Statistical Based Multi-Criteria Decision Making Analysis for Performance Measurement of Batsmen in Indian Premier League

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Abstract: This paper aims to measure the performances of batsmen during first three session of Indian Premier League (IPL) Twenty-20 cricket tournament. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method for multi-criteria decision making has been used to evaluate the performances of batsmen. Analytical Hierarchy Process (AHP) has been used for calculating the weights of the batsmen's criterion and One-way ANalysis Of VAriance (ANOVA) has been used to measure the contribution of the different criterion which is further combined with the AHP results to get the modified weight of each criterion. Finally, this article proposed a statistical based multi-criteria decision making analysis which provides a comparison between the batsmen in three IPL and evaluate the overall performances of batsmen.

Keywords: Performance Measure, Twenty-20 Cricket, AHP, ANOVA, TOPSIS.

I. INTRODUCTION

In the early 70's Multi-Criteria Decision Analysis (MCDA) was introduced as a promising and important field of study for supporting decision makers who are faced with making numerous and conflicting evaluations for both quantitative and qualitative evaluation criteria together. MCDA is a tool used to solve problems for selection from a limited number of alternatives, involves sorting and ranking according Kavita Devi et al [1]. According Carlsson [2], MCDA requires inter- & intra- attribute comparisons, and involve appropriate explicit tradeoffs. Some of the commonly used MCDA techniques like Simple Additive Weighting Model (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Analytical Hierarchy Process (AHP), PROMETHEE, ELECTRE, etc. described by Muralidharan [3].

AHP, developed by Thomas L. Saaty in early 80's [4, 5], is a pair-wise comparison method that involves structuring multiple choice criteria into a hierarchy for assessing the relative importance of these criteria [6]. V.S.Lai et al. [9] applied AHP to the selection of a multimedia authoring system and Maggie et al. [10] used AHP for vendor selection. An advantage of the AHP is that it is designed to handle situations in which the subjective judgments of individuals constitute an important part of the decision process and its hierarchical structure is easy to understand.

TOPSIS is one of the most classical MCDA methods, was first developed by Hwang and Yoon [7], and is based on the idea that the chosen alternative should have the shortest distance from the positive ideal solution and on the other side the farthest distance of the negative ideal solution. Hsu. Shih [8] presented the application of group TOPSIS for incremental analysis to overcome the drawbacks of ratio scales utilized in various MCDA techniques.

One-way ANOVA [20] is a statistical test which is used for comparing means of two or more independent normal samples. One-way ANOVA produces an F statistic, interpreted as the comparison of the variance amongst the different groups with the variance amongst all individuals within those groups.

Cricket is one of the most entertaining and favorite game for many people. Because of its popularity, and the fun and glamour involved in it, more and more people from all around the world are becoming interested in this game. Among different forms of cricket played at the international level, Twenty20 cricket has become the most popular after started IPL in India in the year 2008 by Board for Control of Cricket in India (BCCI) [25, 27].

The paper is organized as follows: literature review has been discussed in Section 2. Section 3 focuses on twenty-20 cricket and IPL. Section 4 presents the proposed methodology and experimental result. Finally, section 5 concludes the paper followed by references.

II. LITERATURE REVIEW

There have been several studies on players' performance in cricket. For example, a single measure of bowling performance in cricket is not good enough to judge and hence combined bowling rate was proposed by H.H.Lemmer [11] and again Lemmer modified the combined bowling rate by dynamic bowling rate to measure the performance of bowlers [13]. To asses the current bowling performances of bowlers together with their career performances the current bowling performance measure was developed by H.H.Lemmer to select the rank of bowlers [14]. In a very small number of matches, how batting and bowling performance measures for ODIs can be adapted for use in the first Twenty20 cricket world cup series have been already developed by H.H.Lemmer [17]. A single measure

was used to access the performance of batsmen in cricket with the help of classification scheme was introduced by H.H.Lemmer in 2004 [12]. Taking an account the strength of the opponents H.H.Lemmer introduced suitable weights with their batting performance and combined bowling performance for rating the players [15]. Traditional average of batsmen replaced by a statistic estimator of average in the case of moderate and high proportions of not-out scores was developed by Lemmer [16].

A graphical display for comparing the performances of bowlers, batsmen and all-rounders are presented by Paul J. van Staden [18]. Player valuations in the IPL by their previous performance, experience and other characteristics of individual players were done by David Parker and et al. [19]. Yuan et al. [21] described a statistical racing technique for algorithms comparisons which performed for a single criterion, using Friedman [22] and ANOVA parametric tests, with multiple comparisons. Garcia et al. [23] proposed a mixed parametric/nonparametric procedure for comparing the convergence of evolutionary algorithms, in a single criterion framework and the observed data are tested by the parametric test ANOVA.

