

## Selection of the all-time best World XI Test cricket team using the TOPSIS method

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### ABSTRACT

The aim of this paper is to apply the technique for order preference by similarity to ideal solution (TOPSIS) as a multi-criteria decision making tool to form the all-time best World XI Test cricket team while taking into consideration over 2600 cricketers participated in Test matches for more than 100 years of cricket history. From the voluminous database containing the performance of numerous Test cricketers, separate lists are first prepared for different positions in the batting and bowling orders consisting of manageable numbers of candidate alternatives while imposing some constraints with respect to the minimum number of innings played (for batsmen), minimum number of tests played (for wicketkeepers and bowlers), and minimum numbers of runs scored and wickets taken (for all-rounders). The TOPSIS method is later adopted to rank those shortlisted cricketers and identify the best performers for inclusion in the proposed World XI Test team. The best World Test cricket team is thus formed as Alastair Cook (ENG) (c), Sunil Gavaskar (IND), Rahul Dravid (IND) (vc), Sachin Tendulkar (IND), Shivnarine Chanderpaul (WI), Jacques Kallis (SA), Adam Gilchrist (AUS) (wk), Glenn McGrath (AUS), Courtney Walsh (WI), Muttiah Muralitharan (SL) and Shane Warne (AUS).

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## 1. Introduction

Cricket is considered as one of the major international sports with respect to participants, spectators and media interest. Today, this game is played in three different formats, i.e. Test, One-day International (ODI) and Twenty-Twenty (T20) at the international level. But, Test cricket is the oldest format among the three. It has also the longest form in the world of sports and is internationally acclaimed due to its highest playing standard. In Test cricket, two teams consisting of 11 players in each play a four-innings match, which may last up to five days. It is generally considered to be the most complete examination of the playing ability and endurance of the participating cricketers. In a Test, the relative strengths of the two competing sides are really tested (Lemmer, 2011).

The first Test match was played between England and Australia in 1877, which was eventually won by Australia by 45 runs. South Africa became the third team to play Test cricket in 1888-89, when they hosted a tour by an under-strength England side. Since the first Test match, there have been more than 2,000 Tests played by 10 teams, i.e. England (ENG), Australia (AUS), South Africa (SA), New Zealand (NZ), India (IND), Pakistan (PAK), Sri Lanka (SL), West Indies (WI), Bangladesh (BAN) and

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Zimbabwe (ZIM). In 2017, Afghanistan (AFG) and Ireland (IRE) were also awarded the Test status to become the 11<sup>th</sup> and 12<sup>th</sup> full members of the International Cricket Council (ICC). The frequency of Tests has steadily increased due to the increase in the number of participating countries, and willingness of the concerned cricket boards to maximize their revenue.

There are some interesting facts and figures in Test cricket. In Test cricket, the most successful team, with respect to both wins and win percentage, is Australia, having won 362 of their 773 Tests (46.83%). The least successful team is Bangladesh who has struggled since their introduction to Test cricket in 2000. Donald Bradman of Australia scored the most runs in a Test series, had the maximum number of double centuries and was a part of the record fifth wicket partnership. His batting average was as high as 99.94. In 1956, England spin bowler Jim Laker took 19 wickets for 90 runs. While taking 10 wickets for 53 runs in the second innings, he became the first bowler to capture all the ten wickets in a Test match innings. West Indies batsman Brian Lara has the highest individual score (400 not out against England in 2004) in Test cricket. Pakistan's Misbah-ul-Haq holds the record of the fastest test half century scoring 50 runs from 21 balls. On the other hand, New Zealand's Brendon McCullum scored 100 runs from 54 balls to hold the record for the fastest Test century. Sri Lankan spinner Muttiah Muralitharan is the highest Test wicket-taker with 800 wickets. India's Sachin Tendulkar has the distinction of having the tally of 15,921 runs in Test cricket. The Test record for most number of dismissals (555) by a wicketkeeper is held by Mark Boucher of South Africa, while the record for most catches (210) by a fielder is held by Rahul Dravid of India (Kimber, 1993).

The process of team selection in Test cricket is a complex decision making problem, being influenced by numerous factors, like the player's individual performance, optimal combination of the players, their physical fitness, playing conditions, strengths and weaknesses of the opponent, and confidence of the selection committee on the players. The performance of a Test cricket team also depends on the quality and fairness of the game, strategies adopted by the coaches and captain; moreover on the involvement and support of the spectators. These above-mentioned factors significantly improve the chances of win of a Test cricket team with an optimal combination of players. There are also many constraints that play key roles in selecting cricketers for a Test team. The manual team selection procedure may have several demerits, like personal liking and disliking, biasness towards a particular player, personal grievances between the team selection committee and players, and social and political pressures. An ill-selected Test cricket team may often lead to failure and for this, the selection committee would become responsible to the spectators/cricket lovers. It also affects the loyalty and morale of the cricketers, resulting in poor performance in a Test match. A sub-optimal/poor team selection which is often responsible for reduced motivation and zeal of the team members thus must have to be avoided. It is always a better approach to employ a scientific tool with strong and valid mathematical foundation for the most befitting Test cricket team selection in less time with minimum complexities.

Beaudoin and Swartz (2003) proposed a new measure for evaluating the performance of batsmen and bowlers in One-day cricket. Barr and Kantor (2004) presented a two-dimensional framework consisting of strike rate and probability of getting out for having a useful, direct and comparative insight into batting performance in One-day International cricket games. Ovens and Bukiet (2006) proposed a novel mathematical modelling approach to compute the expected performance of a cricket batting order in an innings and applied it to quantify the influence of batting order in a One-day cricket game based on the available data. Swartz et al. (2006) applied simulated annealing for finding out the optimal or nearly optimal batting order for the Indian One-day cricket team. Sathya and Jamal (2009) adopted genetic algorithm to compose an optimal cricket team from a set of 50 Indian players, and claimed that it could be applied for any multi-player game while just modifying the corresponding fitness function. Ahmed et al. (2011) applied non-dominated sorting genetic algorithm (NSGA-II) to optimize the overall batting and bowling strength of a cricket team, and find team members in it. The algorithm was employed on a set of players auctioned in Indian Premier League (IPL), 4th edition, while considering their T20 statistical data as the performance parameters. Kamble et al. (2011) demonstrated the application of a

cricket team selection procedure from a set of Indian players in complex situations using analytic hierarchy process (AHP). Aqil Burney et al. (2012) applied genetic algorithm to find out the optimal solution for the problem of cricket team selection and formation, and verified its applicability on a group of top-performing Pakistani cricket players for Test team selection. The proposed team selection process took into account the number of wins and losses, and recent performance of the players in last few matches. Daniyal et al. (2012) adopted individual and moving range control charts for evaluating the batting performance of some of the selected cricketers. Bhattacharjee and Saikia (2014) proposed a composite index measure to evaluate the performance of cricketers irrespective of their expertise, and then applied a 0-1 integer programming approach to form an optimal cricket team. Saikia et al. (2016) pointed out that the selection of an optimal squad in cricket had been a complex decision making problem, introduced a measure to quantify the performance of cricketers into a single numerical value and validated the proposed approach while taking data from the 5<sup>th</sup> edition of IPL. Irvine and Kennedy (2017) identified some key performance indicators that would most significantly affect the outcome of an international T20 cricket match. It was concluded that total number of dot balls bowled, total number of wickets taken and run rate would mainly dictate the result of a T20 cricket match.

