

**Analysis of Performance Indicators in IPL Twenty20 Cricket from 2015 to 2017**

**By**

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## Declaration

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- I have acknowledged all main sources of help.



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## **Summary**

### Analysis of Performance Indicators in IPL Twenty20 Cricket from 2015 to 2017

#### **Introduction:**

Cricket teams practice various batting and bowling strategies when preparing for matches or tournaments. Within the IPLT20 tournament these performance variables are considered as vital due to these variables discriminating between winning and losing teams. All teams participating in the IPLT20 seek a competitive advantage therefore an analysis of performance variables such as boundaries hit by batsmen and runs scored during the power play can be used to predict future success or failure of a cricket team based on the match outcome.

#### **Objectives:**

The purpose of this study was to identify which batting and bowling performance variables correlate with winning and losing teams in the IPLT20 Cricket tournament from 2015-2017. Furthermore, this study is aimed to supply coaches and players with performance outcomes that most significantly influence the winning and losing of an IPLT20 cricket match.

#### **Methods:**

A total of 150 IPLT20 cricket matches between 2015 and 2017 were captured. Six teams were selected for the purpose of this study, namely Delhi Daredevils, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Royal Challengers Bangalore and Sunrisers Hyderabad. These teams all participated in all three season from 2015 to 2017. This will result in 150 matches over the 3 seasons.

#### **Measuring Instruments:**

Retrospective data from the 2015, 2016 and 2017 Indian Premier League Tournament was collected from ESPN Cricinfo website.

## **Data Analysis:**

A reliable data source for this research was found in Statsguru. Statsguru is ESPN Cricinfo's cricket statistics maintenance database. The data was then analysed using the SAS Statistical Software (SAS, 2017).

Data were analysed separately for the team batting first and for the team batting second. The outcome of the match is a binary variable (win/lose) since drawn matches were excluded from the analysis. The association of the potential predictor variables with the match outcome was analysed using univariate logistic regression, fitting each predictor variable, one at a time. The statistical significance of each predictor variable was tested using an exact test (exact conditional logistic regression); the exact P-value is reported. The analysis was carried out using SAS procedure LOGISTIC (see SAS, 2017).

## **Results:**

Variables that predict success in T20 cricket differed for teams batting first and second, respectively.

The significant predictors of winning an IPLT20 cricket match when batting first were: total runs scored in a match ( $p=0.0001$ ), total wickets lost in a match ( $p<0.0001$ ), and wickets taken in a match ( $p<0.0001$ ). The significant predictors of winning an IPLT20 cricket match when batting second were: wickets taken in a match ( $p<.0001$ ) and wickets lost in a match ( $p<.0001$ ).

## **Conclusions:**

The results of this study concludes that there are various performance variables such as the influence of a higher total runs scored, wickets taken in a match and wickets lost in a match correlates positively with success in Indian Premier League T20 cricket between teams batting first and second and can be used as success performance predictors. In contrast to other studies, this study focusses on variables in T20 cricket that reflect the performance of the entire team. From this study it can be concluded that batting first has a higher success rate although bowling data such as wickets taken and wickets lost for teams batting second are the most important predictors of winning.

**Key words:**

Batting, Bowling, Indian Premier League, T20, Runs scored, Wickets lost, Wickets taken, Winning.

**References:**

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## LIST OF ABBREVIATIONS

Ave	Average
ICC	International Cricket Council
IPL	Indian Premier League
IPLT20	Indian Premier League Twenty20
ODI	One Day International
SR	Strike Rate
USA	United States of America
USD	United States Dollar
Wkts	Wickets
PP	Power play
ECB	England and Wales Cricket Board (ECB)
BCCI	Board of Control for Cricket in India
BFW	Batting First and Winning
BFL	Batting First and Losing
BSW	Batting Second and Winning
BSL	Batting Second and Lost

## **OPERATIONAL DEFINITIONS**

### Batting Average:

Total number of runs a batsman has scored divided by the total number of times he has been called out in his/her career.

### Batting Strike Rate:

The number of runs scored per 100 balls faced by a batsman.

### Bowling Average (Ave = Runs/Wickets):

The average number of runs conceded per wicket.

### Cricket:

An international bat and ball team sport, played between two teams of eleven players on an oval shaped field.

### Cricket Pitch:

A central strip on a cricket field where most of the play occur.

### Economy Rate (Econ = Runs/ (overs bowled):

The average number of runs conceded per over. Lower values are preferred since this is the run-rate against a specific bowler for a batting team.

### Fours:

The total number of boundaries (fours = four runs) made.

### International Cricket Council:

The international governing body of cricket.

### Runs:

Total number of runs scored by a player.

### Sixes:

The total number of sixes (=six runs) made.

Strike Rate (SR = Balls/Wickets):

The average number of balls bowled per wicket taken.

Wickets:

The number of wickets taken by a bowler.

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## CHAPTER 1

### 1.1 Introduction

Cricket is an indoor and outdoor sport played with a bat and a ball and currently the most important and celebrated sport in South Asia (Subhani *et al.*, 2012). Cricket is played in a specially prepared area in the centre of a field known as a pitch. The game is being played under certain rules and regulations between two teams consisting of 11 players alternating between batting and bowling/fielding (Perera, 2015, Singh *et al.*, 2015, Stuelcken *et al.*, 2007). The aim of the batsmen is to score as many runs as possible without being dismissed, whereas a bowler is required to dismiss a batsman or restrict a batsman to score runs (Bhattacharjee & Pahinkar, 2012). Cricket is an interesting and complex sport in that it is classified as both a team and an individual sport. While performing as a team sport it is also composed of very discrete passages of play, which involves a player (the bowler) bowling the ball at another player (the batsman), and concurrently the batsman is also taking on the rest of the opposition team in the field (Coterrill, 2011). Three formats of cricket are played at international level namely Test, ODI (one day international) and T20, whereas Four Day, One Day and T20 is played at domestic level (MacDonald *et al.*, 2013). Additionally, in a study done by Shah *et al.* (2017) literature suggests that cricket is a sport game of uncertainty and one cannot predict the outcome of the game up to the last hit or bowl.

This study will focus on the shortest format of the game: T20 Cricket, specifically IPLT20 (Indian Premier League T20). T20 cricket is a fascinating experience coupled with the possibility of making it to the prestigious Olympic spectacle and being the most important cricket format in times to come (Subhani *et al.*, 2012).

### 1.2 Problem Statement

The analysis of sporting data has evolved over the last couple of years by means of the growing technology, which in turn provides most performance data in sport (Perera, 2015). While professional sports organizations continue to seek techniques to augment their on-field success, the growth of sports analytics has concurrently become increasingly competitive and complex (Mondello & Kamke, 2014). Cricket is a growing international sport and with the Indian Premier League in mind, there is an

increasing demand for the statistical analysis of cricket data. Therefore, the aim of the study is to determine the performance indicators that most significantly affect the winning and losing of an IPLT20 cricket match.

Although research from both Peterson *et al.* (2008a) and Douglas and Tam (2010) provides a suitable starting point for further research on performance indicators that most significantly affect T20 cricket, there are important limitations that require consideration. This is supported by Moore *et al.* (2017) stating that the mapping of performance indicators across different T20 playing conditions could assist with team preparation and tactical decision-making. Despite this, performance indicators have yet to be firmly established as a result, greater knowledge of specific tactics and strategies still needs to be determined.

### **1.3 Aim of the study**

The knowledge of batting and bowling performance indicators during an IPLT20 match is important for effective planning and management of players during matches as well as the tournament. A better understanding of the impact of each performance variable on the outcome of a match is essential for coaches and players to implement strategies in order to be successful. The data gathered during this study will ensure that players and coaches have a better understanding of the performance variables that lead to success in a match or tournament.

The purpose of this study

- To identify how batting performance variables such as the total runs scored by a team, maximum individual runs scored, total fours, total sixes, wickets lost in the match and wickets lost in the power play correlate with winning and losing teams in the IPLT20.
- To identify how bowling performance variables such as wickets taken in the match and wickets taken in the power play (PP) correlate with winning and losing teams in the IPLT20
- To provide possible reasons for performance failure of batsmen, bowlers and the team as a whole.



#### **1.4 Significance of the study**

This research project will provide valuable information about significant cricket data, which will differentiate between successful and less successful performance indicators to determine successful outcomes of batting and bowling indicators of performance with respect to the T20 games at the IPLT20 from 2015 -2017. The results will also assist performance personnel of the respective IPLT20 teams to better understand the effect of performance indicators regarding the success of teams and assist in the possible forecasting of future performance. Analysing the statistics of cricket aids in understanding which factors greatly affect performance. This knowledge leads to more specific training programmes and a more educated selection of players for the team.

#### **1.5 Structure of the dissertation**

Chapter One: Introduction and problem statement: The chapter is included herewith in accordance with the guidelines of the Free State University and problem statement.

Chapter Two: Literature review: This chapter will review previous literature which are relevant to the research aims stated in Section 1.4. An overview of cricket, match formats, rules, performance analysis and the effect of the coin toss and home ground advantage. The chapter is included herewith in accordance with the guidelines of the Free State University.

Chapter Three: Research methodology: The chapter is included herewith in accordance with the guidelines of the Free State University.

Chapter Four: Results: The chapter is included herewith in accordance with the guidelines of the Free State University.

Chapter Five: Discussion

Chapter Six: Conclusion

Chapter Seven: Practical Applications

## **CHAPTER 2: Literature Review**

### **2.1 Introduction**

Cricket is an international team sport, which originated in the 16th century from England (Scalan *et al.*, 2016). Since then cricket emerged into a sport of technical finesse, involving various performance variables which may be used to predict performance related to batting and bowling. Within T20 cricket known as a shorter format of the game with limited number of overs the player and team performance is crucial for team selectors and coaches (Shah *et al.*, 2017).

In the past, cricket was played solely within a specific season (winter in Asian countries and summer in Western countries), but the game has gained so much popularity in the last few decades that it is now played throughout the year (Koley, 2011). Cricketers are therefore exposed to more demanding schedules, with longer periods of training and practicing. Cricket performance indicators is categorised into three main variables: general game indicators, batting indicators and bowling indicators (Petersen *et al.*, 2008). It is therefore important that focus is placed on the variables that influence the batting, bowling and fielding performance of a cricket team during a match. Statistical analysis of these performance parameters can aid in determining the variables which are different between winning and losing cricket teams.

A thorough study of analysing performance variables is applicable with the purpose of this chapter to provide an introduction to the game of cricket, an overview of batting and bowling as a success predictors, and the importance of sport analytics in informing coaching and conditioning staff on the demands of cricket performance.

### **2.2 Cricket Match Formats**

Cricket is unique in that three different formats are played at international and domestic level (Petersen *et al.*, 2011). These formats range from long-duration multiday Test matches to short-duration 50 over One-day matches and T20 gameplay (Scalan *et al.*, 2016). The different skills required for each format of cricket can clearly be seen as mostly a different team is selected for each format of the game in professional cricket. These differences influence conditioning and team selection strategies (Peterson *et al.*, 2011). This influences each player's strategy as well as the overall team strategy

for success. According to Chadwick and Arthur (2010) each format of cricket has conformed to a general style of play and can be defined by certain strategy.

### **2.2.1 Test Match**

Test cricket is the longest form of cricket and is considered by coaches, players and fans as the ultimate test of playing ability (Wicktramasinghe, 2014). Test cricket is also widely regarded as the pinnacle of cricket (Petersen *et al.*, 2011). According to a study done by Petersen *et al.* (2011) test match cricket includes a greater overall physical load due to the format being longer and more conservative. Intense planning and cautious play are the mainstays of a test match.

### **2.2.2 One Day (ODI)**

One-day cricket was introduced in the 1960s and is a version of cricket based on limited overs cricket with 50 overs per side (Perera *et al.*, 2015). Due to ODI cricket being a shorter version of the game, it was introduced in order to reduce the frequency of drawn matches and to increase excitement through more aggressive batting (Swartz *et al.*, 2006). Limited overs cricket was introduced first as ODI cricket then later as T20 cricket in an effort to improve attendance of the modern spectator.

### **2.2.3 T20**

The marketing manager of England and Wales Cricket Board (ECB), Stuart Robertson proposed T20 format of cricket with 20 overs per innings in 2001 (Singh *et al.*, 2015). This shorter format of the game attracted huge crowds and became popular as a match can be completed within three hours' time (Singh *et al.*, 2015). Recognising the popularity of T20 cricket, the International Cricket Council (ICC) organised the first T20 World Cup in 2007 which took place in South Africa, which was won by India (Singh *et al.*, 2015).

The first international T20 game was played between England and Australia on the 13<sup>th</sup> of June 2005 at the Rose Bowl in Hampshire (Saikia & Bhattacharjee, 2010).

T20 cricket is more of a spectators' sport than a battle of planning and execution. T20 cricket is the shortest format of cricket (Subhani *et al.*, 2012). Players are more aggressive in an effort to score runs and take wickets in an explosive manner. (Subhani *et al.*, 2012).

Limited overs cricket not only transformed cricket as a sport but also exponentially increased interest in viewing cricket by many new spectators. This spectator interest is due to the game being played at a higher pace, exciting scoring shots, high run rate and the limited time required to complete the game (Saikia & Bhattacharjee, 2010).

T20 is the shortest and fastest version of cricket with each team facing twenty (20) overs, consisting of six (6) balls each, with fielding restrictions being applied in the first six overs of each innings (Petersen *et al.*, 2009).

The difference between victory and defeat can be often defined by one player as T20 cricket is tested more closely by the execution of tasks where the margin for error is very small (Douglas & Tam, 2010). Petersen *et al.* (2009) summarized T20 cricket as a fast pace game and a very popular format in terms of drawing spectators and being profitable for a team. It has been suggested by Bhattacharjee and Pahinkar (2012) that bowlers perceive the T20 format as being tough due to smaller grounds, flatter wickets, thicker bats and shorter format leading to less experimental time for bowlers. Additionally, playing conditions in India where the IPLT20 is being played, has made it exceptionally challenging for bowlers due to the pitches being more suitable for batsmen (Bhattacharjee & Pahinkar, 2012).

### **2.3 Indian Premier League (IPL)**

The Indian Premier League is the first franchisee based cricket tournament initiated by the Board of Control for Cricket in India (Lemmer *et al.*, 2014). Lalit Modi, the Commissioner of IPLT20, hired the service of International Management Group (IGM) to fine-tune the structure of the league. In April 2008, the first season of IPLT20 was played with eight teams owned by franchises (Singh *et al.*, 2015). These teams were named as Chennai Super Kings (CSK), Deccan Chargers (DC), Delhi Daredevils (DD), Kings XI Punjab (KXIP), Kolkata Knight Riders (KKR), Mumbai Indians (MI), Rajasthan Royals (RR) and Royal Challengers Bangalore (RCB). The franchisee formed their teams from a collection of international, national and local players with the existence

of international players in the teams adding talent and glamour to the teams (Singh *et al.*, 2015). The IPLT20 is known as the first cricket tournament where the teams as well as players both were auctioned for millions of dollars (Singh *et al.*, 2015).