MCDA [1, 2] provides an approach that is able to handle a large amount of variables and alternatives assessed in various ways and consequently offer valuable assistance to the decision maker in mapping out the problem. AHP [4, 5] is used to rank, select, evaluate and benchmark a wide variety of decision alternatives. The scale ranges from 1/9 for the 'least valued than', to 1 for 'equal' and to 9 for 'absolutely more important than' covering the entire spectrum of the comparison. The main uniqueness of AHP is its inherent capability to weight a large number of different factors, of different natures, including both qualitative and quantitative data, in order to make a decision based on a formal and numerical process. ANOVA [20], the statistical analysis provides strengthen to the weights of the criterion by their individual percentage of contribution to decision making. TOPSIS [7, 8] is used for multi-criteria analysis to provide the rank of the alternatives by relative closeness between the positive ideal solution and negative ideal solution.

III. TWENTY-20 CRICKET AND INDIAN PREMIER LEAGUE (IPL)

Twenty-20 is a form of cricket, originally introduced in England for professional inter-county competition by the England and Wales Cricket Board (ECB), in 2003 [28]. A Twenty20 game involves two teams; each has a single innings, batting for a maximum of 20 overs. Twenty20 cricket is also known as T20 cricket. The IPL [25, 27] is a professional league for Twenty20 cricket competition in India. It was initiated by BCCI, headquartered in Mumbai. It is currently contested by 10 teams consisting of players from around the world. Its brand value is estimated to be around $3.67 billion in fourth season. According to the Annual Review of Global Sports Salaries by sportingintelligence.com, IPL is the second highest-paid league, based on first-team salaries on a pro rata basis, second only to the NBA. It is estimated that the average salary of an IPL player over a year would be $3.84 million. The inaugural season of the tournament started on 18 April 2008. The final was played in DY Patil Stadium, Nerul, Navi Mumbai. Every team played each other both at home and away in a round robin system. The top four ranking sides progressed to the knockout stage of semi-finals followed by a final. Rajasthan Royals defeated Chennai

Super Kings in a last ball thriller and emerged as the inaugural IPL champion. The 2009 season coincided with the General Elections in India. Owing to concerns regarding players' security, the venue was shifted to South Africa.

Deccan Chargers, who finished last in the first season, were big underdogs, but came out as eventual winners defeating the Royal Challengers Bangalore in the final. In the third session of IPL (2010), the first semi-final was won by Mumbai Indians who defeated Royal Challengers Bangalore by 35 runs. Chennai Super Kings defeated Deccan Chargers in the second semi-final. The final was played between Chennai Super Kings and Mumbai Indians. Chennai Super Kings won by a margin of 22 runs in the 2010 session. Chennai Super Kings won their second consecutive IPL title after defeating Royal Challengers Bangalore by 58 runs in the fourth season of IPL (2011). CSK had beaten RCB in the playoffs too while RCB defeated Mumbai Indians to reach the final. This is the first time a franchise has won two IPL titles, had four consecutive semi-final visits, come to the finals three times, and successfully defended their title. The top four teams namely CSK, RCB, KKR and MI have also qualified for the Champions League. Mumbai Indians are the current Champions League Twenty20 champion 2011.

IV. METHODOLOGY AND EXPERIMENTAL RESULT

By modifying our previous work [29] we proposed a new methodology named as AHP-ANOVA-TOPSIS which is used to handle the multiple attributes of batsmen to measure the performance during first three session of IPL. The steps of AHP-ANOVA-TOPSIS are as follows:

A. *Establish the decision objectives or goals:*

The batting statistics of batsmen for first three session of IPL and the overall statistics which is readily available from IPL website [26] are taken to be considered to establish the rank of the batsmen according their performances during first three session of IPL and overall rank of the batsmen.

B. *Identify the alternatives:*

Here the batsmen of IPL are the selective alternatives and the following conditions are used for selection of players-
   a. Batsmen who played all three session (I, II, III) of IPL.
   b. Batsmen played at least three innings in a particular IPL session.
   c. Batsmen who scored at least 10 runs in a particular session.

C. *Identify the attributes or criterion:*

Batsmen attributes for performance measure are described in the table-1.

Table-1: Batsmen Attribute and its description.

