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The Net Relative Run-Ratio Method (NRRR), a Foolproof Technique to Replace the Net Run Rate (NRR) Method in Evaluating the Authority of Match-Wins

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ABSTRACT

The paper proposes a novel concept called the Net Relative Run Ratio (NRRR) as an alternative to the currently used Net Run Rate (NRR) for evaluating the "degree of authority" of match wins in limited-over cricket. It aims to provide a more nuanced assessment of team performance. In essence, the paper proposes that NRRR offers a more comprehensive and fairer evaluation of team performance in limited-over cricket by accounting for aspects that NRR overlooks, ultimately leading to a more authoritative ranking of teams.

Key words: NRR, RRR, NRRR, Resources, Par-score

INTRODUCTION

When a number of teams participate in the league stage of a cricket tournament and play each other, often many teams end up with the same points and will be difficult to rank them for the process of deciding which teams should go through to the next round. The authority with which the teams win their individual matches is considered under such situations for the selection process. The Currently used net run rate rule (ICC, 2023, Clause 16.10.2) is just a primitive method with several flaws. While all the standard methods which are used for the purpose of setting the target scores in interrupted matches, for the last 25 years or more, consider wickets also as a major parameter in their calculations, surprisingly, this parameter is yet to find a place in the NRR calculation. In the case of chasing a fixed targets, if team-2 achieves it with quite a lot of overs and balls to spare, NRR invariably ends up giving awful results. This is because, whether the team achieves it without losing any wickets or by losing 9 wickets, NRR value does not have an effect on it. The proposed method is based on the resources team-2 had to surrender in achieving the target and hence there are significant changes in RRR values consistent with the wickets they lose in the process of achieving the target.

Examples showing the flaws in the current NRR method

(1) Suppose in a 50 over match, team-1 gets all out for 150 runs. In reply, team-2 makes 151/9 in 25 overs and wins the match. NRR for team-1 is -3.04 and the same for team-2 is +3.04. Here, though the victory of team-2 is essentially marginal, NRR projects it as a massive win. If team-2 wins by say scoring 151/2 in 40 overs (which definitely is a more convincing win), the respective NRR values are -0.775 and +0.775 which is not appropriate. As per the proposed method the RRR values when team-2 scores 151/9 in 25 overs will be -0.106 and +0.106. For 151/2 in 40 overs, the values will be -0.901 and +0.901. Par score table of VJD method (Sportec, 2023) is used for the calculation.

(2) Consider a case of three teams playing a triangular series. Teams A, B and C play each other. Team-A loses to team-B but defeats team-C. Team-B loses to Team-C. If a team earns 2 points for every win, all teams are tied at 2 points. Now it is the solidity of their victory that decides which teams should play the final. Assume the following as their respective scores of a 50 overs a side match:

Match1: Team-A vs. Team-B

Team-A is all out for 150 runs. Team-B wins in 25 overs but only by losing 9 wickets that is by scoring 151/9.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Match2: Team-A vs. Team-C

Team-A scores 275 runs and Team-C just makes 200 runs in reply.

Match3: Team-C vs. Team-B

Team-C scores 245 runs and team-B gets all out for 200 runs.

Here, one can easily make out even without any calculation that Team-A though lost marginally with team-B posted a massive win over team-C and deserves qualification. Team-B gets a just technical win over team-1 in the first game but loses rather decisively to team-C. Team-C has posted a convincing win over team-B, but has lost terribly with team-A. Common sense says that team-A should qualify in any case where as there could be a competition between team-B and team-C for the next place. But as per the current NRR method, the respective NRR values for the teams A,B,C are -0.430, +0.730 and -0.300. That means teams B and C quality for the final clash! This is because, team-A could not overcome the huge negative run rate of -3.04 imposed on them in their first match in spite of their massive win in the second match. The huge gain that team-B has achieved in their net run rate, despite just a marginal win against team-A, protects their position as number one, even when they lost fair and square to team-C in their second match.

As per the proposed method NRRR values for the teams would be +0.699, -0.399 and -0.300. That means team-A and team-C qualify, which makes the true sense.

Another theoretical error of NRR method

In NRR method, the overall NRR value of a team is found not by adding individual NRR values of each match. Instead the total runs scored (adding all the values in the numerator) is divided by the total overs played (adding all values in the denominator). This is mathematically incorrect as the denominators are not the same. But this is not a slip but is an intentionally introduced error. Some of the very high individual values of NRR, as we have seen in the examples cited above cannot be compensated at all, if the individual values are added. When the numerator and denominator are added and then the ratio is calculated, some compensation is found to be achieved. However, adding individual values is the mathematically correct procedure.