It is observed from the above-cited literature review that the application of mathematical tools and techniques in the domain of optimal cricket team selection is really limited. The AHP method and genetic algorithm were mainly utilized for the formation of the best National level Test and One-day cricket teams. It is also noticed that till date, no fruitful endeavour has been put forward to mathematically decide the optimal composition of the Test cricket team for any of the participating countries. Thus, there is an ample scope to deploy any of the existing multi-criteria decision making (MCDM) methods to compose the best National Test cricket team. An MCDM method basically deals with the evaluation and identification of the best course of action/alternative in presence of several mutually conflicting criteria/attributes. Since the inception of Test cricket in 1877, hundreds of players have participated in this sport for their respective countries and some of them have achieved unforgettable traits due to their remarkable contributions in Test cricket. Now, the question always arises in mind that what will the optimal composition of a Test cricket team if all the participated and participating players are taken into account simultaneously. Thus, the objective of this paper is set to compose the all-time best World XI Test team considering all the players from the world of cricket while employing technique for order preference by similarity to ideal solution (TOPSIS) which has already been proven as an efficient MCDM tool for solving complex decision making problems.

## 2. TOPSIS method

The TOPSIS method (Hwang & Yoon, 1981) is an MCDM tool which basically converts multiple attributes of a decision making problem into a single performance response value. It has been emerged out as an effective MCDM method because it involves less number of parameters, has high consistency and less computational effort. It is based on the notion that the best chosen alternative should have the shortest Euclidean distance from the positive-ideal solution, and the farthest from the negative-ideal solution. The positive-ideal solution is a hypothetical solution for which all the attributes correspond to their maximum values in the database, whereas, the negative-ideal solution is that hypothetical solution where all the attributes receive minimum values. This method thus provides a more realistic form of modelling as it allows trade-offs between various criteria, where a poor result in one criterion can be balanced by a good result with respect to another criterion. The procedural steps of TOPSIS method for selecting the best course of action from a set of feasible alternatives in presence of multiple conflicting criteria are presented as below:

- a) Based on the set objectives, identify the pertinent evaluation criteria and a set of alternatives fulfilling those criteria.
- b) With  $m$  number of alternatives and  $n$  number of criteria, a decision/evaluation matrix is developed depicting the performance of all the alternatives with respect to the considered criteria.

$$D = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \quad (1)$$

where  $x_{ij}$  is the performance measure of  $i^{\text{th}}$  alternative against  $j^{\text{th}}$  criterion.

- c) From the original decision matrix, the normalized decision matrix is derived using vector normalization procedure to make it dimensionless with comparable elements.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (2)$$

where  $r_{ij}$  is the normalized value of  $x_{ij}$ .

- d) Using AHP or entropy method (Rao, 2007), determine the priority weight (relative importance) ( $w_j$ ) for each of the criteria.  
e) Obtain the weighted normalized matrix.

$$v_{ij} = r_{ij} \times w_j \quad (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \quad (3)$$

- f) Obtain the positive-ideal (best) and the negative ideal (worst) solutions using the following equations:

$$A^+ = \{v_1^+, v_2^+, \dots, v_n^+\}, \quad (4)$$

$$A^- = \{v_1^-, v_2^-, \dots, v_n^-\}, \quad (5)$$

where  $A^+$  denotes the positive-ideal solution and  $A^-$  expresses the negative-ideal solution. For the  $j^{\text{th}}$  beneficial criterion,  $v_j^+ = \max\{v_{ij}, i = 1, 2, \dots, m\}$  and  $v_j^- = \min\{v_{ij}, i = 1, 2, \dots, m\}$ . Similarly, for the  $j^{\text{th}}$  non-beneficial criterion,  $v_j^+ = \min\{v_{ij}, i = 1, 2, \dots, m\}$  and  $v_j^- = \max\{v_{ij}, i = 1, 2, \dots, m\}$ .

- g) Obtain the separation measures. The separations of each alternative from the positive-ideal and negative-ideal solutions are calculated by the corresponding Euclidean distances, as given in the following equations:

$$S_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2}, \quad i = 1, 2, \dots, m \quad (6)$$

$$S_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2}, \quad i = 1, 2, \dots, m \quad (7)$$

- h) The relative closeness of a particular alternative to the ideal solution is estimated as follows:

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad (8)$$

- i) The alternatives are now arranged in descending order of their  $P_i$  values. The alternative with the highest  $P_i$  value is identified as the most appropriate choice.

An excellent review on the applications of TOPSIS method in diverse fields of technological and managerial decision making is available in Behzadian et al. (2012), Tlig and Rebai (2017) and Bagheri et al. (2018).

### 3. Selection of the all-time best World XI Test cricket team

As the objective of this paper is to compose the all-time best World XI Test team while taking into account all the players from the world of cricket applying TOPSIS method, it becomes the first task to decide about the structure of that team. Like the other National level cricket teams, this World XI Test team also consists of five batsmen (including two openers), one wicketkeeper, one all-rounder, two fast bowlers/pacers and two spinners. In a cricket team, the openers or opening batsmen are those two players who bat first in the innings, i.e. at the number 1 and 2 positions. The role of these two openers in the team is extremely important as they can only provide a good and solid start to the innings. They must be psychologically strong as they have to face the new ball at the start of the innings. At the beginning of an innings, the new ball is hard, moves fast, bounces high, swings in air and seams around unpredictably. As these early conditions are usually in favour of the bowling team, the openers must have patience, sound batting skill, defensive attitude and ability to adjust quickly with the condition of the pitch. They would have the determination to stay longer in the crease to protect the batsmen further down the batting order. If one of them loses his wicket early, it may impose tremendous pressure on the succeeding batsmen. It is often said that an opener needs to be a batter who wants to be an opening batsman. For a Test team, it is always preferred to have a left-hand and right-hand combinations of the openers because of the disruption it can cause to the opponent bowlers trying to establish the correct line and length at the start of the innings.

