Is IPL Responsible for Cricketers' Performance in Twenty20 World Cup?

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Abstract. After the failure of the Indian cricket team to put up a valiant show in Twenty20 world cups in 2009 and 2010 respectively, it was the Indian Premier League (IPL) which was held responsible by the fans, critics and some veteran players of the game. Both the world cups followed the lengthy IPL for the respective years. The players of the Indian national cricket team and the reserve bench went all guns blazing in the IPL matches but presented a poor show while responding to their national duty. The paper examines the performances of some Indian and foreign cricketers in IPL and the corresponding Twenty20 world cups of the said seasons and tries to find out if the national tournament can be held responsible for performance of the cricketers in the global event. A model is developed that can measure the combined performance of a cricketer in batting, bowling or wicket keeping, the three prime abilities of the game. Various cricketing factors related to the performance in the above mentioned abilities are aggregated to a weighted composite index of performance measurement. The performance scores of a cricketer for IPL and corresponding world cup is compared for both the years which in turn help to understand the performance level of the cricketers in the said tournaments.

Keywords: Modelling in Sports, Performance Measurement, Twenty20 Cricket, Correspondence Analysis

1. The Genesis of Twenty20 Cricket

In 2003, faced with five straight years of falling attendances of spectators in the domestic cricket league, the English cricket authorities decided in favour of a shorter version of cricket. Stuart Robertson, the then marketing manager of the England and Wales Cricket board (ECB) proposed a twenty over-a-side cricket tournament. The tournament was planned as a replacement of the Benson and Hedges Cup, a one-day (50-overs a side) domestic cricket tournament.[1] In the new tournament named as the Twenty20 cup, each side would bat for twenty overs and, in effect, the game had been transformed into one that could be finished in three hours—thus not requiring the day-long commitment by spectators to a limited over game (Gupta, 2009). Robertson proposed this format of cricket to county chairmen in 2001 and they voted 11-7 in favour (Neman, 2008). Twenty20 cricket was later introduced in 2003 through the Twenty20 Cup, which had the punch line, "I don't like cricket, I love it". The tournament was a grand success in England; lots of spectators enjoyed and welcome the newest version of the game. Twenty20 format appeared to be the cricket's possible answer to football because of its fast pace, short duration and excitement. Even after the success of the first season of the Twenty20 cup, neither Robertson nor the ECB were probably aware of the new dawn of international cricketing.

After the success of Twenty20 cricket in England it was rapidly engulfed the most parts of the cricket-playing world. In Australia, the first Twenty20 match was played between Western Warriors and the Victoria Bushrangers on January 12, 2005 and was attended by about 20,700 spectators. Soon after, South Africa also incorporated Twenty20 cricket into their domestic game. In July 2006, nineteen West Indies regional teams

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[1] The Benson and Hedges cup is a defunct one-day cricket tournament involving first-class country teams of England and Wales. The tournament started in 1972 and continued to 2002 after which it was dropped and was taken over by the Twenty20 cup. The tournament was initially limited to 55 overs a side and later reduced to 50 overs.

competed in a Twenty20 cricket tournament called Stanford 20/20 tournament. The event has named after billionaire Allen Stanford who financially backed the tournament. Guyana won the inaugural event, defeating Trinidad and Tobago by 5 wickets[2].

While the whole cricketing fraternity was embracing the format of the game that was pulling crowd, the Board of Cricket Control in India (BCCI) thought differently. Veteran cricketers and the BCCI officials were of the opinion that the Twenty20 cricket is but a refined version of '*Gully* Cricket'[3]. Twenty20 was thus viewed as bad taste and was even in opposition to the essence of cricket. A high-powered ICC (International Cricket Council) meeting was held in the summer 2006 to decide about the fate of Twenty20 cricket. The BCCI was the only board to vote against Twenty20 and was outplayed thereof. The meeting resolved to introduce Twenty20 domestic cricket tournaments in the itinerary of all the cricket boards. Thus, in spite of BCCI's reservation against Twenty20 this format of cricket was introduced in India in April, 2007.

On February 17, 2005, the first Twenty20 international match was played between Australia and New Zealand at Eden Park in Auckland, a match which Australia won by 44 runs. In England, the first Twenty20 international match was played between England and Australia at the Rose Bowl in Hampshire on 13 June 2005. Soon Australia hosted their first Twenty20 match at the Gabba on January 9, 2006; playing South Africa. West Indies had their inaugural experience of international Twenty20 when they locked their horns with New Zealand on the 16th of February, 2006. India played their first Twenty20 cricket match on 1st December, 2006 against South Africa at the Wanderers stadium at Johannesburg. India was the last of all test playing nations to participate in this format of cricket.

Recognizing the popularity of the format, the International Cricket Council (ICC), in 2007, organized the first Twenty20 World Cup that was played in South Africa. India sent a team comprised of youngsters of which most of whom not having much of international experience. This happened as most of India's star cricketers wanted rest considering the busy season ahead. Surprisingly, India, which had left four best players behind, won the tournament. This proved to be an incredible boost to this type of cricket in India (Gupta, 2009). The fact that Twenty20 cricket has a huge plethora of excitement in its store was clear to the cricketing fans across the globe and the Indians in particular, after the inaugural ICC Twenty20 world cup.