Attributes /Criterion	Description
INNS	No. of innings played by a batsman in a session.
NO	No. of innings in which a batsman is not out.
RUNS	No. of runs scored by a batsman in a series of tournament.
AVG	No. of Runs scored / Total no. of Out Innings. i.e. No. of Runs scored / (INNS – NO)
SR	Total no. of Runs scored / Total no. of Balls faced by a batsman.

Twenty20 cricket tournament is a very limited over match thus SR of batsmen is the most important attribute for

players performance followed by AVG and RUNS of the batsmen followed by INNS and NO innings of the batsmen. All these attributes are positive attributes that is the higher value of any attributes signifies better performance of batsmen. The dataset consists of several attributes like Player Name, Inns, NO, Runs, Avg, SR and Balls which are clearly shown in the table-2(a) & 2(b).

Table 2(a): Batting Statistics for the players in IPL session-III and IPL session-II.

Player Name	2010 (IPL Session-III)						2009 (IPL Session-II)					
	Inns	NO	Runs	Avg	SR	Balls	Inns	NO	Runs	Avg	SR	Balls
S Badrinath	15	4	356	32.36	117.49	303	11	2	177	19.67	107.9	164
MS Dhoni	11	2	287	31.89	136.67	210	13	5	332	41.5	127.2	261
ML Hayden	16	0	346	21.63	124.01	279	12	1	572	52	144.8	395
JA Morkel	11	3	198	24.75	151.15	131	10	6	97	24.25	138.6	70
SK Raina	16	5	520	47.27	142.86	364	14	0	434	31	140.5	309
HH Gibbs	10	0	267	26.7	113.62	235	14	3	371	33.73	112.8	329
AC Gilchrist	16	0	289	18.06	156.22	185	16	0	495	30.94	152.3	325
RG Sharma	16	2	404	28.86	133.77	302	16	3	362	27.85	114.9	315
A Symonds	16	2	429	30.64	125.81	341	8	1	249	35.57	148.2	168
AB de Villiers	7	0	111	15.86	93.28	119	13	4	465	51.67	131.0	355
G Gambhir	10	1	277	30.78	127.65	217	15	2	286	22	102.9	278
KD Karthik	14	1	278	21.38	117.3	237	13	5	288	36	132.7	217
V Sehwag	14	0	356	25.43	163.3	218	11	1	198	19.8	143.5	138
SC Ganguly	14	1	493	37.92	117.66	419	11	0	189	17.18	91.3	207
DJ Hussey	6	2	94	23.5	109.3	86	4	0	98	24.5	166.1	59
BB McCullum	5	1	114	28.5	103.64	110	13	1	285	23.75	119.3	239
WP Saha	7	4	67	22.33	126.42	53	7	4	72	24	175.6	41
DPMD Jayawardene	13	3	439	43.9	147.32	298	10	4	219	36.5	132.7	165
IK Pathan	13	5	276	34.5	148.39	186	12	2	196	19.6	124.1	158
KC Sangakkara	12	0	357	29.75	138.91	257	13	2	332	30.18	102.5	324
Yuvraj Singh	14	2	255	21.25	128.14	199	14	2	340	28.33	115.3	295
DJ Bravo	8	1	61	8.71	115.09	53	10	2	218	27.25	107.4	203
AM Nayar	3	1	58	29	113.73	51	11	2	193	21.44	127.0	152
SR Tendulkar	15	2	618	47.54	132.62	466	13	2	364	33.09	120.1	303
RS Dravid	11	2	256	28.44	128.64	199	12	0	271	22.58	115.8	234
JH Kallis	16	4	572	47.67	115.79	494	15	2	361	27.77	108.7	332
V Kohli	13	2	307	27.91	144.81	212	13	2	246	22.36	112.3	219
LRPL Taylor	7	3	88	22	117.33	75	11	2	280	31.11	134.6	208
RV Uthappa	14	2	374	31.17	171.56	218	13	2	175	15.91	102.9	170
YK Pathan	14	2	333	27.75	165.67	201	13	1	243	20.25	132.8	183

Table 2(b): Batting Statistics for the players in IPL session-I and overall up to session-III.

