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A Statistical Study of IPL Team Performances

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ABSTRACT

In any sport, team performance evaluation and selection in multi-player sports like cricket especially in the Indian Premier League (IPL) is a complex Multi-Criteria Decision Making (MCDM) problem. Indian Premier League, IPL is considered one of the most successful tournaments of cricket because it provides various opportunities to young players (Indian as well as international) to illustrate their talent at the international level. The tournament is a proper combination of sport and entertainment. To accomplish these activities of performance evaluation and optimal selection of the IPL Teams, proper decisions are required to be made to determine what actions need to be performed and how they are carried out so that the desired best team can be selected. As a result, Multi-Criteria Decision Making (MCDM) becomes an essential part of the problem-solving procedure. The paper will bring your attention to which IPL team has performed best, holistically, based on its statistics for the last 8-9 years. To achieve the result analysis the TOPSIS methodology is applied. The Attributes teams, debut, home ground, total played, wins, lost, tied, highest and lowest score was used to predict the best IPL Team using the TOPSIS-Multi Criteria Decision Making (MCDM) method. IPL, MCDM, topsis, moora, teams, cricket.

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Key Words
IPL, MCDM, topsis, moora, teams, cricket

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INTRODUCTION

Decision making is becoming an important activity in the ultra-modern world despite being invaded with various updated technology advancements assisted decision tools. MCDM method is one of the most efficient ways to find the rankings among several participants which takes into consideration more than one criterion. In daily life also, people try to get to a result after going through multiple possible aspects. Multi criteria decision making (MCDM) is useful both in daily life and in settings such as business, government and medicine. For example, if a person is going to purchase a smartphone then he/she will try to get through all the features such as camera quality, battery backup, processor etc. before purchasing. The main factor in this method is comparison, which shows the best one by taking several similar properties among both two and comparing them. MCDM is concerned with structuring and solving decision and planning problems involving multiple criteria.

The purpose is to support decision-makers facing such problems. Basically the method for evaluating issues with finite or infinite number of options is called multiple criteria decision making. Fuzzy MCDM techniques provide more realistic impacts in problem-solving situations. The idea of fuzzy logic was first advanced by Lotfi Zadeh of the University of California at Berkeley in the 1960s. In recent years, fuzzy logic has seen a considerable rise in the number and variety of applications. Several, fuzzy logic-based approaches have been employed in MCDM to handle linguistic uncertainties and hesitancy. However, there is still a need to handle the high level of uncertainties that exist in decision making problems. The first season of IPL was played between 18th April and 1st June in the year 2008. It is believed in India when the time gets stuck by 7:30 pm in the month of April, May and June, it is because of IPL.

The whole tournament brings lots of entertainment and fantasy across the whole nation. IPL is just not like a normal tournament as it needs so much organizing. The preparation of the tournament starts from the players auction by the respective franchises. In which every team tries to purchase the best possible combination of players in the given budget. Every season's first match is played between the defending champions (last year's winning team) and last year's runner-up. IPL's brand valuation in 2009 was US$ 2 billion and in 2010 it was US$ 4.13 billion. As the success of IPL repeated in 2009 and 2010 it helped Indian cricket to become a cricketing superpower[14]. Cricket for a billion plus Indians is a source of mass exhilaration and depression, security and insecurity, pride and humiliation, bonding and alienation. The IPL has also resulted in an unprecedented windfall for the BCCI and franchise owners of the eight competing teams. In the last two years, two new teams i.e., Lucknow super giants (LSG) and Gujarat titans (GT) have been added to the tournament. The origin of IPL took place after the India's win in 2007 T-20 world cup. IPL is the most recognized cricket tournament in the world not only with the finances but also with the viewership and its billions of spectators across the world. The two teams Chennai super kings (CSK) and Mumbai Indians have won most number of trophies i.e., 5 times each. Royal challengers Bangalore (RCB) is considered to be the most famous team of the tournament based on its billions of fans and can be inferred from the social media interactions. The teams like Kolkata knight riders (KKR) and Sunrisers Hyderabad (SRH) have won the tournament two times each. IPL has brought a revolution in the world of cricket as it gives a golden opportunity for the young players to show their talent, not only from the India but from all the cricket playing nations. After the grand success of IPL, almost every cricket playing nation has started a tournament similar to the IPL. In all the leagues, BBL (Big bash league) is the most famous one which is organized by Australian cricket Board. Other than that, west indies have Caribbean premier league (CPL), Pakistan has Pakistan Super league (PSL). But they are not that famous. IPL has provided various fresh and young talents to the Indian cricket team in recent years. The league also contributes to the nation's economy.