Since the first season of the IPLT20 it has been the most-attended cricket league in the world and in 2014 ranked as sixth by average attendance among all sports leagues. The IPLT20 is supported by enormous financially driven sponsorships, which allows teams to contract reputed international players combined with upcoming Indian talent (Lemmer *et al.*, 2014; Davis *et al.*, 2015). Players earn unprecedented salaries, with the highest paid players earning up to \$100,000 USD per game (Peterson *et al.*, 2008). With an enormous financial injection being invested in the game, franchise owners, management teams and coaches would be wise to apply successful game tactics and select players most capable of executing a proven game strategy (Peterson *et al.*, 2008). Due to franchisees investing a lot of money in their teams, they would expect some returns from their teams in terms of winning the championship which is directly linked to the performance of the teams (Singh *et al.*, 2015).

Shah *et al.* (2017) indicates that every IPLT20 team should be balanced and diversified to enhance the probability of the success. This is supported by a study done by Davis *et al.* (2015) indicating that IPLT20 teams are constantly attempting to improve their line-ups through specific player selection.

The format of the India Premier League T20 competition consists of a round robin stage where eight teams play each other on a home and away basis (Peterson *et al.*, 2008). At the conclusion of all the games, the four top placed teams with the most points allocated progress to the playoff stages (Peterson *et al.*, 2008). The concept of playoffs brought an extra game before the final where 3 games would be played before the finalists could be determined (Khare, 2019). The first qualifier is played between the top 2 teams, the winner of this semi-final progress straight to the final and the loser will progress to the second qualifying match (Khare, 2019). Next, an eliminator game is played between the number 3 and number 4 teams where the loser will get knocked out of the tournament and the winner would go on to play in the second qualifier against the losing team of the first qualifier (Khare, 2019). The winner of the second qualifier would qualify for the final against the winner of the first qualifying match (Khare, 2019).

Within this study only six teams were considered namely: Delhi Daredevils, Kings XI Punjab, Punjab, Kolkata Knight Riders, Mumbai Indians, Royal Challengers Bangalore and Sunrisers Hyderabad.



Figure 1.1 - IPL Teams Map in India (Raj 2013)

## 2.4 Physical and Technical Demands

Cricket is an extremely technical skills-based game and coaches consequently focus on the improvement of skills due to the increase in physical demands required (Webster & Travill, 2018). Cricket players experience substantially different workloads depending on their role within a particular game (Petersen *et al.*, 2011). The most prevalent approach to quantifying the physiological demands of any sport is time-motion analysis using global positioning satellite (GPS) units. Time-motion analysis data contributes in the development of knowledge of positional differences in workload between the different formats of cricket, allowing conditioning coaches to prescribe game-specific training programmes (MacDonald *et al.*, 2013).

Noakes and Durandt (2000) claims that cricket is a game requiring excessive physical skills and mental skill, including the ability to concentrate for prolonged periods and for which high physical fitness cannot on its own fully compensate.

The earliest study to attempt a physiological analysis of the demands of cricket were that of Fletcher (1955) in which test match cricket were analysed. This study included the collection of data during the 1953 Ashes Test Series between England and Australia and tried to predict the average energy expenditure of international cricketers (Noakes & Durandt, 2000).

The physical demands of cricket is being underestimated because of the intermittent nature of the activity as well as the inadequate understanding of the physiological demands of any intermitted activity (Noakes & Durandt, 2000).

International cricket is undergoing a phase of rapid change as it competes to attract an extensive global audience (Noakes & Durandt, 2000). As a result, international cricketers are now exposed to greater physical and psychological demands as these expanded demands include more T20, five- and one-day matches per season, a longer season without a real winter break, more frequent tours and less time spent at home each season (Noakes & Durandt, 2000).

An estimate of the physical activity in bowling during one-day cricket suggests that fast bowlers deliver about 64 deliveries in 40 minutes in which they are expected to run 1.9km in about 5.3 minutes, this equates to an average speed of 21.6 km/h (Noakes & Durandt, 2000). The delivery action would require approximately 64s of upper body action as well as 64 episodes of lower body deceleration, therefore it is apparent that the demands bowling in one-day cricket is not insubstantial (Noakes & Durandt, 2000). It is clear that cricket players need to be athletic to be able to reproduce excellent performance frequently.

A study investigating first-class cricket disclosed fielding data in which fielders cover 15.5km in a 6-hour day (Petersen *et al.*, 2011). This data is further supported by a study done by MacDonald *et al.* (2013) stipulating that fielding intensity is greatest in a T20 match and fielders cover approximately the same distance in One Day and Test cricket but in a shorter period of time.

In a second study, movement patterns stated that 99% of Test batsmen and 98% of ODI batsmen's time was spent in stationary, walking, and jogging movement patterns (Petersen *et al.*, 2011). Petersen *et al.* (2011) suggests that multiday cricket players need the endurance in order to sustain physical performance for over 6 hours a day over multiple days.

In a third study done by Petersen *et al.* (2010), marked differences in movement patterns were evident between positions and game formats, with fast bowlers undertaking the greatest workload of any position in cricket. The study concluded that fast bowlers sprints twice as often, covered over three times the distance sprinting, with much smaller work-to-recovery ratios than other positions (Petersen *et al.*, 2010). Petersen *et al.* (2010) summarised that fast bowlers during multi-day matches covered 22.6 +/- 4.0 km (mean +/- s) total distance in a day (1.4 +/- 0.9 km in sprinting) and wicketkeepers rarely sprinted, despite still covering a daily total distance of 16.6 +/- 2.1 km. Therefore, Petersen *et al.* (2010) concluded that overall, One Day and T20 cricket requires approximately 50 to 100% more sprinting per hour in comparison to multi-day matches. However, multi-day cricket's longer duration resulted in 16-130% more sprinting per day (Petersen *et al.*, 2010).

T20 cricket involves more intense movements and consequently impose different physical and physiological demands on players which directly influences technical decisions made on and off the field (Webster & Travill, 2018). In summary, the shorter formats (T20 and One Day) are more intensive per unit of time, but multi-day cricket has a greater overall physical load (Petersen *et al.*, 2010). The measurement of athletic performance is an exciting task in any sport, especially being very important in competitive sports like cricket which is impacted by player actions (Shah & Patel, 2018).

## **2.5 Psychological demands**

Cricket not only requires various physical demands from players but also comprises of vital psychological components. This argument is supported by a study done by Cotterill (2011) mentioning that cricket as a sport, has a large mental component. Self-confidence, optimal arousal levels, motivation, focus and effective mental preparation are crucial to effective performance (Cotterill, 2011). Cricket matches can last from 3 hours up to 5 days depending on the format and requires players to bat and bowl consistently over a long period of time (Cotterill, 2011). Stressful situations regularly occur within the sport and in response to this players can become engaged in a number of different types of thoughts (Thelwell *et al.*, 2007).



With cricket being both a team and an individual sport it is relevant to address various mental components (Cotterill, 2011). By addressing the individual aspect of the sport includes various benefits including: improving concentration by encouraging cricketers to focus on game specific thoughts, helping the player overcome a natural tendency to dwell on negatives, allowing the athlete to select the appropriate performance behaviours, and preventing the lack of devotion to excessive attention to the mechanics of their automatic skill (Cotterill, 2011). While operating as a team sport it is composed of very discrete passages of play, which involves a player (the bowler) bowling the ball at another player (the batsman) and at the same time the batsman is also taking on the rest of the opposition team in the field (Thelwell *et al.*, 2007). Both batting and bowling require the execution of a complex sequence of actions with batting in particular being classified as a very difficult skill, with minimum error tolerance and severe time constraints, therefore by focusing on the right thoughts could assist in the execution of the correct techniques that will ultimately be conducive to performance (Cotterill, 2007). This is supported by a study done by Thelwell and Maynard (2003), where a mental skills package containing various mental skills techniques is beneficial in enhancing cricketing performance.

Thus, it is crucial to understand the physiological, psychological and technical demands of cricket, initially for the benefit of individual players and teams, but eventually for the survival and growth of the game (Noakes & Durandt, 2000). As cricket players are now expected to perform under more tiring conditions, it is probable that only the best prepared cricketers will perform better, more consistently, with fewer injuries and, as a result, will enjoy longer careers within all formats of the game (Noakes & Durandt, 2000).

## **2.6 Batting**

Cricket batting is a highly constrained task, requiring batsmen to be skilled in order produce complex, full-body movements in response to a bowler's delivery of the ball, with the ultimate aim of producing the most forceful stroke possible to score runs (Stevenson, 2016). Batting is one of the few sports where the batter can strike the ball in a 360° range, which necessitates a wide and varied repertoire of strokes (Portus & Farrow, 2011).

Cricket batsmen have the task of hitting a 7.29 cm diameter leather ball with a 10.8 cm wide wooden bat in such a way as to avoid the ball either hitting the stumps or being caught by one of the members of the opposing team (Müller *et al.*, 2006). Therefore, the technical production of the skill executed often needs to be complemented under stressful time demands where the difference between good and poor bat-to-ball contact can be a matter of a few milliseconds (Portus & Farrow, 2011).

Cricket involves two teams each batting their respective innings and whichever team scores the most runs wins. The T20 innings of a team is terminated by the following three scenarios: whenever a team has completed 20 overs, has lost 10 wickets, or when the second team stops batting when their score exceeds the score of the first team. Batting is comprised of two players of the same team forming a partnership and the batting duties are being alternated from one batsman to his partner after a ball is bowled if either 1, 3 or 5 runs is scored, or if it is the last delivery (i.e. sixth) ball of the over (Swartz *et al.*, 2004). Various batting performance variables can be considered as an important factor within cricket but research suggests that batting performance measure rely heavily on the batting average of a player and a team (Lemmer, 2011). Batters can make use of an array of shots in order to combat the variety of pace, seam, bounce, swing and spin with which bowlers try to defeat them (Harwood *et al.*, 2019).

Batting is considered a complicated task due to the fact that the ball can be bowled at velocities of up to 160 km/h at international level (Müller *et al.*, 2006). Thus, the ball travelling distance between the bowler and the batsmen occurs in less than 500 milliseconds and reaching the batsman in a time far less than the sum total of the visual reaction time of the batsmen and the movement time of the lower extremities and bat (Müller *et al.*, 2006). Land and McLeod (2000) also identified that fast pace bowlers can deliver a cricket ball at speeds of up to 40 m/s (143 km/h), taking around 600 milliseconds to reach the batsman from ball release. In response, a batsman needs to be able to programme and execute an adequate response, with any misjudgement conceivably resulting in dismissal (Stevenson, 2016).

Essentially, Lemmer (2011) suggests that there are two batting strategies from which intermediate strategies can be obtained: (1) aggressive: where a batsman tries to score runs at a high run rate while at a greater risk of losing a wicket and (2) conservative: where the batsman tries to preserve wickets while scoring runs at a

lower rate. In a study done by Nadjan *et al.* (2014), an examination of batting performance indicators revealed that hitting boundary 4's is of greater importance than boundary 6's especially scoring boundary 4's in the last 6 overs of an innings.

That being said, Hardwood *et al.* (2019), claims that batting usually depends on finding the appropriate link between the batter's perception of where the cricket ball will bounce and gross foot movement, forward or backward.

### **2.6.1 Scoring Runs**

Runs can be scored by means of how often the batsmen, at any time while the ball is in play, have crossed the pitch from one end to the other (Lords, 2019). There is an outside boundary around the cricket field, which acts as a clear indication of scoring runs (Manage & Scariano, 2013). When a batsman hits the ball and it reaches the boundary after hitting the ground inside the boundary, four runs (a boundary) are awarded to the batsman, whereas if the ball goes over the boundary without hitting the ground, six runs are awarded to the batsman (Manage & Scariano, 2013).

### **2.7 Batting first and second strategy**

Batting first and second is fundamentally different for batsman and teams due to the situation faced and various factors being significant and having an influence on the outcome of a match (Bhattacharjee & Lemmer, 2016). These factors could include pressure as a measure which were used by the study done by Bhattacharjee and Lemmer (2016). As a cricket match continues some cricket payers may experience mental and physical tiredness which causes an increase of pressure on an individual and team, therefore the decision to bat first or second could be regarded as an important variable when planning a match strategy.

Within a study done by Petersen *et al.* (2008), captains winning the toss decided to field first 57% of the time in which further data revealed that the teams who batted second won 61% of the matches during the 2008 IPLT20 tournament. The option of batting second could be attributed to the fact that play takes place at night and the amount of dew after dark results in a slippery ball, which makes bowling difficult for bowlers (Petersen *et al.*, 2008). Alternatively, Petersen *et al.* (2008) considered the fact that captains may have felt that the team batting first being more fatigued in the field after their batting innings.

Although there are limited studies which analyse the performance of teams batting first or second, Schaefer (2018) suggests that the teams batting first or second will require different strategies at the team and individual level. Teams batting second have a runs target to meet, whereas teams batting first set a runs target (Schaefer, 2018).

## **2.8 Bowling first and second strategy**

Within cricket bowling strategy revolves around restricting runs in which there are two main methods to restrict the opposition teams' runs by bowling a tight line and length, combined with well-placed field in order to limit the batsmen to score runs (Petersen *et al.*, 2008). Alternatively bowlers could bowl more aggressively in order to take wickets (Petersen *et al.*, 2008). Bowling strategy is determined by the type of bowlers used which is determined by various factors such as the number of wickets taken, the number of maiden overs bowled and the number of overs bowled (Petersen *et al.*, 2008). Additionally, Petersen *et al.* (2008) found that the most successful bowling strategy is to utilise specialist bowlers during the first and last six overs of a match and bowlers being more defensive and harder to score from being utilised in the middle eight overs. Additionally, both winning and losing teams averaged nine bowling changes during the innings which had no substantial effect on the chance of winning (Petersen *et al.*, 2008).

Justham *et al.* (2008) undertook a study based on bowling tactics using only three right arm bowlers (a fast bowler, a medium paced bowler and an off-spin bowler) playing three formats of cricket; Test match, 50 over cricket and T20. Within the study the authors found that despite the batsmen's playing style becoming more aggressive within the T20 format of the game; the bowlers did not alter their bowling style (Justham *et al.*, 2008).

Although there are limited studies which analyse the performance of teams batting first or second Petersen *et al.* (2008) presented results indicating that bowlers with the appropriate bowling strategy have a greater influence on the game outcome when compared to batting.

## 2.9 Fielding

Fielders have a very important task at hand when it comes down to dismissing a batsman, and this can be achieved in various ways (MacDonald *et al.*, 2013). The role of fielders is comprised of various factors including of which the most important is saving runs. MacDonald *et al.* (2013) also mentions that it is important for fielders to maintain an adequate level of concentration on every ball of the innings, regardless of their positions. Levels of concentration will vary due to the match format being played. Thus, it could range from 90 minutes in a T20 innings to a total of 6 hours per day in a test match.

Placing of fielders have a tremendous impact on the game and potentially the outcome of a match. Placing of fielders will vary according to the specific skill level, cricket field size, match format and game performance conditions (MacDonald *et al.*, 2013). Research done by MacDonald *et al.* (2013) concluded that the three fielding positions which require most skill and involvement in the game include cover, mid-off and mid-on respectively.