2. The Birth of Indian Premier League

Subhas Chandra, promoter of Zee Telefilms, the satellite television giant of India, was unsuccessful in purchasing the broadcasting rights of cricket events that included the 2003 World Cup cricket and the 2006 Champions trophy. Thus, Subhash Chandra decided to hit back with a new cricket tournament, his own private Twenty20 league for Zee TV called the Indian Cricket League (ICL). A six-team competition in its first year (2007) which has expanded to eight in its second season (2008), drew high profile names to play in its fixtures (Kitchin, 2008). When the Zee Network's ICL was announced, the BCCI felt its monopoly was jeopardized. Accordingly BCCI responded by banning all the Indian players who participated in ICL from participation in any cricket tournament run by BCCI or the state cricket boards that were under the control of BCCI. All the foreign cricket boards were requested to ban all ICL players from their national teams and domestic tournaments. ICL has already wreaked havoc in two national teams-Pakistan and Bangladesh. Pakistan banned 18 players who have joined the ICL and Bangladesh banned 13 of them, for 10-long years (Muraleedharan, 2008). Since India is the largest market for cricket globally, the BCCI is the most influential cricket authority in world cricket. Using its influence the BCCI also managed to get support of the other international cricket boards (Australia, South Africa, Pakistan, Sri Lanka and Bangladesh) in banning their respective players playing in ICL from international cricket. The BCCI also prevented the ICL from hiring state owned stadiums to play their league matches (Vig, 2008). Yet various cricketers joined the ICL at the cost of their international carriers considering the huge compensation they received. Instantly the BCCI responded by creating the Indian Premier League (IPL).

The IPL was in fact modeled on the lines of the English Premier League (football) in the United Kingdom and Major League Baseball in the United States (Viswanath, 2008), where international players add talent and glamour to local teams. Though, the IPL was hastily organized as a response to the rebel

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[2] "Twenty20: Past, Present and Future". India Twenty20. (www.indiatwenty20.com/twenty20-history.html)

[3] The word '*Gully*' means lane in India and Pakistan. *Gully* Cricket refers to the cricket played by armature school boys in the roads. The rules of such games suffer from several distortions mainly owing to lack of proper size that a cricket field requires. Such games are generally played with tennis ball and simply for enjoyment.

Indian Cricket League, but from the onset, its plan were shamelessly ambitious (Hayden, 2011). Nothing of the kind had been attempted in cricket, the scale of operations was unheard of and the millions of dollars being bandied about left large section of people unconvinced about whether the league was sustainable. But Lalit Modi (The Commissioner of IPL) ploughed on, the players brought their A-game to the party and the spectators lapped it up (Vasu, 2011). The Indian Premier League (IPL) is a Twenty20 cricket tournament to be played among eight domestic teams, named after eight Indian states or cities but owned by franchise. The franchise formed their teams by competitive bidding from a collection of Indian and international players and the best of Indian upcoming talent. Team owners bid for the services of cricketers for a total of US $42 million. IPL attracted the world's top players and showcased the best of India's talent. The commercial revenues had been raised through the league structure and sale of inventory makes it the world's richest cricketing tournament (Kitchin, 2008). Several cricketers worldwide especially those of the yester years like Kapil Dev, Erapalli Prasanna and some of the English cricketers like Alastair Cook disapproved the idea of cricketers being auctioned like commodities. But several retired cricketers like Shane Warne, Glen McGrath etc. and present cricketers of world repute like Ricky Ponting, Matthew Hayden, Sanath Jayashuriya etc. found the league good for cricket[4]. "However, the IPL has the ability to generate international fan bases in the same way as the English football's Premier League. IPL is the future and the master of Twenty20 cricket. There may be other leagues, but I believe the IPL will always be superior, because it remains the league most likely to be able to effort the game's next superstar" says Hayden in his auto-biography (Hayden, 2011). IPL changed the game of cricket and made it more popular even in non-test playing countries. The young players of India got an opportunity to come closer to the taste of international cricket as they started playing with and against the legends of the game. IPL is an opportunity for young cricketers to move from the periphery to the center stage. Shastri (2010) opines that- "It has attracted more and more people who want to know more and more about the game and are eager to play it. The money that has come into the game from all quarters has made even test cricket viable now."

3. The League and Team India

However, IPL brought with it a gamut of long playing season. Some of the regular cricketers of team India suffered from fitness problems after the tournament and started to miss the international fixtures that followed the IPL. Virendra Sehwag and Zaheer Khan missed world Twenty20 after IPL-II, Sehwag once again missed the third world Twenty20 in 2010 after IPL-III along with speedster Praveen Kumar for fitness related issues. Yuvraj Singh, Virendra Sehwag, Gautam Gambhir, Zaheer Khan were injured and thereby missed the Caribbean tour after IPL-IV in 2011. It was believed that Indians with such huge exposure to Twenty20 cricket through IPL, shall become unbeatable in this format of the game and would cement their position as world champions which they acquired by winning the ICC world Twenty20 in 2007. Just after IPL season II, followed the second Twenty20 world cup in England and IPL season III was followed by the third Twenty20 world cup in the Caribbean Islands. While almost everyone in the Indian cricketing fraternity was thinking India as Twenty20 specialist post IPL, but the team failed to proceed beyond the super eight stage in both the Twenty20 world cups.

When India failed to put up a valiant show in the Twenty20 world cups in 2009 and 2010 respectively, it was the Indian Premier League (IPL) which was held responsible by the fans, critics and some veteran players of the game. The players of the Indian national cricket team and the reserve bench went all guns blazing in the IPL matches but presented a poor show while responding to their national duty. The followers of this format of the game believed that the experience of Indian players in the IPL should come in handy in the following Twenty20 world cup. But the team India's debacle performance at the Twenty20 world cups in 2009 and 2010 raises some crucial questions. The huge difference in terms of pressure and the quality between the IPL and international cricket was highlighted by the results of the recently concluded Twenty20 world cup (Raman, 2010). "If a team looses all six super eight matches in successive editions of a world event then factor such as luck do not come into the picture. Simply put, India was not good enough." reports a popular Indian sports magazine Sportstar[5].