The league has not only revolutionized the way cricket is played but has also transformed the Indian Economy in various ways. According to the literature times, it should be noted that from 2015-2023 the contribution of IPL has increased to multifold in the Indian GDP. The sectors like tourism industry, Economic Growth, Small Businesses, Infrastructure development, brand building have got a boost after the inception of IPL. According to a report by KPMG in 2015 the IPL contribute around 11.5 billion USD to the India's economy in the year 2015[15].

The league employs a large number of people, including cricketers, support staff, grounds men, security personnel and hospitality staff. In addition the league has created job opportunities in sectors like advertising, marketing and media. IPL brand value was $4.7 billion, which noted a 7% rise as compared to last year, as per the February 2022 reports. In the year 2022, it was $8.5 billion and in the year 2023 it was $15.4 billion, i.e., almost a rise of 80% as compared to the last year. The highest source of income is media rights. IPL is the second highest annual player salary paid tournament in the whole world including all the sports. The tournament tries to contribute to the nation and the world through every possible way. In year 2023 the BCCI announced that for every dot ball thrown in the four playoff games the Indian cricket

board pledges to plant 500 trees, emphasizing its commitment to the environment. The commitment was named as "green dot balls". It shows that the tournament doesn't only focuses upon entertainment and marketing but also tries to make a contribution in framing an eco-friendly environment.

Literature review: Cricket consists of a lot of data and statistics and especially the Indian premier league is a world class tournament which has a lot of technical as well informative data also. The performance analysis of any team can't be based on a single factor and that is why this review aims to collect data as well as knowledge from some already existing papers. All the papers are taken from Google scholar.

As per the modern era, technical methods have found another level of success, for example, DRS (Decision review system) Ultra edge etc. The paper aimed to focus upon the technicality in cricket in today's world. How cricket is supported by Machine learning and its algorithms? Concepts like SVM (Support vector system) logistic regression, random tree etc. have been used to improve the accurate outcome prediction of a game. Initially, it took the physical factors like team performance in terms of both bowling and batting. Further the team strength is also considered as a factor for the prediction and lastly all these factors are combined with Machine learning and its algorithms[1].

Team strategy and tactics in cricket can be influenced by knowledge of the relative importance of team performance indicators. The paper focused upon the bowling and batting performances of the respective teams since the tournament started in 2008. Further, it considered wickets taken and field placement in the first and last six overs of the game as a crucial asset. The paper also looked for the batting team's partnership ability to get the result[2].

The selection of players for a team is one of the main decisions which decides the performance of that respective team in a particular tournament. To implement that the following paper aims to get the best team according to the selection of players. This paper suggests a new method for cricket team selection using data envelopment analysis (DEA). This method takes various outputs to calculate the capabilities of players. It provides scores as the result. The paper has mainly focused upon players from IPL-4 (2011) and has calculated their scores using linear programming DEA model[3].

The above paper has described the selection of players with a unique method. But when it comes to IPL, auction comes into picture. In auction, every player will be purchased by a franchise. The respective paper has aimed at the fields in which the valuation and performance of a player is compared. The result shows which player has performed according to its valuation. So that it will be helpful for the franchise and the owner to retain the player in the next season[4].

The field of data science is the intensive study of data to extract insights and knowledge from the data and apply the acquired knowledge and actionable insights. In cricket there is a term called projected score which is basically the expected score of the batting team according to the current run rate and no of overs left in the inning. After the completion of the first inning the probability of winning the game for a team is also calculated. All these jobs are done with the help of data visualization and technical support. It has considered the programming language python and its various applications and explained how it is used in data analysis and visualization. The paper also assisted the franchise and trainers by explaining about to an emerging player as an X-factor for the team which will surely help their team to win matches in the tournament[5].