It is an extremely difficult task to identify the two best openers for the proposed World Test XI cricket team as there are hundreds of players who opened their Test innings for their respective countries. It is thus always better to reduce the total number of Test openers to a manageable figure based on some predetermined threshold criterion. Based on this perception, in this paper, a list of 21 opening batsmen is prepared in Table 1 who opened at least 140 Test innings for their countries. This list contains seven openers from England, four from Australia, three from South Africa, two each from India, Sri Lanka and West Indies, and one from New Zealand, There are no openers in this list from Pakistan, Bangladesh and Zimbabwe as none of their openers fulfils the criterion of playing at least 140 innings as an opening batsman. The performance of all these 21 shortlisted openers is now evaluated based on 12 pivotal criteria, i.e. number of innings (INN), total runs scored (RUN), number of times bowled (BWD), number of times caught by the fielders (CGT), number of times caught behind the wicket (CB), number of times of leg before the wicket (LBW), number of other modes of dismissal (ODM), average run (AVG), number of fifties scored (50s), number of hundreds/centuries scored (100s), number of outs without scoring a single run (DUCK) and the highest score (HS). The other modes of dismissal include stump out, run out, hit wicket, handed the ball and obstructed the field. A cricketer's batting average is the total number of runs scored divided by the number of times he has been out. In the HS column, an asterisk represents that the particular opener remained not out in that innings. Among these 12 performance measures for the openers, BWD, CGT, CB, LBW, ODM and DUCK are the non-beneficial/cost criteria requiring their lower values, whereas, the remaining six are the beneficial criteria where their higher values are always desired. The pertinent information/statistics for all the considered Test cricket players are accumulated from various web sources, like [www.howstat.com](http://www.howstat.com), [www.espnricinfo.com](http://www.espnricinfo.com), [www.cricbuzz.com](http://www.cricbuzz.com) etc. Each of these considered criteria has its individual relative importance on the final selection decision which can only be estimated while employing AHP or entropy method. The criteria weights measured using AHP method are often biased being influenced by the subjective judgements of the decision makers while developing the relevant pair-wise comparison matrices. Thus, it is always preferred to augment entropy method to determine the weights of the considered criteria as it is based on the amount of information available in the form of a decision/evaluation matrix and its relationship with importance of the criterion. The main advantage of this method is that it estimates the criteria weights from the data given in the decision matrix and is independent of the views of the concerned decision makers (Xu, 2004). It basically measures the uncertainty associated with random phenomena of the information presented in the decision matrix. For selecting the top two openers from a set of 21 alternative choices, the corresponding weights for

the 12 considered criteria are calculated as 0.128, 0.125, 0.081, 0.059, 0.040, 0.068, 0.055, 0.099, 0.090, 0.099, 0.056 and 0.100 respectively. It can be clearly observed that the entropy method provides maximum importance (weight) to the number of innings played by a particular opener and total number of runs scored by him. These weights are provided in the last row of Table 1. Now, based on the procedural steps of TOPSIS method, the decision matrix of Table 1 is first normalized using the vector normalization procedure from which the corresponding weighted normalized matrix is developed. From this matrix, the corresponding positive-ideal and negative-ideal solutions are identified, and the distances of each alternative opener from these two solutions are estimated. The relative closeness of a particular alternative (TOPSIS score) to the ideal solution is then calculated based on which all the 21 openers are subsequently ranked.

**Table 1**  
List of openers with minimum 140 Test innings

Sl. No.	Player	CUN	INN	RUN	BWD	CGT	CB	LBW	ODM	AVG	50s	100s	DUCK	HS	Score	Rank
1.	Mark Taylor	AUS	186	7525	26	65	36	30	16	43.5	40	19	5	334*	0.492	8
2.	Mark Waugh	AUS	209	8029	30	78	47	32	5	41.82	47	20	19	153*	0.463	11
3.	Justin Langer	AUS	182	7696	23	69	42	28	8	45.27	30	23	11	250	0.483	10
4.	Matthew Hayden	AUS	184	8625	21	88	22	26	13	50.74	29	30	14	380	0.564	3
5.	Geoffrey Boycott	ENG	193	8114	30	70	34	27	9	47.73	42	22	10	246*	0.526	5
6.	Graham Gooch	ENG	215	8900	36	70	45	50	8	42.58	46	20	13	333	0.505	7
7.	Michael Atherton	ENG	212	7728	32	74	59	35	5	37.7	46	16	20	185*	0.428	16
8.	Michael Vaughan	ENG	147	5719	22	55	41	17	3	41.44	18	18	9	197	0.432	14
9.	Marcus Trescothick	ENG	143	5825	25	55	39	9	5	43.8	29	14	12	219	0.442	13
10.	Andrew Strauss	ENG	178	7037	25	72	45	25	5	40.91	27	21	15	177	0.423	17
11.	Alastair Cook**	ENG	263	11579	29	95	71	49	4	46.69	55	31	8	294	0.643	1
12.	Sunil Gavaskar	IND	214	10122	33	87	54	17	17	51.12	45	34	12	236*	0.583	2
13.	Virender Sehwag	IND	180	8586	31	82	30	21	10	49.34	32	23	16	319	0.518	6
14.	John Wright	NZ	148	5334	21	65	37	12	6	37.83	23	12	7	185	0.413	18
15.	Gary Kirsten	SA	176	7289	27	71	33	21	9	45.27	34	21	13	275	0.487	9
16.	Herschelle Gibbs	SA	154	6167	35	61	25	18	8	41.95	26	14	11	228	0.399	19
17.	Graeme Smith	SA	205	9265	31	72	40	44	5	48.26	38	27	11	277	0.554	4
18.	Marvan Atapattu	SL	156	5502	22	58	29	22	10	39.02	17	16	22	249	0.349	21
19.	Tillakaratne Dilshan	SL	145	5492	30	48	29	19	8	40.99	23	16	14	193	0.372	20
20.	Gordon Greenidge	WI	185	7558	24	72	31	35	7	44.72	34	19	11	226	0.451	12
21.	Desmond Haynes	WI	202	7487	31	70	37	27	12	42.3	39	18	10	184	0.431	15
		$w_j$	0.128	0.125	0.081	0.059	0.040	0.068	0.055	0.099	0.090	0.099	0.056	0.100		