Player Name	2008(IPL Session-I)						Overall (IPL Session- I, II & III)					
	Inns	NO	Runs	Avg	SR	Balls	Inns	NO	Runs	Avg	SR	Balls
S Badrinath	11	5	192	32	147.69	130	37	11	725	27.9	121.4	597
MS Dhoni	14	4	414	41.4	133.55	310	38	11	1033	38.3	132.3	781
ML Hayden	4	1	189	63	144.27	131	32	2	1107	36.9	137.5	805
JA Morkel	10	3	241	34.43	147.85	163	31	12	536	28.2	147.3	364
SK Raina	14	3	421	38.27	142.71	295	44	8	1375	38.2	142.0	968
HH Gibbs	9	0	167	18.56	109.15	153	33	3	805	26.8	112.3	717
AC Gilchrist	14	1	436	33.54	137.11	318	46	1	1220	27.1	147.3	828
RG Sharma	12	1	404	36.73	147.99	273	44	6	1170	30.8	131.5	890
A Symonds	3	1	161	80.5	153.33	105	27	4	839	36.5	136.6	614
AB de Villiers	6	1	95	19	96.94	98	26	5	671	32.0	117.3	572
G Gambhir	14	1	534	41.08	140.9	379	39	4	1097	31.3	125.5	874
KD Karthik	8	2	145	24.17	135.51	107	35	8	711	26.3	126.7	561
V Sehwag	14	2	406	33.83	184.55	220	39	3	960	26.7	166.7	576
SC Ganguly	13	1	349	29.08	113.68	307	38	2	1031	28.6	110.5	933
DJ Hussey	13	2	319	29	123.17	259	23	4	511	26.9	126.5	404
BB McCullum	4	1	188	62.67	204.35	92	22	3	587	30.9	133.1	441
WP Saha	10	5	159	31.8	133.61	119	24	13	298	27.1	139.9	213
DPMD Jayawardene	12	5	179	25.57	136.64	131	35	12	837	36.4	140.9	594
IK Pathan	10	4	131	21.83	112.93	116	35	11	603	25.1	131.1	460
KC Sangakkara	9	0	320	35.56	161.62	198	34	2	1009	31.5	129.5	779
Yuvraj Singh	14	1	299	23	162.5	184	42	5	894	24.2	131.9	678
DJ Bravo	7	1	178	29.67	132.84	134	25	4	457	21.8	117.2	390
AM Nayar	10	2	206	25.75	149.28	138	24	5	457	24.1	134.0	341
SR Tendulkar	7	1	188	31.33	106.21	177	35	5	1170	39.0	123.7	946
RS Dravid	14	1	371	28.54	124.5	298	37	3	898	26.4	122.8	731
JH Kallis	11	0	199	18.09	108.74	183	42	6	1132	31.4	112.2	1009
V Kohli	12	2	165	15	105.1	157	38	5	718	21.8	122.1	588
LRPL Taylor	4	0	149	37.25	183.95	81	22	5	517	30.4	142.0	364
RV Uthappa	14	5	320	35.56	114.7	279	41	9	869	27.2	130.3	667
YK Pathan	15	1	435	31.07	179.01	243	42	4	1011	26.6	161.2	627

D. For each of the attributes assign weights to measure the performance of the alternatives against each of these and construct a decision matrix by the following steps of AHP:

a) Perform pair-wise comparison according Saaty 9-point preference scale (shown in the table-3).
b) Normalize the raw score.
c) Calculate the Eigen value and Eigen vectors.
d) Perform the consistency check.
e) Computes the weight of the attributes (shown in the table-3).

Table 3: Pair-wise comparison of attributes according Saaty's 9-scale.

	Inns	No	Runs	Avg	SR	Weight
Inns	1	4	1	1	1/2	**0.2013**
No		1	1/3	1/2	1/6	**0.0681**
Runs			1	1/2	1/2	**0.1638**
Avg	*Reciprocal of the upper part of the matrix*			1	1	**0.2394**
SR					1	**0.3275**

E. *Compute an overall contribution of each decision attributes by the following steps of ANOVA (whish is shown in the table -4 for IPL session-I).*

a) It begins with a decision matrix having n attributes and m alternatives.
b) Normalize the raw score.
c) Sum of the square of the raw score for each attributes.
d) Normalize the sum of the square of the raw score for each attributes.
e) Divide the normalized sum by degree of freedom (no. of alternatives – 1) to get the contribution of each attributes.

Table 4: Calculation of ANOVA for IPL session-I.