In this increasing craze of cricket as a game to be watched and played, there is another trend that has come into existence the trend of betting and online fantasy. The paper has taken some cricket betting apps and explained about their working. In cricket betting apps the user must make his teams from playing eleven of both the teams. The points will be allotted according to the performance of every individual player on the team. But the task is not as easy as it seems. It needs a lot of informative knowledge, skills, and luck as well. The trend of these fantasy apps touches its peak in the IPL seasons. The paper has explained the working of these apps to select the top three contestants[6].

The following paper aims for the prediction of match winning probability and in the long term as well as short term duration i.e., for future matches as well as matches that are going to be played tomorrow. IPL Data analysis is all about analyzing the data that is already present in data set using data science, machine learning and python. Not only of matches but also of the players the future prediction is done by the analyzing of data from data set. This is all done to find which player is going to perform well in upcoming matches, which team will win toss and even the match etc[7]. Forming an eleven-member team with an efficient kind of player is not an easy task for any selector or a group of selectors. It is considered as a multicriteria decision system. In the formation of a good and successful cricket team the batting strength and bowling strength of a team are major factors affecting its performance and an optimum trade-off

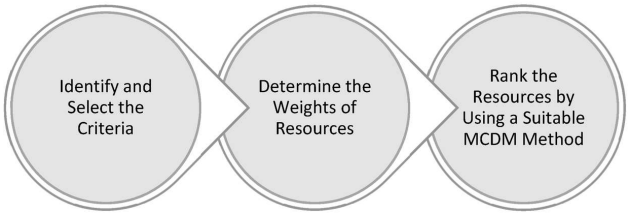

Fig. 1: Working of MCDM

Table 1: Decision Matrix

Beneficial					Non-beneficial				
Team	POS	P	W	L	POS	NR	NRR	FOR	Against
GT	1	28	10	4	21	0	0.5625	8.774512427	8.216661079
LSG	3	28	8.5	5	17.5	0.5	0.2675	8.633102904	8.369320546
CSK	3.57143	98	7.71429	6.14286	15.5714	0.14286	0.22029	8.400702661	8.203182349
MI	3.777778	126	7.555556	6.444444	15.11111	0	0.222889	8.60944744	8.404740273
RCB	4.89	126	6.67	6.89	13.78	0.45	-0.2644	8.482715648	8.561362765
KKR	4.89	126	7	6.89	14.1	0.1	0.185111	8.600663788	8.464470452
SRH	5.12	126	6.244	7.644	13	0.111	0.0622	8.271737067	8.167300579
DC	5.23	126	6.89	7	13.89	0.12	-0.12511	8.212745986	8.334813751
RR	5.285714	98	6.571429	7	13.57143	0.428571	-0.24186	8.478898801	8.727245524
PBKS	6.67	126	5.67	8.34	11.34	0	-0.3539	8.33408729	8.688337224

Table 2: Normalized matrix

Team	POS	P	W	L	PTS	NR	NRR	FOR	Against
GT	0.068868	0.082199	0.428696	0.190434	0.439655	0	0.631423	0.32715121	0.308744122
LSG	0.206604	0.082199	0.364392	0.238042	0.366379	0.600494	0.300276	0.32187886	0.314480359
CSK	0.245957	0.287698	0.330709	0.292452	0.326002	0.171573	0.247282	0.313213989	0.308237654
MI	0.260168	0.369898	0.323904	0.30681	0.316365	0	0.250199	0.320996884	0.315811269
RCB	0.336764	0.369898	0.28594	0.328022	0.288497	0.540444	-0.2968	0.316271783	0.321696418
KKR	0.336764	0.369898	0.300087	0.328022	0.295197	0.120099	0.207792	0.320669392	0.318055653
SRH	0.352604	0.369898	0.267678	0.363919	0.272167	0.13331	0.069821	0.308405602	0.306889383
DC	0.36018	0.369898	0.295372	0.333259	0.2908	0.144118	-0.14044	0.306206163	0.313183753
RR	0.364017	0.287698	0.281715	0.333259	0.28413	0.514708	-0.27149	0.316129474	0.327929525
PBKS	0.45935	0.369898	0.243071	0.397055	0.237413	0	-0.39726	0.310730284	0.326467531