\*\* till 28th August, 2017

It can be revealed from Table 1 that Alastair Cook of England and Sunil Gavaskar of India occupy the top positions in the ranking list of the openers. Hence, they are unanimously included in the World XI Test cricket team as the two opening batsmen. They also virtually satisfy the requirement of the left and right handed batting combination in the team. Mathew Hayden (AUS) and Graeme Smith (SA) respectively are at the third and fourth positions in the ranking list of the openers. The roles of the batsmen at the third, fourth and fifth positions in the Test batting order are also important as they have to face an older ball which is likely to turn and will be responsible to make a competitive score in the match. They must be good stroke players and have the ability to attack, consolidate or defend according to the prevailing circumstances in the match. If the openers lose their wickets in the early stage of the innings, these top order batsmen must bear the responsibility to solidify the team's innings. Tables 2, 3 and 4 respectively show the lists of the Test players shortlisted for the third (with minimum 120 innings), fourth (with minimum 140 innings) and fifth positions (with minimum 130 innings) of the proposed World XI Test team. The list of the shortlisted players for the third position in batting order has 14 cricketers (four from Australia, three from West Indies, two from England, two from India, one each from South Africa, Sri Lanka and Pakistan). Similarly, in Table 3, there are 17 alternative batsmen (four from England, three from Pakistan, two each from Australia, India, New Zealand, West Indies and Sri Lanka) identified for the fourth position in the batting order of the World XI Test team. There are also 17 cricketers in Table 4 (four from England, three from India, three from Pakistan, two from Sri Lanka, two from West Indies, and one each from Australia, New Zealand and South Africa) shortlisted for the fifth position in the batting order. For all these three batting positions, based on the shortlisted players' performance data, the corresponding values of the criteria weights are estimated using entropy method, and it is observed that maximum importance is provided to the number of innings

played and total runs scored by a cricketer. The TOPSIS method-based analysis identifies Rahul Dravid from India for the third, Sachin Tendulkar also from India for the fourth and Shivnarine Chanderpaul from West Indies for the fifth positions in the batting order of the proposed World XI Test team.

**Table 2**

List of number 3 position players with minimum 120 Test innings

Sl. No.	Player	CUN	INN	RUN	BWD	CGT	CB	LBW	ODM	AVG	50s	100s	DUCK	HS	Score	Rank
1.	Neil Harvey	AUS	137	6149	34	52	20	17	4	48.42	24	21	7	205	0.248	8
2.	Ian Chappell	AUS	136	5345	21	51	28	18	8	42.42	26	14	11	196	0.186	11
3.	David Boon	AUS	190	7422	32	76	28	25	9	43.66	32	21	16	200	0.354	5
4.	Ricky Ponting	AUS	287	13378	36	111	42	47	22	51.85	62	41	17	257	0.840	2
5.	Tom Graveney	ENG	123	4882	26	49	18	9	8	44.38	20	11	8	258	0.178	13
6.	Mark Butcher	ENG	131	4288	12	51	24	26	11	34.58	23	8	10	173*	0.141	14
7.	Dilip Vengsarkar	IND	185	6868	16	75	45	19	8	42.13	35	17	15	166	0.332	6
8.	Rahul Dravid	IND	286	13288	55	87	64	34	14	52.31	63	36	8	270	0.869	1
9.	Zaheer Abbas	PAK	124	5062	21	43	30	13	6	44.8	20	12	10	274	0.178	12
10.	Kumar Sangakkara	SL	233	12400	24	118	44	19	11	57.41	52	38	11	319	0.758	3
11.	Hashim Amla**	SA	183	8281	31	55	42	32	9	49	35	26	10	311*	0.434	4
12.	Richie Richardson	WI	146	5949	20	59	24	26	5	44.4	27	16	8	194	0.226	10
13.	Rohan Kanhai	WI	137	6227	22	69	18	16	6	47.53	28	15	7	256	0.241	9
14.	Ramnaresh Sarwan	WI	154	5842	17	67	21	31	10	40.01	31	15	12			
till 28th August, 2017 **		w <sub>j</sub>	0.226	0.169	0.014	0.038	0.022	0.023	0.010	0.036	0.197	0.121	0.051			

**Table 3**

List of number 4 position players with minimum 140 Test innings

Sl. No.	Player	CUN	INN	RUN	BWD	CGT	CB	LBW	ODM	AVG	50s	100s	DUCK	HS	Score	Rank
1.	Greg Chappell	AUS	151	7110	20	66	21	16	9	53.86	31	24	12	247*	0.369	12
2.	Allan Border	AUS	265	11174	53	79	52	16	21	50.56	63	27	11	205	0.480	4
3.	Wally Hammond	ENG	140	7249	38	53	9	12	12	58.46	24	22	4	336*	0.404	9
4.	David Gower	ENG	204	8231	28	69	49	36	4	44.25	39	18	7	215	0.383	10
5.	Nasser Hussain	ENG	171	5764	20	56	44	34	1	37.19	33	14	14	207	0.313	16
6.	Kevin Pietersen	ENG	181	8181	28	71	36	31	7	47.29	35	23	10	227	0.369	13
7.	Gundappa Vishwanath	IND	155	6080	41	50	31	16	7	41.93	35	14	10	222	0.307	17
8.	Sachin Tendulkar	IND	329	15921	54	127	42	63	10	53.79	68	51	14	248*	0.643	1
9.	Stephen Fleming	NZ	189	7172	24	80	35	28	12	40.07	46	9	16	274*	0.327	15
10.	Ross Taylor**	NZ	146	6030	16	49	25	30	8	47.11	27	16	12	290	0.339	14
11.	Javed Miandad	PAK	189	8832	21	64	38	33	12	52.57	43	23	6	280*	0.437	6
12.	Inzamam-Ul-Haq	PAK	200	8830	22	83	26	34	13	49.61	46	25	15	329	0.436	7
13.	Younis Khan	PAK	213	10099	27	74	40	46	7	52.06	33	34	19	313	0.446	5
14.	Aravinda De Silva	SL	159	6361	13	76	29	24	6	42.98	22	20	7	267	0.371	11
15.	Mahela Jayawardene	SL	252	11814	29	102	65	33	8	49.85	50	34	15	374	0.556	2
16.	Viv Richards	WI	182	8540	36	71	35	21	7	50.24	45	24	10	291	0.415	8
17.	Brian Lara	WI	232	11953	36	93	51	37	9	52.89	48	34	17	400	0.5419	3
		w <sub>j</sub>	0.142	0.154	0.067	0.040	0.055	0.040	0.037	0.063	0.101	0.087	0.075	0.138		