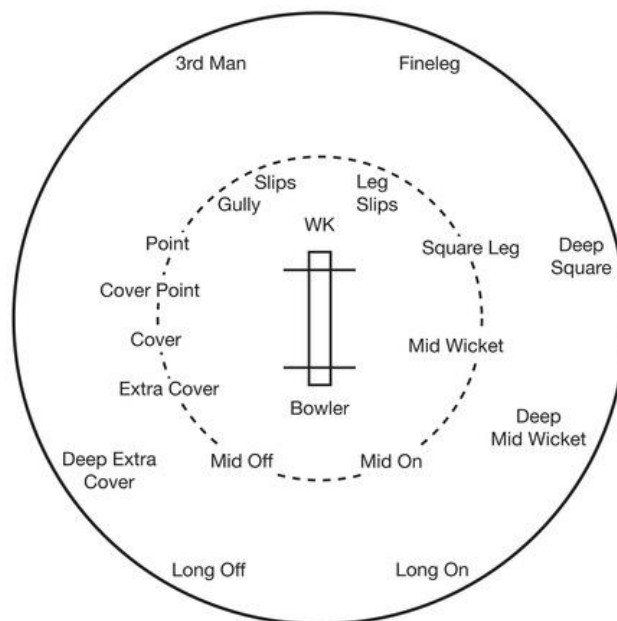


Figure 1.2 Cricket fielding positions (Go Harsh 2011)

### 2.9.1 Field Restrictions

As part of fast paced limited overs cricket, the ICC introduced power play overs in 2005 (Silva *et al.*, 2015). Field restrictions, in the case of T20 cricket, is known as a “power play” being initiated. During this action only two fielders are allowed outside of the 30 yard (27.4m) circle (marked by a white line) on the field (Douglas & Tam, 2010). Fielding restrictions are introduced in limited over matches. These rules restrict the fielding captain to: keep nine fielders within a 30-yard circle for the first six overs (Bhattacharjee *et al.*, 2016). The nine fielders include the bowler and wicket keeper (Bhattacharjee *et al.*, 2016).



Figure 1.3 - Power -play field restriction illustration (Sharma 2018)

Silva *et al.* (2015) remarked that the power play overs favour the batting team. The power play overs are thought to make run scoring easier and faster. Although run scoring is faster, the power play overs also correspond with the loss of wickets as pressure usually increases on the batsmen with less time to perform in T20 matches. Silva *et al.* (2015) suggested the shortened version, that is T20 cricket, has an optimal placement of the power play overs.

## 2.10 Team Selection and Batting Order

Good team selection is a vital aspect for success in all team sports. Nowadays, team selection is a very subjective decision making procedure and is controlled by coaches and captains using their gut feel or a player's current form and performance (Bharathans *et al.*, 2015). Currently most of the team selections are being done using different heuristics, past experience or at most some basic methodologies (Bharathans *et al.*, 2015).

Selection of a cricket team under various constraints such as number of batsmen, bowlers, all-rounders and a wicket keeper is a complex task, as the management team are required to consider a number of qualitative and quantitative attributes namely: individual skills, performance statistics, physical fitness, psychological factors, injuries as well as being challenged by only allowing 4 international players and 7 Indian players in the starting XI (Bharathans *et al.*, 2015).

There are numerous performance variables, which should be considered when a player's performance is measured, but it is important to know and distinguish whether all variables should be considered for player evaluation or only a subset of variables (Bharathans *et al.*, 2015).

In the same study done by Bharathans *et al.* (2015), stipulates that player selection include the evaluation of a player across multiple dimensions namely: batting and bowling performance variables based on the role in the team compared to the specific opponent.

Optimal line-ups within T20 cricket consists of three components namely: team selection, batting order and bowling order (Perera *et al.*, 2015).

When it comes to the tradition of batting order in cricket, it is a known fact that the order in which the batsmen will take the field is strategically arranged from superior batsmen, at the front of the line-up, to inferior batsmen towards the rear of the batting order (Swartz *et al.*, 2006). Combining partnerships in a batting order requires a balance of various factors such as; effective batsmen pairs and team psychology (Swartz *et al.*, 2006). The batting order seems to become a trade-off between science and a delicate art used by coaches and captains (Swartz *et al.*, 2006).

Schaefer (2018) implies that scoring runs and more specifically scoring sixes for the team batting first suggests that being more aggressive in stroke play and general batting approach when batting first puts the bowlers under pressure. With this suggestion, it is clear that it puts the bowling team's batsmen under pressure even before they have their chance to chase the runs total, therefore it is clear that batting order is of importance (Schaefer, 2018).

Nadjan *et al.* (2014) suggests that team selection should be based on batsmen that have the required skillsets to take low risk decisions but still score boundaries during the first 10 overs of an innings, capable of scoring boundary 4's while not taking significant risks looking to score boundary 6's.

### **2.11 Environmental and External Factors**

Cricket is a game with various factors affecting the outcome of a match; the weather, the pitch, the players as well as the spectators attending the match (Bukiet & Ovens, 2006).

Factors such as the season, pitch and weather conditions have a direct influence on batting performance (Lemmer, 2011). Within the T20 format a cricket batsman should not only get a good score, but the faster the player gets, the better (Lemmer, 2011). The cricket pitch is regarded as detrimental within cricket and often the pitch is prepared by its curator keeping in mind the strengths and weaknesses of the home team (Saika & Bhattacharjee, 2010). During the winter season, day-night matches get much affected by dew drops which could make playing conditions difficult on the pitch for batsmen and the grip of the ball for bowlers (Saika & Bhattacharjee, 2010).

### **2.12 Coin Toss and Home Advantage**

For a cricket match to start a coin is tossed and the team that wins the toss is provided with an opportunity to choose between batting or fielding first. Thus, the team winning the toss, gains an advantage of taking the benefit of the playing conditioning such as the pitch condition, weather conditions and crowd advantage by choosing to bat or to field first whereas the team choosing to bat second has the advantage of knowing the



rate at which scoring is to be done (run rate), in order to win the game (Saikia & Bhattacharjee, 2010).

Within sport it is evident that a team playing at its home ground is supposed to have several advantages. This is due to the home crowd supporting their team, in addition to that the team playing at home is well aware of the weather and some other ground specific features that may influence the performance of players (Saikia & Bhattacharjee, 2010). However, Saikia and Bhattacharjee (2010) found that the home team does not gain any significant advantage in the matches played at its home ground, however the result of a coin toss has got a significant impact on the outcome of a match. Saikia and Bhattacharjee (2010) maintains that the outcome of the toss loses its significance in the context of the result of a T20 match. T20 cricket tends to be more competitive than any other cricket formats and also indicates that a team will win or lose a T20 match based on its performance without being dependent on the result of the toss or/and venue of the match (Saikia & Bhattacharjee, 2010).

### **2.13 Performance Analysis**

Cricket is one of various sports in which statistics feature heavily and the specific batting, bowling and fielding statistics within every match gives clear picture of each and every facet of cricket (Prakash *et al.*, 2016). Najdan *et al.* (2014) maintains that very little performance analysis research has been conducted on T20 cricket to date, and further research is required as the dynamics of the game are very different to that of the longer cricket match formats. Therefore, within the context of this current study, the key performance indicators sustaining successful performance have yet to be identified.

Sports performance is vital in the development of professional athletes in order to perform optimally at a professional level. Therefore by making use of sport performance indicators and the management thereof has been regarded as an area of interest for coaches and performance personnel in order to develop athletes to perform at high level of sporting excellence (Halvorsen *et al.*, 2013). According to Davenport and Harris (2007), analytics can be classified as descriptive and predictive which is effective for this study. Descriptive analytics entails the gathering and organising of data with the aim of dealing with the qualities of data (Davenport & Harris,

2007). Reasons for this can be anything from commentators having something interesting to talk about, to using statistics for a cricket player ranking system, and statistics are also used to calculate odds on sport bets (Chadwick & Arthur, 2010).

Additionally, predictive analytics provide suggestions for implementing solutions to occurring problems (Davenport & Harris, 2007). Often being disregarded, Perera, (2015) identified sports analytics to be a major determining factor in the occurrence of various problems associated with sports, such as the ranking of teams, ranking of player and team performances which in turn directly influences negotiation of player contracts, physical and mental training and strategies for winning games. The game of cricket produces lots of numerical information, and is one of those sports that have involved statisticians from the start (Lemmer *et al.*, 2014). Research done entailing performance analysis conducted in cricket, has focused on the 50 overs version of the game (Najdan *et al.*, 2014). Studies suggest that there are currently limited literature conducted on T20 cricket, therefore the main outcome measures associated with performance have not been clearly identified.

There has been a fair amount of research done on performance analysis of cricket players in the literature but few research has been done on specific performance indicators differentiates between winning and losing teams. Researchers have used various statistical methods in order to identify specific cricket performance indicators. Petersen *et al.* (2008) elaborated on the performance analysis of IPLT20 cricket between winning and losing teams by making use of the effect size statistical method. Petersen *et al.* (2008) ranked effect sizes from highest to lowest to identify which performance indicators were most closely associated with successful performance. Najjan *et al.* (2014) also made use of the effect size statistical methods in order to determine determinants of success in T20 cricket. Manage *et al.* (2013) applied the first principal component method to rank T20 batsmen and bowlers. This method is useful to quantify a players' contribution, which could lead to a ranking structure based on their performances. Sharma (2013) showed how the factor analysis approach could be useful to identify the performance analysis of the players in the IPLT20.

Hughes and Bartlett (2002) define a performance indicator as a selection, or combination of action variables that aim to define some or all aspects of a performance. The analysis of recorded cricket statistics such as batting averages,

bowling economy, batting strike rate and wickets taken, is used to rate the efficiency of individual players and in turn the entire team (Stretch *et al.*, 2000). Batting and bowling statistics feature heavily and is currently used by performance personnel as a tool for illustration, comparison and predicting outcomes of matches (Manage & Scariano, 2013; Kimber & Hansford, 1993). Batting and bowling performance indicators used within the game of cricket and applicable to this study includes: total runs, batting average, batting strike rate, fours, sixes, wickets taken, bowling average, strike rate and economy rate (Manage & Scariano, 2013). Petersen *et al.* (2008a) suggests that teams participating in the IPLT20 matches hit 79% more boundary sixes than compared to 50-over cricket matches. Petersen *et al.* (2008a) also identified that IPLT20 cricket teams have a 58% higher run rate than those in 50-over cricket matches. Thus 50-over cricket performance indicators include greater occurrence of 50+ partnerships, whereas in 20-over matches, taking wickets in the last 6 overs and limiting the run rate can change the outcome of a match tremendously (Petersen *et al.*, 2008b). Davis *et al.* (2015) states that run differential are the key performance indicator of team performance. Additionally, Davis *et al.* (2015) also states that other factors such as batting position should be considered as it is easier to score runs for an opening batsmen than a batsman who bats in position 7. Petersen *et al.* (2008a) suggests that taking more wickets, particularly during the final six overs of the innings and having a greater run rate per over are the most significant indicators of success. Thus, successful teams are those that best achieve both batting and bowling performance indicators (Petersen *et al.*, 2008b).

Batting slowly in a T20I cricket match puts pressure on the batting team and forces an increase in aggressive batting (Bhattacharjee & Lemmer, 2016). Schaefer *et al.* (2017) showed that scoring runs in the first five overs of a T20I cricket match is important for both teams batting first and second. Additionally, Douglas and Tam (2017) recently concluded that the top 5 performance indicators for success in the IPLT20 tournament were the ability to losing less wickets in the game, losing less wickets in the power play while batting, scoring more runs per over, scoring more runs in the middle eight overs, and bowling more dot balls. For teams batting first scoring more sixes in the match increases the probability of success while teams batting second, scoring more fours in a match increases the probability of success (Schaefer *et al.*, 2017). Additionally Peterson *et al.* (2008) suggested that the three best indicators of success

in the IPLT20 were taking more wickets in the game, taking more wickets in the last six overs and having a higher run rate. Additionally in the same study, winning teams captured more wickets particularly in the first and last six overs and were more effective in containing the opposition teams' run scoring in the middle eight overs (Petersen *et al.*, 2008).

According to MacDonald *et al.* (2013) fielding is a detrimental performance indicator within cricket due to all players being obliged to field, whereas Lemmer (2008) concluded the result of a match depends on team effort and not only individual performances. Norman and Clarke (2010) suggested that cricket pitches are prepared in favour of batsmen for T20 and ODI matches. Batting in T20I is seen by supporters to be the main attraction of cricket and drives the result of cricket. Hughes and Bartlett (2010) state that by using batting as a measure of performance in a cricket match is difficult in the absence of a measure of bowling as a performance variable.

The major differences between winning and losing teams in the 2008 IPLT20 tournament were that winning teams took more wickets and maintained a higher run rate, while losing teams scored a higher proportion of their runs from singles (Peterson *et al.*, 2008).

From this study it can be concluded that the top four batsmen are in most cases more important to winning the cricket match than others. Additionally, scoring runs in the first five overs of a T20I cricket match is significant for both teams batting first and second, therefore batting aggressively and scoring runs quickly in the first five overs is essential to winning a T20I cricket match (Schaefer, 2018). In the same study done by Schaefer (2018) results concluded that scoring runs amongst the top four batsmen batting second is an important aspect to winning, whereas for teams batting first scoring runs quickly at the end of the innings is a winning strategy. Along with the specific batting order being quite significant, so is the amount of sixes scored during a cricket match, whereas the amount of fours scored has got no significance to winning matches (Schaefer, 2018).

Various researchers have done a number of statistical analyses which have been used in sports analytics. In a study done by Douglas and Tam (2010) they used inferential statistics such as the Students t-test and the Cohen's d-test in order to investigate statistical differences between various performance variables and winning. The results

of this study provided insightful information concerning the main differences between winning and losing teams. Although the study did investigate the differences between winning and losing teams, the study did not create any analysis that could be used for predicting success in future cricket matches which is regarded as a shortcoming in the research done. The univariate logistic regression is a powerful statistical tool for analysing the differences between winning and losing cricket teams as well as creating a base for future prediction models (Peng *et al.*, 2002).

Keeping the various research methods in mind, in this paper a study has been carried out using the factor analysis approach, similarly to Sharma (2013). Factor analysis is one of the widely used methods multivariate data analysis (Hair *et al.*, 2007). The purpose of factor analysis is to study the interrelationship among variables in an effort to find a new set of factors fewer in number than the original variables as supported by (Sharma, 2013). The method of factor analysis which has been successfully used to explain an important hypothesis in cricket in is the reason for applying this method to this study.

## **2.14 Summary**

This review explained various components important and applicable for overall cricketing performance. There are quite a few differences between the various formats of cricket and the differences has a direct influence on various performance variables, which differs between the three cricketing formats. There are various performance factors influencing the outcome (winning and losing) of matches. The performance variables used to predict the outcome of a match will be different between teams batting first and second. Analysis of statistics between various IPLT20 teams for winning and losing will reveal which performance indicators most significantly affect the winning and losing of an IPLT20 cricket match.