Table 3: Weight age normalized matrix

Team	POS	P	W	L	PTS	NR	NRR	FOR	Against
GT	0.008608	0.010275	0.053587	0.023804	0.054957	0	0.078928	0.040893901	0.038593015
LSG	0.025825	0.010275	0.045549	0.029755	0.045797	0.075062	0.037535	0.040234858	0.039310045
CSK	0.030745	0.035962	0.041339	0.036557	0.04075	0.021447	0.03091	0.039151749	0.038529707
MI	0.032521	0.046237	0.040488	0.038351	0.039546	0	0.031275	0.04012461	0.039476409
RCB	0.042096	0.046237	0.035743	0.041003	0.036062	0.067556	-0.0371	0.039533973	0.040212052
KKR	0.042096	0.046237	0.037511	0.041003	0.0369	0.015012	0.025974	0.040083674	0.039756957
SRH	0.044076	0.046237	0.03346	0.04549	0.034021	0.016664	0.008728	0.0385507	0.038361173
DC	0.045022	0.046237	0.036921	0.041657	0.03635	0.018015	-0.01755	0.03827577	0.039147969
RR	0.045502	0.035962	0.035214	0.041657	0.035516	0.064339	-0.03394	0.039516184	0.040991191
PBKS	0.057419	0.046237	0.030384	0.049632	0.029677	0	-0.04966	0.038841286	0.040808441

needs to be reached. This paper represents a NSGA-II algorithm to enhance the overall batting and bowling strength of the team. This algorithm is basically used to find the best possible team with a limited budget. For example, an auction is held for the selection of players in IPL. In which every franchise has limited budget for making a squad of at least 18 players and a max of 26 players. The methodology used in this paper is generic and can be extended up to any sports[8]. Bowlers are the main strength of the team. As well as the batsmen the performance of bowlers is also very crucial for the winning of a team. Becoming a good bowler is not an easy task for anyone who wants to be. It needs a lot of hard work, practice, skills and good strength to run. The paper analyzes the performance of bowlers in the IPL. It is done with the help of artificial neural networks. The performance of the bowlers in first three seasons of IPL their performance is predicted in the fourth season and their mobility is tested in the fourth season[9]. A part from all these stuffs like bowling performance, batting performance etc. The result of a game also depends on things like toss and venue. The decision of toss depends upon the pitch condition and the weather forecast. The esteemed paper analyses the influence on winning probability of the team. The tool which is used in the methodology is called design of experiments (DOE). The teams which have participated between 2008 and 2018 are considered in this study. This is done to help teams to set their winning strategy after the toss is done[10].

Table 4: Max and Min Values

V+	V-
0.057419	0.008608
0.046237	0.010275
0.053587	0.030384
0.049632	0.023804
0	0.075062
-0.04966	0.078928
0.03827577	0.040893901
0.038361173	0.040991191
0.054957	0.029677

Table 5: Euclidean distance values

Si+	Si-
0.144513	0.082568
0.126793	0.050382
0.09106	0.082125
0.087812	0.100917
0.075572	0.127676
0.082732	0.09605
0.06874	0.106774
0.046872	0.124895
0.073632	0.123501
0.034406	0.162836

Step 6: Calculate the Performance Score and Rank the Scores.