**Table 4**

List of number 5 position players with minimum 130 Test innings

Sl. No.	Player	CUN	INN	RUN	BWD	CGT	CB	LBW	ODM	AVG	50s	100s	DUCK	HS	Score	Rank
1.	Michael Clarke	AUS	198	8643	37	73	35	19	12	49.11	27	28	9	329	0.432	8
2.	Colin Cowdrey	ENG	188	7624	31	74	42	19	7	44.07	38	22	9	182	0.437	7
3.	Mike Gatting	ENG	138	4409	34	39	14	31	6	35.56	21	10	16	207	0.309	17
4.	Graham Thorpe	ENG	179	6744	27	70	23	22	9	44.66	39	16	12	200*	0.416	10
5.	Ian Bell	ENG	205	7727	33	71	45	25	6	42.69	46	22	14	235	0.458	5
6.	Mohammad Azharuddin	IND	147	6215	19	70	23	18	6	45.04	21	22	5	199	0.428	9
7.	Sourav Ganguly	IND	188	7212	26	85	29	23	8	42.18	35	16	13	239	0.405	12
8.	VVS Laxman	IND	225	8781	39	83	35	21	13	45.97	56	17	14	281	0.492	2
9.	Nathan Astle	NZ	137	4702	14	58	29	19	7	37.02	24	11	11	222	0.358	15
10.	Saleem Malik	PAK	154	5768	31	58	19	19	5	43.7	29	15	12	237	0.376	13
11.	Mohammad Yousuf	PAK	156	7530	20	57	35	20	12	52.29	33	24	11	223	0.410	11
12.	Misbah-Ul-Haq	PAK	132	5222	9	46	27	26	4	46.63	39	10	9	161*	0.447	6
13.	Ab De Villiers**	SA	176	8074	31	67	31	23	8	50.46	39	21	7	278*	0.476	3
14.	Arjuna Ranatunga	SL	155	5105	18	70	24	18	13	35.7	38	4	12	135*	0.349	16
15.	Thilan Samaraweera	SL	132	5462	15	38	27	17	15	48.77	30	14	11	231	0.365	14
16.	Clive Lloyd	WI	175	7515	27	72	37	15	10	46.68	39	19	4	242*	0.471	4
17.	Shivnarine Chanderpaul	WI	280	11867	25	98	47	55	6	51.37	66	30	15	203*	0.631	1
** till 28 <sup>th</sup> August, 2017		w <sub>j</sub>	0.162	0.109	0.091	0.058	0.075	0.028	0.066	0.082	0.121	0.059	0.089	0.061		

The position of a wicketkeeper in a cricket team is particularly crucial because every team wants someone having safe hands behind the wicket, as one mistake in that area can lead a team to defeat. A good and potential wicketkeeper must also keep the morale of his team high by encouraging the bowlers as well as fielders. He is the best person in the team who can visualize the movement of the ball in air and guide his bowlers to bowl accordingly. A wicketkeeper is also expected to at least bat reasonably well in the middle order. Table 5 shows a list of 14 candidate wicketkeepers shortlisted based on the criterion to play at least 70 Test matches. It includes 4 wicketkeepers from England, three from Australia, two from India, two from West Indies, two from New Zealand, and one each from Pakistan and South Africa. For a wicketkeeper, the number of tests played is more important than the number of innings as all the related statistics are usually expressed with respect to the number of Test matches. The performance of all these 15 wicketkeepers is now evaluated with respect to 14 criteria as number of Test matches (MTC), number of catches taken (CTC), number of stumpings (STP), RUN, BWD, CGT, CB, LBW, ODM, AVG, 50s, 100s, DUCK and HS. These 14 evaluation criteria are again divided into two groups, i.e. beneficial (MTC, CTC, STP, RUN, AVG, 50s, 100s and HS) and non-beneficial (BWD, CGT, CB, LBW, ODM and DUCK) based on their effects on the decision making process. The corresponding TOPSIS scores for the 15 wicketkeepers are now determined, as exhibited in Table 5, which finally lead to their ranking order. It is noticed that Adam Gilchrist from Australia is at the top most position of the list with a TOPSIS score of 0.675, followed by Alec Stewart of England with a score of 0.520. Hence, Adam Gilchrist is chosen to be the wicketkeeper of the proposed World XI Test cricket team.

**Table 5**

List of wicketkeepers with minimum 70 Tests

Sl. No.	Player	CUN	MTC	CTC	STP	RUN	BWD	CGT
1.	Rod Marsh	AUS	96	343	12	3633	27	67
2.	Ian Healy	AUS	119	366	29	4356	16	83
3.	Adam Gilchrist	AUS	96	379	37	5570	16	64
4.	Godfrey Evans	ENG	91	173	46	2439	36	52
5.	Alan Knott	ENG	95	250	19	4389	30	57
6.	Alec Stewart	ENG	133	227	14	8463	40	87
7.	Matt Prior	ENG	79	243	13	4099	20	50
8.	Syed Kirmani	IND	88	160	38	2759	29	42
9.	M. Singh Dhoni	IND	90	256	38	4876	15	62
10.	Adam Parore	NZ	78	194	7	2865	8	47
11.	B. Mccullum	NZ	101	167	11	6453	29	73
12.	Wasim Bari	PAK	81	201	27	1366	19	32
13.	Mark Boucher	SA	146	532	23	5515	40	75
14.	Jeff Dujon	WI	81	267	5	3322	21	45
15.	Denesh Ramdin	WI	74	202	11	2898	23	46
		$w_j$	0.11	0.12	0.09	0.06	0.07	0.05

**Table 5**

List of wicketkeepers with minimum 70 Tests

Sl. No.	CB	LBW	ODM	AVG	50s	100s	DUCK	HS	Score	Rank
1.	23	13	7	26.52	16	3	12	132	0.325	12
2.	35	18	7	27.4	22	4	18	161*	0.426	6
3.	20	12	5	47.61	26	17	14	204*	0.675	1
4.	15	6	10	20.5	8	2	17	104	0.348	10
5.	18	21	8	32.75	30	5	8	135	0.372	8
6.	40	40	7	39.55	45	15	14	190	0.520	2
7.	18	7	7	40.19	28	7	13	131*	0.387	7
8.	11	12	8	27.05	12	2	7	102*	0.350	9
9.	32	12	7	38.09	33	6	10	224	0.500	3
10.	25	20	9	26.28	14	2	6	110	0.288	14
11.	27	33	5	38.64	31	12	14	302	0.479	5
12.	19	10	6	15.88	6	0	19	85	0.280	15
13.	35	25	7	30.3	35	5	17	125	0.494	4
14.	15	17	6	31.94	16	5	8	139	0.335	11
15.	23	18	2	25.88	15	4	9	166	0.313	13
	0.05	0.03	0.05	0.05	0.07	0.09	0.07	0.09		