Player Name	Original value					Square of the normalized value				
	Inns	NO	Runs	Avg	SR	Inns	NO	Runs	Avg	SR
S Badrinath	15	4	356	32.4	117.5	0.0018	0.0049	0.0016	0.0014	0.0009
MS Dhoni	11	2	287	31.9	136.7	0.0009	0.0012	0.0010	0.0014	0.0012
ML Hayden	16	0	346	21.6	124	0.0020	0.0000	0.0015	0.0006	0.0010
JA Morkel	11	3	198	24.8	151.2	0.0009	0.0028	0.0005	0.0008	0.0015
SK Raina	16	5	520	47.3	142.9	0.0020	0.0077	0.0034	0.0030	0.0013
HH Gibbs	10	0	267	26.7	113.6	0.0008	0.0000	0.0009	0.0009	0.0008
AC Gilchrist	16	0	289	18.1	156.2	0.0020	0.0000	0.0011	0.0004	0.0016
RG Sharma	16	2	404	28.9	133.8	0.0020	0.0012	0.0021	0.0011	0.0012
A Symonds	16	2	429	30.6	125.8	0.0020	0.0012	0.0023	0.0012	0.0010
AB de Villiers	7	0	111	15.9	93.28	0.0004	0.0000	0.0002	0.0003	0.0006
G Gambhir	10	1	277	30.8	127.7	0.0008	0.0003	0.0010	0.0013	0.0011
KD Karthik	14	1	278	21.4	117.3	0.0015	0.0003	0.0010	0.0006	0.0009
V Sehwag	14	0	356	25.4	163.3	0.0015	0.0000	0.0016	0.0009	0.0017
SC Ganguly	14	1	493	37.9	117.7	0.0015	0.0003	0.0031	0.0019	0.0009
DJ Hussey	6	2	94	23.5	109.3	0.0003	0.0012	0.0001	0.0007	0.0008
BB McCullum	5	1	114	28.5	103.6	0.0002	0.0003	0.0002	0.0011	0.0007
WP Saha	7	4	67	22.3	126.4	0.0004	0.0049	0.0001	0.0007	0.0010
DPMD Jayawardene	13	3	439	43.9	147.3	0.0013	0.0028	0.0024	0.0026	0.0014
IK Pathan	13	5	276	34.5	148.4	0.0013	0.0077	0.0010	0.0016	0.0014
KC Sangakkara	12	0	357	29.8	138.9	0.0011	0.0000	0.0016	0.0012	0.0013
Yuvraj Singh	14	2	255	21.3	128.1	0.0015	0.0012	0.0008	0.0006	0.0011
DJ Bravo	8	1	61	8.71	115.1	0.0005	0.0003	0.0000	0.0001	0.0009
AM Nayar	3	1	58	29	113.7	0.0001	0.0003	0.0000	0.0011	0.0008
SR Tendulkar	15	2	618	47.5	132.6	0.0018	0.0012	0.0048	0.0030	0.0011
RS Dravid	11	2	256	28.4	128.6	0.0009	0.0012	0.0008	0.0011	0.0011
JH Kallis	16	4	572	47.7	115.8	0.0020	0.0049	0.0041	0.0030	0.0009
V Kohli	13	2	307	27.9	144.8	0.0013	0.0012	0.0012	0.0010	0.0014
LRPL Taylor	7	3	88	22	117.3	0.0004	0.0028	0.0001	0.0006	0.0009
RV Uthappa	14	2	374	31.2	171.6	0.0015	0.0012	0.0018	0.0013	0.0019
YK Pathan	14	2	333	27.8	165.7	0.0015	0.0012	0.0014	0.0010	0.0018
Sum-->						0.0365	0.0526	0.0418	0.0365	0.0340
Sum/ Degree of freedom-->						0.0013	0.0018	0.0014	0.0013	0.0012
Normalized contribution-->						0.1813	0.2611	0.2076	0.1813	0.1688

F. *Calculate the resultant weight for each attribute by the following formula:*

$$W_i^R = normalized\ (W_i^{AHP} \times W_i^{ANOVA} \times (no.\ of\ alternatives)) \quad (1)$$

The resultant weight for each attribute of batsmen for IPL session-I is presented in the table-5.

Table 5: Normalized Resultant Weight of Attributes in IPL-I

	Weight				
	Inns	**NO**	**Runs**	**Avg**	**SR**
From AHP	0.2013	0.0681	0.1638	0.2394	0.3275
From ANOVA	0.1813	0.2611	0.2076	0.1813	0.1688
Resultant	1.0949	0.5334	1.0201	1.3021	1.6585
Normalized	**0.1952**	**0.0951**	**0.1819**	**0.2321**	**0.2957**

G. *Compute an overall assessment measure for each decision alternative by the following steps of TOPSIS (For IPL session-I the calculations of TOPSIS are presented in the table 6):*

a) TOPSIS begins with a decision matrix having n attributes and m alternatives.
b) Construct the weighted (derived from step-6) normalized decision matrix.
c) Obtain the positive-ideal and negative-ideal solutions.
d) Determine the separation distance between the alternatives from the positive-ideal and negative-ideal solutions.
e) Calculate the relative closeness to the ideal solution.

Table 6: Calculation of TOPSIS and the ranking of players for IPL session-I.