The captain of the Indian team, M S Dhoni opined that the Indian team was not an energetic one while they went into the ICC world Twenty20 because of protracted schedule of IPL (*The Hindu, June 17*, 2009).

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[4] Comments of cricketers and officials on the Indian Premier League after the auction for the first season were reported in different newspapers. These information were collected from *Sportstar*, March 1, 2008; Vol. 31, No. 9.
[5] "India at Barbados: Falling short!" *Sportstar*, Vol. 33, No. 21, pp. 16.

However, Dhoni himself was in favour of IPL as he coined the tournament as stage rehearsal for Twenty20 world cup prior to the second season of IPL.[6] Before the start of IPL season II, which was played in South Africa[7], several other Indian cricketers also felt the same. Yusuf Pathan commented prior to season II- "The IPL is a good opportunity for the Indian team to prepare before it heads for the ICC Twenty20 world cup."[8]

Gary Kristen, the coach of team India confessed that too much of cricket by his team and the timing of IPL were the main reasons for team India not being able to defend their title in England. He also suggested that pull out of the players from next version of the IPL, especially those who may be representing the country in the world Twenty20 (*The Assam Tribune, June 17*, 2009). The physiotherapist of Indian cricket team John Gloster said that players should avoid tournaments like the IPL to make sure that they are at the zenith of their physical and mental fitness before a crucial international tournament like world Twenty20, provided it is scheduled immediately after IPL (*The Times of India, June 30*, 2009). However, the former veteran cricketers of India like, Sandeep Patil, Chandu Borde and Lalchand Rajpat avowed that IPL should not be excused for team India's early exit from continuous two Twenty20 world cups because not only Indian players but many foreign players also participated in this national tournament under different franchisees (*The Assam Tribune, June 17*, 2010). Their thoughts were also echoed by the legendary Indian fast bowler and India's bowling coach, Venkatesh Prasad- "I would not use the IPL as an excuse. I feel the players could not have asked for better preparation coming into the world Twenty20. If any one of them had been picked, they should have performed. In fact, the IPL is the best preparation they'd have got. What more do you want than being in the middle and getting to know various situations?"[9] Raman (2010) commented that- "If the fitness level of some players was suspect, I am sure the coach of the Indian team has seen enough in his cricketing career to resort to prevention rather than crying over spilt milk".

The discussion set the background of the paper. The paper tries to compare the performance of some Indian and foreign cricketers in IPL and the corresponding Twenty20 world cups of the said seasons and tries to find out if the national tournament can be held responsible for performance of the cricketers in the global event.

However, it is not an easy task to measure the performance of cricketers. Therefore, a model is developed in this paper to quantify the performance of batsmen, bowler and wicket keeper based on a number of factors. These factors are adjusted by using appropriate weights on the basis of their relative importance and accordingly a composite index of performance measure is developed.

4. Objective of the Study

The main objective of this study is to compare the performance of some Indian and foreign cricketers in IPL and the corresponding Twenty20 world cups of 2009 and 2010 and to find out if the national tournament can be held responsible for performance of the cricketers in the global event. Accordingly the following sub-objectives are identified which would enable the researchers to reach their goal.

- to develop a performance measure for cricket players that can combine the contribution of a cricketer both as batsman and as bowler/wicket keeper.
- to select a subset of cricketers who had participated in both IPL II and the second Twenty20 World cup and measure their performance in the League as well as the world cup.
- to select a subset of cricketers who had participated in both IPL III and the third Twenty20 World cup and measure their performance in the League as well as world cup.
- to investigate the existence of any relation between IPL performance and world cup performance of

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[6] India captain MS Dhoni believes the second edition of the Indian Premier League will be the perfect build-up before the side travels to England to defend their Twenty20 World Cup title in June. Dhoni says- "I think it will be important to focus on the IPL more. It (IPL) would not help us only. It will help other players also who are part of IPL, which is a big tournament." Retrieved from *http://business.rediff.com/cricket/* (Posted on February 24, 2009).

[7] As the dates of IPL season 2 clashed with those of the election to be held in India the government expressed their incapability of providing sufficient security personal for the tournament. Thus, the tournament was shifted in its last moment to South Africa.

[8] *http://cricket.rediff.com/report/2009/apr/07/ipl-t20-world-cup-yusuf-pathan.htm* (Posted on April 07, 2009).

[9] *http://cricket.rediff.com/report/2009/jul/17/venkatesh-prasad-ipl-t20-world-cup.htm* (Posted July 17, 2009)

the selected cricketers for the two seasons.

- to identify if the foreign cricketers are better in adjusting their performance between national duty and IPL compared to the Indian counterparts.

5. Review of Literature

Each cricket match generates a huge amount of numerical information and often termed by various academicians as a game of statisticians delight. Thus, it is obvious that several statistical works would engross cricket. Some of the frequent statistical works involving cricket are performance measurement, decision making, team selection, predicting scores in rain truncated matches and so on. However, in this paper the relevant literature pertaining to performance measurement of the players in different sports is discussed.

Performance measurement and classification of players based on their performance can be considered as a researchers' delight irrespective of the sports under consideration. Bloomfield, Polman and O'Donoghue (2007) evaluate the physical demands of English Football Association Premier League soccer of three different positional classifications viz. defender, midfielder and striker. Carvajal and others (2009) classified elite Cuban baseball players into five categories based on the roles they played in the field that includes infielders, outfielders, catches, first basemen and pitchers. Similarly, mention can be made of Clerke (1997) in soccer and cricket, Gabbett (2002) in rugby, McGee and Burkett (2003) in football, Grenn, Schwandt and Triantis (2007) in atheletics, etc.