Theory behind the proposed (NRRR) method

Since all the overs in a match do not have the same potency and this also varies with the wickets available in hand, "taking overs as denominator" does not give the required accuracy. It is the resources used (as per D/L method) or the effective normal score (as per VJD method) which should occupy the space of overs as the denominator. But the difficulty is that, these values are not publically available. Hence, if it is required to utilize these values for calculation, the method has to be developed as an integral part of these programs and it will be a complicated affair. But, fortunately the par-score tables which are the outputs of these methods does the help. These par-score tables are readily available with the scorers, as in every match, when team-2 starts their innings; these tables are to be issued mandatorily. Revised par score table are also to be issued when matches restart after interruptions. Here what we need is only the final par score table.

Before discussing the theory behind the proposed method, it will be interesting to see, mathematically what the most correct approach is. If RRR denotes the relative run ratio, mathematically:

$$\textbf{RRR for team-1} = \frac{Parscore}{Score\ of\ team-2}$$

And

$$\textbf{RRR for team-2} = \frac{Score\ of\ team-2}{Parscore}$$

In this approach, the central value will be "1" instead of "0" like in the NRR method and the method to be proposed in this paper. Winning team gets a value more than one and losing team gets a value between one and

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zero. There will be no negative values. NRRR value will be the average of the RRR values). This means, if there are three games, and the RRR values are say a, b and c for a team, the NRRR value will be (a + b + c)/3.

If we consider the example of triangular series above:

RRR values for team-A will be 0.94 and 1.375 for their two matches and their NRRR value will be (0.94+1.375)/2 = 1.1575.

RRR for team-B will be 1.06 and 0.816 and NRRR value will be (1.06+0.816)/2 = 0.9380

RRR for team-C will be 0.72 and 1.225 and NRRR value will be (0.72+1.225)/2 = 0.9725

Clearly, Team-A easily qualifies and Team-C qualifies edging out Team-B.

Though this is a mathematically accurate method; in cricket, team-1 scoring say 400 runs (in a 50 over format game) and getting team-2 all out for 200 runs is treated as a much exciting and authoritative performance than team-1 scoring 100 runs and getting team-2 all out for 50 runs. According to this method, under both the situations RRR values are 2 and 0.5 respectively for the winning and losing teams. However if this fact is acceptable to the authorities (ICC), there is no need to search for another method. However, from the NRR formula, one can presume that the ICC is looking forward to a method giving significance to high scoring than relying just on the ratio between the scores. Under this circumstance, staying in the same line of thought of the NRR method, a new method giving credence to high scoring is proposed here.

How the equation for the parameter, relative run ratio (RRR), is derived and how the net relative run ratio (NRRR) is calculated etc., are explained below. It is also felt that, Performance Index (PI) could perhaps be a better name for RRR and Overall Performance Index (OPI) for NRRR. However, in this paper, the names RRR and NRRR are made use of.

$$\text{RRR for Team-1} = \frac{Score\ of Team1}{Resources\ used\_Team1} - \frac{Score\ of\ Team2}{Resources\ used\_Team2} \quad (1)$$

$$\text{Parscore\_Team2} = \frac{Resources\ used\_Team2 * Score\ of\ Team1}{100} \quad (2)$$

Hence

$$\text{Resources used\_Team2} = \frac{Parscore\_Team2 * 100}{Score\ of\ team1} \quad (3)$$

Also, the resources used_Team-1 will be 100% when the score of team-1 is the final value in the par-score table.

Applying these conditions in Eq.1, it becomes:

$$\text{RRR for team-1} = \frac{Score\ of\ Team1}{100} - \frac{Score\ of\ Team2 * Score\ of\ Team1}{Parscore\_Team2 * 100}$$

$$\textbf{RRR for team-1} = \frac{\boldsymbol{Score\ of\ Team1}}{\mathbf{100}}\left[\mathbf{1} - \frac{\boldsymbol{Score\ of\ Team2}}{\boldsymbol{Parscore\_Team2}}\right] \quad (4)$$

Where:

Score of Team1 is the last value in the final par-score table.

