Modified Group Decision Algorithm for Performance Appraisal of Indian Premier League Cricketers

PABITRA KUMAR DEY
Department of Computer Application, Dr.B.C.Roy Engineering College,
Durgapur-06, INDIA.
dey_pabitra@yahoo.co.in
DIPENDRA NATH GHOSH
Department of Computer Science & Engineering, Dr.B.C.Roy Engineering College,
Durgapur-06, INDIA.
ghoshdipen2003@yahoo.co.in
ABHOY CHAND MONDAL
Department of Computer Science, University of Burdwan,
Burdwan, INDIA.
abhoy_mondal@yahoo.co.in

Abstract: - Multi Criteria Decision Making (MCDM) is a major technique in the field of performance appraisal. In time to time numerous MCDM procedures are proposed to solve multi criteria problems. The different methods may provide different results on the same problem, which is the major fault of MCDM. To overcome this our proposed technique namely as Modified Group Decision Analysis (MGDA) plays the vital role. Indian Premier League (IPL) T-20 cricket tournament dataset is to be considered for applying MGDA. The assessment of the players by using four different MCDM techniques considered as an input of group decision method and the output produces the rank of the players. The result shows that proposed model yields more realistic way to judge the players and resolve deficiency of MCDM process.

Key-Words: - Group Decision, IPL, MCDM method, Performance Appraisal, Spearman Ranking

1 Introduction

Decision Making is the most key factor for an organization. A right decision gives the organization much more benefit in all respect. In early, decision made with a single or two criteria by the decision makers but nowadays decision maker take their decisions on the basis of numerous criteria and new techniques are created for problem solving. One state-of-the-art that decision makers are used to make their decision is known as Multi Criteria Decision Making (MCDM). In early 70's Multi Criteria Analysis was introduced to help the decision makers to evaluate the performance appraisal of any organization or person. Several MCDM methods like Weighted Sum Method (WSM), Analytical Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), COmplex PRoportional ASsessment(COPRAS), VIKOR, ELECTRE, PROMETHEE, etc. illustrated by Muralidharan [1] & Pourjavad [2].

AHP, the pair-wise comparison process with hierarchical representation was launched in 1980 by T.L.Saaty [3, 4] to support the decision makers for assessing the relative importance between criteria and determining ranking of the alternatives [5]. In the proposed method AHP is used for calculating the weights of the different criteria of the players. TOPSIS was first introduced by Hwang and Yoon [6], which is based on the relative closeness among the positive ideal solution and the negative ideal solution. In 2011 Bowlers performance evaluation in IPL using AHP-TOPSIS and AHP-COPRAS was done by us [7]. Statistical Analysis was introduced in MCDM [8] for overcome the drawback of AHP by us in the year 2012 and Multi-Criteria decision tree approach [9] used for classify the all-rounders in IPL into several class so that the all-rounders base price fixed for similar type players derived in 2013. COPRAS is a procedure for multi-criteria evaluation of both maximizing and minimizing the critera, launched by Zavadskas, Kaklauskas [10]. In 1998, Opricovic [11] initiated a new technique known as VIKOR which determines compromise solution for a problem with opposing criteria to reach the final solution by ranking and selecting from a set of alternatives.

In this fast entertainment era Twenty-20 cricket becomes one of the most popular entertaining sports among all different forms of cricket played at the international level [12, 13]. The popularity of Twenty-20 cricket reach the peak after started IPL in India in the year 2008 by Board for Control of Cricket in India (BCCI) [14, 15, 16]. Initially, IPL started with 8 franchises or teams but in IPL session-V 9 teams took participated. The franchise owner formed their teams by competitive bidding from a collection of Indian and Overseas international players and the best of Indian upcoming talents. In cricket players are several jobs like batting, bowling (spin or fast), wicket-keeping, fielding, captaincy etc. H.H. Lemmer proposed several techniques for calculating the performance of bowlers, batsmen [17, 18, 19]. A graphical display for comparing the performances of bowlers, batsmen and all-rounders are presented by Paul J. van Staden [20]. Player valuations in the IPL by their previous performance, experience and other characteristics of individual players were done by David Parker and et al. [21].