In cricket, the work of Elderton (1945) seems to be the transcendental achievement in which he used statistical analysis of cricket data to demonstrate some of the fundamental aspects of statistics. Wood (1945) examined the performance of consistency in cricket and applied the geometrical distribution to model cricket scores based on results from test cricket. Schofield (1988) estimated production functions for English county cricket teams using data from one-day and three-day cricket matches and found evidence that though batting and bowling are important characteristics to team's success, bowling is perhaps more important. Kimber and Hansford (1993) proposed a non-parametric approach based on runs scored for assessing batting performance of cricketers. Two comprehensive measure, called as combined bowling rate (CBR) and dynamic bowling rate (DBR) developed by Lemmer in 2002 and 2005 to measure the current bowling performance of the bowlers in one-day and test cricket respectively. Lemmer (2004, 2006) developed a classification scheme for batsmen and bowlers using performance data of one-day international (ODI) matches and Test cricket. The use of stochastic dominance rules demonstrates by Damodaran (2006) to analyze the batting performance of Indian cricketers in ODI cricket. Tan and Ramachandran (2010) ranked the all-rounders in test cricket, both past and present, in accordance with a mathematical formulae derived from batting and bowling records. Brettenny (2010) reviewed the different existing measures of players' performance in cricket and used them to select players for a fantasy league using the binary integer programming model.

The IPL has emerged as a focus of attention and a hot-spot for researchers from various disciplines. This is mainly because the players' salaries are decided through auction. The valuation of players obtained through auction and availability of players' performance has allowed researchers to infer on different aspects of the game. Consequently, some literature on performance of Twenty20 cricket has evolved of late. Lemmer (2008) discussed the performance of batsmen and bowlers in the first Twenty20 world cup. In terms of the all-round performance of the players, in the first edition of IPL, Van Staden (2008) used the term ideal all-rounder, batting all-rounder and bowling all-rounder to characterize the performance of all-rounders. Van Staden (2009) developed a performance measure for cricketers' in Twenty20 cricket considering data from IPL-I. Lenten, Geerlind and Konya (2009) compared a range of cross sectional models to study the factors determining the performance of cricketers in different forms of the game including IPL. Suleman and Saeed (2009) attempted to test the hypothesis whether the performances of cricketers can be treated as real option. In this regard, they developed a performance index which is called SS Index to measure the performance of batsmen, bowler, all-rounder and wicket keeper separately.

Traditionally, different measures like batting average and strike rate are mostly used to understand the performance of batsman in cricket. On the other hand, bowling average, economy rate and bowlers strike rate are used to measure the performance of bowlers. It is widely recognized, such statistics have severe limitations in assessing the true abilities of a player's performance (Lewis, 2005). Also, since the different traditional measures are in different units of measurement so it is difficult to combine them. All these limitations to measure the performance of the cricketers were well discussed by Lewis (2005). However,

attempt has been made by Bar and Kantor (2004) and Lemmer (2008), to develop a performance measure for batsmen by combining the traditional measures of performances. But these two measures can't be used to measure the performance of all-rounders. Lewis (2005) proposed an alternative measure of player performance to overcome the above discussed limitations on the basis of well-established Duckworth/Lewis method. It can be used not only to measure the performance of batsmen and bowlers but can also be used to measure the performance of all-rounders. However, one has to note ball-by-ball information of a match or series of matches to apply the performance measure developed by Lewis (2005). To collect the ball-by-ball information of a match or a series of matches is a tedious job as one has to watch each ball of all the matches of the entire series. Though, some of the websites like *cricinfo.org*, *cricwaves.com*, etc. are providing ball-by-ball information of a match but in a descriptive form. Thus, one has to read this information and note them down in quantitative terms for necessary computation, a task which is by no means simple. It would be better if the scorecard of a match can be utilized for measuring the performances of players. This has lead to the development of a model that can be used to measure the *batting*, *bowling* and *wicket keeping* performance of cricketers that can be combined into a single index based on data from the scorecard. The developed performance measure can be used to measure the performance of a batsman, bowler, all-rounder and wicket keeper simultaneously.

6. Methodology

A player's performance is not reflected well enough through a particular characteristic or factor. For example, the batting average does not reflect the performance well enough to estimate the batting ability of a batsman because it does not take into account any other skills of the batsman like strike rate, average percentage contribution to teams' total etc. Therefore, it is very essential to incorporate all other important aspects to measure the performance of cricketers. Thus, a model is developed in this paper to measure the performance of cricketers by considering a number of factors. The developed performance measure considers the three prime abilities of the game viz. *batting*, *bowling* and *wicket keeping* simultaneously. Various cricketing factors considered under the above mentioned abilities are adjusted by using appropriate weights based on their relative importance. The performance scores are computed for each cricketer separately for the two IPLs and the corresponding Twenty20 world cups of the said seasons. Correlation coefficients are calculated separately for the season 2009 and 2010, to investigate the relationship between IPL performance and world cup performance of the selected cricketers. Finally, to attain the fourth objective of the study, correspondence analysis is used to compare the performance of Indian and foreign cricketers.

7. Data and Model Formulation

The data pertinent to the performances of the players in the 2009 and 2010 season of IPL and corresponding Twenty20 world cups are collected from the website *www.cricinfo.org*. From data, various statistics can be computed to quantify the individual performance of cricketers (i.e. strike rate, economy rate, etc.) but such statistics are only able to represent the partial story of a player's performance.

