

A DEA MODEL FOR SELECTION OF CRICKET TEAM PLAYERS

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Abstract: Cricket has become one of the most popular sport tournaments in the world over the last few decades. Winning a game of cricket depends a lot on the team players selected. Many studies have been conducted to analyze various dimensions of the game such as batting strategies, bowling strategies, efficiency of players. To form a winning team for cricket tournaments, analysis and evaluation of past performance of the cricket players is required to select players strategically. The project suggests an effective technique for selecting cricket team members by measuring the efficiency of cricket players using Data Envelopment Analysis (DEA).

Key Words: Data Envelopment Analysis, Decision Making Unit, High Score, Strike Rate

1. INTRODUCTION

Cricket is a relatively new and promising research area in comparison with other sports such as baseball, soccer, etc. Cricket is an immensely popular sport in the Indian subcontinent (India, Pakistan, Sri Lanka and Bangladesh) and its popularity sometimes affects other sports. India is being considered as the hub of international cricket in the world. Studies suggest that at times players do not show their actual performances due to unethical practices such as match fixing. A new method for cricket team selection using Data Envelopment Analysis (DEA) is proposed. DEA algorithm is proposed, which is the formulation for evaluation of cricket players in different capabilities using multiple outputs. This evaluation process determines efficient and inefficient cricket players and ranks them on the basis of DEA scores. The ranking can be used to decide the required number of players for a cricket team in each cricketing capability. The estimated method has the advantage of considering multiple factors related to the performance of players in multiple capabilities. This DEA

Aggregation gives the scores of players objectively instead of using subjective computations. The estimated DEA method can be used to form a cricket team from several clubs. This method can also be used for improving the performance of in efficient players the proposed DEA method can suggest solutions.

2. EXISTING SYSTEM

Efficiency scores of Indian cricket players for selection of a potentially winning team for test match series has been evaluated. Expert's advices play an important role while selecting a team for test match. According to experts every

player has to do batting, therefore, a bowler having better batting strike rate is given more preference over other players. As per the efficiency scores, our selected players are:

V Kohli, CA Pujara, PP Shaw, M Vijay, AM Rahane, S Dhawan, RA Jadeja, R Ashwin, I sharma, GH Vihari, UT Yadav, H Pandaya, M Shami.

TABLE II: BOWLING STATISTICS OF INDIAN CRICKET PLAYERS

Players	Overs	Mdns	Runs	Wkts	Ave	Econ	SR	5	10	DEA Score
R Ashwin	2975.1	607	8551	336	25.44	2.87	53.1	26	7	1
KuldeepYadav	133	16	480	19	25.26	3.6	42	1	0	1
I Sharma	2763	540	8893	256	34.73	3.21	64.7	8	1	1
GH Vihari	10.3	1	38	3	12.66	3.61	21	0	0	1
UT Yadav	1072.5	183	3844	117	32.85	3.58	55	2	1	1
HH Pandya	156.1	19	528	17	31.05	3.38	55.1	1	0	0.965447
Mohammed Shami	1123.4	191	3835	128	29.96	3.41	52.6	3	0	0.964748
RA Jadeja	1824.2	462	4348	185	23.5	2.38	59.1	9	1	0.929057
B Kumar	558	141	1644	63	26.09	2.94	53.1	4	0	0.874516
JJ Bumrah	245.3	47	716	28	25.57	2.91	52.6	2	0	0.865876

Indian cricket team selected by BCCI for India - England test match series(2018) include the following players:

V Kohli, CA Pujara, PP Shaw, AM Rahane, S Dhawan, KL Rahul, K Nair, R Ashwin, RA Jadeja, I Sharma, GH Vihari, UT Yadav, H Pandaya, M Shami, S Thakur, J Bumrah, RR Pant(Wicket Keeper).

3. PROPOSED SYSTEM

It is a model that quantifies the performance of batsman and bowlers, for predicting the players analysis. Data cleaning is applied to remove all the null values that are present in our dataset.

Batting Measures	Description
Batting rate	The ratio r/inn , where r means no of runs scored and inn means the no of innings played.
Strike rate of batsman	The ratio r/o , where r means no of runs scored and o denotes the no of overs.
No of fours	The fours scored by the batsman.
No of sixes	The sixes scored by the batsman.

Bowling Measures	Description
Bowling rate	trs/wick, where trs means total runs yielded by the bowler and wick means no of wickets taken by the bowler.
Strike rate of bowler	bb/wick, where bb means the no of balls the bowler bowled and wick means no of wickets taken by the bowler.

$$\begin{aligned} \max_{u_r, v_i} h_0 &= \sum_{r=1}^s u_r y_{r0} \\ \text{s. t. } \sum_{i=1}^m v_i x_{i0} &= 1 \\ \sum_{r=1}^s u_r y_{rj} &\leq \sum_{i=1}^m v_i x_{ij} \quad j = 1, 2, \dots, n \\ u_r &\geq 0 \quad r = 1, 2, \dots, s \\ v_i &\geq 0 \quad i = 1, 2, \dots, m \end{aligned}$$

where,

$$\begin{aligned} u_r &= t\mu_r \quad (r = 1, 2, \dots, s), \\ v_i &= t\gamma_i \quad (i = 1, 2, \dots, m) \text{ and } t = \left(\sum_{i=1}^m \gamma_i x_{i0} \right)^{-1} \end{aligned}$$

The dual for the above model can be expressed as follows:

$$\begin{aligned} \text{s. t. } \sum_{j=1}^n \lambda_j x_{ij} &\leq \theta_0 x_{i0} \quad i = 1, 2, \dots, m \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq y_{r0} \quad r = 1, 2, \dots, s \\ \lambda_j &\geq 0 \quad j = 1, 2, \dots, n \end{aligned}$$

Where “SM” denotes the secret message, “T” represents the original document, “WD” is a watermarked document and “K” denotes Key.