Performance and management teams of various IPLT20 teams should take all physical demands of every match into consideration as each match has got an influence on the next match (Peterson *et al.*, 2011). Thus an analysis of batting variables that include but are not limited to the number of number wickets lost in the match, wickets lost in the power play, total runs scored, fours and sixes scored may

be used to predict future success or failure of a team in the IPLT20 tournament. An analysis of bowling variables that include but are not limited to the number of wickets taken and wickets taken in the power play may be used to predict future success or failure of a team in each format of the game in the IPLT20 tournament.

Determining the performance indicators which most significantly affect the winning and losing of IPLT20 cricket matches could provide the performance and management staff with a better understanding of what is required of each player to be successful in this format of cricket. The review of the literature also indicates that more research is needed in this field of research.

## **CHAPTER 3: Methodology**

### **3.1 Introduction**

The aim of this research project were to determine the performance indicators that most significantly affect the outcome of the IPLT20 by examining various performance indicators relating to cricket performances such as batting, bowling and fielding statistics within the Indian Premier League from 2015 to 2017, and how it had an influence on various external factors, which will be discussed further in the study. This chapter further elaborates on the study designed and methodology which were used in order to clarify the research question. Factors relevant to the research process for this study includes the theoretical perspectives on research methodology and design, participants, data collection procedure, equipment to be used, analysis and description of the collected data.

### **3.2 Theoretical Perspectives on Research Design and Methodology**

Research is regarded as a body of knowledge and is used to determine how things are as compared to how they might be (Thomas *et al.*, 2015). Research can be qualitative or quantitative. Quantitative research allows for findings to be based on generalization, accept or reject theoretical propositions whereas qualitative research is composed of the understanding of a phenomenon, and a new theory (Jones, 2015). The significant difference between quantitative and qualitative research is the expression of information. Quantitative research includes data which is objective – numerical, therefore statistical analysis is used and qualitative research includes data which is subjective – in the form of words where individual interpretation is used within the analysis (Jones, 2015).

### **3.3 Study Design**

The study design of a research project has been regarded as vital in the research process and contributes to the guidance assist the researcher to help gather information (Welman *et al.*, 2005). This study is a quantitative study with the use of an observational design to determine which performance variables had an influence on performance in the IPLT20 competition, using factor analysis. The purpose of factor analysis is to study the interrelationship among variables in an effort to find a new set

of factors fewer in number than the original variables (Sharma, 2013). According to Jones (2015), quantitative research focus, is concise with logistic and deductive reasoning. Furthermore, quantitative research allows for a cause-and-effect relationship occurrence with the describing and understanding of relationships and with that determining the causality among variables (Burns & Grove, 2001).

Statistical data from Cricinfo.com were analyzed to investigate performance indicators influencing cricket analytics in the IPLT20 competition from 2015 to 2017. Sharma (2013) identified various indicators and therefore the prevalence of the following indicators will be examined: batting average, highest total runs per game, strike rate, fours, and sixes, bowling average, economy, strike rate and wickets taken.

### **3.4 Study Participants**

Participants were arranged in the form of teams. A total of 150 professional cricket matches played in the Indian Premier League over 3 seasons were observed and analysed. The match data were gathered on ESPN Cricinfo which archives all performance statistics for every team and match played by means of ball by ball commentary and match score cards (Cricinfo, 2009). Cricinfo is public domain and can be accessed by any individual.

Due to the international availability of the statistical data on the Cricinfo website, this study included the following six teams: Delhi Daredevils, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Royal Challengers Bangalore and Sunrisers Hyderabad. All procedures were submitted for approval to the Department of Exercise and Sport Sciences and the Health Sciences Research Ethics committee of the University of the Free State.

#### **3.4.1 Sampling**

For the purpose of this study, stratified-simple random sampling were used to determine participants. By making use of a too small sample will give unreliable results therefore six teams were chosen to participate in this study. Due to the international availability of the statistical data, practical considerations such as funding and time to collect data will not negatively influence the sample selection size. The IPLT20 is usually contested by eight to nine teams but for this study only six teams were used



due to these teams being available in all applicable seasons, therefore biased sampling is not intentional but rather practical with regards to a fair comparison of teams and players involved.

#### **3.4.1.1 Inclusion & Exclusion Criteria**

Inclusion:

1. The team must be included in any of the six participating IPLT20 teams chosen for this study.
2. The team must be listed on the cricinfo.com website.
3. The team must have appeared in all 3 seasons (2015, 2016 and 2017) of the IPLT20.

Exclusion:

1. Teams who did not adhere to the inclusion criteria.

#### **3.4.1.2 Withdrawal of Study Participants**

Teams breaching the international cricket rules and regulations will be withdrawn from the study.

### **3.5 Data Collection Procedure**

A quantitative study with an observational design by means of retrospective data analysis was used to determine batting and bowling performance variables that correlate the highest with the success of a team in IPLT20 cricket. Data from the years 2015, 2016 and 2017 Indian Premier League T20 Tournament were collected from Cricinfo. All data was captured in Microsoft Excel 2013 and subsequently converted into a SAS data set. Data were statistically analysed to evaluate and compare the variables for winning and losing IPLT20 cricket teams. The following variables were analysed in this study: total runs scored, max runs scored, number of fours, number of sixes scored in a cricket match, as well as wickets lost, wickets lost in the power play, wickets taken in the match and wickets taken in the power play. In this research, a strong and reliable data source were essential which was found in Statsguru. Statsguru is ESPN Cricinfo's cricket statistics maintenance database. This database stores all match data with live ball by ball commentary (Munir *et al.*, 2015). ESPN

Cricinfo is considered to be a reliable source as it is used in professional cricket as well as being referenced by many published authors.

### **3.6 Equipment / Measurement**

#### **3.6.1 Specifications**

The data were obtained from *Statsguru*, the cricket statistics database on the Cricinfo website, using the R package *cricket* (Ganesh, 2016). ESPN Cricinfo is a sports news website in which various cricketing statistics can be withdrawn and used by the public. The website corresponds international sporting news, articles, live coverage and *Statsguru*, which holds the database of cricket matches and players since the 18<sup>th</sup> century. Cricinfo is public domain and can be accessed by any individual by means of the internet.

#### **3.6.2 Validity and Reliability**

Collection of a large dataset is the main perspective of a data mining and machine learning research and collecting data with proper understanding from reliable source is most important. In this research, a strong and reliable data source is needed which was found in *Statsguru*. The ESPN Cricinfo statistics maintenance database is known as *Statsguru*, where all the data relating to all the matches of cricket are saved and published. Cricinfo is a website that is referenced by other journal articles such as: Bhattacharjee and Pahinkar (2012). In order to evaluate the study's reliability, the measurement methods were evaluated. In this study no tests or experiments were used. Archival data were observed and recorded. An observational design does entail the risk of random errors made by the observer or within the Cricinfo website. The observation of enough data will occur for these random errors to be minimal to none. The data which were extracted from Cricinfo, were selected according to participating teams and is specific to the topic of the study and will aid in completing the objectives of the study. There is much valuable information hidden in cricket data. However, the quantity of the data is becoming too large to handle. Over 80 000 cricket matches has been played until 2019. ESPN Cricinfo, itself, carries over 3700 ODI match and 552 T20 match scorecards and ball-to-ball data details (Nair, 2016).

An intra-observer and inter-observer reliability test were conducted by Claybrook (2015) on Match 3 between Ireland and Zimbabwe at Sylhet and Match 7 between Netherlands and Zimbabwe at Sylhet. For the intra-observer test the author recoded these two games a month after the initial coding. A second observer, an experienced cricketer also coded the matches once. The author's two observations were compared using Altman's (1991) Kappa Analysis to provide an intra-observer reliability value. The author's first observation was then also compared to the second observer's data using the same analysis to provide an inter-observer reliability value.

The lowest intra-observer Kappa value identified is 0.99. While the lowest inter-observer value was 0.97. These provide figures very good strength of agreement between observations based on Altman (1991) Kappa analysis. Differences between the author and second observer's data can be explained by a coding error in which the second observer identified a run out as a wicket to the bowler. Other marginal differences found between the author's two observations and the second observer data can be explained by lapses in concentration during the coding process. Intra-observer and inter-observer reliability test for determination of bowler type (seam and spin) was of perfect agreement (Kappa=1).

### **3.6.3 Limitations**

Expensive equipment is the main reason why this study did not make use of time motion and notational systems that are commonly used in a variety of sports at the present time. ESPN's Cricinfo statistics is internationally available and appropriate to meet the objectives of this study.

### **3.7 Pilot Study**

A pilot study were not applicable to this study as no equipment or testing procedures is needed for data collection.

## **3.8 Analysis of Data**

### **3.8.1 Data**

Data from 25 IPLT20 cricket matches over three IPLT20 seasons was available, comprising, among others, for each team participating in these matches the following data:

### **3.8.2 Dependent variable:**

- Win / loss

### **3.8.3 Performance characteristics (predictor/independent variables):**

- total runs scored by a team
- maximum individual runs scored
- total fours
- total sixes
- wickets lost in the match
- wickets lost in the power play
- wickets taken in match
- wickets taken in power play

### **3.8.4 Objective**

To identify significant predictors for winning the match among the performance characteristics.

### **3.8.5 Statistical Analysis**

Data obtained from the IPLT20 matches were recorded in Microsoft Excel. The data was then analysed using the SAS statistical software (SAS, 2017).

A total of 150 IPLT20 cricket matches between 2015 and 2017 were captured. Six teams were selected for the purpose of this study, namely Delhi Daredevils, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Royal Challengers Bangalore and Sunrisers Hyderabad. These teams all participated in all three season from 2015 to 2017. Fifty matches per season records were randomly selected and observed.

Due to the different match situations faced by the team batting first and second, respectively, the data were analysed separately for the teams batting first and for the teams batting second. The outcome of the match is a binary variable (win/lose) since drawn matches and matches influenced by the Duckworth-Lewis system were excluded from the study. The association of the potential predictor variables with the match outcome was analysed using univariate logistic regression, fitting each predictor variable, one at a time. The statistical significance of each predictor variable was tested using an exact test (exact conditional logistic regression). Furthermore, an odds ratio and associated 95% confidence interval is reported which reflects the effect (that is, the increase in the odds of winning) associated with an increase of one unit of the predictor variable. The analysis was carried out using SAS procedure LOGISTIC (SAS, 2017).

#### 3.8.5.1 Simple logistic regression

Simple (univariate) logistic regressions were carried out whereby the dependent variable was regressed against each of the independent variables, one independent variable at a time.

#### 3.8.5.2 Multiple logistic regression

Multiple (multivariate) logistic regressions were carried out whereby the dependent variable was regressed against the full set of independent variables.

#### 3.8.5.3 Multiple logistic regression with model selection

Multiple (multivariate) logistic regressions were carried out whereby the dependent variable was regressed against the full set of independent variables. Stepwise model selection was used. Starting with the intercept in the model, at each step of the stepwise procedure the score chi-square statistic is calculated for each effect not yet in the model. If the largest of these statistics is significant at the 0.1 significance level (SL entry=0.1), the corresponding effect is added to the model. Then the Wald test statistic for all effects in the model is calculated, and the least significant effect is removed if it is not significant 0.1 significance level (SL stay=0.1). The stepwise procedure terminates if no further effect can be added to the model, or if the current model is identical to a previously fitted model (SAS 2017).

Data were extracted from Cricinfo and recorded in an Excel spreadsheet to be stored on various backup software. Further analysis will be done by a biostatistician using the recommended software and mathematical methodologies to be converted into a SAS data set. The connotation of the performance indicators which will be the determining factors in this study with regards to the outcome of a match will be analysed using univariate logistic regression, fitting each predictor indicators separately.

The statistical significance of each performance variable will be tested using an exact test (exact conditional logistic regression); the exact P-value will be reported. Furthermore, an odds ratio and associated 95% confidence interval will be reported. Means, standard deviations, frequencies and percentages will be calculated for categorical data while significance will be set at  $P < 0.05$  for comparative analysis. All values will be presented as mean and graphed to show possible variations between performance variable and the influence thereof on performance output.

### **3.9 Implementation of Findings**

Knowledge of cricket performance is important and often disregarded. Cricket analytics has been identified as a major determining factor in the occurrence of various problems associated with sports, such as the ranking of teams, ranking of players and team performances which directly influences negotiation of player contracts, physical and mental training and strategies for winning games (Perera, 2015).

With these findings, performance personnel can educate and practice this as a tool for illustration, comparison and predicting outcomes of games (Manage & Scariano, 2013; Kimber & Hansford, 1993).

### **3.10 Ethical Aspects**

Ethical clearance and permission in order to conduct the abovementioned research were obtained in writing from the following professional bodies:

- The Health Sciences Research Ethics committee of the University of the Free State;
- The Department of Exercise and Sport Sciences at the University of the Free State

The research proposal has been submitted to The Health Sciences Research Ethics Committee of the University of the Free State for approval.  
Ethical Clearance number: UFS-HSD2018/0843/3107

## CHAPTER 4: Results

### 4.1 Introduction

Cricket is one of the sports which is dominated by statistics, and the batting, bowling and fielding statistics of a match gives a clear picture of various facets within cricket (Prakash *et al.*, 2016) According to Bhattacharjee and Pahinkar (2012), a team's performance is not defined through a single cricket indicator. Therefore, various performance indicators must be considered and their influence in the IPLT20 format (Bhattacharjee & Pahinkar, 2012).

Cricket is a game of technical finesse consisting of various performance variables, which may influence overall cricket performance by a team (Schaefer, 2018). Mukherjee (2014) suggested that the quantification of individual cricket performances based on averages is of importance. The current study investigated performance variables based on team averages, rather than the performance characteristics of individual players. Studies by Schaefer (2018), Irvine and Kennedy (2017), and Douglas and Tam (2010) provide extensive evidence that statistical analysis of performance variables will assist in determining how specific performance variables can distinguish between winning and losing a match.

There is a lack of recent research on the identification of specific statistical differences between the winning and losing team in a cricket match, especially when dividing the winning and losing teams into batting first and second. Lemmer *et al.* (2014) stated that predicting the outcome of a match in any sport is difficult due to various influential performance indicators. Therefore, it is necessary to review the important aspects of batting and bowling in order to understand why the analysis of cricket statistics is a research field worth pursuing. Analysing individual batting performance is important but some researchers, such as Mukherjee (2013) suggest that the manner in which cricket players perform as part of a team is also just as important.

Determining predictors of winning in ODI cricket can provide performance and management personnel with a better understanding of what is required of a team to be successful in the T20 format of cricket. Therefore, this study will identify performance variables by means of statistics that discriminate between winning and losing teams. Furthermore, the study will reveal which variables correlate the highest



with successful outcomes within the T20 format of the game for teams batting first or second.

## 4.2 Results

### 4.2.1 Batting First and Second

Table 1 and Table 2 present the mean values of each potential predictor variable, respectively for the winning and losing teams; Table 1 presents the data for teams batting first and Table 2 for teams batting second. Statistical significance was set at the 95% confidence interval ( $p < 0.05$ ).