Score of Team-2 is the final score of Team2 at the end of the match and

Parscore_Team2 is the required par-score for team-2 corresponding to the overs and balls played and wickets lost. If team-2 gets all out, this value will be the final value in the par score table.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

RRR for team-2= -1*(RRR of team-1)

The net relative run rate (NRRR) of a team is calculated as the sum of all their RRR values in individual matches.

This calculation is very simple. If the final par score table of the match is available, the RRR values can be calculated in a time less than a minute.

Sample calculations

Exammple-1: Team-1 makes 252/5 in 50 overs. Team-2 all out for 177

RRR for team-1 = (252/100) * (1-177/252) = +0.750

RRR for team-2 = -0.750

Exammple-2: Bangladesh 140 runs in 20 overs. Australia 100/2 in 11.2 overs when the match got terminated (WC-2024 match).

RRR for Bangladesh = (140/100) * (1-100/72) = -0.544

[72 is the DLS (ICC, 2023) par score at the time of interruption for 2 wickets]

RRR for Australia = +0.544

Had Australia lost 4 wickets at the time of interruption, the RRR values would have been:

RRR for Bangladesh = (140/100) * (1-100/78) = -0.390

[78 is the DLS par score at the time of interruption for 4 wickets]

RRR for Australia = +0.390

Easy to use worksheets are prepared to make the calculations easier and free from manual errors (Fig-1).

Table-B in Fig-1 can be used to determine a team's requirement in a particular match like, for how many runs they should win or for in how many overs and balls they should win based on the wickets lost; to achieve a specified NRRR.

It has been applied to various cases under different situations and found to give extremely logical results. Tables-1 and 2 show the results, when this method was applied to the IPL 2024 league matches.

CONCLUSION

The NRR method being followed by the ICC is an out-dated system and it is high time to amend it. A purely mathematical approach, described in this paper, also could be a good alternative. However, that approach does not give additional credence to high scores in cricket matches and hence this new NRRR method is devised and proposed here. The proposed method is matchlessly superior to the NRR method. It is fool proof and the calculation procedure is also simpler than that of the NRR method. An earliest implementation of this method will be beneficial to the cricketing community.

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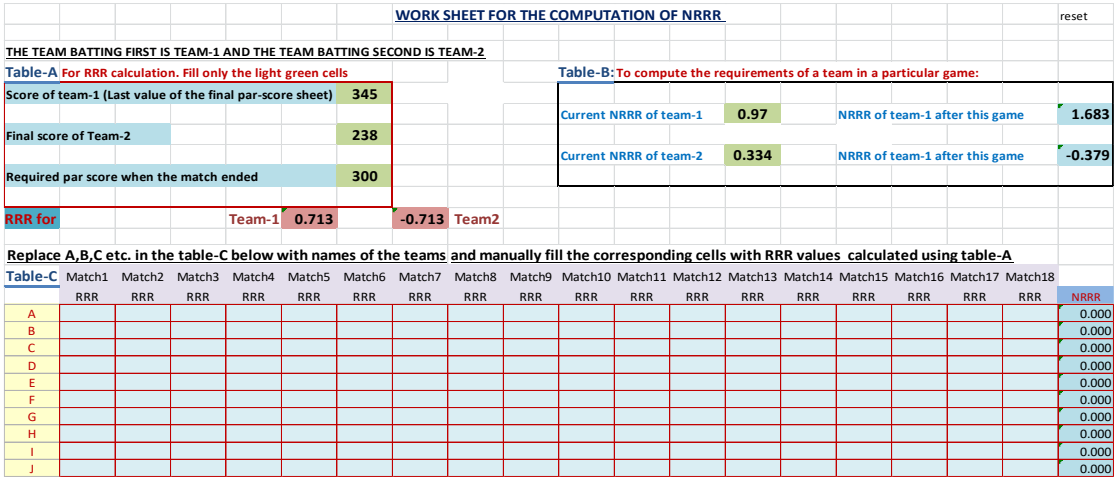
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Fig-1: Work sheet for RRR and NRRR calculations



WORK SHEET FOR THE COMPUTATION OF NRRR

reset

THE TEAM BATTING FIRST IS TEAM-1 AND THE TEAM BATTING SECOND IS TEAM-2

Table-A For RRR calculation. Fill only the light green cells

Score of team-1 (Last value of the final par-score sheet)	345
Final score of Team-2	238
Required par score when the match ended	300

RRR for Team-1 0.713 -0.713 Team2

Table-B: To compute the requirements of a team in a particular game:

