E-ISSN: 2717-3453 | P-ISSN: 2783-1442

Journal of Fuzzy Extension and Applications

www.journal-fea.com

J. Fuzzy. Ext. Appl. Vol. 1, No. 2 (2020) 98–107.

Paper Type: Research Paper

Prediction of Pakistan Super League-2020 Using TOPSIS and Fuzzy TOPSIS Methods

Muhammad Jafar[1,*], Faizullah Khan[1], Amir Naveed[1]

[1] Department of Mathematics, Faculty of Basic Sciences Lahore Garrison University, Lahore, Pakistan; naveedjafar@lgu.edu.pk; mailto:kfaizullah520@gmail.com; raoaamir432@gmail.com.

Citation:

Jafar, M., Arab, A., Khan, F., Naveed, A. (2020). Prediction of Pakistan super league-2020 using TOPSIS and fuzzy TOPSIS methods. *Journal of fuzzy extension and application, 1* (2), 98-107.

Received: 21/01/2020 Reviewed: 29/02/2020 Revised: 05/03/2020 Accept: 30/04/2020

Abstract

We lived in uncertain word and prediction in this uncertain word is a major issue. Prediction in cricket is very complex because there are many factors which are effecting on results. Weather, pitch, Conditions, Home grounds are some of these factors. In this article it is aimed to predict the results of PSL-2020 by using TOPSIS and Fuzzy TOPSIS methods. It will be interesting because first time in PSL history it is going to be held in Pakistan. But we use some serious factor to predict the winner of PSL-2020.

Keywords: PSL, TOPSIS, Prediction, Cricket.

1 | Introduction

Pakistan Super League (PSL) is a professional Twenty20 cricket league in Pakistan contested during February and March every year, with each team play matches in double round robin format. The league is founded by the Pakistan Cricket Board (PCB) in Lahore on 9 September 2015 with initial participation of 5 teams but now there are 6 teams represented by 6 major cities 0f Pakistan including Islamabad, Lahore, Multan, Karachi, Peshawar and Quetta.

The commercial rights to the initial franchises were sold for US$93 million for a ten-years period while the 6th franchise was originally formed in 2017 bought by Schone properties in US$5.2 million per annum for 8 years contract means the total contract for that team was worth US$41.6 million that makes it the most expensive team of PSL but unfortunately the contract was terminated by the PCB just after one year due to the non-payment of annual fee by the franchise. Ali Khan Tareen and Taimoor Malik are the new owners of the 6th team as they won the bid for US$6.2 million per annum for 7 years period.

The 1st edition of the PSL was entirely played in UAE due to security reasons, Islamabad United was the 1st champions, Peshawar Zalmi were the 2017 PSL champions, Islamabad were again won the title in 2018 while Quetta Gladiators are the current champions of the HBL PSL.The PSL 2020 season is now going to be held entirely in Pakistan for the 1st time as by the directions of Pakistani Prime

Corresponding Author: naveedjafar@lgu.edu.pk

http://dx.doi.org/10.22105/jfea.2020.249363.1011

Minister. The tournament will be played from February 20, 2020 to March 22, 2020. Four venues including Lahore, Karachi, Multan and Rawalpindi will host whole the tournament.

Cricket is said to be a game of uncertainties, if we talk about the T20 game then it's really a difficult task to predict about the Twenty20 game as it's the limited overs game and a single player can overcome on the situation [2] and changed the whole map of the game in just few minutes [3]. The combination of key players (Batsmen with good average and bowlers with good economy rates) also plays an important role in match winning [4] for this purpose these 3 factors (batting, bowling, key players) [1] are strongly recommended to add in the stats to help in prediction because more the key players will have the more chances to win the match.

The stats in this article are based on the upcoming edition of the PSL 2020. About 90% data in stats is taken from the website cicinfo.com that's considered to be the most authentic and most visiting website in all over the world for cricket's updates and stats. The 9 important attributes which are considered to be the most important in match wining or lost with names C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9,C_{10} and C_{11} are taken out with 6 teams named as T_1 , T_2 , T_3, T_4, T_5 and T_6.