Table 1 indicates statistically significant differences between winning and losing teams with regard to total runs scored, maximum individual runs scored, total fours, total sixes, wickets lost in the match, wickets lost in the power play (PP), wickets taken in the match and wickets taken in the power play (PP).

Table 1. Team batting first: mean values of potential predictors for winning and losing teams

Team potential predictor of success	Means		p value <sup>a</sup>
	Lose	Win	
Total runs	141.13	172.79	0.0001
Max individual runs	51.5	69.3	0.0014
Total fours	11.72	15.49	0.0016
Total sixes	5.41	7.35	0.0266
Wickets lost match	6.78	4.53	<.0001
Wickets lost PP	1.56	0.95	0.0275
Wickets taken match	3.91	7.42	<.0001
Wickets taken PP	1.22	1.91	0.0243

\* Statistically significant;

<sup>a</sup>p-value from univariate logistic regression analysis (exact conditional score test)

Table 2 shows the significant differences between wickets taken and lost for teams batting second.

Table 2. Team batting second: mean values of potential predictors for winning and losing teams

Team potential predictor of success	Means		p value <sup>a</sup>
	Lose	Win	
Total runs	139.7	141.25	0.8474
Max individual runs	50.26	57.09	0.1092
Total fours	12.49	13.53	0.3199
Total sixes	5.12	5.22	0.9088
Wickets lost match	7.42	3.91	<.0001
Wickets lost PP	1.91	1.22	0.0243
Wickets taken match	4.53	6.78	<.0001
Wickets taken PP	0.95	1.56	0.0275

\* Statistically significant;

<sup>a</sup>p-value from univariate logistic regression analysis (exact conditional score test)

Tables 3 and 4 represent the results of the statistical analysis completed using a univariate logistic regression. Table 3 represents the results for teams batting first. Table 4 represents the results for teams batting second.

Table 3. Univariate logistic regression: Predictors of match outcome; Team batting first

Predictor Variable	<sup>a</sup> 95% CI	Odds ratio	p Value <sup>b</sup>	Test Statistic <sup>b</sup>
Total runs	1.014 to 1.054	1.032	0.0001	10.7692
Max individual runs	1.013 to 1.063	1.036	0.0014	9.4658
Total fours	1.058 to 1.325	1.177	0.0016	9.2488
Total sixes	1.017 to 1.406	1.182	0.0266	4.5471
Wickets lost match	0.434 to 0.766	0.588	<.0001	17.8994
Wickets lost PP	0.374 to 0.951	0.608	0.0275	5.3237
Wickets taken match	1.576 to 3.326	2.191	<.0001	31.1595
Wickets taken PP	1.057 to 2.607	1.612	0.0243	5.2802

Note:<sup>a</sup>Profile likelihood confidence interval; <sup>b</sup>Exact conditional score test

Table 3 presents the odds ratio (odds of winning) with 95% CIs. The odds ratio for a variable in the logistic regression represents how the odds change with a 1-unit increase of that variable. Table 3 shows that the highest odds ratio for bowling is wickets taken per match. This means that for every increase in wickets taken by one wicket, increases the odds of winning by 2.191. Table 3 also shows the highest odds ratio for batting is sixes scored. This means that for every increase in sixes scored by one six, increases the odds of winning by 1.182.

Tables 1 and 3 show the reliance on total runs, wickets lost in the match and wickets taken in the match for the team batting first in the IPLT20.

Table 4. Univariate logistic regression: Predictors of match outcome; Team batting second

Predictor Variable	<sup>a</sup> 95% CI	Odds ratio	p Value <sup>b</sup>	Test Statistic <sup>b</sup>
Total runs	0.988 to 1.016	1.001	0.8474	0.041
Max individual runs	0.995 to 1.050	1.022	0.1092	2.6129
Total fours	0.949 to 1.183	1.057	0.3199	1.0572
Total sixes	0.860 to 1.190	1.012	0.9088	0.0228
Wickets lost match	0.301 to 0.635	0.456	<.0001	31.1595
Wickets lost PP	0.384 to 0.946	0.620	0.0243	5.2802
Wickets taken match	1.305 to 2.303	1.700	<.0001	17.8994
Wickets taken PP	1.052 to 2.676	1.645	0.0275	5.3237

Note: <sup>a</sup>Profile likelihood confidence interval; <sup>b</sup>Exact conditional score test

Tables 2 and 4 show the reliance on wickets lost in the match and wickets taken in the match for the team batting second in the IPLT20.

#### 4.2.2 Total Runs Scored

Teams batting first and winning (BFW) scored on average (M=172.79) total runs. Teams batting second and winning (BSW) scored on average (M=141.25) total runs.

According to the univariate logistic regression total runs scored are positively related to winning the match for teams batting first (p=0.0001). That is to say, the higher the number of runs scored in a match by the IPLT20 team batting first the higher the probability that the team has of winning the cricket match. The increase in probability of success is shown in Figure 1.4 and Figure 1.5.

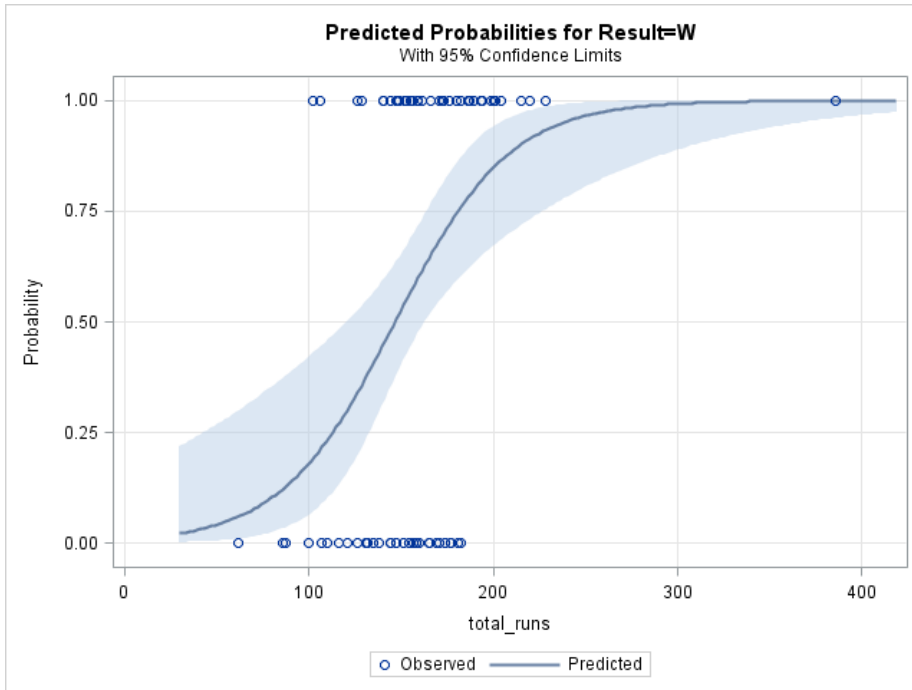


Figure 1.4. Probability graph for total runs scored in a match when batting first.

The small increase in probability of success as a function of the total runs scored for teams batting second – shown in Figure 1.5. This variable is not significantly related to winning ( $p=0.8474$ ).

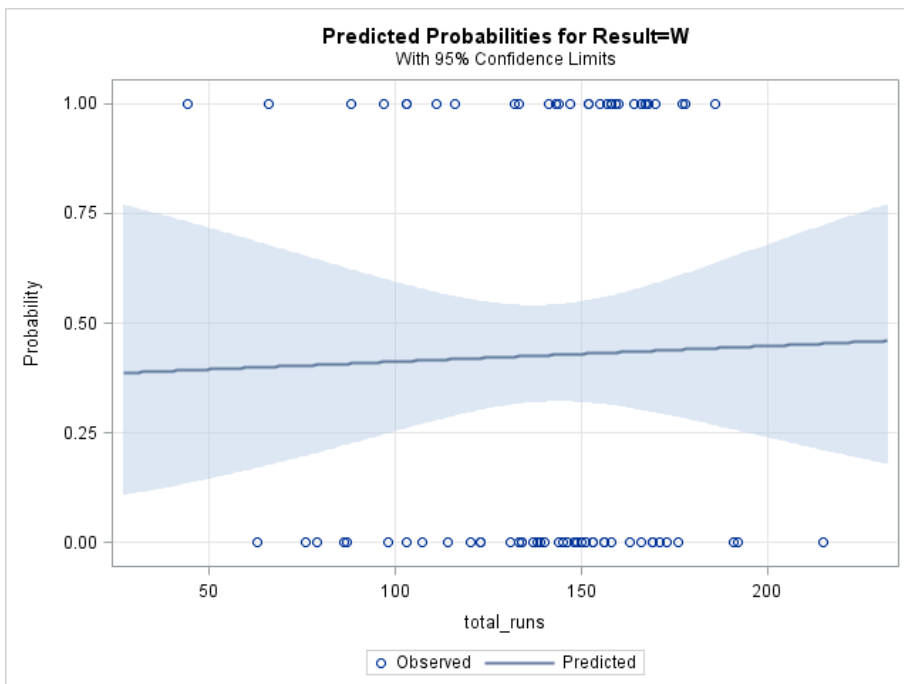


Figure 1.5. Probability graph for total runs scored in a match when batting second.

### 4.2.3 Maximum Runs

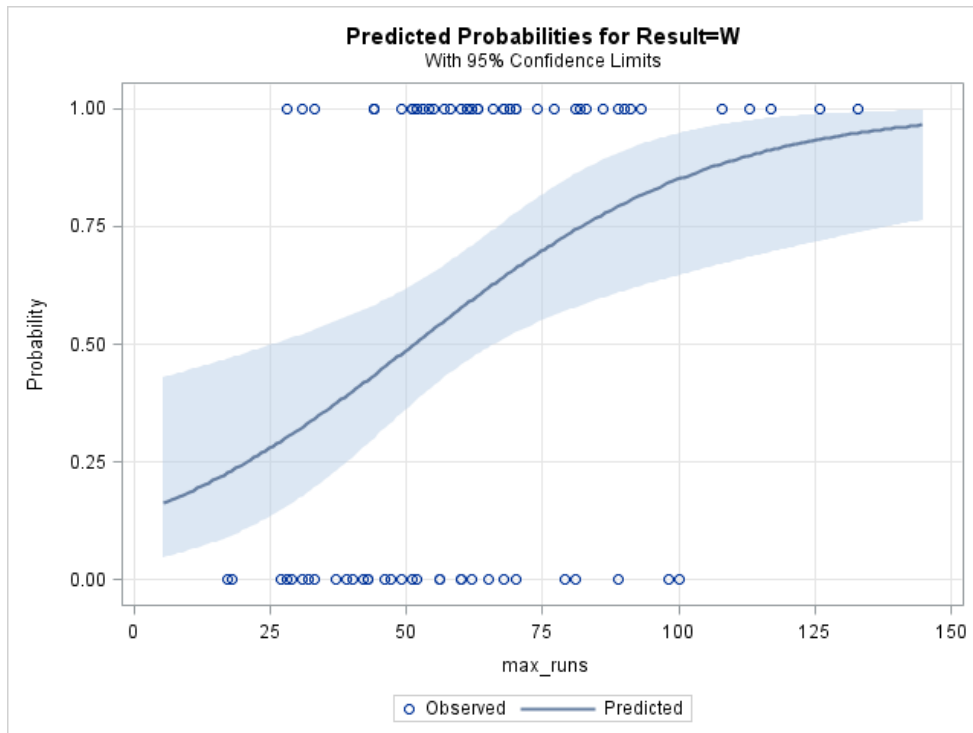


Figure 1.6. Probability graph for maximum individual runs scored in a match when batting first.

According to the univariate logistic regression the highest individual runs scored by a batsman are positively related to winning the match for the teams batting first ( $p=0.0014$ ). This means that the higher the maximum individual runs scored by a batsman in an IPLT20 team, the higher the probability that the team has of winning the cricket match. The increase in probability of success is shown in Figure 1.6. The higher maximum individual runs scored by a batsman in an IPLT20 team for teams batting second is not significantly related ( $p=0.1092$ ) – Figure 1.7.

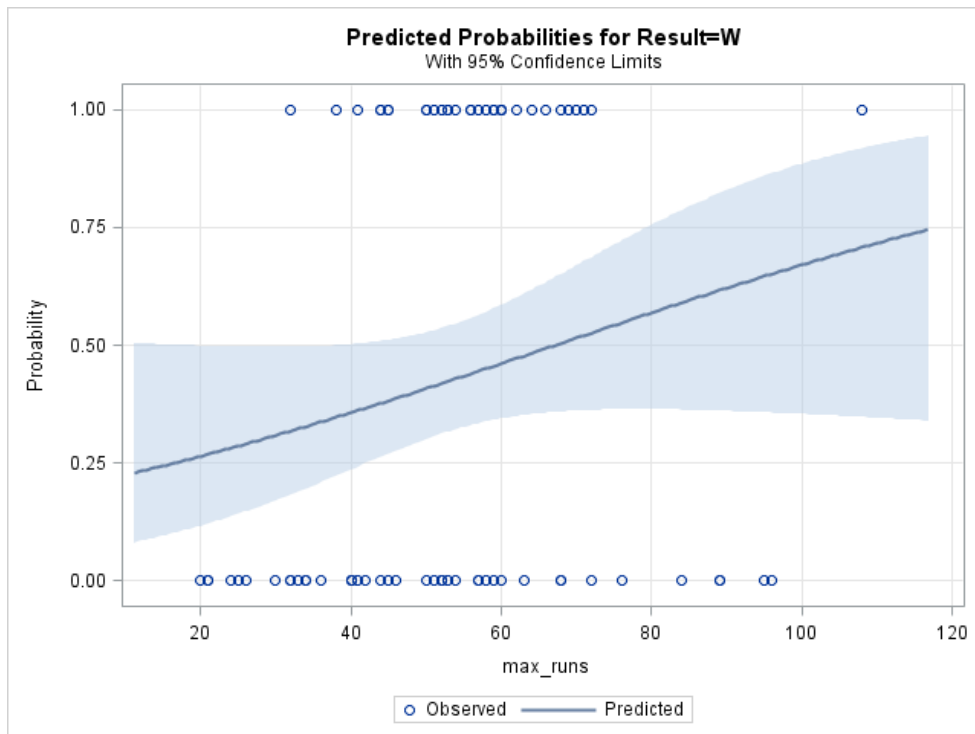


Figure 1.7. Probability graph for maximum individual runs scored in a match when batting second.

#### 4.2.4 Boundaries

##### Fours

Tables 1 and 2 present the average number of boundaries (fours and sixes) scored during a cricket match for both the winning and losing teams. The results between the winning and losing teams batting first and second are compared. According to the univariate logistic regression the number of fours scored is significantly related to winning the cricket match for teams batting first ( $p=0.0016$ ) as shown in Figure 1.8 that represents the increase in probability of success.