In a cricket team, an all-rounder is that player who can bat as well as bowl. An all-rounder must provide a Test team with the much required balance with his ability to take wickets and score runs. He can act as an extra bowler for his team and also as a good batsman to rescue his team at the time of batting collapse. Thus, an all-rounder can provide the much required rest to the regular bowlers of his team and also support his team with his bat. Table 6 shortlists 14 all-rounders from all the Test playing nations who have scored at least 2000 runs and captured a minimum of 150 wickets. This list of all-rounders consists of three players for India, three from New Zealand, two from Australia, two from England, two from South Africa, and one each from Pakistan and West Indies. For evaluation of the performance of all these 14 all-rounders, 18 critical criteria are considered which contain both the measures for the batsmen and bowlers. These criteria are MTC, INN, RUN, number of outs (OUT), AVG, 50s, 100s, DUCK, HS, number of balls bowled (BB), number of maidens (MDN), number of wickets taken (WCK), total runs conceded (RC), bowling average (BAVG), economy rate (ECY), strike rate (STR), number of times five wickets taken in an innings (5W/I) and number of times ten or more wickets taken in a Test match (10W/M). The bowling average is simply the ratio of the total runs conceded to the number of wickets taken. Economy rate is the average number of runs conceded per over by a bowler. The strike rate for a bowler is defined as the average number of balls bowled per wicket taken. Among these 18 evaluation criteria for the all-rounders, MTC, INN, RUN, AVG, 50s, 100s, HS, BB, MDN, WCK, 5W/I and 10W/M are the beneficial attributes, and the remaining are the non-beneficial performance measures requiring their lower values. As usual, based on the entropy method, the priorities of all these criteria are estimated, as provided in Table 6.

**Table 6**

List of all-rounders with minimum 2000 runs and 150 wickets (Part 1)

Sl. No.	Player	CUN	MTC	INN	RUN	OUT	AVG	50s	100s	DUCK	HS
1.	K. Miller	AUS	55	87	2958	80	37	13	7	5	147
2.	R. Benaud	AUS	63	97	2201	90	24.5	9	3	8	122
3.	I. Botham	ENG	102	161	5200	155	33.6	22	14	14	208
4.	A. Flintoff	ENG	79	130	3845	121	31.8	26	5	17	167
5.	K. Dev	IND	131	184	5248	169	31.1	27	8	16	163
6.	R. Shastri	IND	80	121	3830	107	35.8	12	11	9	206
7.	R. Ashwin**	IND	52	72	2035	62	32.8	11	4	3	124
8.	R. Hadlee	NZ	86	134	3124	115	27.2	15	2	12	151
9.	C. Cairns	NZ	62	104	3320	99	33.5	22	5	7	158
10.	D. Vettori	NZ	112	174	4531	151	30	23	6	20	140
11.	I. Khan	PAK	88	126	3807	101	37.7	18	6	8	136
12.	S. Pollock	SA	108	156	3781	117	32.3	16	2	9	111
13.	J. Kallis	SA	166	280	13289	240	55.4	58	45	16	224
14.	G. Sobers	WI	93	160	8032	139	57.8	26	2	12	365
		$w_j$	0.06	0.1	0.08	0.02	0.05	0.1	0.15	0.03	0.1

**Table 6**

List of all-rounders with minimum 2000 runs and 150 wickets (Part 2)

Sl. No.	BB	MDN	WCK	RC	BAVG	ECY	STR	5W/I	10W/M	Score	Rank
1.	10461	337	170	3906	22.98	2.24	61.54	7	1	0.15	11
2.	19108	805	248	6704	27.03	2.11	77.05	16	1	0.12	14
3.	21815	788	383	10878	28.4	2.99	56.96	27	4	0.34	3
4.	14951	506	226	7410	32.79	2.97	66.15	3	0	0.13	13
5.	27740	1060	434	12867	29.65	2.78	63.92	23	2	0.24	6
6.	15751	657	151	6186	40.97	2.36	104.3	2	0	0.19	9
7.	15314	517	292	7377	25.26	2.89	52.45	26	7	0.31	4
8.	21918	809	431	9611	22.3	2.63	50.85	36	9	0.37	2
9.	11698	414	218	6410	29.4	3.29	53.66	13	1	0.14	12
10.	28814	1197	362	12441	34.37	2.59	79.6	20	3	0.23	7
11.	19458	727	362	8258	22.81	2.55	53.75	23	6	0.30	5
12.	24353	1211	421	9733	23.12	2.4	57.85	16	1	0.16	10
13.	20232	848	292	9535	32.65	2.83	69.29	5	0	0.64	1
14.	21599	974	235	7999	34.04	2.22	91.91	6	0	0.23	8
	0.04	0.04	0.04	0.04	0.02	0.03	0.02	0.06	0.12		

\*\* till 28th August, 2017

The corresponding TOPSIS scores are calculated and the candidate all-rounders are then ranked depending on the descending values of their TOPSIS scores. It can be revealed from this table that Jacques Kallis from South Africa emerges out as the best all-rounder for inclusion in the proposed World XI Test cricket team. Richard Hadlee of New Zealand is the second best all-rounder. In a Test match, the main goal of any bowler is to take the wicket of the opponent batsman, followed by trying to prevent him from scoring runs. Depriving a batsman from scoring runs often makes him frustrated and compels him to attempt risky shots to score. In addition, stopping the batsman from scoring runs keeps him at the crease to face consecutive balls which may be a tactical strategy. The success of a Test cricket team primarily lies on its skilled fast bowlers, with spinners in the support roles. At the start of an innings in a Test match, two fast bowlers/pacers/seamers share the bowling attack for the fielding side while trying to exploit the early favourable condition of the pitch. At this time, the ball is used to move fast and swing in air, causing difficulty for the opponent's opening batsmen to play and score runs. If these two fast bowlers can make a breakthrough of the opponent's innings by taking a couple of wickets at the beginning of the innings, the opponent team will be under tremendous pressure and will face a huge difficulty to recover from that awkward situation. In the history of International Test cricket, there exist hundreds of fast bowlers sharing the responsibilities to start the bowling attacks for their respective countries. While trimming down these large number of fast bowlers into a convenient figure, a list of 23 fast bowlers is prepared in Table 7 based on the criterion that they should have played at least 70 Test matches for their countries. This list contains six fast bowlers from Australia, four from England, four from South Africa, three from West Indies, two from India, two from Pakistan, and one each from New Zealand and Sri Lanka. The performance of all these 23 fast bowlers is now evaluated based on ten criteria, i.e. MTC, BB, MDN, WCK, RC, BAVG, ECY, STR, 5W/I and 10W/M. The weights of these criteria are also determined while employing entropy method and it is revealed that number of matches played by a fast bowler has the maximum importance, followed by the number of maidens he bowled and number of 10 or more wickets he took in a Test match. The corresponding TOPSIS scores are computed as shown in Table 7 based on which the considered fast bowlers are subsequently ranked. Glenn McGrath of Australia and Courtney Walsh of West Indies occupy the top two positions in the ranking of the candidate fast bowlers, and can be considered for inclusion in the all-time World XI Test cricket team. The third and fourth positions are respectively captured by Wasim Akram of Pakistan and James Anderson of England.