2| Material and Methods

The 5th edition of the HBL PSL is going to start from February 20, 2020 in Pakistan. The best players from all over the world are taking part with their relative franchises with 6 of the following teams:

T_1= Quetta Gladiators.
T_2= Islamabad United.
T_3= Karachi Kings.
T_4= Peshawar Zalmi.
T_5= Multan Sultan.
T_6= Lahore Qalandars.

Attributes. Some important attributes that plays important role in match wining are as follows with explanation of each one separately.

C1	C2	C3	C4	C5	C6
Fifties	Chased	Matches won	Matches lost	Win percentage	Lost percentage
C7	**C8**	**C9**	**C10**	**C11**	
2QA		Batting average>24	Bowling S.R	Economy rate	

C1–fifties. Fifties plays an important role in T20 cricket. It also helps to see the overall performance by whole the team, More the fifties maker in the team will have the more chances to adopt the pressure. The data shows the performance regarding fifties of all the teams in last 4 editions of the PSL.

C_2–chased. Chasing is a slightly a difficult task in T20 cricket if the opposite team makes a good total in 1st inning. So the team having good chasing skills will definitely have chances to win the match as well as to adopt the pressure in every situation. In stats the previous record is collected from last 4 editions which clearly shows the chasing abilities by a specific team.

C3–match won. It also an important factor to encourage the teams expectations and moral values. Winning matches shown the previous performance of the team and likely to have to perform well in future on the basis of previous record except of that the pitches, venues and some players are changed for upcoming PSL.

C_4–match lost. It shows the bad performance of the team. The team with most of the lost matches definitely will be considered as the weak team at all but restricted till the expectation as its T20 game and we can't predict with more confidently regarding the strongest and weakest team.

C_5–Win % AGE. Clearly shows the teams combined performance in last 4 editions. As the percentage mostly lies in decimal but in stats it's taken as exact numeric value i.e. instead of taking 58.69%. More the winning percentage shows the team's overall performance in last 4 editions of the PSL.

C_6–lost percentage. Lost percentage shows the weakness of the team. The team with more percentage in matches lost is likely to be consider as the weakest side of the tournament but except of that mostly players are changed or replaced every year so it's not the 100% surety to claim about its performance by just seeing previous record of the weakest team.

C_7–all out. It shows the team's confidence regarding to adopt the pressure in critical situations and also the consistency of the players in difficult situations. More the all outs shows the previous record about their performance in limited overs cricket.

C_8–key players. Key players also plays an important role in match winning .The team with more key players probably have the more chances to win the match or even title. Key players in stats are included with best batting, bowling averages and best economy rates.

C_9–best batting averages. Good batting line up is also a key factor for the team, batting averages taken in stats is >24 means no of best batsmen in a team. More the players with average >24 will increase the chances of winning the match or create a big total on board that helps to win the matches.

C_9 –bowling strike rate. Bowling strike rate is the average number of balls bowled per wicket taken, lower the strike rate means more effective a baller is taking wickets quickly. In stats just those players are taken out who have the best strike rates that is consider to be as <19.

C_{11}–economy rate. Economy rate is the average number of runs conceded for each over bowled. A lower economy rate is preferable. In stats just those bowlers are to be choose out to whom economy rates are less than 8.

Table 1 shows the statistical behavior of the teams performances. The data is collected up to 4 editions of the PSL.

Table 1. Statically behavior of the collected data that is take up to 4 editions of the PSL.

Teams/ Attributes	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}
T_1	31	20	26	16	62	38	6	6	5	2	2
T_2	31	18	25	18	58	42	5	6	6	4	4
T_3	27	8	17	23	43	57	4	6	6	3	3
T_4	36	15	27	19	59	41	4	4	6	2	2
T_5	12	5	7	12	37	63	6	4	4	1	4
T_6	24	5	10	24	31	69	7	4	4	2	3

3| Calculations

TOPSIS technique is used to calculate an MCDM problem. So the weights are assigned according to the importance of each of the attribute.