To measure the performance of players it is necessary that players' statistics for large number of games should be considered. The actual quality of a player may not be properly judged from one or two games. The effects of outstanding or poor, single performances are smoothed over the larger number of games (Lewis, 2005). The expectations regarding level of performance can't be gauged fairly from only one match therefore individual performances across a series of matches are required to provide a suitable frame of reference. The nature of the professional sport ensures that the majority of individuals will experience sufficient match-play to enable this type of methodology to be deployed (Bracewell and Ruggiero, 2009). Thus, some selection criterion needs to be set up which will also help to identify changes in performance of players. The players are selected based on the following criteria.

- The player was in playing eleven of atleast 5 matches in two IPLs (II and III) as well as in the second and third edition of the Twenty20 world cups.
- Either the player has bowled atleast 5 overs in each of the two IPLs and Twenty20 world cups or has faced atleast 50 balls or both.

There were only 15 players who had found to satisfy both the criteria accurately. All these players were considered for the study.

7.1. The performance measure

The performance measure of the ith player is given by,

$$S_i = S_{i1} + \delta_i \tag{1}$$

where

$$\delta_i = \begin{cases} S_{i2}^{a_i} + S_{i3}^{1-a_i} - 1, & \text{if } i^{th} \text{ player is either a bowler or wicket keeper} \\ 0, & \text{if } i^{th} \text{ player is neither a bowler nor wicket keeeper} \end{cases}$$

where, a_i is an indicator variable with,

$$a_i = \begin{cases} 1, & \text{if } i^{th} \text{ player is a bowler} \\ 0, & \text{if } i^{th} \text{ player is a wicket keeper} \end{cases}$$

with, S_{i1} = Performance score for batting

S_{i2} = Performance score for bowling

S_{i3} = Performance score for wicket keeping

7.2. Different factors considered for batting

To measure the batting performance of a cricketer in Twenty20 cricket a number of factors are considered. These factors are number of innings in which the player had actually batted, batting average of the batsman, strike rate of the batsman and average percentage contribution to the team total. The values of these factors for each of the player are normalized and then weights of these factors are calculated based on their relative importance. All the normalized scores for considered factors are multiplied by their corresponding weights and then added together to get S_{i1} (i.e. the performance score for batting for the ith batsman). Below a discussion is made about the different characteristics and their formulae.

7.2.1 Batting average

The batting average is defined as the number of runs scored in all innings divided by the number of completed innings i.e. the number of innings in which the batsman was out. The batting average of the ith player is given by,

$$BA_i = \frac{\text{Number of runs scored by the } i^{th} \text{ player in a given series}}{\text{Total number of complete innings by the } i^{th} \text{ player in that series}} \tag{2}$$

7.2.2 Number of innings played

All the teams have a number of players in their squad. Each team tries to ground its best players in the playing eleven. In IPL, a team cannot include more than four foreign players. Some players may not be available for injuries or engaged in their national duties (valid for foreign players). Some may be included in the playing eleven and yet may not get an opportunity to bat. Thus, the number of innings the ith player goes into the pitch of 22 yards with his bat is considered as one of the measures of his performance. This is because the team gets a service from the cricketer as batsman.

7.2.3 Strike rate

Strike rate of a batsman is defined as the number of runs scored per k balls. Generally, k is taken to be 100. Thus, strike rate of the ith batsman (SRB_i) is the number of runs scored per 100 balls by him. It is calculated by,

$$SRB_i = \frac{\text{Total number of runs scored by the } i^{th} \text{ player}}{\text{Total number of balls faced by the } i^{th} \text{ player}} \times 100 \tag{3}$$

7.2.4 Average percentage of contribution to the team total

The average percentage of contribution to the team total is defined as the number of runs scored by the ith player divided by the team's total score in a given innings. It is calculated by

$$APC_i = \underset{j}{Average} \left(\frac{Runs \ scored \ by \ the \ i^{th} \ player \ in \ the \ j^{th} \ innings}{Team's \ total \ score \ in \ the \ j^{th} \ innings} \times 100 \right) \tag{4}$$

7.3. Different factors considered for bowling

The different factors that are considered while computing the performance score of bowler are number of innings in which the player was bestowed with the responsibility of bowling, bowling average, economy rate and strike rate of the bowler. The values of these factors, for each of the player are normalized and then weights of these factors are calculated based on their relative importance. As earlier, all the normalized scores for the considered factors are multiplied by their corresponding weights and then added together to get S_{i2} (i.e. the performance score for the ith bowler). The definition of the different characteristics is provided in the subsequent sections.

7.3.1 Number of innings played

In a Twenty20 match, a player can bowl a maximum of four overs. Thus, the fielding captain has to use atleast 5 bowlers for playing complete twenty overs. Depending on the requirement, he may or may not ask a player to bowl. Thus, the number of innings in which a captain has entrusted the responsibility of bowling to a given player should be noted and included in the computation of performance score for bowling. This is because the team gets a service from the cricketer as bowler.