**Table 7**

List of fast bowlers (pacers) with minimum 70 Tests

Sl. No.	Player	CUN	MTC	BB	MDN	WKT	RC	BAVG	ECY	STR	5W/I	10W/M	Score	Rank
1.	Dennis Lillee	AUS	70	18467	652	355	8493	23.92	2.76	52.02	23	7	0.557	5
2.	Craig McDermott	AUS	71	16586	583	291	8332	28.63	3.01	57.00	14	2	0.232	15
3.	Glenn McGrath	AUS	124	29248	1470	563	12186	21.64	2.5	51.95	29	3	0.664	1
4.	Jason Gillespie	AUS	71	14234	630	259	6770	26.14	2.85	54.96	8	0	0.124	19
5.	Brett Lee	AUS	76	16531	547	310	9555	30.82	3.47	53.33	10	0	0.107	22
6.	Mitchell Johnson	AUS	73	16001	514	313	8892	28.41	3.33	51.12	12	3	0.288	14
7.	Brian Statham	ENG	70	16056	595	252	6261	24.85	2.34	63.71	9	1	0.166	18
8.	Bob Willis	ENG	90	17357	554	325	8190	25.2	2.83	53.41	16	0	0.184	17
9.	James Anderson**	ENG	127	27862	1142	495	13684	27.64	2.95	56.29	23	3	0.590	4
10.	Stuart Broad**	ENG	107	22003	828	385	11009	28.59	3	57.15	15	2	0.371	12
11.	Zaheer Khan	IND	92	18785	624	311	10247	32.95	3.27	60.4	11	1	0.200	16
12.	Ishant Sharma**	IND	77	14775	474	218	8051	36.93	3.27	67.78	7	1	0.117	21
13.	Chris Martin	NZ	71	14026	486	233	7839	33.64	3.35	60.2	10	1	0.122	20
14.	Wasim Akram	PAK	104	22627	871	414	9779	23.62	2.59	54.65	25	5	0.597	3
15.	Waqar Younis	PAK	87	16224	516	373	8788	23.56	3.25	43.5	22	5	0.458	9
16.	Allan Donald	SA	72	15519	661	330	7344	22.25	2.84	47.03	20	3	0.343	13
17.	Makhaya Ntini	SA	101	20834	759	390	11242	28.83	3.24	53.42	18	4	0.471	8
18.	Dale Steyn**	SA	85	17286	622	417	9303	22.31	3.23	41.45	26	5	0.493	7
19.	Morne Morkel**	SA	78	15129	540	272	7893	29.02	3.13	55.62	6	0	0.096	23
20.	Chaminda Vaas	SL	111	23438	895	355	10501	29.58	2.69	66.02	12	2	0.391	11
21.	Malcolm Marshall	WI	81	17584	613	376	7876	20.95	2.69	46.77	22	4	0.422	10
22.	Courtney Walsh	WI	132	30019	1144	519	12684	24.44	2.54	57.84	22	3	0.604	2
23.	Curtly Ambrose	WI	98	22103	1001	405	8502	20.99	2.31	54.58	22	3	0.494	6
		$w_j$	0.184	0.142	0.162	0.082	0.044	0.041	0.080	0.054	0.087	0.123		

\*\* till 28th August, 2017

Like the fast bowlers in a Test team, the spinners are also responsible in taking the opponent's wickets and restricting them to a moderate score which will be easy to chase. A spinner in a cricket team can turn the ball while pitching it on the cracks and footmarks of the fast bowlers on the crease. The world of cricket has also witnessed some remarkable spinners famous for their bowling and wicket taking abilities. From those, a pool of 21 spinners is developed in Table 8, shortlisting them based on the criterion that they should have played at least 50 Test matches for their respective countries. This list of 21 alternative spinners consists of seven spinners from England, five from India, four from Pakistan, two from Australia, two from Sri Lanka and one from West Indies. The procedure for their performance evaluation is same as that for the fast bowlers. When they are ranked depending on their computed TOPSIS scores, Muttiah Muralitharan from Sri Lanka and Shane Warne from Australia are identified as the top two spinners for inclusion in the World XI Test team. Basically, Muttiah Muralitharan supersedes all his competitors with a TOPSIS score of as high as 0.914. Anil Kumble of India and Rangana Herath of Sri Lanka respectively occupy the third and fourth positions in the derived ranking list. Muttiah Muralitharan has been renowned for his great off-break bowling and Shane Warne has been the king of leg-spin bowling. Their inclusions in the World XI Test team also fulfil the much desired off-spinner and leg-spinner combination in a cricket team.

**Table 8**

List of spinners with minimum 50 Tests

Sl. No.	Player	CUN	MTCS	BB	MDN	WCK	RC	AVG	ECY	STR	5W/I	10W/M	Score	Rank
1.	Shane Warne	AUS	145	40705	1762	708	17995	25.42	2.65	57.49	37	10	0.584	2
2.	Nathon Lyon**	AUS	67	15565	471	247	8245	33.38	3.18	63.02	11	1	0.119	15
3.	Ray Illingworth	ENG	61	11784	702	122	3807	31.2	1.94	96.59	3	0	0.101	18
4.	Derek Underwood	ENG	86	21862	1239	297	7674	25.84	2.11	73.61	17	6	0.303	6
5.	Phil Edmonds	ENG	51	12028	613	125	4273	34.18	2.13	96.22	2	0	0.088	20
6.	John Emburey	ENG	64	15391	741	147	5646	38.41	2.2	104.7	6	0	0.104	17
7.	Ashley Giles	ENG	54	12180	397	143	5806	40.6	2.86	85.17	5	0	0.074	21
8.	Monty Panesar	ENG	50	12475	468	167	5797	34.71	2.79	74.7	12	2	0.118	16
9.	Graeme Swann	ENG	60	15349	493	255	7642	29.97	2.99	60.19	17	3	0.169	10
10.	B. S. Chandrasekhar	IND	58	15963	584	242	7199	29.75	2.71	65.96	16	2	0.148	11
11.	Srinivas Venkataraghavan	IND	57	14877	696	156	5634	36.12	2.27	95.37	3	1	0.102	19
12.	Bishan Singh Bedi	IND	67	21364	1096	266	7637	28.71	2.14	80.32	14	1	0.183	9
13.	Anil Kumble	IND	132	40850	1575	619	18355	29.65	2.7	65.99	35	8	0.514	3
14.	Harbhajan Singh	IND	103	28580	869	417	13537	32.46	2.84	68.54	25	5	0.326	5
15.	Iqbal Qasim	PAK	50	13019	649	171	4807	28.11	2.22	76.13	8	2	0.122	14
16.	Abdul Qadir	PAK	67	17126	608	236	7742	38.81	2.71	72.57	15	5	0.215	8
17.	Mushtaq Ahmed	PAK	52	12526	405	185	6100	32.97	2.92	67.71	10	3	0.136	13
18.	Danish Kaneria	PAK	61	17697	517	261	9082	34.8	3.08	67.8	15	2	0.147	12
19.	Muttiah Muralitharan	SL	132	44039	1792	800	18180	22.73	2.48	55.05	67	22	0.915	1
20.	Rangana Herath**	SL	83	23465	739	389	10992	28.26	2.81	60.32	31	8	0.376	4
21.	Lance Gibbs	WI	79	27115	1313	309	8989	29.09	1.99	87.75	18	2	0.248	7
		$w_j$	0.150	0.151	0.118	0.132	0.045	0.042	0.055	0.039	0.106	0.163		