Weight	0.15	0.08	0.12	0.03	0.09	0.08	0.02	0.17	0.16	0.08	0.02
Attributes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11

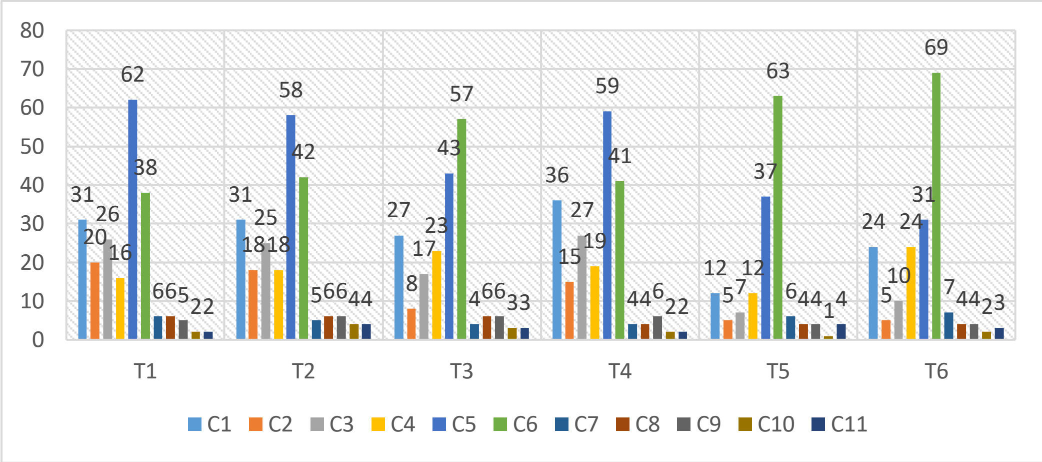

Fig. 1. Graphical representation of the above mentioned data.

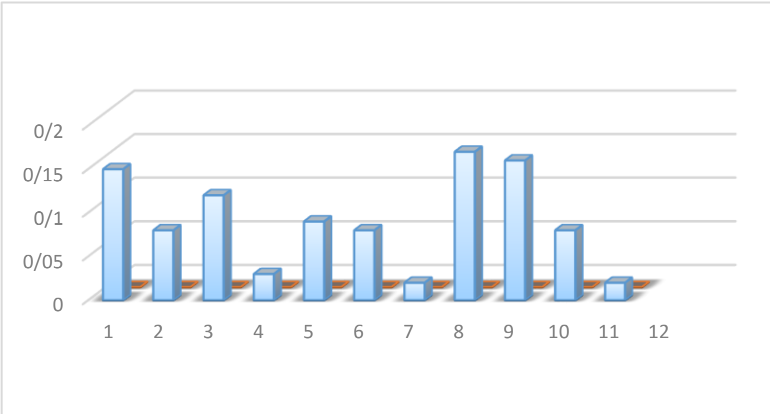

Fig. 2. Graphical behavior of the above mentioned weights to the attributes.

There is a great demand of game prediction for that many of the mathematical formulas are to be used for prediction by using MCDM techniques that is used to choose the best one amongst multiple criteria's.

3.1| TOPSIS Prediction

TOPSIS, Technique for order of preference by similarity to ideal solution, a tool for calculating the best one from the collected data. TOPSIS technique is applied to calculate the weights by given data that is collected up to 4 editions of the PSL which is easily available on "www.cricinfo.com" that is considered to be one of the best cricketing website in the world. To apply the technique some important attributes that are considered to play an important role in match or title winning including Fifties, chased, matches won, matches lost, win percentage, lost percentage, best batting average, best bowling strike rate, best economy rate with 6 teams T_1, T_2, T_3, T_4, T_5, and T_6 as decision makers are taken.

Step 1. Calculate normalized matrix.

$$X_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{n} X^2{}_{ij}}}.$$

Weight	0.15	0.08	0.12	0.03	0.09
T/C	C_1	C_2	C_3	C_4	C_5
T1	0.453777	0.613428	0.523360293	0.341899075	0.508470092
T2	0.453777	0.552085	0.503231051	0.384636459	0.47566557
T3	0.395225	0.245371	0.342197115	0.49147992	0.352648612
T4	0.526967	0.460071	0.543489536	0.406005151	0.483866701
T5	0.175656	0.153357	0.140904694	0.256424306	0.303441829
T6	0.351311	0.153357	0.201292421	0.512848612	0.254235046