Current NRRR of team-1	0.97	NRRR of team-1 after this game	1.683
Current NRRR of team-2	0.334	NRRR of team-1 after this game	-0.379

Replace A,B,C etc. in the table-C below with names of the teams and manually fill the corresponding cells with RRR values calculated using table-A

Table-C	Match1 RRR	Match2 RRR	Match3 RRR	Match4 RRR	Match5 RRR	Match6 RRR	Match7 RRR	Match8 RRR	Match9 RRR	Match10 RRR	Match11 RRR	Match12 RRR	Match13 RRR	Match14 RRR	Match15 RRR	Match16 RRR	Match17 RRR	Match18 RRR	NRRR
A																			0.000
B																			0.000
C																			0.000
D																			0.000
E																			0.000
F																			0.000
G																			0.000
H																			0.000
I																			0.000
J																			0.000

Table-1: RRR calculation for the IPL 2024 league matches

Sl. No	*Team-1*	*Team-2*	*Team-2 wickets*	*Par score*	*TEAM-1*	*TEAM-2*	*RRR Team-1*	*RRR Team-2*
1	*173*	*176*	*4*	*157*	***RCB***	***CSK***	*-0.209*	*0.209*
2	*174*	*177*	*6*	*166*	***DC***	***PBKS***	*-0.115*	*0.115*
3	*208*	*204*	*7*	*208*	***KKR***	***SRH***	*0.040*	*-0.040*
4	*193*	*173*	*6*	*193*	***RR***	***LSG***	*0.200*	*-0.200*
5	*168*	*162*	*9*	*168*	***GT***	***MI***	*0.060*	*-0.060*
6	*176*	*178*	*6*	*168*	***PBKS***	***RCB***	*-0.105*	*0.105*
7	*206*	*143*	*8*	*206*	***CSK***	***GT***	*0.630*	*-0.630*
8	*277*	*246*	*5*	*277*	***SRH***	***MI***	*0.310*	*-0.310*
9	*185*	*175*	*5*	*185*	***RR***	***DC***	*0.100*	*-0.100*
10	*182*	*186*	*3*	*144*	***RCB***	***KKR***	*-0.531*	*0.531*
11	*199*	*178*	*5*	*199*	***LSG***	***PBKS***	*0.210*	*-0.210*
12	*162*	*168*	*3*	*153*	***SHR***	***GT***	*-0.159*	*0.159*
13	*191*	*171*	*6*	*191*	***DC***	***CSK***	*0.200*	*-0.200*
14	*125*	*127*	*4*	*92*	***MI***	***RR***	*-0.476*	*0.476*
15	*181*	*153*	*10*	*181*	***LSG***	***RCB***	*0.280*	*-0.280*
16	*272*	*166*	*10*	*272*	***KKR***	***DC***	*1.060*	*-1.060*
17	*199*	*200*	*7*	*197*	***GT***	***PBKS***	*-0.030*	*0.030*
18	*165*	*166*	*4*	*145*	***CSK***	***SRH***	*-0.239*	*0.239*
19	*183*	*189*	*4*	*172*	***RCB***	***RR***	*-0.181*	*0.181*