7.3.2 Bowling average

The principle criterion used for rating and comparing bowlers in cricket is the bowling average. The average for a bowler is calculated by dividing the number of runs conceded in a match (or a series of matches) by the number of wickets taken in those matches. The bowling average for the ith player be denoted by,

$$BWA_i = \frac{\text{Total number of runs conceded}}{\text{Total number of wickets taken}} \tag{5}$$

7.3.3 Economy rate

Another important measure of bowling performance is the economy rate. A bowler's economy rate is defined as the number of runs conceded per k balls. The number k is often chosen to be 6, so that ER_i (economy rate of the ith player) may be defined as the number of runs conceded by the bowler per over (i.e. 6 balls).

$$ER_i = \frac{\text{Total number of runs conceded by the } i^{th} \text{ bowler}}{\text{Total number of balls bowled by the } i^{th} \text{ bowler}} \times 6 \tag{6}$$

7.3.4 Bowler's strike rate

The fourth criterion is the bowler's strike rate. This was originally proposed by Sir Donald Bradman. It is the number of balls bowled divided by the number of wickets taken. The bowlers strike rate for the ith player is denoted by BSR_i and is given by,

$$BSR_i = \frac{\text{Total number of balls bowled by the } i^{th} \text{ player}}{\text{Total number of wickets taken by the } i^{th} \text{ player}} \tag{7}$$

7.4 Different factors considered for wicket keeping

To measure the performance of a wicket keeper the different factors considered are number of matches played as wicket keeper, number of catches taken per match, number of stumping per match and number of bye runs conceded per match. Here the phrase 'per match' means the number of matches when the player kept the wickets for his team. This is because some of the teams have more than one player in their playing eleven who are capable of wicket keeping.

7.4.1 Number of matches played as a wicket keeper

The number of matches in which the player played as a wicket keeper is noted and included in the computation of performance score of a wicket keeper. This is because the team gets a service from the cricketer as wicket keeper.

7.4.2 Number of catches taken per match

Catch is a method of dismissing a batsman in the game of cricket. If the ball is caught by the wicket keeper after the ball has touched the striker's bat or glove holding the bat, but before touching the ground, then normally it is known as "caught behind". The total number of catches taken by the player played as a wicketkeeper is noted and included in the computation.

7.4.3 Number of stumping

Stumping is a form of dismissal of a batsman in cricket, in which batsman can be out stumped if the wicket keeper puts down the wicket while batsman is out of his crease. So, the total number of stumping by a wicket keeper is considered to measure the performance of the keeper.

7.4.4 Number of bye runs conceded

If the ball passes the batsman without being hit by the bat or by the body of the batsman then it generally proceeds to the wicket keeper. The wicket keeper is expected to hold the ball. However, if the wicket keeper fumbles or misses the ball then the batsman tries to take runs. The runs scored in this fashion are considered as bye runs and are added to the team total. So, that total number of bye runs conceded by a wicket keeper is also included in the study to measure wicket keeping performance. However, it may be noted that the lesser number of bye runs scored against a wicket keeper better is his performance.

8. Normalization

The developed performance measure in this paper is a linear combination of traditional performance measures under the abilities of *batting*, *bowling* or *wicket keeping*. Further, Lewis (2005) mentioned that the traditional measures of performances do not allow combining of the abilities of batting and bowling as they are based on incompatible scales. Therefore, to overcome this limitation use of normalization is essential in this model. Normalization aids to eliminate the unit of measurement and variability effect of all the traditional performance measures. Based on normalization, the traditional performance measures under the abilities of *batting*, *bowling* and *wicket keeping* come within a similar range from 0 to 1. Since normalization makes the measures unit free, so they can be combined through addition.

Let X_{ijk} be the observed values of the ith player for the jth factor (i.e. Batting average, Strike rate, etc.) of the kth skill (i.e. Batting, Bowling and Wicket keeping). Out of the different factors considered for performance measurement some are having positive dimension like batting average, batting strike rate, number of stumping etc. as they are directly related to the skill of the player. While some of the factors like Economy rate, number of bye runs conceded etc. have negative dimension as they are negatively related to the skill of the player. Now, if the factor represents positive dimension then it is normalized as

$$Y_{ijk} = \frac{X_{ijk} - \min_i(X_{ijk})}{\max_i(X_{ijk}) - \min_i(X_{ijk})} \tag{8}$$

and if the factor represents negative dimension then it is normalized as

$$Y_{ijk} = \frac{\max_i(X_{ijk}) - X_{ijk}}{\max_i(X_{ijk}) - \min_i(X_{ijk})} \tag{9}$$

9. Determination of weights

The next step would be to determination of weights for second and third season of the Twenty20 world cups and IPL. Basically, simple averages provide equal importance to each of the variables. But when variables are weighted to a composite measure, the relative importance of the variables is considered. Other than the arbitrary weighting techniques, there are different statistical methods of weighting as well. Iyenger and Sudarshan (1982) assumed that the weights vary inversely as the variation in the respective variables. This conception has been thoroughly applied in this study to determine the weights of different factors that are associated with the various skills of the cricketers.

Let Y_{ijk} be the normalized value of the ith players for the jth factors of the kth skills where i (= *1, 2, ..., n*) represents players; j (= *1, 2, 3, 4*) for the four different factors considering under each of the k skills (for example under batting skill different factors are number of innings, strike rate, batting average, average percentage of contribution to the team total); $k = 1, 2, 3$ represents the different skills viz. batting (1), bowling (2) and wicket keeping (3). If w_{jk} represents the weight of the jth factor under the kth skill then it is calculated as

$$w_{jk} = \frac{C_k}{\sqrt{\underset{i}{Var}(Y_{ijk})}}, \quad j = 1, 2, 3, 4 \text{ and } k = 1, 2, 3 \tag{10}$$

where, $\sum_{j=1}^{4} w_{jk} = 1$ for all k

C_k is a normalizing constant that follows

$$C_k = \left[\sum_{j=1}^{4} \frac{1}{\sqrt{\underset{i}{Var}(Y_{ijk})}} \right]^{-1}$$

The choice of the weights in this way would ensure that the large variation in any one of the factor would not unduly dominate the contribution of the rest of the factors (Iyenger and Sudarshan, 1982). In Table 2 one can see the different factors along with its respective weights obtained from using equation (10) (See Appendix-A).