In the proposed methodology at first performance measure and overall ranking are calculating separately by using WSM, TOPSIS, COPRAS, VIKOR with weight obtain by AHP. After that correlation coefficient is calculated among the techniques and finally group decision apply to ranking the players using additive and multiplicative ranking method. This proposed algorithm overcomes the constraints of the MCDM that ranking by several techniques provide different rank of the same alternatives with same criteria.

The paper is organized as follows: Section 2 focuses on the different terminologies that are used to judge the players. Section 3 discusses about the proposed methodology. Experiment and results are carried out on section 4. Finally, section 5 concludes the paper.

2 Terminologies used

In cricket there are several categories of players like batsman, fast bowler, spin bowler, all-rounder, wicket keeper etc. The vital role of batsman in cricket is to score the runs for his team whereas the bowlers bowl their predefined quota of over in a match to restrict the opponent in a lower total and take wickets. In cricket bowlers are mainly two types. One is Fast Bowler who can bowl very fast and other is Spinner who can bowl with rapid rotation but the speed is much less than the fast bowler. In cricket All-rounder are those players who can bat and bowl for their team plays an important role. Wicket-Keeper role is to keep the bowl behind the wicket.

The importance criteria of a batsman which are used to assess the performance of batsman are as follows:

BT-INNS: No. of innings played a particular batsman in a series.

BT-NO: No. of not out innings of a batsman in a tournament while batting.

BT-RUNS: Total runs scored by a cricketer in a series of matches.

BT-AVG: The total number of runs he has scored divided by the number of times he has been out.

BT-SR: The average number of runs scored per 100 balls faced by a batsman.

BT-FIFTY: The number of innings in which the batsman scored fifty to ninety-nine runs.

The following properties of a bowler play the vital role to estimate the player's performance in T-20 cricket:

BL-INNS: No. of innings played a particular player in a series.

BL-OVERS: Total no. of over bowled by a player during a series of matches.

BL-WKTS: Total no. of dismissals made by a bowler in a tournament.

BL-AVG: It is the ratio of runs conceded per wickets taken.

BL-SR: The average number of balls bowled per wicket taken by a bowler.

BL-ECON: The average number of runs conceded per over by a player when bowling.

For measuring the performance of an all-rounder depend on all the criteria of both batsman and bowler.

BT-INNS, BT-NO, BT-RUNS, BT-AVG, BT-SR, BT-FIFTY, BL-INNS, BL-SR, BL-OVERS, BL-WKTS, BL-AVG, BL-ECON.

In respect of cricket all the batting criteria and first three criteria of bowlers are positive that means increase the value of this property are more effective for increase of player performance whereas last three criteria of bowlers are negative in nature i.e. lesser value of these criteria give more importance to evaluate player importance in the team. In Twenty-20 cricket BT-RUNS, BT-AVG, BT-SR is the major property for batsman and BL-AVG, BL-SR, BL-ECON are plays the vital role for bowler.

3 Proposed Methodology

Flowchart of our new technique namely Modified Group Decision Algorithm (MGDA) is as follows:

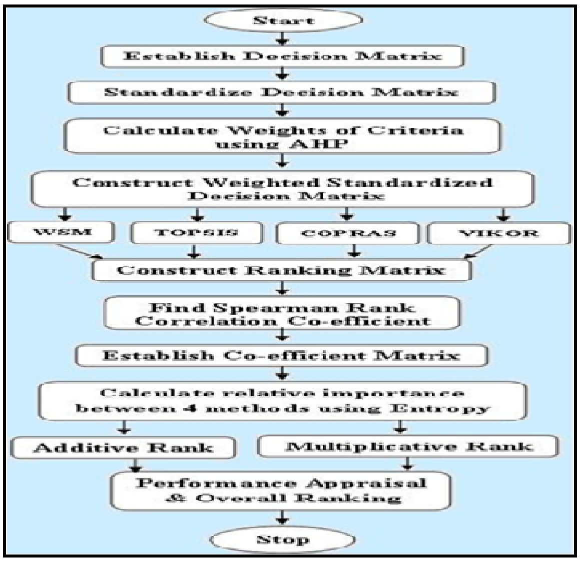

Fig.1. Flowchart of MGDA

Detailed steps of MGDA describe below:

Step-1: Decision matrix having n criteria/attributes and m alternatives. The decision matrix is represented as

$$D = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \qquad (1)$$

Step-2: Normalization Methods for normalized the decision matrix.