Fours scored is not significantly related to winning an IPLT20 cricket match for teams batting second ( $p=0.3199$ ) although the odds ratio indicates a positive correlation to winning, however it is not statistically significant.

The small increase in probability of success as a function of the number of fours scored for teams batting second - shown in Figure 1.9.

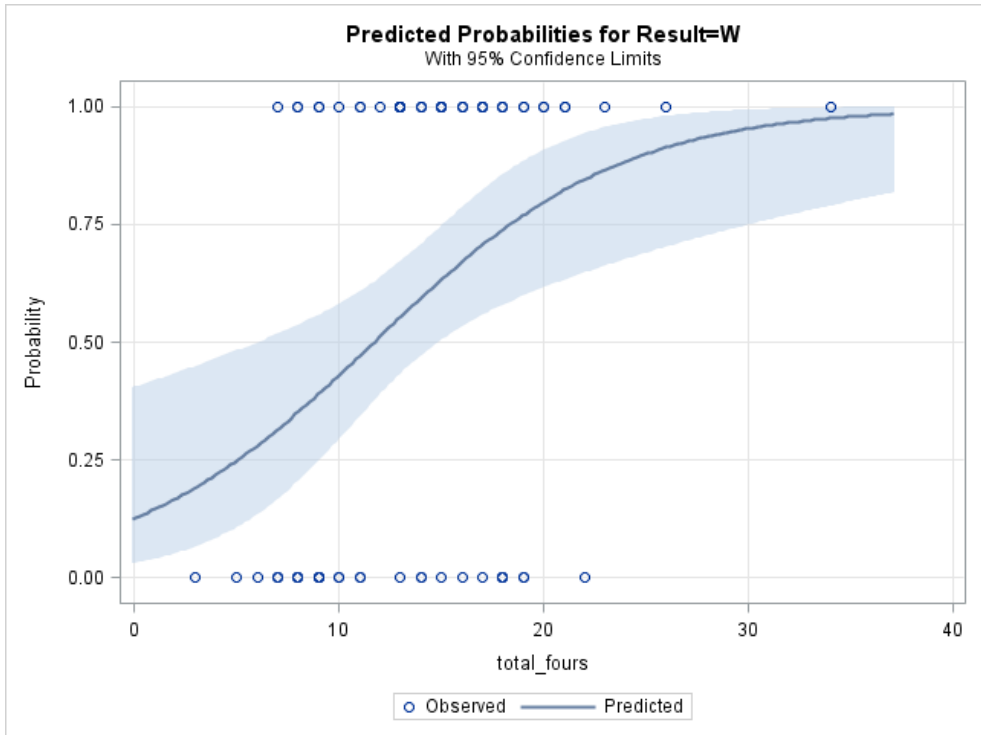


Figure 1.8. Probability graph for total fours scored in a match when batting first.

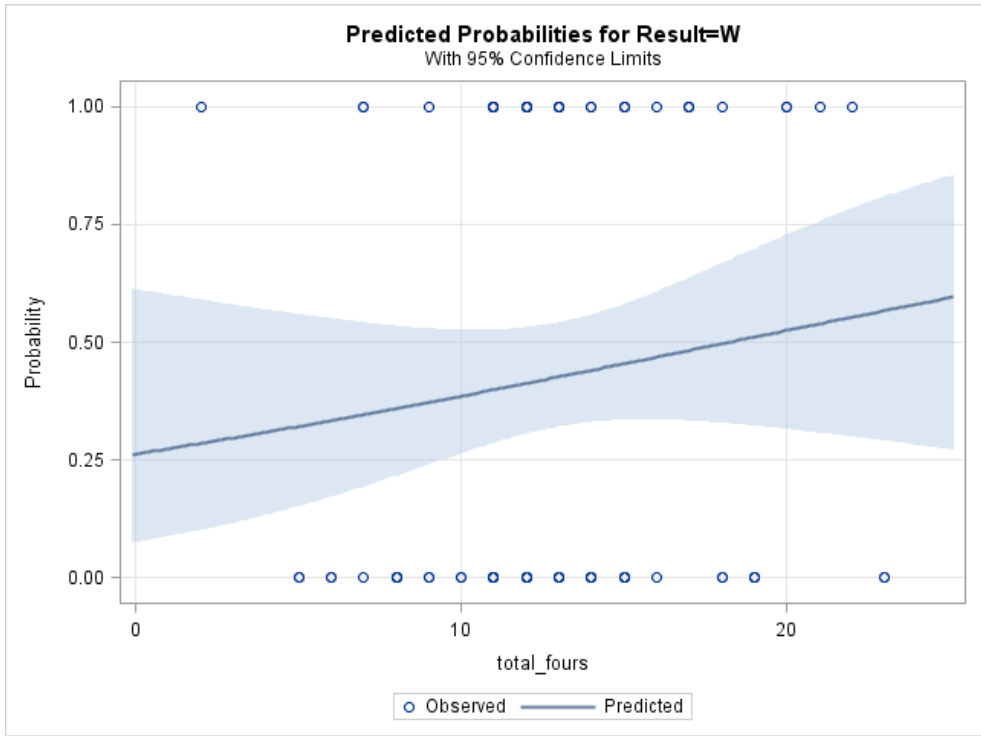


Figure 1.9. Probability graph for total fours scored in a match when batting second.

Sixes

As reported in Tables 1 and 2 the average number of sixes scored was (M=7.35) during the cricket matches is much higher for teams batting first and winning (BFW)



than it is for teams batting first and losing (BFL) ( $M=5.41$ ), teams batting second and winning (BSW) scored ( $M=5.22$ ) sixes, and teams batting second and losing (BSL) scored 5.12 sixes. The amount of sixes scored in an IPLT20 cricket match is significantly related to winning an IPLT20 cricket match for teams batting first ( $p=0.0266$ ). That is to say, the higher the number of sixes scored by the IPLT20 team batting first the higher the probability that that team has of winning the cricket match. This increase in probability of success is shown in Figure 1.10.

The amount of sixes scored is not significantly related to winning an IPLT20 cricket match for teams batting second ( $p=0.9088$ ) although the odds ratio indicates a positive correlation to winning, however it is not statistically significant. That is to say, the higher the number of sixes scored by the IPLT20 team batting second the lower the probability the team has of winning the cricket match. This probability of success is shown in Figure 1.11.

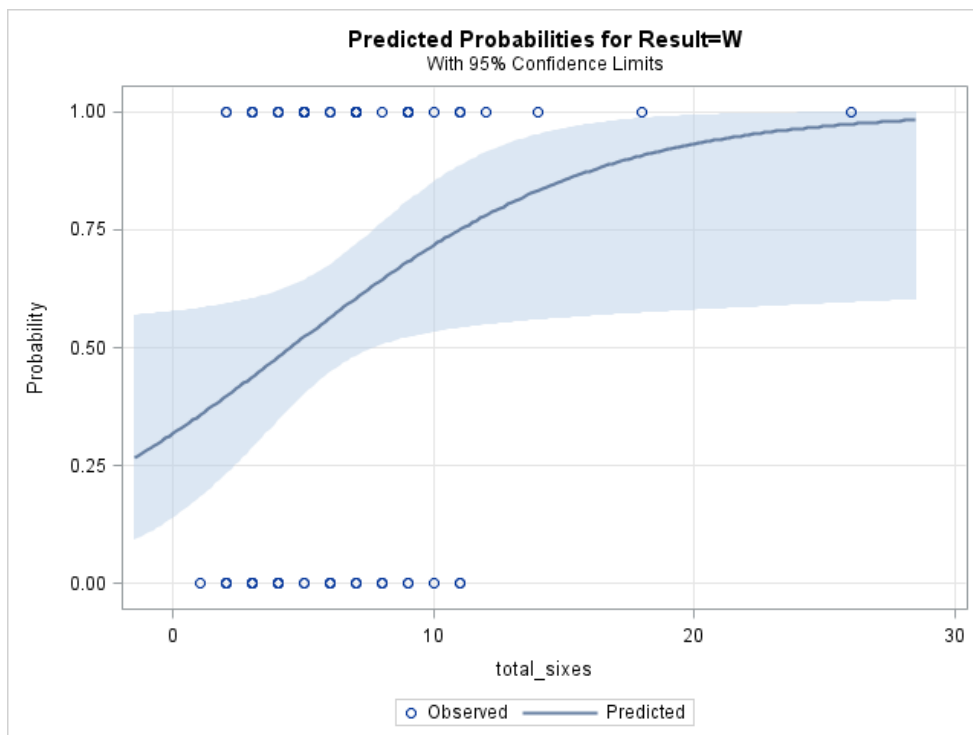


Figure 1.10. Probability graph for total sixes scored in a match when batting first.

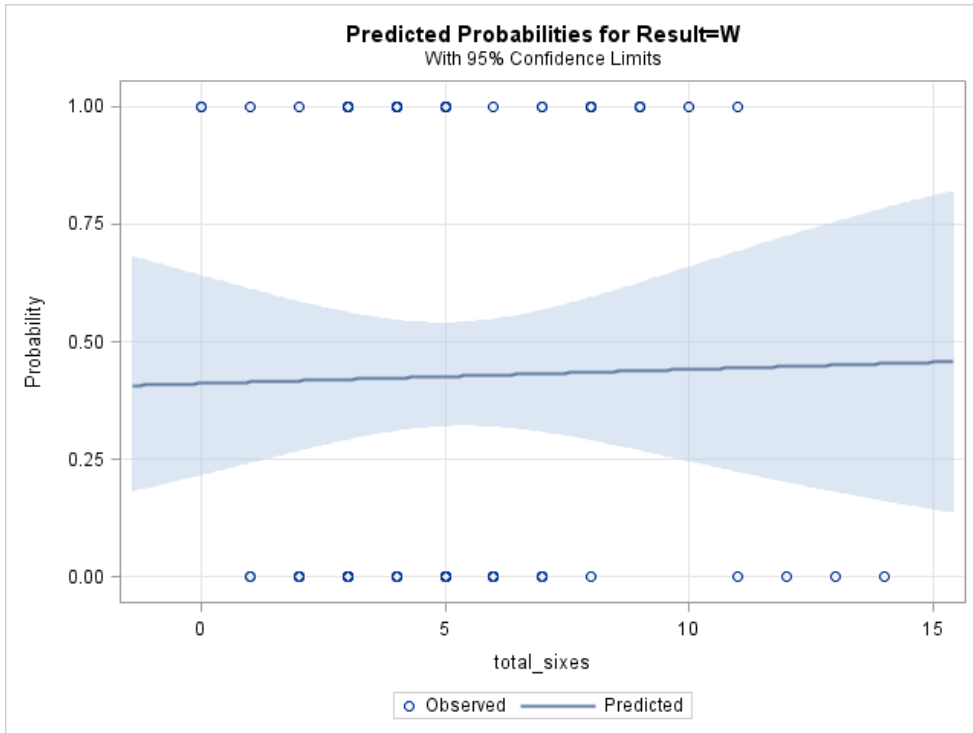


Figure 1.11. Probability graph for total sixes scored in a match when batting second.

#### 4.2.5 Wickets Lost

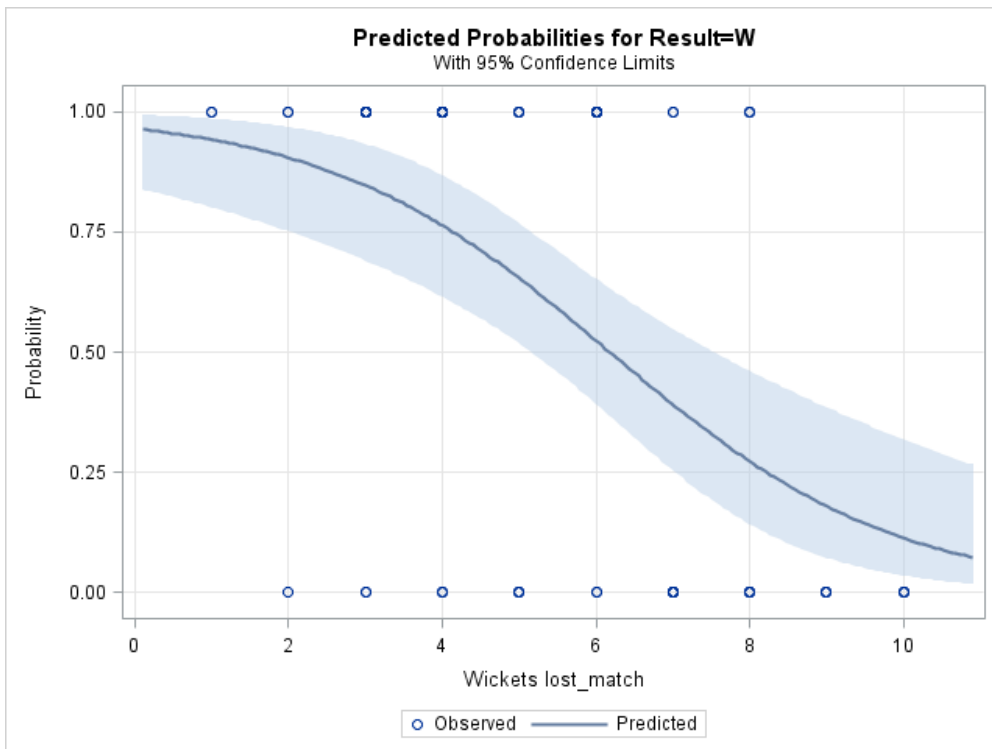


Figure 1.12. Probability graph for wickets lost in a match when batting first and winning.

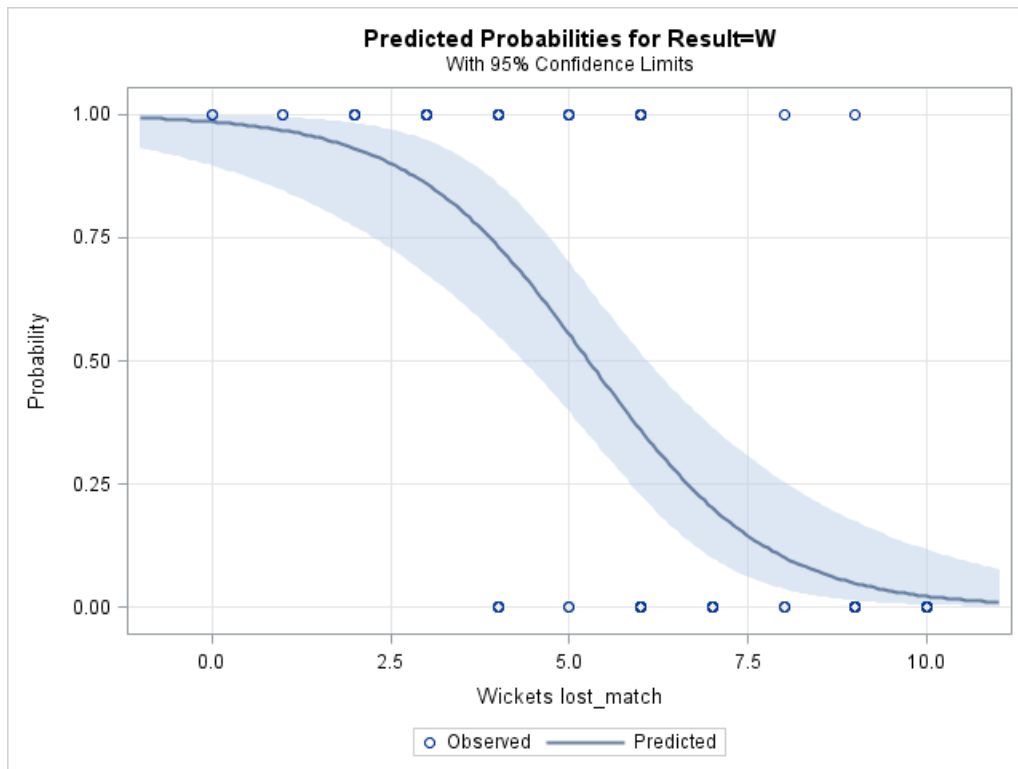


Figure 1.13. Probability graph for wickets lost in a match when batting second and winning

The decrease in probability of success as a function of the wickets lost in a match for teams batting first and winning as is shown in Figure 1.12 as well as teams batting second and winning is shown in Figure 1.13. Thus an increase in wickets lost decreases the chances for success for teams batting first and winning as well as batting second and winning.