Player Name	Original value					Weighted normalized value					Positive Ideal Solution	Negative Ideal Solution	Relative Close-ness	Rank
	Inns	NO	Runs	Avg	SR	Inns	NO	Runs	Avg	SR				
S Badrinath	15	4	356	32.4	117.5	0.0082	0.0067	0.0073	0.0087	0.0088	0.00810	0.01301	0.6161	6
MS Dhoni	11	2	287	31.9	136.7	0.0060	0.0033	0.0059	0.0085	0.0103	0.01017	0.01011	0.4985	13
ML Hayden	16	0	346	21.6	124	0.0087	0.0000	0.0071	0.0058	0.0093	0.01275	0.01016	0.4436	18
JA Morkel	11	3	198	24.8	151.2	0.0060	0.0050	0.0041	0.0066	0.0114	0.01154	0.00952	0.4521	16
SK Raina	16	5	520	47.3	142.9	0.0087	0.0083	0.0107	0.0126	0.0108	0.00297	0.01820	0.8598	1
HH Gibbs	10	0	267	26.7	113.6	0.0055	0.0000	0.0055	0.0071	0.0086	0.01351	0.00768	0.3625	24
AC Gilchrist	16	0	289	18.1	156.2	0.0087	0.0000	0.0059	0.0048	0.0118	0.01340	0.01012	0.4304	21
RG Sharma	16	2	404	28.9	133.8	0.0087	0.0033	0.0083	0.0077	0.0101	0.00883	0.01230	0.5821	10
A Symonds	16	2	429	30.6	125.8	0.0087	0.0033	0.0088	0.0082	0.0095	0.00855	0.01267	0.5972	9
AB de Villiers	7	0	111	15.9	93.28	0.0038	0.0000	0.0023	0.0043	0.0070	0.01758	0.00315	0.1520	30
G Gambhir	10	1	277	30.8	127.7	0.0055	0.0017	0.0057	0.0082	0.0096	0.01164	0.00893	0.4343	19
KD Karthik	14	1	278	21.4	117.3	0.0077	0.0017	0.0057	0.0057	0.0088	0.01268	0.00864	0.4053	22
V Sehwag	14	0	356	25.4	163.3	0.0077	0.0000	0.0073	0.0068	0.0123	0.01165	0.01104	0.4867	14
SC Ganguly	14	1	493	37.9	117.7	0.0077	0.0017	0.0101	0.0101	0.0089	0.00868	0.01355	0.6096	7
DJ Hussey	6	2	94	23.5	109.3	0.0033	0.0033	0.0019	0.0063	0.0082	0.01531	0.00564	0.2694	27
BB McCullum	5	1	114	28.5	103.6	0.0027	0.0017	0.0023	0.0076	0.0078	0.01549	0.00586	0.2744	26
WP Saha	7	4	67	22.3	126.4	0.0038	0.0067	0.0014	0.0060	0.0095	0.01459	0.00832	0.3632	23
DPMD Jayawardene	13	3	439	43.9	147.3	0.0071	0.0050	0.0090	0.0117	0.0111	0.00562	0.01490	0.7262	4
IK Pathan	13	5	276	34.5	148.4	0.0071	0.0083	0.0057	0.0092	0.0112	0.00824	0.01361	0.6227	5
KC Sangakkara	12	0	357	29.8	138.9	0.0066	0.0000	0.0073	0.0080	0.0105	0.01148	0.01030	0.4729	15
Yuvraj Singh	14	2	255	21.3	128.1	0.0077	0.0033	0.0052	0.0057	0.0096	0.01195	0.00908	0.4319	20
DJ Bravo	8	1	61	8.71	115.1	0.0044	0.0017	0.0012	0.0023	0.0087	0.01793	0.00364	0.1688	29
AM Nayar	3	1	58	29	113.7	0.0016	0.0017	0.0012	0.0078	0.0086	0.01645	0.00591	0.2644	28
SR Tendulkar	15	2	618	47.5	132.6	0.0082	0.0033	0.0127	0.0127	0.0100	0.00578	0.01741	0.7508	3
RS Dravid	11	2	256	28.4	128.6	0.0060	0.0033	0.0052	0.0076	0.0097	0.01118	0.00907	0.4479	17
JH Kallis	16	4	572	47.7	115.8	0.0087	0.0067	0.0117	0.0128	0.0087	0.00459	0.01785	0.7953	2
V Kohli	13	2	307	27.9	144.8	0.0071	0.0033	0.0063	0.0075	0.0109	0.01004	0.01045	0.5100	12
LRPL Taylor	7	3	88	22	117.3	0.0038	0.0050	0.0018	0.0059	0.0088	0.01476	0.00682	0.3162	25
RV Uthappa	14	2	374	31.2	171.6	0.0077	0.0033	0.0077	0.0083	0.0129	0.00843	0.01269	0.6010	8
YK Pathan	14	2	333	27.8	165.7	0.0077	0.0033	0.0068	0.0074	0.0125	0.00945	0.01165	0.5522	11
Maximum values V* =						0.0087	0.0083	0.0127	0.0128	0.0129				
Minimum values V' =						0.0016	0.0000	0.0012	0.0023	0.0070				