2.1:

$$r_{ij} = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)} \quad , j = 1,2,\dots,n \qquad (2)$$

2.2:

$$r_{ij} = \frac{x_{ij}}{\max(x_i)} \quad , \quad j = 1,2,\dots,n \qquad (3)$$

2.3:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad , \quad j = 1,2,\dots,n \qquad (4)$$

2.4:

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad , \quad j = 1,2,\dots,n \qquad (5)$$

Step-3: AHP

3.1: Saaty 9-point preference scale is used for constructing the pair-wise comparison matrix.

Table 1. Saaty's 9 point scale

Scale	Compare factor of i and j
1	Equally Important
3	Weakly Important
5	Strongly Important
7	Very Strongly Important
9	Extremely Important
2,4,6,8	Intermediate value between adjacent

Let A represents $n \times n$ pair-wise comparison matrix:

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{21} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & 1 \end{bmatrix} \qquad (6)$$

3.2: Normalize each cell by normalization 2.4 method.

3.3: Calculate Weight by

$$W_i = \frac{\sum_i x_{ij}}{n} \quad , \quad i = 1,2,\dots,m \qquad (7)$$

3.4: Perform Consistency check.

3.4.1: C, an n-dimensional column vector describing the sum of the weighted values for the importance degrees of the attributes defined as

$$C = [C_i]_{nx1} = AW^T, \qquad i = 1,2,...,n \tag{8}$$

3.4.2: To avoid inconsistency in the pair-wise comparison matrix, Saaty [3] suggested the use of the maximum eigen value λmax to calculate the effectiveness of judgment. The maximum eigen value λmax can be determined as follows:

$$\lambda_{\max} = \frac{\sum_{i=1}^{n} c.v_i}{n}, \qquad i = 1,2, ..., n \tag{9}$$

3.4.3: With λmax value, a consistency index (CI) can then be estimated by

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{10}$$

3.4.4: Consistency ratio (CR) can be used as a guide to check the consistency

$$CR = \frac{CI}{RI} \tag{11}$$

, where RI denotes the average random index with the value obtained by different orders of the pair-wise comparison matrices are shown in table 2. The value of CR ≤ 0.10 is the consistent criteria.

Table 2. Table of random index

Matrix Order	1,2	3	4	5	6	7	8
R.I.	0	0.52	0.89	1.12	1.26	1.36	1.41
Matrix Order	9	10	11	12	13	14	
R.I.	1.46	1.49	1.52	1.54	1.56	1.58	

Step-4: Construct the weighted normalized matrix vij. This is calculated by multiplying each column of the matrix rij by the weight wj, which is calculated by AHP. So,

$$v_{ij} = w_j . r_{ij} \tag{12}$$

Step-5: Use four different MCDM methods one by one.

5.1: WSM

5.1.1: Calculate the sum of $v_{ij}\ for\ j = 1,2,...,n$ i.e;

$$P_j = \sum_{i=1}^{m} v_{ij}\ for \quad j = 1,2,....,n \tag{13}$$

5.1.2: Rank the alternatives according to Pi values in descending order.

5.2: TOPSIS

5.2.1: Obtain the 'ideal' (best) and 'negative-ideal' (worst) solutions. The 'ideal' (best) and 'negative-ideal' (worst) solutions can be expressed as

$$v_j^+ = \left\{ \begin{array}{l} \left(\sum_i^{\max} v_{ij} \mid j \in J \right), \\ \left(\sum_i^{\min} v_{ij} \mid j \in J' \right) \quad \mid i = 1,2,..., m \end{array} \right\}$$
$$= \{ v_1^+ \quad v_2^+ \quad ... \quad v_n^+ \} \tag{14}$$

$$v_j^- = \left\{ \begin{array}{l} \left(\sum_i^{\min} v_{ij} \mid j \in J \right), \\ \left(\sum_i^{\max} v_{ij} \mid j \in J' \right) \mid i = 1,2,..., m \end{array} \right\}$$
$$= \{ v_1^- \quad v_2^- \quad ... \quad v_n^- \} \tag{15}$$

where J= (j =1, 2, ..., n)/j is associated with the beneficial attributes and J' =(j =1, 2, ..., n)/j is associated with the non-beneficial attributes.