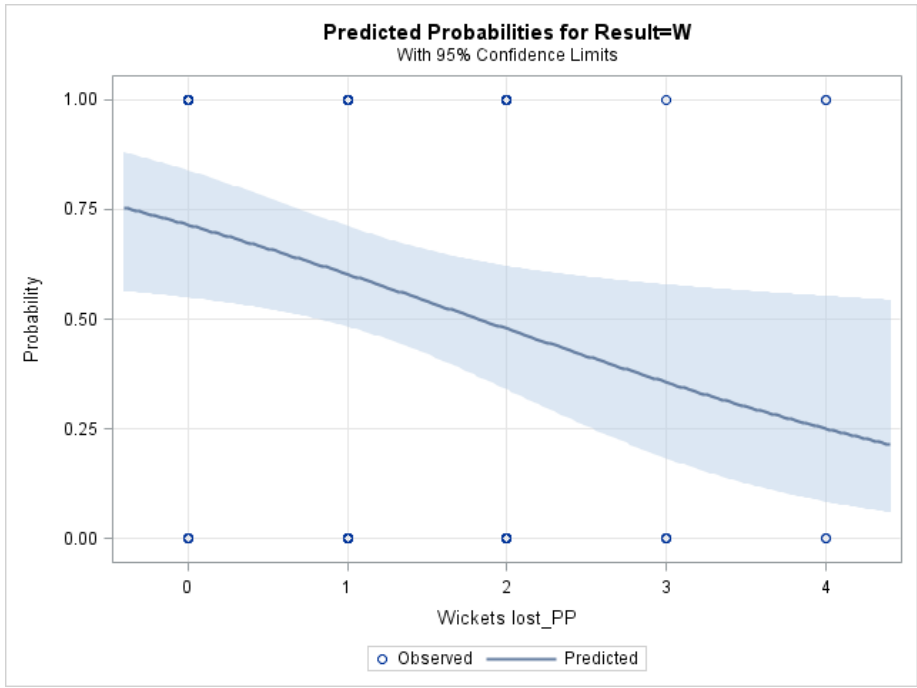


Figure 1.14. Probability graph for wickets lost in the power play when batting first and winning.

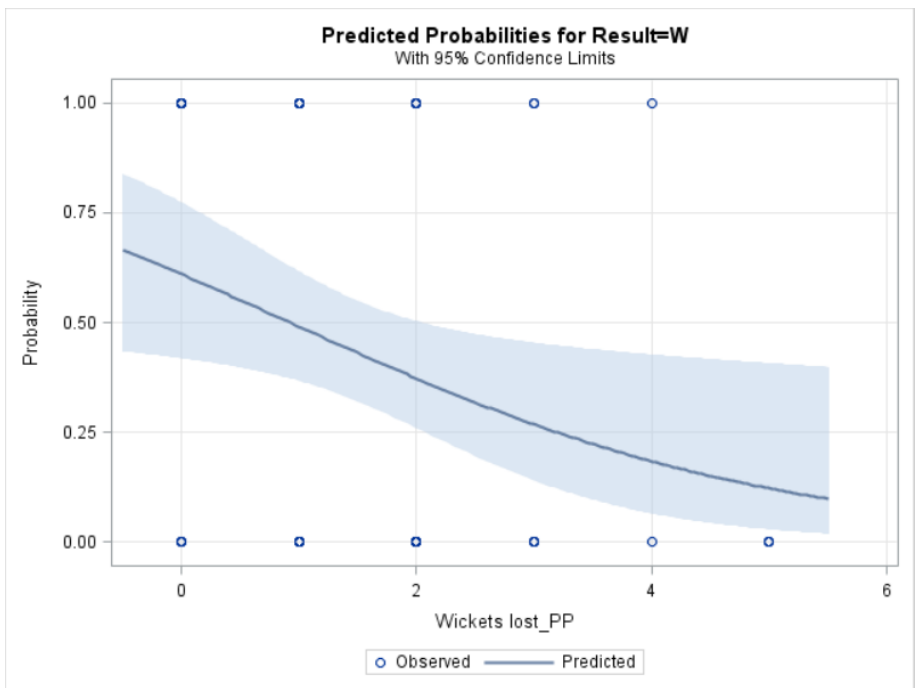


Figure 1.15. Probability graph for wickets lost in the power play when batting second and winning.

The decrease in probability of success as a function of the wickets lost in the power play for teams batting first and winning as is shown in Figure 1.14 as well as teams batting second and winning is shown in Figure 1.15. Thus an increase in wickets lost in the power play decreases the chances for success for teams batting first and winning as well as batting second and winning. This variable is significantly related to both teams batting second and winning ( $p=0.0243$ ) as well as teams batting first and winning ( $p=0.0275$ ).

#### 4.2.6 Wickets Taken

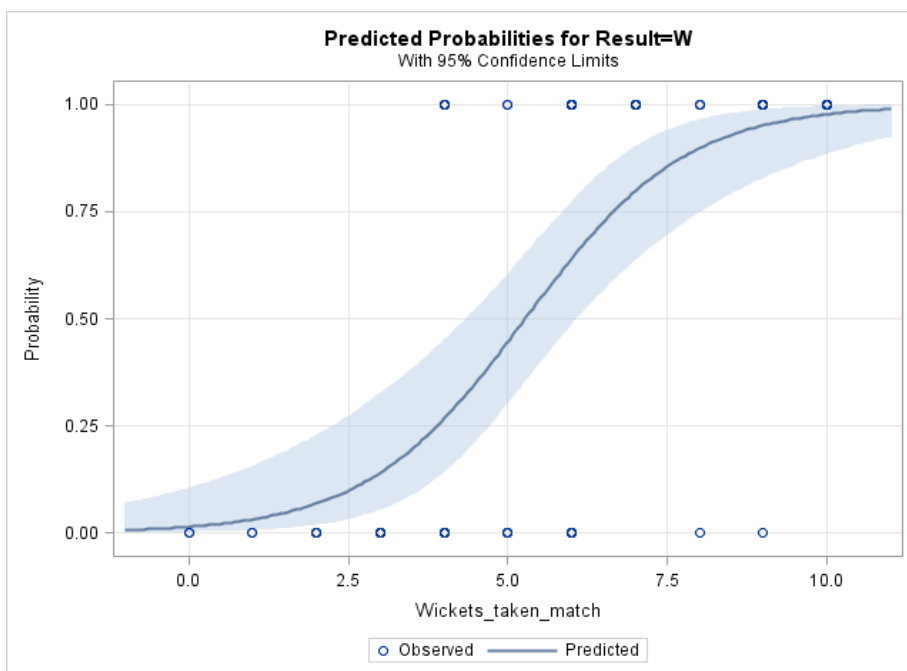


Figure 1.16. Probability graph for wickets taken in a match when batting first and winning.

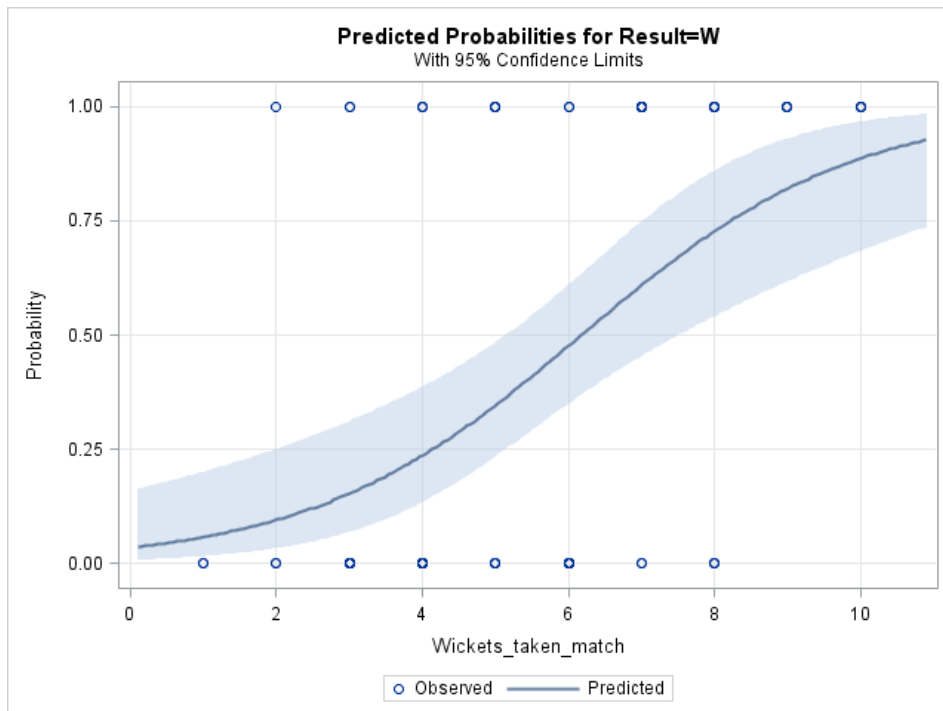


Figure 1.17. Probability graph for wickets taken in a match when batting second and winning.

As reported in Tables 1 and 2 the average number of wickets taken ( $M=7.42$ ) during the recorded cricket matches is much higher for BFW than it is for teams batting first and losing (BFL) was ( $M=3.91$ ), teams batting second and winning (BSW) took ( $M=6.78$ ) wickets, and teams batting second and losing (BSL) lost on average ( $M=4.53$ ) wickets per match. The number of wickets taken throughout an IPLT20 cricket match is positively related to winning an IPLT20 cricket match for teams batting first ( $p<.0001$ ) as well as teams batting second ( $p<.0001$ ). That is to say, the higher the number of wickets taken by the IPLT20 team batting first and second the higher the probability that that team has of winning the cricket match. This increase in probability of success is shown in Figure 1.16 and Figure 1.17.

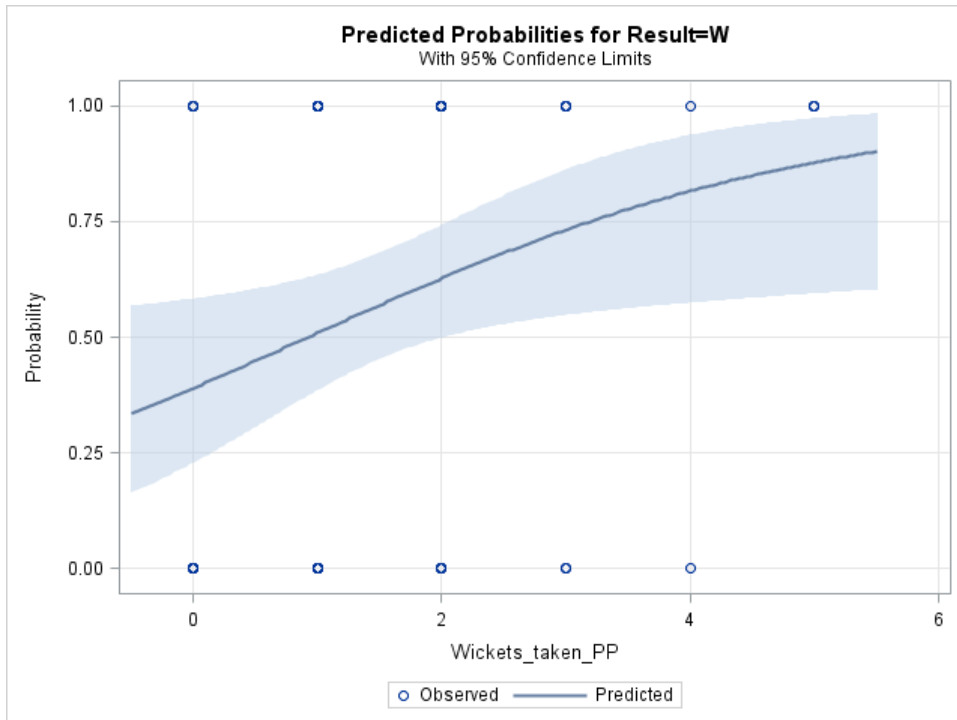


Figure 1.18. Probability graph for wickets taken in the power play when batting first and winning.

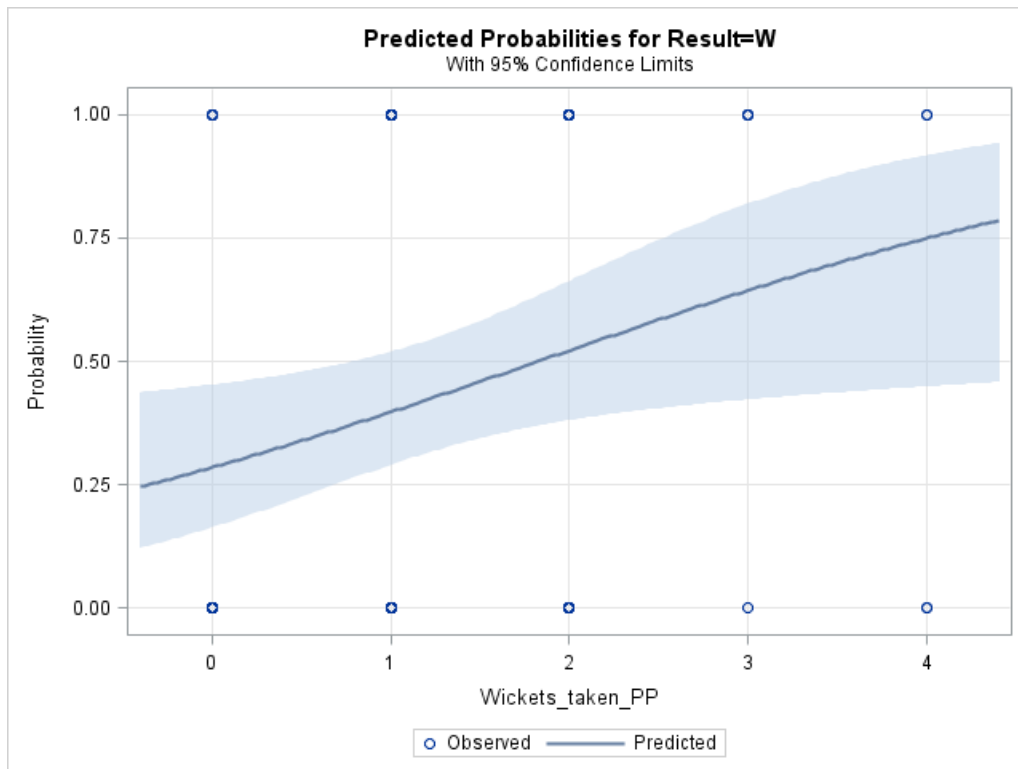


Figure 1.19. Probability graph for wickets taken in the power play when batting second and winning.