H. Rank the alternatives according step-4.7e:

By using this proposed methodology we evaluate the performances and provide their ranking for IPL session-I, II, III and also calculated the overall performances and the overall rank of the players which is shown in the table-7.

Table 7: Ranking of the players during first three session of IPL and the overall ranking of the players.

Player Name	IPL session-III (2010)		IPL session-II (2009)		IPL session-I (2008)		Overall	
	Result	Rank	Result	Rank	Result	Rank	Result	Rank
S Badrinath	0.6161	6	0.2709	29	0.4505	10	0.4981	13
MS Dhoni	0.4985	13	0.6399	3	0.5566	1	0.6880	2
ML Hayden	0.4436	18	0.6557	2	0.4721	8	0.5216	12
JA Morkel	0.4521	16	0.4464	12	0.4054	15	0.4866	14
SK Raina	0.8598	1	0.4832	10	0.5214	3	0.7645	1
HH Gibbs	0.3625	24	0.5292	6	0.1697	29	0.3368	24
AC Gilchrist	0.4304	21	0.5301	5	0.4426	11	0.5493	8
RG Sharma	0.5821	10	0.5032	7	0.4406	12	0.6147	4
A Symonds	0.5972	9	0.4117	16	0.5463	2	0.4521	18
AB de Villiers	0.1520	30	0.7383	1	0.1155	30	0.3351	25
G Gambhir	0.4343	19	0.3800	18	0.5171	4	0.5286	10
KD Karthik	0.4053	22	0.5866	4	0.2512	24	0.4281	20
V Sehwag	0.4867	14	0.3079	25	0.4981	7	0.5236	11
SC Ganguly	0.6096	7	0.2056	30	0.3617	20	0.4337	19
DJ Hussey	0.2694	27	0.2802	28	0.3802	17	0.2237	29
BB McCullum	0.2744	26	0.3553	19	0.5154	5	0.2866	27
WP Saha	0.3632	23	0.4031	17	0.4235	13	0.4123	21
DPMD Jayawardene	0.7262	4	0.4973	8	0.4174	14	0.6350	3
IK Pathan	0.6227	5	0.3129	23	0.3259	21	0.4565	17
KC Sangakkara	0.4729	15	0.4309	15	0.3680	19	0.4567	16
Yuvraj Singh	0.4319	20	0.4460	13	0.3684	18	0.4688	15
DJ Bravo	0.1688	29	0.3219	22	0.2419	25	0.1597	30
AM Nayar	0.2644	28	0.3120	24	0.3141	23	0.2371	28
SR Tendulkar	0.7508	3	0.4887	9	0.2320	26	0.5836	5
RS Dravid	0.4479	17	0.3063	26	0.3855	16	0.4065	22
JH Kallis	0.7953	2	0.4558	11	0.2157	28	0.5557	7
V Kohli	0.5100	12	0.3474	20	0.2306	27	0.3609	23
LRPL Taylor	0.3162	25	0.4312	14	0.3198	22	0.3195	26
RV Uthappa	0.6010	8	0.2815	27	0.5017	6	0.5418	9
YK Pathan	0.5522	11	0.3356	21	0.4712	9	0.5568	6