5.2.2: Determine the separation distance between the alternatives.
The separation of each alternative from the 'ideal' solution is given by

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+ \right)^2}, \quad i = 1,2,...,m \tag{16}$$

The separation from the 'negative-ideal' solution is denoted by

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^- \right)^2}, \quad i = 1,2,...,m \tag{17}$$

5.2.3: Calculate the relative closeness to the ideal solution, which can be expressed as

$$C_i = \frac{S_i^-}{\left(S_i^+ + S_i^-\right)}, \qquad i = 1,2,...,m \tag{18}$$

5.2.4: Rank the alternatives according to Ci values in descending order.

5.3: COPRAS

5.3.1: Sums Pj of attributes values which larger values are more preferable (optimization direction is maximization taken) calculation for each alternative (line of the decision-making matrix) by the given formula:

$$P_j = \sum_{i=1}^{m} v_{ij} \ \ for \quad j = 1,2,....,n \tag{19}$$

5.3.2: Sums Rj of attributes values which larger values are more preferable (optimization direction is maximization) calculation for each alternative (line of the decision-making matrix):

$$R_j = \sum_{i=1}^{m} v_{ij} \ \ for \quad j = 1,2,....,n \tag{20}$$

5.3.3: Calculation of the relative weight of each alternative Qj:

$$Q_j = P_j + \frac{\sum_{j=1}^{n} R_j}{R_j \sum_{j=1}^{n} \frac{1}{R_j}} \tag{21}$$

5.3.4: Calculation of the utility degree of each alternative:

$$N_j = \frac{Q_j}{Q_{\max}} 100\% \tag{22}$$

5.4: VIKOR

5.4.1: Compute the values S_i and Q_i, $i = 1, 2, \cdots, m$, using the relations

$$S_i = \sum_{j=1}^{n} w_j r_{ij}$$

$$Q_i = \max_j \{w_j r_{ij} \,\vdots\, j = 1,2,...,n\} \tag{23}$$

5.4.2: Compute the index values R_i, $i = 1, 2, \cdots, m$, using the relation

$$R_i = \frac{v(S_i - S^*)}{(S^- - S^*)} + \frac{(1-v)(Q_i - Q^*)}{(Q^- - Q^*)} \tag{24}$$

Where

$$S^* = \min_i S_i, \ S^- = \max_i S_i$$

$$Q^* = \min_i Q_i, Q^- = \max_i Q_i$$

and $0 \le v \le 1$ with $v \approx 0.5$. (25)

5.4.3: Rank the alternatives, sorting by the value of $\{S_i, Q_i$ and $R_i | i = 1,2,...,m\}$, in decreasing order and two compromise conditions must satisfied:

C1. Acceptable advantage:
$R(A^{(2)}) - R(A^{(1)}) \ge 1/(m-1)$, where $A^{(2)}$ is the alternative with second position in the ranking list by R; m is the number of alternatives.

C2. Acceptable stability in decision making: Alternative $A^{(1)}$ must also be the best ranked by $\{S_i$ or/and $Q_i | i = 1,2,...,m\}$.

If one of the conditions is not satisfied, then a set of compromise solutions is proposed, which consists of:

- Alternatives $A^{(1)}$ and $A^{(2)}$ if only condition C2 is not satisfied.
- Alternatives $A^{(1)}, A^{(2)}, ..., A^{(M)}$ if condition C1 is not satisfied. $A^{(M)}$ is determined by the relation $R(A^{(M)}) - R(A^{(1)}) < 1/(m-1)$ for maximum M (the positions of these alternatives are close).

Step-6: Spearman Rank Correlation co-efficient ρ is calculated by the following formula:

$$\rho = 1 - \frac{6 \sum_{i}^{n} D_i^2}{n\,(n^2 - 1)} \tag{26}$$

where Di = Difference between ranks of two different methods for same alternative and n= number of alternatives.