The number wickets taken throughout an IPLT20 cricket match is positively related to winning an IPLT20 cricket match for teams batting first ( $p < .0001$ ) as well as teams batting second ( $p < .0001$ ). That is to say, the higher the number of wickets taken by the IPLT20 team batting first and second the higher the probability that that team has of winning the cricket match. This increase in probability of success is shown in Figure 1.16 and Figure 1.17.

The small increase in probability of success as a function of the wickets taken in the power play teams batting first and winning is shown in Figure 1.18 as well as teams batting second and winning is shown in Figure 1.19. Wickets taken for teams batting first and winning in the power play as well as teams batting second and winning is significantly related to winning (BFW) was ( $p = 0.0243$ ) and (BSW) was ( $p = 0.0275$ ).



## CHAPTER 5: Discussion

The results analysed within this study indicates that there are various batting and bowling performance indicators such as number of total runs scored per team, maximum runs scored by a batsman, type of boundaries scored (fours and sixes), wickets taken in a match and in the power play as well as wickets lost in the match and in the power play that significantly correlate to the success of a cricket team in the IPLT20 tournament. This study confirms that the various batting performance variables determines success in an IPLT20 cricket match differ for teams batting first and teams batting second.

### 5.1 Total Runs Scored

Within this study it was found that teams batting first and winning scored an average of 172.79 runs and teams batting first and losing scored an average of 141.13 runs. Teams batting second and winning scored an average of 141.25 and teams batting second and losing scored an average of 139.7 runs. With the data suggested it must be kept in mind that the team batting second and losing are restricted by the opposition score, thus an average total score will be less than the teams batting first and winning.

Data also suggests that teams batting first and scoring at least an average of 150 or more runs have a greater chance of winning compared to teams batting second and having to chase a run total. Data does however not consider external factors such as home ground advantage, venue, temperature and time of the day. Teams batting second have the responsibility of chasing a specific total which already places more pressure on them to perform. Pressure to perform leads to batting more aggressively and the side then loses its wickets. This can be related to the data of this study stipulating that teams batting second score an average of less than 150 runs.

Peterson *et al.* (2008a) found that winning teams scored an average of 163 runs whereas losing teams scored an average of 150 runs during the 2008 Indian Premier League tournament. However, Douglas and Tam (2010) found the average score for winning teams to be 158 runs and 133 runs for losing teams respectively during the 2009, T20 World Cup. When comparing this study to studies done by Peterson *et al.* (2008a) and Douglas and Tam (2010) one can agree that teams should be scoring an average total of 150 runs and more in order for the match outcome to be successful,

although it is highly likely that the average total runs has increased over the past 2 seasons (2018 & 2019) due to the game evolving. In order to score more runs batters, have the responsibility to bat aggressively but in turn refrain from losing wickets. A higher total runs leads to batting more aggressively which can put bowlers under pressure. Bowlers being under pressure especially in the shorter format of the game could lead to bowling more bad deliveries in their effort to get the batsmen out. Therefore, a higher run total could affect the psychological aspect of a bowlers. The probability is also there with teams batting second and losing may have lost the match because the teams were chasing a high runs total.

The results of this study suggest that a high total runs scored per match for teams batting first is very important for winning a cricket match. Therefore, the more runs scored, the higher the probability of success in an IPLT20 cricket match.

## **5.2 Maximum Individual Runs Scored**

Players of winning teams accumulated an average of 69.3 maximum individual runs when batting first and 57.09 when batting second. Players of losing teams accumulated an average 51.50 maximum individual runs when batting first and 50.26 when batting second. The average maximum individual runs will be higher in winning teams batting first due to the total runs of these teams being higher. This is in agreement with the statement by Nadjan *et al.* (2014), stating that teams should focus on at least one batsman contributing a score of 50 or above.

Most performance measures available in cricket are concerned with the performance of individual players (Singh *et al.*, 2015). With this statement, it can be agreed that maximum individual runs scored can be considered as a valuable batting performance indicator.

## **5.3 Boundaries**

### **Fours and Sixes**

Boundaries form a vital part within the game of cricket and the ability to score boundaries (fours and sixes) is an essential batting performance indicator. With regards to this study, data between the winning and losing teams batting first and

second were compared with regards to the influence of boundaries scored. Teams batting first and winning scored on average more fours than teams batting second and winning. Winning cricket teams that bat first and second, score on average more fours (BFW = 15.49 ; BSW = 13.53) than the losing teams (BFL = 11.72 ; BSL = 12.49).

Teams batting first and losing scored on average 11.72 fours per match and teams batting second and losing scored on average 12.49 fours per match. Teams batting first and losing scored on average 5.41 sixes in a match and teams batting second and losing scored an average of 5.12 sixes per match. This is an indication that the average sixes between winning and losing teams is not a clear indicator of success. Within this study data revealed that, the amount of sixes scored ( $p=0.0266$ ) throughout an IPLT20 cricket match is positively related to winning an IPLT20 cricket match for teams batting first, whereas amount of sixes scored is negatively related to winning an IPLT20 cricket match for teams batting second ( $p=0.9088$ ). That is to say, the higher the number of sixes scored by the IPLT20 team batting second the lower the probability the team has of winning the cricket match. Schaefer (2018), agrees with this study by hitting boundary fours to be of greater importance than boundary sixes.

Previous studies highlighted the importance of scoring boundaries within cricket and to which effect it contributes to success. In a study done by Nadjan *et al.* (2014), analysed singles compared to boundaries scored. Data highlighted the importance of hitting boundary 4's and 6's rather than looking for singles (Nadjan *et al.*, 2014). This is in agreement with studies done by (Petersen *et al.*, 2008a; Douglas & Tam, 2010).

This analysis could suggest that batting first in an innings allows teams to play more aggressively and score more boundaries in order to set up a higher total for the team batting second to chase. Along with that teams batting first is not restricted by a runs total scored by the other team, whereas the team batting second rely less on scoring sixes, but attempt to build a more consistent innings in order to reach the runs total scored by the team batting first.

#### **5.4 Wickets Lost in the Match and Power Play**

Teams batting first and losing lost 6.78 wickets on average per match and teams batting second and losing lost 7.42 wickets on average. This could be attributed to the

fact that the teams having to bat second need to chase a specific runs total in which aggressive batting causes an increase in wickets lost.

Teams batting first and winning lost 4.53 wickets per match and teams batting second and winning lost 3.91 wickets on average per match. According to the univariate logistic regression the decrease in wickets lost in a match are significantly related to winning a match for teams batting first ( $p < .0001$ ) and second ( $p < .0001$ ).

A study done by Nadjan *et al.* (2014) highlighted the importance of retaining wickets lost especially within the first 10 overs of a match. Additionally Bhattacharjee and Lemmer (2016) states that one over within T20 cricket is equivalent to 5% of the total number of balls the batting team has to face. Thus losing too many early wickets creates pressure for the team batting second and it becomes hard to achieve a specific runs total (Bhattacharjee & Lemmer, 2016).

### **5.5 Wickets Taken in the Match and Power Play**

Winning cricket teams that bat first and second, took on average more wickets (BFW = 7.42 ; BSW = 6.78) than the losing teams (BFL = 3.91 ; BSL = 4.53). Winning cricket teams that bat first and second took on average more wickets during the power play (BFW = 1.91 ; BSW = 1.56) than losing teams (BFL = 1.22 ; BSL = 0.95). This is an indication that the average wickets taken between winning and losing teams is a clear indicator of success. All bowling variables within this study correlate with success although wickets taken for teams batting first ( $p < .0001$ ) and teams batting second ( $p = 0.0001$ ) has got a higher correlation to winning an IPLT20 cricket match compared to wickets taken in the power play.

Batting first indicates a higher odds ratio for bowling is wickets taken per match. This means that for every increase in wickets taken by one wicket, increases the odds of winning by 2.191.

Thus this study correlates with the study done by Nadjan *et al.* (2014) where taking more wickets when bowling is key to restricting opposition run scoring.

Bhattacharjee *et al.* (2016) analysed the influence of the power play in T20 cricket in which it was found the power play overs comprise of 30% of the bowling resources available to the batting team. According to the study done by Bhattacharjee *et al.*

(2016) data of the study indicates that the team which outplays its opponent in the power play generally has a greater chance for success.

## **CHAPTER 6: Conclusion**

In this study, data were analysed using a univariate logistic regression in order to identify how batting performance variables such as total runs scored, maximum individual runs scored, number of boundaries, wickets lost in a match, wickets lost in

the power play, wickets taken in a match and wickets taken in the power play are significantly related to winning a T20 cricket match.

The total number of runs scored for the team batting first is significant. Thus a high total runs scored per match for teams batting first is an essential performance predictor for success. Along with a high total runs scored, maximum individual runs scored by a batsmen is also considered as a predictor for success. Individual batting performance is crucial to increasing the total score for a team.

The amount of fours scored by IPLT20 teams batting first is significant and correlates with winning a cricket match. The amount of sixes scored is not as significant when compared to the significance of fours scored.

That is to say, the higher the number of sixes scored by the IPLT20 team batting second the lower the probability the team has of winning the cricket match. Schaefer (2018), agrees with this study by hitting boundary fours to be of greater importance than boundary sixes.

Wickets taken and lost within a match when batting first also significantly relates to the success of winning a T20 cricket match. Wickets taken by the winning teams batting first and second significantly correlates to the success of a team in an IPLT20 match. The non-significant results in Table 3 can be attributed to the fact that the team batting second cannot exceed the runs of the opposition by many runs. Teams preventing wickets lost in the power play have a greater chance for success, thus a less aggressive batting approach during the power play is essential for success. Bowling data for teams batting second all show significant differences when compared to batting data. Wickets lost and wickets taken are the most important predictors of winning for teams batting second whereas, total runs scored, wickets lost and wickets taken are the most important predictors of winning for teams batting first.

The results of this study concludes that there are various performance variables such as the influence of a higher total runs scored, maximum runs scored, boundaries scored, wickets lost in a match, wickets lost in the power play, wickets taken in a match and wickets taken in the power play correlates positively with success in the IPLT20 cricket between teams batting first and second and can be used as success performance predictors. From this study it can be concluded that bowling performance variables is significantly related for teams batting second as well as the higher total

runs scored in T20 cricket are in most cases more important to winning a cricket match than others. Total runs scored for the team batting first will always be greater if the match is won, therefore keeping wickets lost to a minimum by the middle and lower order batsmen shows greater significance for success.

Within this study, it is evident that different significant success predictors for winning an IPLT20 cricket match suggest that further research into performance success predictors is necessary. This study can therefore be used as a foundation in an effort to investigate which performance variables is of importance in determining success within T20 cricket.

## **CHAPTER 7: Practical Application**

The significance of scoring a high run total is evident in this study, which places importance on scoring more runs through boundaries by players scoring a high individual maximum run total. Batting coaches should implement appropriate batting strategies, enforce an attacking game plan and batting order develop in order to enable batsmen to score runs and hit boundaries. Implementing a strategy of aggressive batting by the team batting first is advantageous. Teams batting second should expect higher individual runs scored from top order batsmen with a conservative approach in order to refrain from losing wickets as well as placing more focus on the bowling at hand by taking more wickets early in the innings as well as keeping wickets lost to a minimum when batting.

IPLT20 teams should consider a strong batting order or possibly capitalise on bowlers in such a way that they can attack their opponent within the power play overs.

Bowling also forms an essential part to predict the success of a team. Taking more wickets in the match by the team batting first is essential and therefore the team bowling second should consider the importance of taking wickets early within the innings.

This study also indicates the importance of the coin toss before a match as the option of batting first is essential to winning a cricket match.



## **CHAPTER 8: Limitations and Future Research**

This study focused on batting and bowling data. Whereas fielding performance variables would have contributed positively on the study, the amount of existing research available on this topic is limited.

A limitation of the study is that only six teams played in 2015, 2016 and 2017's IPLT20 seasons. Other teams played in on or 2 of the above mentioned seasons.

Within this study various performance variables were not included in the study due to the unavailability of raw data. Superior strike rates by batsmen is important but is necessary coincide with runs scored thus being out for 4 runs from two balls is a superior strike rate of 200% but this contribution to winning is minimal.

Future studies can include more batting, bowling and fielding performance variables, data as potential success predictors of T20 cricket.

T20 cricket will benefit from a comparative study done on different teams over a three-year period, due to the limited research on T20 cricket. Research on T20 cricket lacks in comparison to the vast amount of research available on ODI and Test Cricket.

The researcher suggests a deeper look into fielding performance variables and bowling performance variables of the six teams, within the same IPLT20 seasons, used in this study.

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## Addendum A: Ethics Approval



### Health Sciences Research Ethics Committee

13-Aug-2018

Dear Miss Surita Sloane

Ethics Clearance: **Analysis of performance indicators in IPL T20 cricket from 2015 to 2017** Principal

Investigator: **Miss Surita Sloane**

Department: **Exercise and Sport Sciences (Bloemfontein Campus)**

#### **APPLICATION APPROVED**

Please ensure that you read the whole document

With reference to your application for ethical clearance with the Faculty of Health Sciences, I am pleased to inform you on behalf of the Health Sciences Research Ethics Committee that you have been granted ethical clearance for your project.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2018/0843/3107**

The ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the HSREC for approval to ensure we are kept up to date with your progress and any ethical implications that may arise. This includes any serious adverse events and/or termination of the study.

A progress report should be submitted within one year of approval, and annually for long term studies. A final report should be submitted at the completion of the study.

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email [EthicsFHS@ufs.ac.za](mailto:EthicsFHS@ufs.ac.za).

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours Sincerely

**Dr. SM Le Grange**  
**Chair : Health Sciences Research Ethics Committee**

**Health Sciences Research Ethics Committee**

**Office of the Dean: Health Sciences**

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## Addendum B: Turn it in Digital Receipt

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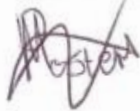
## Addendum C: Grammar Editing

### Language Editing

This is to certify that the paper with the title *Analysis of Performance Indicators in IPL Twenty20 Cricket from 2015 to 2017* to be submitted by Surita Sloane has been edited for language by Ruan Mostert.

Neither the research content nor the author's intentions were altered in any way during the editing process.

Ruan Mostert



29 January 2020