
0.0285- 0.2003= -0.1718 (A9 = Wilfried Zaha)
-0.0879- 0.1633= -0.2512 (A10 = Sadio Mane)

3.4 AHP-TOPSIS method

In Figure 13 below is a data flow or flowchart system from the use of the AHP-TOPSIS method for selecting the best EPL player with a pairwise comparison scale.

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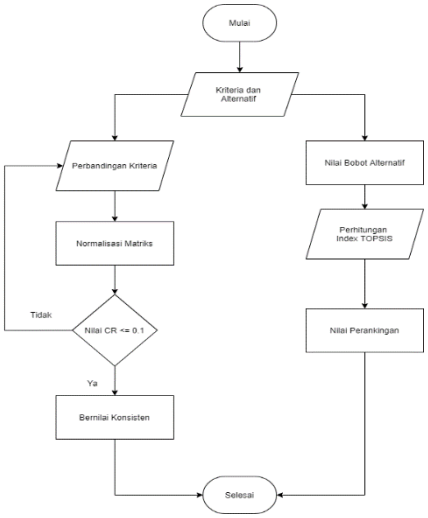

Fig 13. Flow chart selection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale

The results of research and testing of the AHP-TOPSIS method were carried out using data from the official website of the English League 2020/2021 to determine the best player in October. Criteria data are processed using the AHP method as the main ingredient of calculations and comparisons based on Table 1. which will produce normalization values, preferences, consistency index values, consistency ratios and criteria weights. There are 7 criteria that are taken to determine the best player, namely goals (C1), assists (C2), shot on target (C3), wins (C4), passes (C5), fouls (C6), and appearances (C7). A sample of ten players will be made which will later be used as alternative data using the TOPSIS method calculation. Criteria and alternatives data are shown based on table 4 and table 5.

In the alternative assessment, there are alternative weight provisions which are shown based on the following table 9:

Table 9.
Determination of alternative weights

Score	Information
1	Less
2	Enough
3	Good
4	Very good

From the alternative weight provisions then analyzed with alternative data sourced from the premier league website and produce a value as shown in Figure 14.

Hasil Analisa

Kode	Nama	Goals	Assist	Shot on Target	Wins	Passes	Fouls	Appearences
A001	Son Heung-Min	4	2	4	3	3	4	4
A002	Jamie Vardy	4	1	3	3	2	1	4
A003	Patrick Bamford	3	2	3	3	2	1	4
A004	Harry Kane	3	4	4	3	3	4	4
A005	Dominic Calvert-Lewin	4	1	4	3	3	2	4
A006	Mohamed Salah	4	1	4	3	4	3	4
A007	Wilfried Zaha	3	1	2	3	3	1	4
A008	Sadio Mane	3	1	3	3	4	2	3
A009	Danny Ings	3	1	3	3	3	2	4
A010	Raul Jimenez	2	1	3	3	4	4	4

Fig 14. Result of alternative calculation analysis

The image above is alternative data that has been provided with alternative weight provisions and will then be squared for normalized decision matrix calculations.

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Kuadrat

Kode	C01	C02	C03	C04	C05	C06	C07
A001	16	4	16	9	9	16	16
A002	16	1	9	9	4	1	16
A003	9	4	9	9	4	1	16
A004	9	16	16	9	9	16	16
A005	16	1	16	9	9	4	16
A006	16	1	16	9	16	9	16
A007	9	1	1	9	9	1	16
A008	9	1	9	9	16	4	9
A009	9	1	9	9	9	4	16
A010	4	1	9	9	16	16	16

Fig 15. Alternative square values

Normalisasi

Kode	C01	C02	C03	C04	C05	C06	C07
A001	0.3763	0.3592	0.3763	0.3162	0.2985	0.4714	0.3234
A002	0.3763	0.1796	0.2822	0.3162	0.199	0.1179	0.3234
A003	0.2822	0.3592	0.2822	0.3162	0.199	0.1179	0.3234
A004	0.2822	0.7184	0.3763	0.3162	0.2985	0.4714	0.3234
A005	0.3763	0.1796	0.3763	0.3162	0.2985	0.2357	0.3234
A006	0.3763	0.1796	0.3763	0.3162	0.398	0.3536	0.3234
A007	0.2822	0.1796	0.1881	0.3162	0.2985	0.1179	0.3234
A008	0.2822	0.1796	0.2822	0.3162	0.398	0.2357	0.2425
A009	0.2822	0.1796	0.2822	0.3162	0.2985	0.2357	0.3234
A010	0.1881	0.1796	0.2822	0.3162	0.398	0.4714	0.3234