Table 3. Correlation coefficient values with various characteristics

Correlation Coefficient value	Nature Of Correlation	Description of Relationship
0.9 – 1.0	Very High	Very Strong

0.7 – 0.9	High	Marked
0.4 – 0.7	Moderate	Substantial
0.2 – 0.4	Low	Definite
< 0.2	Slight	Small

Step-7: Establish the coefficient matrix of four method correlation coefficient between four methods.

Step-8: Calculate relative importance between 4 methods according the following steps-

8.1: For the given normalized coefficient matrix, pij , entropy Ej of the set of alternatives for method j is

$$E_j = -\frac{1}{\ln(m)}\sum_{i=1}^{m} p_{ij}.\ln(p_{ij}),$$

$$for\ j = 1,2,...n \qquad (27)$$

8.2: Degree of diversification of the information provided by the outcomes is

$$D_j = 1 - E_j \qquad for\ j = 1,2,...n \qquad (28)$$

8.3: Normalized weights of the methods are

$$W_j = \frac{D_j}{\sum_{i=1}^{n} D_j} \qquad for\ j = 1,2,...n \qquad (29)$$

Step-9: Group Decision

9.1: Additive ranking rule is used for group decision as follows:

$$r_a^G = \frac{\sum_{DM=1}^{G} W_{DM} r_{a.DM}}{G} \qquad (30)$$

9.2: Multiplicative ranking rule is as follows:

$$r_a^G = [\prod_{DM=1}^{G} W_{DM} r_{a.DM}]^{1/G} \qquad (31)$$

Where G = number of MCDM method,

W_{DM} = Relative influence of each MCDM,

$r_{a.DM}$ = Rank obtained for each alternative a in MCDM,

r_a^G = Rank obtained for each alternative a.

Step-10: Overall performance appraisal and ranking of players.

4 Experiment & Result

Here we consider IPL last three session statistics as the decision matrix for cricketer performance assessment for different sector in cricket.

Table 4. Table for spin bowler of IPL-2012

ID	Player	Inns	Overs	Wkts	Ave	Econ	SR
14	Ajit Chandila	4	14	5	17.2	6.14	16.8
15	Akshath Reddy	1	3	1	32	10.66	18
19	Amit Mishra	14	47	13	29	8.02	21.69
25	Ankeet Chavan	8	27.33	7	33.71	8.63	23.42
26	Ankit Sharma	9	24.16	4	41.25	6.82	36.25
31	Ashok Menaria	3	3.33	1	23	6.9	20
38	Bhargav Bhatt	5	16.5	2	68	8.24	49.5
43	Brad Hodge	2	2	1	21	10.5	12
44	Brad Hogg	9	36	10	25.3	7.02	21.6
54	Daniel Vettori	9	35	5	47.2	6.74	42
56	David Hussey	6	9	3	21	7	18
72	Glenn Maxwell	2	3	1	22	7.33	18
75	Harbhajan Singh	16	54	6	64	7.11	54
79	Iqbal Abdulla	8	22	4	36	6.54	33
90	Johan Botha	11	41	9	33	7.24	27.33
91	JP Duminy	6	12	1	104	8.66	72
99	KP Appanna	6	17	6	24.66	8.7	17
116	Marlon Samuels	8	28.66	8	27	7.53	21.5
118	Michael Clarke	5	11	2	33.5	6.09	33
128	Murali Kartik	11	36	4	66.5	7.38	54
130	Muttiah Muralitharan	10	40	15	17.33	6.5	16
139	Pawan Negi	6	22	7	21.71	6.9	18.85
140	Piyush Chawla	16	57	16	26.18	7.35	21.37
142	Pragyan Ojha	9	30	9	24.44	7.33	20
146	Rahul Sharma	11	37	9	33.33	8.1	24.66
151	Ravichandran Ashwin	18	65.83	14	30.85	6.56	28.21
152	Ravindra Jadeja	14	35	12	22.75	7.8	17.5
155	Robin Peterson	4	8	3	23.33	8.75	16
157	Roelof van der Merwe	3	10	2	30	6	30
169	Shadab Jakati	15	41	9	37.22	8.17	27.33
170	Shahbaz Nadeem	12	45	8	39.75	7.06	33.75
171	Shakib Al Hassan	8	30	12	16.25	6.5	15
186	Sunil Narine	15	59.16	24	13.5	5.47	14.79
188	Suresh Raina	7	14	2	52.5	7.5	42
205	Yusuf Pathan	12	22.16	4	45.25	8.16	33.25

***Modified* Group Decision Analysis (MGDA)--** The proposed methodology is basically a five stage algorithm which consist the following stages-

First stage is calculated the weight of the criteria with the help of Saaty's pair wise AHP method.