4.3 DEA MODEL WITH EXPLICIT OUTPUT

For selection of members of a cricket team, it is assumed that there are ‘n’ players. The ‘s’ outputs of jth player are denoted by the set :

$$y_j = (y_{1j}, y_{2j}, \dots, y_{sj})$$

A general DEA model, with such explicit outputs, for calculating the efficiency of the kth player (k = 1, 2, ..., n) is as follows :

4. METHODOLOGY

ALGORITHMS

4.1 BASIC DEA MODEL

$$\begin{aligned} \max \mu_0 &= \frac{\sum_{r=1}^s \alpha_r x_{r0}}{\sum_{i=1}^m \beta_i y_{i0}} \\ \text{s. t. } \frac{\sum_{r=1}^s \alpha_r x_{rj}}{\sum_{i=1}^m \beta_i y_{ij}} &\leq 1 \quad j = 1, 2, \dots, n \\ \alpha_r &\geq 0 \quad r = 1, 2, \dots, s \\ \beta_i &\geq 0 \quad i = 1, 2, \dots, m \end{aligned}$$

The model determines the efficiency of n DMUs where $x_1^j, x_2^j, \dots, x_m^j$ are the m inputs and $y_1^j, y_2^j, \dots, y_s^j$ are the s outputs of the jth DMU and $\alpha_r, \beta_i \geq 0$ are the weight vectors associated with rth output and ith input of DMU, respectively to be determined.

4.2 LINEAR MODEL

To obtain the solution of a fractional programming problem, it needs to be first converted into a linear programming problem using a method given by Charnes and Cooper. Since the basic DEA model involve fractions, its corresponding linear programming problem is mathematically expressed as:

$$s. t. \sum_{j=1}^n y_{rj} \lambda_j - y_{rk} h \geq 0 \quad r = 1, 2, \dots, s$$

$$\sum_{j=1}^n \lambda_j = 1$$

$$\lambda_j \geq 0 \quad j = 1, 2, \dots, n$$

The dual of above model can be written as:

$$\min u_0$$

$$s. t. - \sum_{r=1}^s y_{rj} u_r + u_0 \geq 0 \quad j = 1, 2, \dots, n$$

$$\sum_{r=1}^s y_{rk} u_r = 1$$

$$u_r \geq 0 \quad r = 1, 2, \dots, s$$

4.4 EFFICIENCY EVALUATION FOR BATSMEN

Runs: Total number of runs scored by a player while batting in cricket matches. This factor is very important for measuring the efficiency of a player.

Strike Rate (SR): Ratio of total runs scored to the total bowls faced multiplied by 100. It means the number of runs scored by a player per 100 balls.

Strike Rate (SR) = ((Total scores scored by a player) / (Total number of balls faced by a player))*100

Batting Average (Ave): A batting average represents how many runs, on average, a batsman scores before getting out. The higher the batting average, the better the batsman's ability to score runs without getting out.

Batting Average= Runs / (number of times out) = Runs / (Innings - Not Outs)

100s: Total number of 100's hits by a batsman i.e. number of full centuries hit by a batsman.

50s: Total number of 50's hit by a batsman i.e. number of half centuries hit by a batsman.

4s & 6s: Total number of boundaries hit by a batsman for 4 and 6 runs.

4.5 EFFICIENCY EVALUATION OF BOWLERS

4.4 EFFICIENCY EVALUATION OF BOWLERS

Overs: One over is equal to delivery of 6 balls by a bowler. Here Over means total number of overs delivered by a bowler.

Maiden Overs (Mdns): Maiden over is an over in which no runs have been scored by a batsman.

Runs: Number of runs given by a bowler during his bowling turn.

Wickets (Wkts): Number of wickets taken by a bowler.

Average (Ave): Number of runs per wicket taken.

Average (Ave) = Total Runs / Wickets Taken

Economy Rate (Econ): Bowling economy rate is defined as total number of runs conceded divided by number of overs delivered. Economy Rate = Total Runs Conceded / Number of Overs delivered

Strike Rate (SR): Bowling Strike Rate is a measurement of a bowler's average number of balls bowled for every wicket taken.

Strike Rate = Total number of balls bowled / Total Number of Wickets taken

5's & 10's: This parameter is only used for test matches means 5 or 10 wickets in a single match this parameter is very effective for judging a bowler for test match

5. FUTURE WORK

Efficiency scores of cricket players for selection of a potentially winning team for test match series have been evaluated. Expert's advices play an important role while selecting a team for test match. According to experts every player has to do batting, therefore, a bowler having better batting strike rate is given more preference over other players. This model predicts the runs scored by batsman and the wickets taken by the bowler which helps in selecting the good team. It is a precise one for performance analysis of batsmen and bowlers. In future, we can select upcoming good players and added to the previous selected team.

6. CONCLUSION

A DEA model was formulated incorporating batting-bowling parameters of cricket players. Efficiency of each player served as a basis for his inclusion in the team. On comparing the players selected through our technique, the results matches to a great extent. The players which were efficient according to model proposed in the paper were actually the players who played in the matches. This shows that the proposed model can be used for selecting a cricket team.

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