0.08	0.02	0.17	0.16	0.08	0.02
C_6	C_7	C_8	C_9	C_{10}	C_{11}
0.292584827	0.449719013	0.480384461	0.389249472	0.324442842	0.262612866
0.32338323	0.374765844	0.480384461	0.467099366	0.648885685	0.525225731
0.43887724	0.299812676	0.480384461	0.467099366	0.486664263	0.393919299
0.315683629	0.299812676	0.320256308	0.467099366	0.324442842	0.262612866
0.485074845	0.449719013	0.320256308	0.311399578	0.162221421	0.525225731
0.531272449	0.524672182	0.320256308	0.311399578	0.324442842	0.393919299

Step 2. Calculate the weighted normalized matrix.

$$V_{ij} = X_{ij} \times W_j.$$

Weight	0.15	0.08	0.12	0.03	0.09
T/C	C_1	C_2	C_3	C_4	C_5
T1	0.068067	0.049074	0.062803235	0.010256972	0.045762308
T2	0.068067	0.044167	0.060387726	0.011539094	0.042809901
T3	0.059284	0.01963	0.041063654	0.014744398	0.031738375
T4	0.079045	0.036806	0.065218744	0.012180155	0.043548003
T5	0.026348	0.012269	0.016908563	0.007692729	0.027309765
T6	0.052697	0.012269	0.02415509	0.015385458	0.022881154

0.08	0.02	0.17	0.16	0.08	0.02
C_6	C_7	C_8	C_9	C_{10}	C_{11}
0.023406786	0.00899438	0.081665358	0.062279916	0.025955427	0.005252257
0.025870658	0.007495317	0.081665358	0.074735899	0.051910855	0.010504515
0.035110179	0.005996254	0.081665358	0.074735899	0.038933141	0.007878386
0.02525469	0.005996254	0.054443572	0.074735899	0.025955427	0.005252257
0.038805988	0.00899438	0.054443572	0.049823932	0.012977714	0.010504515
0.042501796	0.010493444	0.054443572	0.049823932	0.025955427	0.007878386

Step 3. Calculate the ideal best and ideal worst values.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
V+	0.079045	0.049074	0.065218744	0.007692729	0.045762308	0.023406786	0.005996254	0.081665358	0.074735899	0.051910855	0.010504515
V-	0.026348	0.012269	0.016908563	0.015385458	0.022881154	0.042501796	0.010493444	0.054443572	0.049823932	0.012977714	0.005252257

Step 4. Calculate the Euclidean distance from the idea best.

Jafar et al. | J. Fuzzy. Ext. Appl. 1(2) (2020) 98-107

$$Si^{+} = \left[(\textstyle\sum_{j=1}^{m} V_{ij} - V_j^{+})^2\right]^{0.5}.$$

Step 5. Calculate the Euclidean distance from the ideal worst.

$$Si^{-} = \left[(\textstyle\sum_{j=1}^{m} V_{ij} - V_j^{-})^2\right]^{0.5}.$$

Step 6. Calculate the performance score.

$$P_i = \frac{Si^{-}}{Si^{+}+Si^{-}}.$$

Teams	Si+	Si-	Pi	Rank
Quetta Gladiators	0.032	0.085	0.728429	2
Islamabad United	0.014	0.091	0.865348	1
Karachi Kings	0.049	0.063	0.560988	4
Peshawar Zalmi	0.04	0.085	0.679043	3
Multan Sultan	0.1	0.011	0.099888	6
Lahore Qalandars	0.082	0.03	0.269933	5

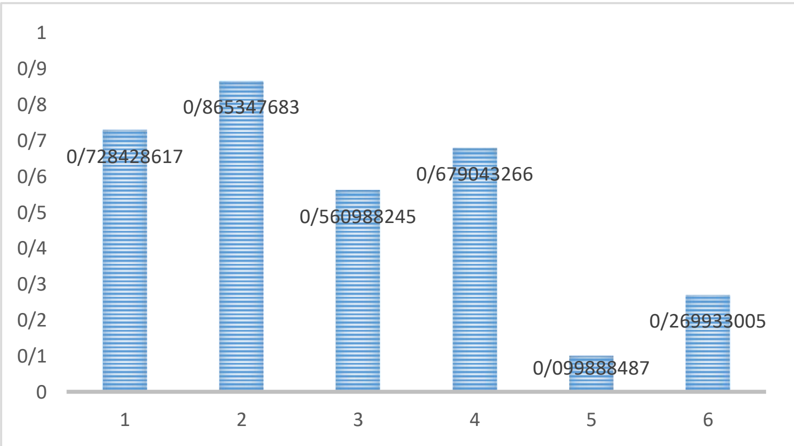

Fig. 3. Graphical representation of the final results against each team.