Fig 16. Normalized decision matrix

After obtaining the normalized decision value which is calculated from one of the alternative table columns then divided by the root of the number of alternative columns squared using the AHP-TOPSIS formula calculation 3, the next step is to calculate the value. The weighted normalized decision matrix is shown based on Figure 17 below:

Normalisasi Terbobot

Kode	C01	C02	C03	C04	C05	C06	C07
A001	0.0905	0.0556	0.0332	0.0674	0.0255	0.0243	0.0537
A002	0.0905	0.0278	0.0249	0.0674	0.017	0.0061	0.0537
A003	0.0679	0.0556	0.0249	0.0674	0.017	0.0061	0.0537
A004	0.0679	0.1112	0.0332	0.0674	0.0255	0.0243	0.0537
A005	0.0905	0.0278	0.0332	0.0674	0.0255	0.0122	0.0537
A006	0.0905	0.0278	0.0332	0.0674	0.034	0.0182	0.0537
A007	0.0679	0.0278	0.0166	0.0674	0.0255	0.0061	0.0537
A008	0.0679	0.0278	0.0249	0.0674	0.034	0.0122	0.0403
A009	0.0679	0.0278	0.0249	0.0674	0.0255	0.0122	0.0537
A010	0.0453	0.0278	0.0249	0.0674	0.034	0.0243	0.0537

Fig 17. Weighted normalized decision matrix

The calculation of the weighted normalized decision matrix value is done by multiplying the priority value by the normalized decision matrix value for each column using the AHP-TOPSIS formula, calculation 4. The next step is to calculate the positive and negative ideal solutions for each of the criteria shown based on Figure 18 below:

Solusi Ideal

Kode	C01	C02	C03	C04	C05	C06	C07
positif	0.0905	0.1112	0.0332	0.0674	0.034	0.0061	0.0403
negatif	0.0453	0.0278	0.0166	0.0674	0.017	0.0243	0.0537

Fig 18. Positive and negative ideal solutions

Positive and negative ideal solutions can be formulated by determining the positive and negative ideal solution matrices, namely each row of the criteria table by entering the maximum value for positive and the minimum value for negative [2] using the AHP-TOPSIS formula of calculations 5 and 6.

Matriks Solusi Ideal POSITIF

Kode	C01	C02	C03	C04	C05	C06	C07
A001	0	0.00309	0	0	7.0E-5	0.00033	0.00018
A002	0	0.00695	7.0E-5	0	0.00029	0	0.00018
A003	0.00051	0.00309	7.0E-5	0	0.00029	0	0.00018
A004	0.00051	0	0	0	7.0E-5	0.00033	0.00018
A005	0	0.00695	0	0	7.0E-5	4.0E-5	0.00018
A006	0	0.00695	0	0	0	0.00015	0.00018
A007	0.00051	0.00695	0.00027	0	7.0E-5	0	0.00018
A008	0.00051	0.00695	7.0E-5	0	0	4.0E-5	0
A009	0.00051	0.00695	7.0E-5	0	7.0E-5	4.0E-5	0.00018
A010	0.00205	0.00695	7.0E-5	0	0	0.00033	0.00018

Fig 19. The distance between the values of each positive ideal solution matrix

Matriks Solusi Ideal NEGATIF

Kode	C01	C02	C03	C04	C05	C06	C07
A001	0.00205	0.00077	0.00027	0	7.0E-5	0	0
A002	0.00205	0	7.0E-5	0	0	0.00033	0
A003	0.00051	0.00077	7.0E-5	0	0	0.00033	0
A004	0.00051	0.00695	0.00027	0	7.0E-5	0	0
A005	0.00205	0	0.00027	0	7.0E-5	0.00015	0
A006	0.00205	0	0.00027	0	0.00029	4.0E-5	0
A007	0.00051	0	0	0	7.0E-5	0.00033	0
A008	0.00051	0	7.0E-5	0	0.00029	0.00015	0.00018
A009	0.00051	0	7.0E-5	0	7.0E-5	0.00015	0
A010	0	0	7.0E-5	0	0.00029	0	0

Fig 20. The distance between the values of each ideal solution matrix is negative

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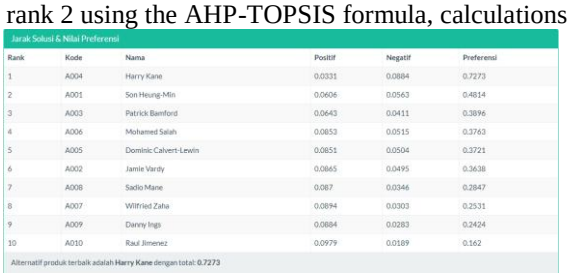
The calculation of the distance between the value of each positive and negative ideal solution matrix, namely by the value of each weighted normalization decision matrix criterion subtracted by the positive and negative ideal solutions then rank 2 using the AHP-TOPSIS formula, calculations 7 and 8.