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

20	*234*	*205*	*8*	*234*	***MI***	***DC***	*0.290*	*-0.290*
21	*163*	*130*	*10*	*163*	***LSG***	***GT***	*0.330*	*-0.330*
22	*137*	*141*	*3*	*117*	***KKR***	***CSK***	*-0.281*	*0.281*
23	*182*	*180*	*6*	*182*	***SRH***	***PBKS***	*0.020*	*-0.020*
24	*196*	*199*	*7*	*196*	***RR***	***GT***	*-0.030*	*0.030*
25	*196*	*199*	*3*	*141*	***RCB***	***MI***	*-0.806*	*0.806*
26	*167*	*170*	*4*	*147*	***LSG***	***DC***	*-0.261*	*0.261*
27	*147*	*152*	*7*	*145*	***PBKS***	***RR***	*-0.071*	*0.071*
28	*161*	*162*	*2*	*117*	***LSG***	***KKR***	*-0.619*	*0.619*
29	*206*	*186*	*6*	*206*	***CSK***	***MI***	*0.200*	*-0.200*
30	*287*	*262*	*7*	*287*	***SRH***	***RCB***	*0.250*	*-0.250*
31	*223*	*224*	*8*	*223*	***KKR***	***RR***	*-0.010*	*0.010*
32	*89*	*92*	*4*	*41*	***GT***	***DC***	*-1.107*	*1.107*
33	*192*	*183*	*10*	*192*	***MI***	***PBKS***	*0.090*	*-0.090*
34	*176*	*180*	*2*	*164*	***CSK***	***LSG***	*-0.172*	*0.172*
35	*266*	*199*	*10*	*266*	***SRH***	***DC***	*0.670*	*-0.670*
36	*222*	*221*	*6*	*222*	***KKR***	***RCB***	*0.010*	*-0.010*
37	*142*	*146*	*7*	*135*	***PBKS***	***GT***	*-0.116*	*0.116*
38	*179*	*183*	*1*	*162*	***MI***	***RR***	*-0.232*	*0.232*
39	*210*	*213*	*4*	*203*	***CSK***	***LSG***	*-0.103*	*0.103*
40	*224*	*220*	*8*	*224*	***DC***	***GT***	*0.040*	*-0.040*
41	*206*	*171*	*8*	*206*	***RCB***	***SRH***	*0.350*	*-0.350*
42	*261*	*262*	*2*	*240*	***KKR***	***PBKS***	*-0.239*	*0.239*
43	*257*	*247*	*9*	*257*	***DC***	***MI***	*0.100*	*-0.100*
44	*196*	*199*	*3*	*183*	***LSG***	***RR***	*-0.171*	*0.171*
45	*200*	*206*	*1*	*148*	***GT***	***RCB***	*-0.784*	*0.784*
46	*212*	*134*	*10*	*212*	***CSK***	***SRH***	*0.780*	*-0.780*
47	*153*	*157*	*3*	*120*	***DC***	***KKR***	*-0.472*	*0.472*
48	*144*	*145*	*6*	*138*	***MI***	***LSG***	*-0.073*	*0.073*
49	*162*	*163*	*3*	*139*	***CSK***	***PBKS***	*-0.280*	*0.280*

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

50	*201*	*200*	*7*	*201*	***SRH***	***RR***	*0.010*	*-0.010*
51	*169*	*145*	*10*	*169*	***KKR***	***MI***	*0.240*	*-0.240*
52	*147*	*152*	*6*	*103*	***GT***	***RCB***	*-0.699*	*0.699*
53	*167*	*139*	*9*	*167*	***CSK***	***PBKS***	*0.280*	*-0.280*
54	*235*	*137*	*10*	*235*	***KKR***	***LSG***	*0.980*	*-0.980*
55	*173*	*174*	*3*	*143*	***SRH***	***MI***	*-0.375*	*0.375*
56	*221*	*201*	*8*	*221*	***DC***	***RR***	*0.200*	*-0.200*
57	*165*	*167*	*0*	*66*	***LSG***	***SRH***	*-2.525*	*2.525*
58	*241*	*181*	*10*	*241*	***RCB***	***PBKS***	*0.600*	*-0.600*
59	*231*	*196*	*8*	*231*	***GT***	***CSK***	*0.350*	*-0.350*
60	*157*	*139*	*8*	*157*	***KKR***	***MI***	*0.180*	*-0.180*
61	*141*	*145*	*5*	*126*	***RR***	***CSK***	*-0.213*	*0.213*
62	*187*	*140*	*10*	*187*	***RCB***	***DC***	*0.470*	*-0.470*
63	***NO MATCH***				***GT***	***KKR***	*0.000*	*0.000*
64	*208*	*189*	*9*	*208*	***DC***	***LSG***	*0.190*	*-0.190*
65	*144*	*145*	*5*	*133*	***RR***	***PBKS***	*-0.130*	*0.130*
66	***NO MATCH***				***SRH***	***GT***	*0.000*	*0.000*
67	*214*	*196*	*6*	*214*	***LSG***	***MI***	*0.180*	*-0.180*
68	*218*	*191*	*7*	*218*	***RCB***	***CSK***	*0.270*	*-0.270*
69	*214*	*215*	*6*	*202*	***PBKS***	***SRH***	*-0.138*	*0.138*
70	***NO MATCH***				***RR***	***KKR***	*0.000*	*0.000*

Table-2: NRRR values for different teams.

TEAMS	KKR	SRH	RR	RCB	CSK	DC	LSG	GT
POINTS	**20**	**17**	**17**	***14***	*14*	*14*	*14*	12
NRRR	3.602	2.458	0.858	***1.011***	*0.979*	*-1.079*	*-3.599*	-2.906