3.2| Calculations via Fuzzy TOPSIS

Step 1. Assign the fuzzy numbers to the group of decision makers on the basis of attributes regarding each of the criteria.

T/C	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}
T_1	8,6,7	9,7,8	8,6,7	8,6,7	9,7,8	2,3,5	6,5,4	9,7,8	8,6,7	8,6,7	8,6,7
T_2	8,6,7	8,6,7	6,5,4	6,5,4	8,6,7	6,5,4	2,3,5	6,5,4	6,5,4	6,5,4	8,6,7
T_3	6,5,4	2,3,5	6,5,4	2,3,5	2,3,5	6,5,4	2,3,5	9,7,8	8,6,7	6,5,4	6,5,4
T_4	9,7,8	6,5,4	9,7,8	6,5,4	8,6,7	2,3,5	2,3,5	6,5,4	8,6,7	2,3,5	2,3,5
T_5	1,1,2	1,1,2	2,3,5	2,3,5	2,3,5	8,6,7	8,6,7	6,5,4	2,3,5	1,1,2	8,6,7
T_6	2,3,5	1,1,2	1,1,2	1,1,2	1,1,2	9,7,8	9,7,8	6,5,4	2,3,5	2,3,5	6,5,4

Jafar et al. | J. Fuzzy. Ext. Appl. 1(2) (2020) 98-107

Decision Maker 2.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}
T_1	9,7,8	9,7,8	8,6,7	8,6,7	9,7,8	1,1,2	6,5,4	9,7,8	9,7,8	9,7,8	8,6,7
T_2	8,6,7	8,6,7	6,5,4	6,5,4	8,6,7	2,3,5	1,1,2	6,5,4	8,6,7	8,6,7	6,5,4
T_3	6,5,4	1,1,2	6,5,4	2,3,5	2,3,5	6,5,4	2,3,5	9,7,8	8,6,7	8,6,7	6,5,4
T_4	8,6,7	6,5,4	8,6,7	6,5,4	8,6,7	2,3,5	2,3,5	6,5,4	6,5,4	2,3,5	2,3,5
T_5	1,1,2	1,1,2	2,3,5	6,5,4	2,3,5	8,6,7	8,6,7	6,5,4	2,3,5	1,1,2	8,6,7
T_6	2,3,5	1,1,2	1,1,2	6,5,4	1,1,2	8,6,7	9,7,8	6,5,4	2,3,5	2,3,5	8,6,7

Step 2. Construct the combined decision matrix by using the following formula.

$$\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij}) \quad \text{where } a_{ij} = \min_k\{a_{ij}^{\ k}\}, \quad b_{ij} = \frac{1}{k}\sum_{k=1}^{k} b_{ij}^{\ k}, \quad c_{ij} = \max_k\{c_{ij}^{\ k}\}.$$

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}
T_1	8,6.33,8	8,6.66,8	8,3,7	8,6.33,8	8,6.66,8	1,1.66,5	2,4.33,5	9,7,8	8,6.66,8	8,6.33,8	6,5.66,7
T_2	8,6,7	8,6,7	6,5,4	6,5.33,7	8,6,7	2,3.66,5	1,1.66,5	6,5.33,7	6,5.33,7	6,5.66,7	6,5.66,7
T_3	6,3,4	1,2.33,5	6,5,4	2,3,5	2,3,5	6,5,4	2,3,5	9,7,8	8,6.33,7	6,5.33,7	6,5,4
T_4	8,6.66,8	6,5,4	8,6.66,8	6,5,4	8,6,7	2,3,5	2,3,5	6,5,4	6,5.66,7	2,3,5	2,3,5
T_5	1,1.66,5	1,2.33,4	2,3,5	2,3.66,5	2,3,5	8,6,7	8,6,7	6,5,4	2,3,5	1,1,2	8,6,7
T_6	1,2.33,5	1,1.66,5	1,1,2	1,4.33,8	1,1,2	8,7,8	9,7,8	6,5,4	2,3,5	2,3,5	6,5.33,7

Step 3. Compute the normalized fuzzy decision matrix by using formulae.