Jarak Solusi & Nilai Preferensi

Rank	Kode	Nama	Positif	Negatif	Preferensi
1	A004	Harry Kane	0.0331	0.0884	0.7273
2	A001	Son Heung-Min	0.0606	0.0563	0.4814
3	A003	Patrick Bamford	0.0643	0.0411	0.3896
4	A006	Mohamed Salah	0.0853	0.0515	0.3763
5	A005	Dominic Calvert-Lewin	0.0851	0.0504	0.3721
6	A002	Jamie Vardy	0.0865	0.0495	0.3638
7	A008	Sadio Mane	0.087	0.0346	0.2847
8	A007	Wilfried Zaha	0.0894	0.0303	0.2531
9	A009	Danny Ings	0.0884	0.0283	0.2424
10	A010	Raul Jimenez	0.0979	0.0189	0.162

Alternatif produk terbaik adalah **Harry Kane** dengan total: **0.7273**

Fig 21. Preference value and ranking result

From the calculation of the distance between the value of each positive and negative ideal solution matrix then the sum will produce one value for each alternative and the preference value is calculated with the result of a negative value divided by the negative value in the mine with a positive value using the AHP-TOPSIS formula of calculation 9, then get a final stage value as a ranking which later can be used for the decision support system of the best soccer players in the English league in October using the AHP-TOPSIS method.

4. Conclusion

At the conclusion of the research related toselection of the best EPL players using the AHP, PROMETHEE, and TOPSIS methods with a pairwise comparison scale as follows:

The design of the scoring system for the best players in the English league can produce an alternative score processing and automatic criteria that are accurate and can innovate by having a comparison method that has clearly described the process flow and calculations with the combined method, it will be more accurate in ranking results and can Look at the differences between the calculations of the two comparison methods.

For pairwise comparisons in the combination of these methods, namely AHP-PROMETHEE with AHP-TOPSIS, it produces the main assessment of the two comparisons of the AHP method based on 7 criteria data. selection of the best EPL players that is consistency index 0.078, ratio index 1.32, consistency ratio 0.059 (consistent value). The process that will be continued in the PROMETHEE method is the calculation of data taken from 10 alternative players that the A01 alternative, namely Son Heung-Min, is proven to have the highest ranking results with a total value of 0.3082. And in the order of priority fully using the PROMETHEE method from 10 alternative player data, the ranking results from the highest to the lowest are Son Heung Min (A01), Mohamed Salah (A06), Dominic Calvert-Lewin (A05), Jamie Vardy (A02), Patrick Bamford (A03), Harry Kane (A04), Danny Ings (A09), Raul Jimenez (A10), Wilfried Zaha (A07), Sadio Mane (A08). The second comparison process will be continued after the AHP calculation in the TOPSIS method, namely the calculation of data taken from 10 alternative players that the A04 alternative, Harry Kane, is proven to have the highest ranking result with a total value of 0.7473. And in full order of priority using the PROMETHEE method from 10 alternative player data, the ranking results from highest to lowest are Son Heung Min (A01), Patrick Bamford (A03), Mohamed Salah (A06), Dominic Calvert-Lewin (A05), Jamie Vardy (A02), Danny Ings (A09), Wilfried Zaha (A07), Sadio Mane (A08). Raul Jimenez (A10). And in full order of priority using the PROMETHEE method from 10 alternative player data, the ranking results from highest to lowest are Son Heung Min (A01), Patrick Bamford (A03), Mohamed Salah (A06), Dominic Calvert-Lewin (A05), Jamie Vardy (A02), Danny Ings (A09), Wilfried Zaha (A07), Sadio Mane (A08). Raul Jimenez (A10). And in full order of priority using the PROMETHEE method from 10 alternative player data, the ranking results from highest to lowest are Son Heung Min (A01), Patrick Bamford (A03), Mohamed Salah (A06), Dominic Calvert-Lewin (A05), Jamie Vardy (A02), Danny Ings (A09), Wilfried Zaha (A07), Sadio Mane (A08). Raul Jimenez (A10).

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