After the formation of the all-time best World XI Test cricket team consisting of 11 cricketers, it is the final task to decide the captain of this proposed team. It is observed that among the selected 11 Test players, eight cricketers became the captains of their respective countries. Their captaincy records are provided in Table 9. It is noticed from this table that Adam Gilchrist of Australia and Jacques Kallis of South Africa had encouraging percentages of win in Test matches that they captained. But, their experience as a Test team captain has been miserably poor, even less than in ten Test matches. They basically acted as the stop-gap captains for their respective teams. Hence, it is advised to appoint Alastair Cook of England as the captain of the World XI Test cricket team, along with Rahul Dravid as the vice-captain. Thus, the all-time best World Test team is formed as Alastair Cook (ENG) (c), Sunil Gavaskar (IND), Rahul Dravid (IND) (vc), Sachin Tendulkar (IND), Shivnarine Chanderpaul (WI), Jacques Kallis (SA), Adam Gilchrist (AUS) (wk), Glenn McGrath (AUS), Courtney Walsh (WI), Muttiah Muralitharan (SL) and Shane Warne (AUS). Based on his all round ability to both bat and bowl, Richard Hadlee of New Zealand may be the twelfth man in this team. The ESPN Cricinfo proposed an all-time Test XI team consisting of Jack Hobbs (ENG), Leonard Hutton (ENG), Donald Bradman (AUS), Sachin Tendulkar (IND), Viv Richards (WI), Garry Sobers (WI), Adam Gilchrist (AUS) (wk), Malcolm Marshall (WI), Shane Warne (AUS), Wasim Akram (PAK) and Dennis Lillee

(AUS) based on their achievements in Test matches. In that all-time Test XI team, there were four players from Australia, three from West Indies, two from England, and one each from India and Pakistan. It was formed based on the opinions of 12 members of the jury (each juror was asked to pick a first XI and a second) and depending on the points allotted to each of the players, a list was prepared consisting of those having the maximum points. As this process was based on the opinions and preferences of the jury members, it is supposed to be not always absolutely free from biasness and personal choices. On the other hand, to mark its 150<sup>th</sup> anniversary, Wisden Cricketers' Almanack, a cricket reference book published from England, formed another all-time Test XI team comprising Jack Hobbs (ENG), WG Grace (ENG), Donald Bradman (AUS) (c), Sachin Tendulkar (IND), Viv Richards (WI), Garry Sobers (WI), Alan Knott (ENG) (wk), Wasim Akram (PAK), Shane Warne (AUS), Malcolm Marshall (WI) and Sydney Barnes (ENG). This selection process was based on shortlisting 11 players from more than 2,600 people appeared in Test matches across 150 years of the Wisden's life. Points were allocated to each of the players based on their performance in the history of World cricket. The list consisted of four cricketers from England, three from West Indies, two from Australia, one each from India and Pakistan. It was also not at all free of controversy and criticism from the cricket lovers as it included twice any many cricketers from England as compared to Australia. It had only two cricketers from the Asian cricket playing nations. Thus, it is observed that the formation of the two above-mentioned all-time best Test cricket teams has no concrete mathematical foundation and is not free from biasness. Hence, the best World XI Test team which is formed taking into consideration the shortest Euclidean distances of the alternatives from the positive-ideal solutions is more realistic and absolutely free from any involvement of the decision makers. Excepting New Zealand and Pakistan, it includes players from the remaining six Test playing countries, having no biasness towards any particular nation. It also includes some of the cricketers from the lists prepared by ESPN Cricinfo and Wisden.

**Table 9**

List of captains for the Test playing countries

Sl. No.	Player	Matches as captain	Won	Lost	Drawn	% of win
1.	Alastair Cook (ENG)	59	24	22	13	40.68
2.	Sunil Gavaskar (IND)	47	9	8	30	19.15
3.	Rahul Dravid (IND)	25	8	6	11	32.00
4.	Sachin Tendulkar (IND)	25	4	9	12	16.00
5.	Shivnarine Chanderpaul (WI)	14	1	10	3	7.14
6.	Jacques Kallis (RSA)	2	1	1	0	50.00
7.	Adam Gilchrist (AUS)	6	4	1	1	66.67
8.	Courtney Walsh (WI)	22	6	7	7	27.27

#### 4. Conclusions

Since over the 100 plus years of Test cricket history, there have been more than 2600 players participated in Test matches for their respective countries. It is thus really a challenging task to try for the formation of the all-time best World XI Test cricket team from the available voluminous database. In this paper, a multi-criteria decision making tool, in the form of TOPSIS method, is adopted in an attempt to form the best World XI Test team taking into consideration all the cricketers from the ten Test playing nations. This huge volume of data containing the numbers of cricketers for each of the positions in the batting and bowling orders is reduced into manageable figures while considering some specific threshold values, i.e. minimum number of innings played (for batsmen), minimum number of Tests played (for wicketkeepers and bowlers), and minimum number of runs scored and wickets taken (for all-rounders). Using TOPSIS method, which is based on ranking of the considered alternatives depending on their distances from the ideal solution, the best World XI Test cricket team is thus formed comprising Alastair Cook (ENG) (c), Sunil Gavaskar (IND), Rahul Dravid (IND) (vc), Sachin Tendulkar (IND), Shivnarine Chanderpaul (WI), Jacques Kallis (RSA), Adam Gilchrist (AUS) (wk), Glenn McGrath (AUS), Courtney Walsh (WI), Muttiah Muralitharan (SL) and Shane Warne (AUS).

This Test team is supposed to be more practical and free from any human judgement. The TOPSIS method can also be applied to form the all-time best World One-day and T20 cricket teams. It can practically be employed to find out the best possible combination of players for any multi-player game for any country.

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