$$r_{ij} = \left(\frac{a_{ij}}{c_j^{\,+}}, \frac{b_{ij}}{c_j^{\,+}}, \frac{c_{ij}}{c_j^{\,+}}\right) \text{ and } c_j^{\,+} = \max_i\{c_{ij}\} \text{ (Beneficial criteria).}$$

$$r_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right) \text{ and } a_j^- = \min_i\{a_{ij}\} \text{ (Non beneficial criteria).}$$

	Bnf	**Bnf**	**Bnf**	**Non Bnf**	**Bnf**
Wght	**8,6,9**	**6,5,4**	**7,5,8**	**6,5,4**	**6,3,5**
T/C	**C_1**	**C_2**	**C_3**	**C_4**	**C_5**
T1	1,0.79125,1	1,0.8325,1	1,0.375,0.875	0.125,0.1579,0.125	1,0.8325,1
T2	1,0.75,1	1,0.75,0.875	0.75,0.625,0.5	0.1428,0.1876,0.166	1,0.75,0.875
T3	0.75,0.375,0.5	0.125,0.291,0.625	0.75,0.625,0.5	0.2,0.33,0.5	0.25,0.375,0.625
T4	1,0.8325,1	0.75,0.626,0.5	1,0.8325,1	0.25,0.2,0.166	1,0.75,0.875
T5	0.125,0.2075,0.625	0.125,0.291,0.5	0.25,0.375,0.625	0.2,0.27,0.166	0.25,0.375,0.625
T6	0.125,0.291,0.625	0.125,0.2075,0.625	0.125,0.125,0.25	0.125,0.230,1	0.125,0.125,0.25
Non Bnf	**Non Bnf**	**Bnf**	**Bnf**	**Bnf**	**Bnf**
3,4,7	**4,5,6**	**9,7,9**	**9,6,8**	**6,5,7**	**7,6,8**
C_6	**C_7**	**C_8**	**C_9**	**C_{10}**	**C_{11}**
0.2,0.602,1	0.2,0.230,0.5	1.125,0.875,1	1,0.8325,1	1,0.791,1	0.8571,0.8085,1
0.2,0.2732,0.5	0.2,0.6024,1	0.75,0.666,0.875	0.75,0.666,0.875	0.75,0.7075,0.875	0.8571,0.8085,1
0.25,0.22,0.166	0.2,0.33,0.5	1.125,0.875,1	0.75,0.666,0.875	0.75,0.666,0.875	0.8571,0.7142,0.5715
0.2,0.33,0.5	0.2,0.33,0.5	0.75,0.625,0.5	0.75,0.7075,0.875	0.25,0.375,0.625	0.285,0.4285,0.7142
0.1425,0.166,0.12	0.1425,0.166,0.125	0.75,0.625,0.5	0.25,0.375,0.625	0.125,0.125,0.25	1.1428,0.8571,1
0.125,0.1425,0.125	0.12,0.14,0.111	0.75,0.625,0.5	0.25,0.375,0.625	0.25,0.375,0.625	0.8571,0.7614,1

Step 4. Calculate weighted normalized fuzzy decision matrix.

$$v_{ij} = r_{ij} \times w_j.$$

Such that $A1 \otimes A2 = (a1,b1,c1) \otimes (a2,b2,c2) = (a1 \times a2, b1 \times b2, c1 \times c2)$.