Table 6: Performance score and rank

Pi	Rank
0.363606	9
0.284363	10
0.474204	8
0.534717	7
0.628177	3
0.537248	6
0.608348	5
0.72712	2
0.626484	4
0.825564	1

Comparison Between Two Methods:

Table 7: Comparison of topsis and moora

Rank (topsis)	Rank (moora)
10	9
9	10
8	8
7	7
2	3
6	6
5	5
4	2
3	4
1	1

As per the abstract, Cricket is like a religion in India. There is a huge fan base of IPL in the country and in recent years, it has become even more huge and diverse because of social media. The players are appreciated as well as trolled every day on social media platforms like twitter, Instagram etc. The following paper described the feedback of people shared on these platforms through comments and tweets. During covid, IPL was played in UAE without any spectators in the ground but still the management tried to entertain the people with same experience by providing artificial sounds. The paper is done by studying the feedback shared by people to understand their views about the matches and the tournament. This also relates to the opinion of people that they are happy with the broadcasts or they want to go to stadium for watching the matches[11]. Apart from all the technical and practical stuff taken above, some of the people believe on luck and destiny of the teams as well as players. The paper aims to find a result based on which captain's nationality has been most successful in the last ten seasons in the league. The success of a captain has been analyzed on the basis of the number of times the team he led, reached the Top 4 of the tournament. The odds discussed are about the probability that a captain of a particular nationality had at the beginning of the tournament[12].

From the review it can be concluded that in this new world of cricket, it's not easy to calculate any result without technical support as every individual player consists of a lot of data and stats. The trend of cricket formats has shifted from test and one-day to T-20 and T-10. The spectators are preferring to watch short format games as they are full of thrillers and entertainment. In India the T-20 format got a pace after the year 2007, when India won the T-20 world cup and this leads to the formation of world class tournament like IPL.

METHODS

Moora method: Multi-objective optimization (or programming) also known as multicriteria or multi-attribute optimization, is the process of simultaneously optimizing two or more conflicting attributes (objectives) subject to certain constraints.

Step 1: The first step is to determine the objective and to identify the pertinent evaluation attributes.

$$A_{ij} = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ . & . & & . \\ . & . & & . \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{pmatrix}$$

Step 2: The next step is to represent all the information available for the attributes in the form of a decision matrix. The data are given in eq (1) are represented as matrix×Where is the performance

$$A_{ij} = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ . & . & & . \\ . & . & & . \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

measure of alternative on attribute is the number of alternatives and is the number of attributes. Then a ratio system is developed in which each performance of an alternative on an attribute is compared to a denominator which is a representative of all the alternatives concerning that attribute.

Step 3: The best choice is the square root of the sum of squares of each alternative per attribute. This ratio can be expressed as below. Where is a dimensionless number that belongs to the interval [0,1] representing the normalized performance of alternative on attribute.

$$\mathrm{xij}=\frac{\mathrm{xij}*}{\sqrt{\sum_{\mathrm{i}}^{\mathrm{m}}=1\mathrm{xij}}}(\mathrm{j}=1,2,...,\mathrm{n})$$

Step 4: For multi-objective optimization, these normalized performances are added in the case of maximization (for beneficial attributes) and subtracted in the case of minimization (for non-beneficial attributes). Then the optimization problem becomes. where is the number of attributes to be maximized, (*n-g*) is the number of attributes to be minimized and is the normalized assessment value of ith alternative concerning all the attributes.

$$yi=\sum_{j}^{g}=1\,xij*\quad\sum_{j}^{n}=g+1\;xij*$$

In some cases, it is often observed that some attributes are more important than others. In importance more important to an attribute, it copies multiplied with its corresponding weight (significance coefficient) (Brauers *et al*.). When these attribute weights are taken into consideration eq.3 becomes as follows. Where is the weight of attribute, which can be determined by applying the analytic hierarchy process (AHP) or entropy method.

$$yi=\sum_{i=1}^{g}xij*-\sum_{i=g+1}^{n}wj\;xij$$

Step 5: The value can be positive or negative depending on the totals of its maxima (beneficial attributes) and minima (non-beneficial attributes) in the decision matrix. An ordinal ranking of shows the final preference. Thus the best alternative has the highest value, while the worst alternative has the lowest value.