10. Computation of performance score

The performance score of S_{i1}, S_{i2} ans S_{i3} for batting, bowling and wicket keeping are computed as follows:

The batting performance ($k = 1$) of the ith player is calculated by

$$S_{i1} = \sum_{j=1}^{4} w_{j1} Y_{ij1} ; \qquad j = 1, 2, 3, 4 \tag{11}$$

The bowling performance ($k = 2$) of the ith player is calculated by

$$S_{i2} = \sum_{j=1}^{4} w_{j2} Y_{ij2} ; \qquad j = 1, 2, 3, 4 \tag{12}$$

The performance ($k = 3$) of the ith wicket keeper is calculated by

$$S_{i3} = \sum_{j=1}^{4} w_{j3} Y_{ij3} ; \qquad j = 1, 2, 3, 4 \tag{13}$$

On obtaining the values of S_{i1}, S_{i2} and S_{i3} the performance measure S_i of the ith player is computed using (3). The performance measures of all the players are computed and then converted into corresponding performance index (PI_i). The performance index of the ith player is denoted by PI_i and is given by,

$$PI_i = \frac{S_i}{\underset{i}{\max}(S_i)} \tag{14}$$

The performance index for each player is a number lying between zero and one (i.e. $0 < PI \leq 1$). Higher value of the performance index better is the performance of the players.

11. Results and discussions

The performance indices are calculated individually for all the fifteen players who had satisfied the previously mentioned criteria. The calculated performance index values for each of the said seasons of IPL and the corresponding Twenty20 world cups are given in Table 3 (See Appendix-B).

11.1. Correlation

The correlation coefficient is a measure of the degree of linear relationship between two or more variables/factors. The correlation coefficient is calculated separately for the IPL performance index and the world cup performance index of the selected cricketers for the season 2009 and 2010. The results are provided in the following table.

Table 1: Correlation coefficient values for IPL and Twenty20 world cup

Season	Performance Index score	Correlation coefficient (r)	Sig. value
2009	IPL2 and WC2	0.237	0.376
2010	IPL3 and WC3	0.334	0.207

In table 1, for the season 2009 and 2010, the value of correlation coefficient between IPL performance

and world cup performance of selected cricketers are 0.237 and 0.334 respectively. Though there exists positive relationship between the performance of cricketers in national tournament and global event but the values are not significant. Therefore, it can be concluded that the performance of cricketers in IPL seasons and corresponding Twenty20 world cups for the said seasons are uncorrelated.

11.2. Correspondence analysis

In statistics, different techniques are available to examine the relationship between or among the variables. However, to analyze the categorical data viz. cross-table or contingency table, the correspondence analysis is an ideal technique because of its ability to extract the most important dimensions and allowing simplification of the data matrix (Doey and Kurta, 2011). It is specially designed to show how data deviate from expectation when the row and column variables are independent in contingency table (Friendly, 1991). However, if any one wishes to analyze continuous data with correspondence analysis, then originally continuous data can be categorized into discrete variables and subsequently analyzed as a discrete data. In correspondence analysis, there is no need to assume any theoretical distribution priori like many other statistical techniques (Doey and Kurta, 2011) and hence it is a non-parametric technique. To perform correspondence analysis first of all one has to calculate categorical profiles as well as relative frequencies and then compute the chi-square statistics - a weighted Euclidean distance – to measure the association between variables (Nath and Sinha, 2011). The basic goal of correspondence analysis is to explain the most inertia or variance in the model, in the least number of dimensions (Doey and Kurta, 2011).

Now based on performance scores of the players below the data matrix for correspondence analysis is described. At first, the players those who are considered for the study are segregated as Indian and foreign players. Then for second and third season of IPL and corresponding Twenty20 world cups, the performance of the players are classified into two different categories on the basis of performance scores generated using equation (14). For selected cricketers, the average performance scores of each of the tournament have been computed to determine their performance categories. In a tournament, if the performance score of a player is above average then the performance is denoted as good performance and below average is denoted as poor performance. Thus, the originally continuous data is converted into categorical data and the correspondence analysis is used to compare the performance of Indian and foreign cricketers in said IPL and Twenty20 world cups. The analysis is performed using SPSS version 17.0.

The output of the correspondence analysis can be seen in the Appendix-C where singular values and chi-square statistics are presented for each of the said IPL and corresponding Twenty20 world cups. The sum of inertia provided in the summary table (see Appendix-C) is called total inertia. But the present study has only one dimension so the inertia of dimension 1 and total inertia is same. Inertia means variance in the context of correspondence analysis. Total inertia may be interpreted as the percent of inertia (variance) in the original correspondence table (see Appendix-C) explained by all the computed dimensions in the correspondence analysis. Moreover, the correspondence analysis uses a chi-square statistics to test for total variance explained along with the associated probabilities (Doey and Kurta, 2011). If the chi-square statistics is significant (i.e. less than 0.05) then there is a relationship between the performance of Indian and foreign players in the said tournaments. It is very imperative to note that chi-square statistics can be used to examine the associations between categories of the same variable but not between variables of the different categories (Doey and Kurta, 2011). By looking at the significant column of each of the summary table in Appendix-C for IPL2, WC2, IPL3 and WC3, it is seen that the respective significant values are 0.132, 0.519, 0.057 and 0.833. All these significant values are greater than 0.05 which indicates the performances of Indian and foreign players in national and global tournaments are fairly independent. Therefore, it is not reasonable to comment that the IPL is responsible for the performance of Indian players in the corresponding Twenty20 world cups that followed.