Table 5. Pair-wise Comparison of bowling criteria

Criteria	INNS	OVERS	WKTS	AVG	SR	ECON
INNS	1.000	1.000	0.333	0.200	0.250	0.167
OVERS	1.000	1.000	0.500	0.250	0.333	0.250
WKTS	3.000	2.000	1.000	0.500	1.000	0.500
AVG	5.000	4.000	2.000	1.000	1.000	1.000
SR	4.000	3.000	1.000	1.000	1.000	1.000

Weights of the Bowler's criteria are as follows:

$$\left.\begin{array}{ll} W_{inns} = 0.0522, & W_{avg} = 0.2560, \\ W_{overs} = 0.0649, & W_{sr} = 0.2122, \\ W_{wkts} = 0.1503, & W_{econ} = 0.2643 \end{array}\right\} \quad (32)$$

Second stage is used different MCDM method to evaluate performance of the players with ranking.

Table 6. Ranking in different method

ID	TOPSIS	Rank	COPRAS	Rank	VIKOR	Rank	WSM	Rank
14	0.678	12	0.526649	10	0.36691	13	0.721	7
15	0.5833	24	0.291629	32	0.70269	34	0.4426	32
19	0.7393	6	0.623119	7	0.33624	9	0.7058	9
25	0.6368	19	0.447919	18	0.45718	20	0.5823	24
26	0.5375	28	0.361859	26	0.4738	23	0.5587	26
31	0.6151	22	0.374549	24	0.47756	24	0.6194	18
38	0.3328	34	0.23482	34	0.67253	33	0.3335	34
43	0.6224	20	0.3617	27	0.65144	31	0.5087	29
44	0.7132	8	0.567417	8	0.30766	7	0.7114	8
54	0.4979	30	0.371404	25	0.48902	27	0.5374	27
56	0.6455	16	0.446481	19	0.4294	17	0.6578	14
72	0.6202	21	0.378891	22	0.48297	25	0.6101	20
75	0.3796	32	0.403894	21	0.63333	30	0.4692	30
79	0.5704	26	0.377087	23	0.45335	19	0.594	22
90	0.6581	15	0.515398	12	0.35032	10	0.6601	13
91	0.0679	35	0.171014	35	1	35	0.1073	35
99	0.6658	13	0.464434	17	0.44676	18	0.6101	19
116	0.6801	11	0.507673	15	0.36183	12	0.6626	12
118	0.5589	27	0.327251	30	0.4839	26	0.586	23
118	0.5589	27	0.327251	30	0.4839	26	0.586	23
128	0.3425	33	0.320443	31	0.67084	32	0.4044	33
130	0.8173	2	0.741225	2	0.18019	2	0.8197	2
139	0.6882	10	0.520765	11	0.35574	11	0.6955	11
140	0.7955	3	0.713599	3	0.23984	5	0.7785	4
142	0.705	9	0.549721	9	0.32978	8	0.6956	10
146	0.6623	14	0.50839	14	0.38561	14	0.6317	15
151	0.7291	7	0.670486	5	0.23421	3	0.7695	5
152	0.7554	5	0.637296	6	0.30313	6	0.7322	6
155	0.6374	18	0.406433	20	0.47365	22	0.5813	25
157	0.5796	25	0.339137	29	0.47254	21	0.6057	21
169	0.6403	17	0.511813	13	0.39666	16	0.6224	16
170	0.5966	23	0.476134	16	0.38608	15	0.6207	17
171	0.7736	4	0.68754	4	0.23555	4	0.7912	3
186	0.9656	1	1	1	0	1	0.9716	1
188	0.4449	31	0.271566	33	0.56596	29	0.4442	31
205	0.5307	29	0.361049	28	0.50024	28	0.513	28

Spearman co-efficient correlation technique describes the correlation between the methods in stage three.