Detailed study of each step on MOORA method

Step 1: First let us take this dataset with each of the criteria holding a 0.125% weightage. Based on the selection problem the alternatives and attributes values in the decision matrix is

Step 2: Normalize decision matrix

Step 3: Each performance value of an alternative on a criterion against the other alternative performances on that criterion is computed as. is a dimensionless number between [0,1] and the normalized performance of.

$$x_{ij*}=\frac{xji}{\sqrt{\sum_{j}^{m}=1xji}}\quad(i=1,2,\ldots,m,\,j=\;1,2,\;\ldots,n)$$

Step 4: Normalized performance values of beneficial criteria are added. Then the same procedure is repeated for the non-beneficial criteria. Finally the sums for non-beneficial criteria are subtracted from the sums for beneficial criteria as seen in eq (3). The result is the overall performance score of each alternative. In this formula, g and (n−g) are the number of criteria to be maximized and minimized, respectively. Sometimes, decision-makers want to give more importance to a criterion than others.

$$yi=\sum_{i=1}^{g}xij*-\sum_{i=g+1}^{n}wj\;xij$$

Step 5: Now the ranks of each attribute are considered to be the final outcome.

TOPSIS method: TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) which is one of the multi-criteria decision making methods and provide the possibility of choosing the best alternative, was developed by Yoon and Hwang in 1981[15]. TOPSIS is known to be an efficient method and can be easily applied in the solution of multi-criteria decision making problems and it can be used to make comparisons between options[18]. TOPSIS is one of the multi-criteria decision making methods that is used to define solutions among many alternatives[19]. TOPSIS is used in many different fields and solution alternatives are created considering the shortest way to the positive-ideal solution and the longest way to the negative-ideal solution[13-16]. MCDM is a subfield of operations research (or) and it has the potential to enhance engineering decision-making in all areas, from design to manufacture. However, it is especially helpful for applications in high-technology market sectors, where product differentiation and competitive advantage are frequently attained by just very small gains in material performance[11]. Both traits and objectives can be used as criterion. According on the nature of the problems, various writers divide MCDM approaches into two groups. Multi-objective and multi-attribute decision making (MCDM) (MCDM)[12].

Steps involved in topsis method

Step 1: Creating the Decision Matrix (A) Decision matrix that is created by the decision maker is a_{mxp}

dimensional matrix. In rows, there are decision points that are ranked in superiority and in columns, there are evaluation factors that are used in the decision-making process. The decision matrix is shown below. In the A_{ij} matrix, m represents the number of decision points and n represents the number of evaluation factors.

Step 2: Creating the Normalized Matrix ®.

$$\bar{X}ij = \frac{Xij}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}}$$

Normalized Matrix is calculated by using elements from A matrix and using the formula below. Using Normalization formula

$$R_{ij} = \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ . & . & \cdots & . \\ . & . & . & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{pmatrix}$$

R matrix is obtained as below.

Step 3: First, weight values (w_i) related to evaluation factors are determined. Then, by multiplying the elements in each row of R matrix with respective w_i values, V matrix is created. V matrix is shown below.

$$Vij = \bar{X}ij \times Wj$$

$$V_{ij} = \begin{pmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ . & . & \cdots & . \\ . & . & \cdots & . \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{pmatrix}$$

Step 4: Calculate the max and min value of all the values in the table.

Step 5: Calculate the Euclidean distance from the ideal best

$$S + i = \sum_{i=1}^{m} (v_i - v + j)^2 \, 0.5$$

$$S - i = \sum_{i=1}^{m} (v_i - v - j)^2 \, 0.5$$

Step 6: Calculate the performance score and rank the scores

Step 1*:* Categorize Dataset The Dataset Was Obtained From The Web[16]

Step 2: Normalize the decision matrix.

CONCLUSION

The studies and methods that took place in the paper to analyze the best performing team in the tournament across the recent 8-9 years conclude that PBKS(Punjab Kings) team has performed best among all and that too consistently. The method of MCDM brought a classification in the result which took various attributes into account. The technical as well as theoretical combination of analyzation has brought the best possible result for the topic. The paper will help the future researchers and readers to get a described knowledge about the performance of teams as well as technical support which is used for data calculation and storage in the game of cricket. The studies also include the budget in the IPL tournament.

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