	Bnf	Bnf	Bnf	Non Bnf	Bnf
Wght	**8,6,9**	**6,5,4**	**7,5,8**	**6,5,4**	**6,3,5**
T/C	**C_1**	**C_2**	**C_3**	**C_4**	**C_5**
T1	8,4.7475,9	6,4.1625,4	7,1.87,6.7	0.75,0.7895,0.5	6,2.49755,5
T2	8,4.5,9	6,3.75,3.5	5.25,3.125,4	0.8568,0.938,0.664	6,2.25,4.375
T3	6,2.25,4.5	0.75,1.4575,2.5	5.25,3.125,4	1.2,1.65,2	1.5,1.125,3.1285
T4	8,4.995,9	4.5,3.125,2	7,4.1625,8	1.5,1,0.64	6,2.25,4.125
T5	1,1.245,5.626	0.75,1.4550,2	1.75,1.875,5	1.2,1.35,2	1.5,1.125,3.125
T6	1,1.7475,5.625	0.75,1.037,2.5	0.875,0.625,2	0.75,1.15,4	0.75,0.375,1.25
Non Bnf	**Non Bnf**	**Bnf**	**Bnf**	**Bnf**	**Bnf**
3,4,7	**4,5,6**	**9,7,9**	**9,6,8**	**6,5,7**	**7,6,8**
C_6	**C_7**	**C_8**	**C_9**	**C_{10}**	**C_{11}**
0.6,2.408,7	0.8,1.15,3	10.125,6.125,9	9,4.995,8	6,3.955,7	5.99,4.851,8
0.6,1.092,3.5	0.8,3.012,6	6.75,4.662,7.875	6.75,3.996,7	4.5,3.5375,6.125	5.99,4.851,8
0.75,0.88,1.162	0.8,1.65,3	9,5.39,7.92	9,4.74,7	4.5,3.3,6.125	5.25,3.75,4
0.6,1.32,3.5	0.8,1.65,3	5.94,3.85,3.96	5.58,4.62,7	1.5,1.875,4.37	1.75,2.25,5
0.42,0.64,0.84	0.56,0.80,0.72	5.94,3.85,3.96	2.25,2.25,5	0.75,0.625,1.75	7,4.5,7
0.36,0.57,0.84	0.48,0.70,0.66	5.94,3.85,3.96	2.25,2.25,5	1.5,1.875,4.375	5.25,3.96,7

Step 5. Compute the Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS) by given formula.

$$A^{+} = (v_1^{+}, v_2^{+} \ldots \ldots v_n^{+}) \text{ where } v_j^{+} = {}^{\max}_{\ i}\{v_{ij3}\}.$$
$$A^{-} = (v_1^{-}, v_2^{-} \ldots \ldots v_n^{-}) \text{ where } v_j^{-} = {}^{\min}_{\ i}\{v_{ij1}\}.$$

	C 1	C2	C3	C4	C5	C6	C 7	C8	C9	C10	C11
FPIS = A+	8,4.995,9	6,4.1625,4	7,4.1625,8	0.75,1.15,4	6,2.49755,5	0.6,2.408,7	0.8,3.012,6	10.125,6.125,	9,4.995,8	6,3.955,7	5.99,4.851,8
FNIS = A-	1,1.245,5.6	0.75,1.037,	0.875,0.625	0.75,1.15,4	0.75,0.375,	0.36,0.57,0.	0.48,0.70,0.	5.94,3.85,3.	2.25,2.25,5	0.75,0.625,	1.75,2.25,5

Step 6. Calculate the distance from each alternative to the FPIS and then FNIS by using distance formula as mentioned below.

$$d(x, y) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}.$$

Distance from FPIS.

T/C	C_1	C_2	C_3	C_4	C_5
T1	0.142894192	0	1.521573336	2.0314166	0
T2	0.285788383	0.37423533	2.5909397	1.967769485	0.388107051
T3	3.25499744	3.830831348	2.5909397	1.2232095	2.916048
T4	0	1.562733	0	1.9887454	0.505181
T5	4.981511685	3.711749374	3.73252176	1.1913192	2.924003035
T6	4.862676946	3.632320207	5.355045323	0	3.912826

C_6	C_7	C_8	C_9	C_{10}	C_{11}
0	2.03854883	0	0	0	0
2.158846606	0	2.220857117	1.53411223	1.031169441	0
3.485184261	1.902195574	0.995364255	0.595825758	1.071548723	2.433091381
2.116108378	1.902195574	4.003808603	2.068576403	3.24002572	3.353744226
3.70152329	3.308017735	4.003808603	4.549634601	4.698010217	0.84524178
3.714002513	3.364686414	4.003808603	4.549634601	3.24002572	0.883455526

Distance from FNIS.