Table 7. Correlation Coefficient Matrix

2012	TOPSIS	COPRAS	VIKOR	WSM
TOPSIS	1.0000	0.9381	0.9272	0.9401
COPRAS	0.9381	1.0000	0.9585	0.9471
VIKOR	0.9272	0.9585	1.0000	0.9273
WSM	0.9401	0.9471	0.9273	1.0000

Each MCDM methods are very strong relationship with each other according Spearman Rank Correlation Coefficient Rule.

Entropy method produces the importance between the MCDM methods in the fourth stage.

$$\left.\begin{array}{l} W_{TOPSIS} = 0.249736, \\ W_{COPRAS} = 0.250474 \\ W_{VIKOR} = 0.249876, \\ W_{WSM} = 0.249914 \end{array}\right\} \quad (33)$$

Finally at the last stage, Additive & Multiplicative ranking method measures the overall performance and ranking of the players.

Table 8. Overall Ranking

ID	Player	Add. Value	Rank	Mul. Value	Rank
14	Ajit Chandila	0.16273	10	0.161402	10
15	Akshath Reddy	0.10301	30	0.098254	32
19	Amit Mishra	0.173672	7	0.173138	7
25	Ankeet Chavan	0.140574	19	0.139191	19
26	Ankit Sharma	0.126209	26	0.124215	25
31	Ashok Menaria	0.135689	21	0.132732	21
38	Bhargav Bhatt	0.078121	34	0.077205	34
43	Brad Hodge	0.11738	29	0.113543	29
44	Brad Hogg	0.170639	8	0.169727	8
54	Daniel Vettori	0.121925	27	0.120582	27
56	David Hussey	0.147644	16	0.145684	17
72	Glenn Maxwell	0.135354	22	0.132541	22
75	Harbhajan Singh	0.102909	31	0.102367	30
79	Iqbal Abdulla	0.132844	23	0.13059	23
90	Johan Botha	0.157858	13	0.156875	13
91	JP Duminy	0.021997	35	0	35
99	KP Appanna	0.145923	18	0.144382	18
116	Marlon Samuels	0.158233	12	0.157016	12
118	Michael Clarke	0.126556	25	0.123195	26
128	Murali Kartik	0.088772	33	0.088308	33
130	Muttiah Muralitharan	0.203182	2	0.202904	2
139	Pawan Negi	0.162076	11	0.160803	11
140	Piyush Chawla	0.193665	3	0.193387	3
142	Pragyan Ojha	0.166601	9	0.16561	9
146	Rahul Sharma	0.153655	14	0.152724	14
151	Ravichandran Ashwin	0.186448	5	0.186098	5
152	Ravindra Jadeja	0.179368	6	0.178833	6
155	Robin Peterson	0.136929	20	0.134788	20
157	Roelof van der Merwe	0.130607	24	0.127158	24
169	Shadab Jakati	0.151162	15	0.150452	15
170	Shahbaz Nadeem	0.146649	17	0.145698	16
171	Shakib Al Hassan	0.191707	4	0.191309	4
186	Sunil Narine	0.25	1	0.25	1
188	Suresh Raina	0.101446	32	0.099235	31
205	Yusuf Pathan	0.121132	28	0.11959	28

5 Conclusion

This article hence presented puts forward the idea of integrating the several multi criteria decision making techniques in a single algorithm in the field of sports for an optimized performance appraisal for players. Our proposed technique MGDA overcomes the limitations of different MCDM methods for ranking by provides us better solution in the field of multi criteria analysis.

MGDA was applied for batsman, fast bowler and spin bowler statistics of IPL session IV, V and VI separately and produce accurate result every time. For calculating the weights of the criteria using AHP satisfy the consistency checking property which proofs its trueness. Every time correlation between two methods produces very strong relationship which suggests that our individual MCDM methods calculate precise results.

The additive ranking and the multiplicative rankling of the players are almost same which confirmed the accuracy of the technique. By using MGDA the IPL franchisee owner can measure the player performance and may be calculated the player true salary which they offer to a player so that their team performs according their potentiality and they make profit from IPL.