The comparative chart of the ranking of players during IPL session-I, II, III and overall ranking of players according the best 10 overall players performance is described in the fig.1.
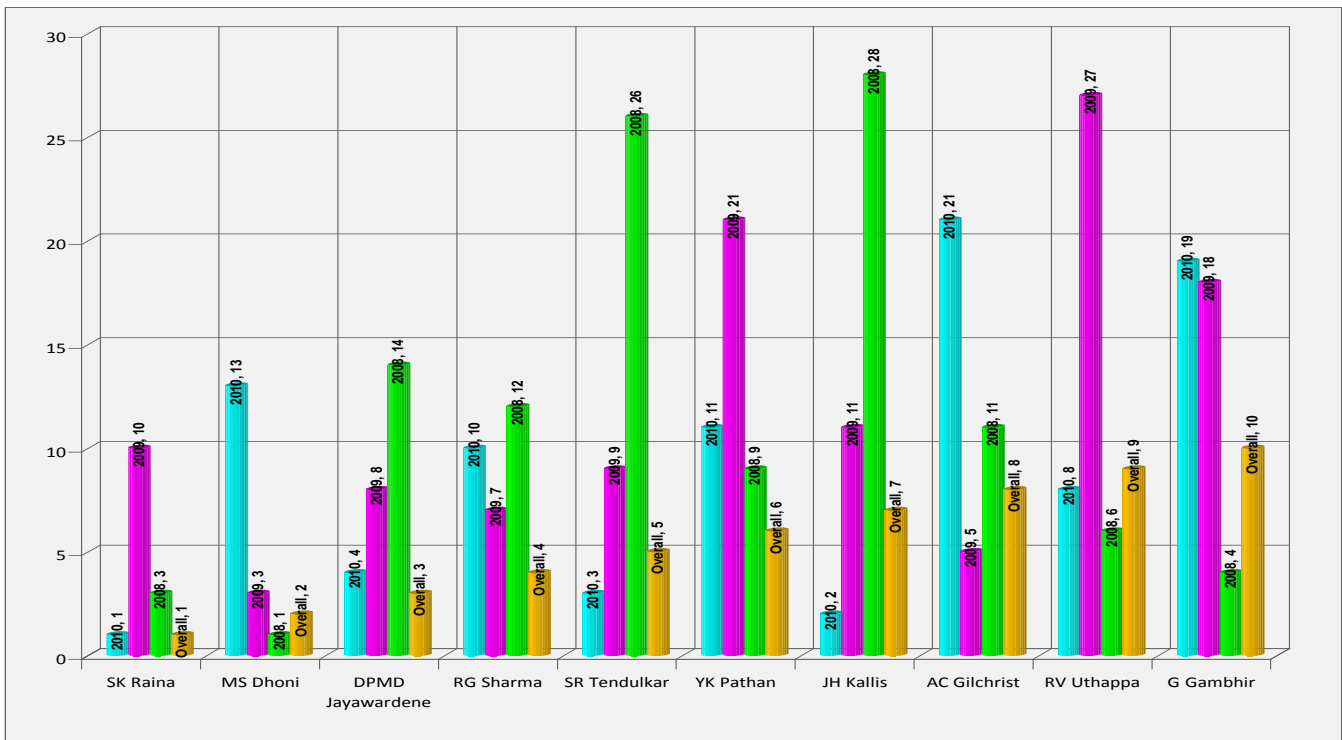

Figure.1: Comparative ranking of the overall best 10 batsmen.

V. CONCLUSION

In IPL session-I (2008) and session-III (2010) the Indian batsmen performed better than the others but in session-II (2009) the foreigner performed well. The performances of SK Raina and MS Dhoni had been tremendously good for the first three session of IPL. The performances of DPMD Jayawardane and RG Sharma have been very good throughout the IPL. JH Kallis, SR Tendulkar, DPMD Jayawardane and V Kohli performances are gradually increased and the performance of BB McCullam is decreased from session-I to session-III. AB de Villars and HH Gibbs obtain their best rank in session-II which played in their own country, South Africa but they failed to perform well in India. KD Karthik got his best rank in IPL-II. S Badrinath, RV Uthappa and YK Pathan could not play up to the mark in South Africa (IPL-II) and they obtained their lowest rank in IPL-II. SC Ganguly and IK Pathan played tremendously well in IPL session-III and got their best rank in first three session of IPL, but in IPL-IV auction no IPL franchises were bidding for SC Ganguly at first. Yuvraj Singh, one of the best talented cricketers of India for limited overs game who hit six sixes in a row in first twenty20 cricket world cup, could not play to his potential in first three session of IPL. One of the best Srilankan cricketers KC Sangakara's performances had not been good enough during the tournament. DJ Bravo, West-Indian allrounder's performance was very poor in all IPLs. Overall performances of the Indian players' were better than that of the foreigners.

The selectors of Indian cricket team give chance to the new young talents in the national team. For fare selection of players this proposed performance measurement of batsmen plays a very important role. Our proposed methodology is also useful in IPL player's auction to bid the appropriate value of the player according their performances. Thus base price of the players is also calculated with the help of this proposed methodology so that the players get their optimum price. By this statistical multi-criteria analysis the players improve their performances so that they get better opportunity to select in the national team and also get the maximum price in the auction. The same methodology is also used for performance measure of bowlers and all-rounders.

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