T/C	C_1	C_2	C_3	C_4	C_5
T1	4.921090064	3.63232	4.514999077	2.0314166	3.92131859
T2	4.864116946	3.70463	3.12999	1.967769485	3.664666
T3	3.015399	0.241188	3.12999	1.2232095	1.245493
T4	4.98048	2.49481	5.355045323	1.9887454	3.6214
T5	0	0.376364	1.942133	1.1913192	1.243734
T6	0.29011	0	0	0	0

C_6	C_7	C_8	C_9	C_{10}	C_{11}
3.724002513	1.388104223	4.003808603	4.549634601	4.698010217	3.353744226
2.424574464	3.364686414	2.355325101	3.016538634	3.727634695	3.494042
0.34248309	1.46975	3.023066875	4.311326169	3.667821788	2.273030283
1.60163582	1.46975	0	2.627153085	1.731030522	0
0.053229	0.081649658	0	0	0	3.494042549
0	0	0	0	1.733553052	2.52811524

Step 7. Calculate the di^{+} and di^{-} by using the formula mentioned below.

$$di^{+} = \sum_{j=1}^{n} d(v_{ij}, v_j^{+}) \quad di^{-} = \sum_{j=1}^{n} d\left(v_{ij}, v_j^{-}\right).$$

Step 8. Calculate the Closeness Coefficient (CCi) for each alternative.

$$CCi = di^{-}/(di^{+} + di^{-}).$$

Teams	di+	di-	Cci	RANK
Quetta Gladiators	5.734432958	40.73844871	0.8766069	1
Islamabad United	12.55182534	35.71397374	0.739943695	2
Karachi Kings	24.29923594	23.9427577	0.496305312	4
Peshawar Zalmi	20.7411183	25.87005015	0.555018272	3
Multan Sultan	37.64734128	8.382471407	0.182109614	5
Lahore Qalandars	37.51848185	4.551778292	0.108194679	6

So T_1 (Quetta Gladiator) has the most chances to win PSL-2020.

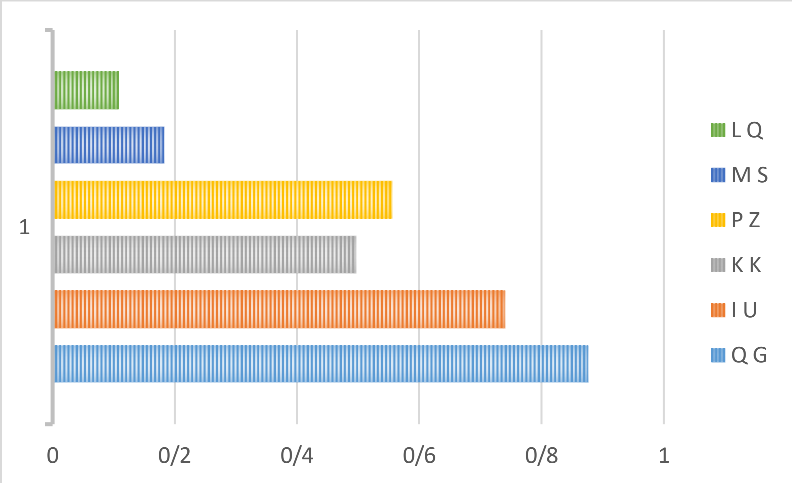

Fig. 4. Graphical representation of the final results by FTOPSIS.

4| Conclusion

The purpose of this research is to predict about the expected winner of PSL-5-2020.Although it's really a problematic task to predict about the game like this especially when we talk about limited overs cricket. Many of the factors including pitch ,weather conditions, availability of the key players directly impacts on the game, except of all that this research paper is based on the previous records of all the teams as well as availability of the key players for the upcoming edition of the PSL. So by collected records and mathematically point of view the results shows that team Islamabad United probably have the more chances to win the PSL-2020 by TOPSIS technique but fuzzy TOPSIS shows slightly different results with wining chances of another strongest and well deserved winning team Quetta Gladiators as well as the teams Multan Sultans and Lahore Qalandars have the lowest chances to win the title.

References

[1] Ahmed, F., Deb, K., & Jindal, A. (2013). Multi-objective optimization and decision making approaches to cricket team selection. *Applied soft computing*, *13*(1), 402-414.

[2] Bhattacharya, R., Gill, P. S., & Swartz, T. B. (2011). Duckworth–Lewis and twenty20 cricket. *Journal of the operational research society*, *62*(11), 1951-1957.

[3] Davis, J., Perera, H., & Swartz, T. B. (2015). Player evaluation in Twenty20 cricket. *Journal of sports analytics*, *1*(1), 19-31.

[4] Perera, H. P., & Swartz, T. B. (2013). Resource estimation in T20 cricket. *IMA journal of management mathematics*, *24*(3), 337-3