Our new method used well known techniques in the modified way with structure format to help the decision maker to make their decision with no trouble and very swiftly. It is also used in various field of multi criteria problem and provides optimum solution to find the performance appraisal and ranking according the alternatives performance.

References:

[1] C. Muralidharan, (2000), Application of Analytic Hierarchy Process (AHP) in materials and human resource management under group decision making environment, Unpublished Ph.D. Thesis, Annamalai University.

[2] Ehsan Pourjavad, Hadi Shirouyehzad (2011), A MCDM Approach for Prioritizing Production Lines: A Case Study, published in *International Journal of Business and Management (IJBM),* Vol. 6, No. 10; October 2011, pp:221- 229, URL: http://dx.doi.org/10.5539/ijbm.v6n10p221.

[3] T.L. Saaty, The Analectic Hierarchy Process, McGraw-Hill, New York, 1980.

[4] T.L. Saaty, "Priority Setting in Complex Problems," *IEEE Transactions on Engineering Management,* Vol.30, No.3, pp.140-155, 1983.

[5] Christos Douligeris and Ian J. Pereira, "A Telecommunications Quality Study Using the Analytic Hierarchy Process," *IEEE Journal on Selected Areas in Communications*, Vol. 12, No. 2, 1994.

[6] C.L. Hwang, K. Yoon, Multiple Attribute Decision Making Methods and Applications, *Springer, Berlin Heidelberg*, 1981.

[7] Pabitra Kumar Dey, Dipendra Nath Ghosh and Abhoy Chand Mondal, "A MCDM Approach for Evaluating Bowlers Performance in IPL", in *Journal of Emerging Trends in Computing and Information Sciences,* ISSN 2079-8407, Vol-2, No-11(November 2011), pp- 563- 573.

[8] Pabitra Kumar Dey, Dipendra Nath Ghosh and Abhoy Chand Mondal, "Statistical Based Multi-Criteria Decision Making Analysis for Performance Measurement of Batsmen in

Indian Premier League", in *International Journal of Advanced Research in Computer Science (IJARCS)*, ISSN 0976-5697, Vol. 3 No. 4 (July-August 2012), pp- 51-57.

[9] Pabitra Kumar Dey, Dipendra Nath Ghosh and Abhoy Chand Mondal, "Multi-Criteria Decision Tree Approach to Classify All-rounder in Indian Premier League", communicated in *International Journal of Advanced Science and Technology (SERSC)*, ISSN: 2005-4238, Vol.-52(March 2013), pp-93- 100.

[10] A.Kaklauskas, E.K. Zavadskas. (1996). Multicriteria Evaluation of Building (Pastat ų sistemotechninis įvertinimas). Vilnius: Technika.

[11] S. Opricovic, Multicriteria Optimization of Civil Engineering Systems, *Faculty of Civil Engineering*, Belgrade (1998).

[12] http://en.wikipedia.org/wiki/Twenty20.

[13] Cricinfo: http://www.cricinfo.com/.

[14] Blog: http://premierleaguecricket.in

[15] http://en.wikipedia.org/wiki/Indian_Premier_League.

[16] IPL, http://iplt20.com/.

[17] H.H. Lemmer, "The Combined Bowling Rate as a Measure of Bowling Performance in Cricket", *South African Journal for Research in Sport, Physical Education and Recreation*, Vol. 24, No. 2, pp.37-44, 2002.

[18] H.H. Lemmer, "A Measure for the Batting Performance of Cricket Players", *South African Journal for Research in Sport, Physical Education and Recreation*, Vol. 26, No. 1, pp.55-64, 2004.

[19] H.H. Lemmer, "The Allocation of Weights in the Calculation of Batting and Bowling Performance Measures", *South African Journal for Research in Sport, Physical Education and Recreation*, Vol. 29, No. 2, pp.75-85, 2007.

[20] Paul J. van Staden, "Comparison of Bowlers, Batsmen and All-rounders in Cricket using Graphical Displays", *Technical Report of University of Pretoria*, 08-01, ISBN: 978-1-86854-733-3.

[21] David Parker, Phil Burns and Harish Natarajan, "Player Valuations in the Indian Premier League", *Frontier Economics, October 2008*.