12. Conclusion

From the results obtained through correspondence analysis, the performance of Indian and foreign players in IPL and corresponding Twenty20 world cups are not found to be significant. Thus, the national tournament IPL cannot be held responsible for the poor performance of the players in the global events in 2009 and 2010 season. Also, the data does not have sufficient evidence to claim that IPL tournaments are helping the Indian players in their performance in the corresponding tournaments. Some other reasons need to be marked.

One reason definitely is the fitness issues of the players. If player like Sehwag, Ghambir who can be the

game changers, start loosing their place to relatively inexperienced ones on issues related to fitness then teams performance is bound to suffer. Another reason is the hectic schedule of Indian cricketers. It is interesting to note that, in the 2009 Twenty20 world cup, India was the last team to arrive to England, five days after the IPL final and had chosen not to play any practice matches (Sinha, 2010).

One more reason of India's debacle at Twenty20 world cup was the inability of the players to handle the short pitched delivery. In 2009 Twenty20 world cup, three teams viz. England, West Indies and South Africa exploited team India with this technique and the result was humiliating exit from the global event for defending champions of inaugural Twenty20 world cup. Similar technique was applied by every team against team India in 2010 Twenty20 world cup as well. Team after team has successfully targeted the Indian batsmen with lifting deliveries. Unless some of the young Indian batsmen learn to cope with short-pitched bowling from the quicks, the side will continue to disappoint.

Indian batsmen's approach in this format of the game, become vivid during the IPL. This help the coaches and bowlers of the opponent teams to develop appropriate counter strategy. As new game plan for the world cup cannot be formulated is such haste so the game plan of the opponents remains fruitful.

The proposed model of performance measurement can also be used to measure the performance of senior and junior cricketers, professional football players, film stars and even politicians by changing the indicator variables. The developed statistical model would be useful for the followers of this format of the game of cricket to comprehend the utility of IPL in Indian Cricket.

13. Acknowledgement

14. References

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Appendix-A

Table 2: Different factors with its respective weights in IPL & Twenty20 world cup

	Factors	**IPL2 weights**	**WC2 weights**	**IPL3 weights**	**WC 3 Weights**
Batting	Number of innings	0.22789	0.17611	0.23631	0.16273
	Batting average	0.26042	0.28682	0.249	0.27383
	Batting strike rate	0.29462	0.26816	0.25397	0.30429
	Average percentage of contribution	0.21706	0.26889	0.26071	0.25912
Bowling	Number of innings	0.22912	0.22927	0.28392	0.25401
	Bowling average	0.28071	0.23076	0.25106	0.2597
	Economy rate	0.21086	0.29682	0.21878	0.24984
	Bowler's strike rate	0.27929	0.24313	0.24622	0.23643
Wicket keeping	Number of matches played as wicket keeper	0.25	0.25	0.25	0.33333
	Number of catches taken	0.25	0.25	0.25	0.33333
	Number of stumping	0.25	0.25	0.25	0.33333
	Number of bye runs conceded	0.25	0.25	0.25	0.0001

Appendix-B

Table 3: Performance index values of players in IPL and Twenty20 world cup

Sl. No	Players Name	PI of IPL2	PI of WC2	PI of IPL3	PI of WC3
1	BB McCullum	0.37699	0.28681	0.25125	0.36175
2	DJ Bravo	0.59709	0.96425	0.29347	0.90513
3	MS Dhoni	0.87475	0.38859	0.76073	1
4	Y Singh	0.72847	0.68616	0.83114	0.92218
5	SK Raina	0.93730	0.41142	1	0.55914
6	YK Pathan	0.68205	0.69656	0.74943	0.84937
7	H Singh	0.73734	0.75438	0.97214	0.46035
8	JH Kallis	0.66989	0.99691	0.96874	0.98533
9	AB de Villiers	0.54228	0.51135	0.20261	0.44933
10	JA Morkel	0.69626	0.76278	0.77824	0.54150
11	TM Dilshan	1	0.66184	0.40902	0.42709
12	K Sangakara	0.74911	1	0.78913	0.73643
13	M Jayawardene	0.35077	0.42713	0.54120	0.81592
14	SL Malinga	0.52635	0.81501	0.14861	0.71221
15	G Gambhir	0.41897	0.32208	0.41134	0.28626
	Average	**0.65918**	**0.64569**	**0.60714**	**0.66747**

Appendix-C

Table 4: Correspondence table for performance of Indian and foreign players in IPL2, WC2, IPL3 and WC3

Tournaments	Players	Performance		Active Margin
		Poor	Good	
In IPL2	Indian	1	5	6
	Foreign	5	4	9
	Active Margin	6	9	15
In WC2	Indian	3	3	6
	Foreign	3	6	9
	Active Margin	6	9	15
In IPL3	Indian	1	5	6
	Foreign	6	3	9
	Active Margin	7	8	15
In WC3	Indian	3	3	6
	Foreign	4	5	9
	Active Margin	7	8	15

The summary table of correspondence analysis is the most important table provided in the SPSS output. The singular values provided in summary table are measures of association by dimension between the row and column variables where larger values indicating stronger relationship. The inertia column gives the total variance explained by each dimension in the model which is obtained by squares of the singular values.

Table 5: Summary table of correspondence analysis

Tournaments	Dimension	Singular Value	Inertia	Chi Square	*P*-value
IPL2	1	.389	.151	2.269	.132*
WC2	1	.167	.028	.417	.519*
IPL3	1	.491	.241	3.616	.057*
WC3	1	.055	.003	.045	.833*

*(p-value > 0.05)