Analysis of tries scored during the 2018 and 2019 super rugby tournaments

BY

GABRIEL PIETER GREEF

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Supervisor: Prof. F.F Coetzee

Co-supervisor: Prof. W.J Kraak

Declaration

I, Gabriel Pieter Greeff, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree at this or any other university.

GPGreeff

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GP Greeff

2014103523

gabriegreeff@gmail.com

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Abstract

Introduction: The last few years, the professional rugby union defensive system improved and lead to teams scoring fewer tries. The growth of professionalism in sport has aided this with many teams now having a performance analysis staff to support the coaching process. Part of their job is to analyse performances of their teams and conduct analysis on opposition teams to then share this information with the management and support team. Analysing and understanding the performance indicators pertaining to tries can assist coaching staff with information to develop and rethink attacking strategies.

Aim of the study: The primary aim of the study is to analyse the try scoring profile of the 2018 and 2019 Super Rugby competition.

Methods: The current study included all the Super Rugby matches that was played during the 2018 and 2019 seasons. Video footage of all Super Rugby matches were supplied by the South African Rugby Union technical department. All videos was then analysed according to set performance indicators using Nacsport Scout+ video analysis software. All data was captured using data Microsoft Excel software.

Results: The current study revealed that tries were responsible for most of the modes of scoring and points for both the 2018 and 2019 rugby seasons. The results indicated that during 2018 the percentage points contribution of tries was 65% (4,570 out of 7,069) and during 2019 it was 46% (811 out of 1,779). When looking at zonal locations where the tries orginated from the results revealed that 75% of the tries for the 2018 and 2019 seasons originated from the attacking half of the field (Zone A & B) and 64% Channel 1. Lineouts were the set piece origin for 37% and 39% of the tries for 2018 and 2019. Turnovers won were the general play origin for 22% of the tries for both the 2018 and 2019 seasons.

Conclusions: In summary, tries were scored originating from all over the field, but more tries were scored in Zone A and B. Tries originated from several different possession platforms, where set pieces: lineouts and general play: turnovers won

were the main ones platforms in both 2018 and 2019 seasons. Fundamentally, coaches and specialist attacking coaches will be able to use these try scoring profiles to improve technical and tactical skills and develop a framework to plan and execute effective plays and tactics in training to score more tries and concede less tries in matches. The results found in this study can be used to guide further research around this topip. Future studies should compare the findings with that of other professional rugby tournaments for the example the United Rugby Championships, Top14 and the newly formed Super Rugby tournament. Lastly, research should focus on the try scoring profile in women's rugby to see if similar trends are evident.

Keywords: **Rugby Union, performance indicators, mode of scoring, tries**

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List of abbreviations

TMO	Television Match Official
IRB	International Rugby Board
PI’s	Performance indicators
PA	Performance analysis
PPs	Performance profiles
TAS	Team Attacking Superiority
WR	World Rugby
M	Meters
KPI’s	Key Performance Indicators
Sec	Second

Chapter 1

INTRODUCTION AND PROBLEM STATEMENT

1.1 INTRODUCTION

Rugby union ("rugby") is currently one of the most popular sports in the world, with several competitions around the year that teams can participate in. In fact, Hume *et al*. (2017) reported over 7.7 million rugby players, spanning across 129 countries. After the professional status obtained in 1995, has rugby evolved into a much faster, and more dynamic sport, with greater emphasis on the physical elements of matches. The implication of that was that players are involved in more frequent and powerful contact situations (Eaves & Hughes, 2003, Van Rooyen *et al*., 2008).

Vaz *et al*. (2011) stated in this regard that professionalism in rugby has also resulted in the need for improved scientific and analytical support to maximise optimal performance. (Liebermann *et al*., 2002) agrees and stated that with all the changes to the game, the use and development of science and technology in the sport have also increased, allowing for more practical and accurate methods of describing the loads and demands of the sport. Sheridan (2007) concluded in this regard that rugby consistently changes over time due to either technological advances and/or law changes. However, the profile of rugby rarely remains the same, as coaches, referees and players frequently push players further and shift their boundarries for success (Eaves *et al*., 2008). The main contributing factors to the above statement are specialised coaches, law changes, improved training and technology; these evolutional changes can be traced by means of statistics (Schoeman *et al*., 2017).

It is a fact that success in rugby is measured by the winning team scoring more points than the opposing team (Van Rooyen *et al*., 2006). Five points are awarded for scoring a try or being awarded a penalty try, two points for successfully converting a try and

three points for a successful penalty kick or a drop goal. During a match, teams can accumulate points by one or more of these modes of scoring. It is important to note, that all of these modes can be decisive in determining the outcome of a match (Ortega *et al*., 2009; Stefani, 2009; Lim *et al*., 2011; Vaz *et al*., 2011).

However, the number of tries scored has the biggest significance when comparing the impact it has on match outcome, when analysing data form different competitions including the: English Premiership 2016-2017, 2016-2017 Pro 12, 2016-2017 Top 14 and the 2017 Super Rugby tournaments (Schoeman *et al.,* 2019). Equally important is the fact that the competition where the most tries were scored is the Super Rugby competition. Thus, the Super Rugby competition leans to a running orientated game. An examination of the 2008 to 2013 Super Rugby tournaments indicated that the number of points scored during a match increased but was only due to an increase in penalty kicks, therefore the number of tries scored decreased (Kraak *et al*., 2016). The teams that scored the most tries during the 2007 Rugby World Cup, was most likely to win the game 81% of the time (World Rugby, 2007). The Super 14 Rugby games of the Crusaders, Force and Lions between 2006-2008 were analysed, as they represented the top, middle and bottom teams of the log in every season. The aim of the study was to determine if team attacking superiority (TAS) could help to predict try scoring in the Super 18 Rugby season. Furthermore, results indicate that if a team achieves three consecutive TAS or less, they are 67% probable to score a try. In addition, the odds ratio indicated that attacking teams are significantly more probable to score after maintaining four or more TAS periods (Lim *et al*., 2011).

Defensive systems has improved in professional rugby with increased tackle percentage and structure, these factors differentiate winning and losing teams from each other (Schoeman *et al*., 2017). Improved defensive structures also led to less line breaks resulting in fewer tries being scored. A study completed on the 2008 to 2013 Super Rugby seasons indicated fewer kicks and scrums and more tackles and ball carries (Kraak *et al*., 2016). Defensive strategies of a team plays a significant role in there overall sucsess (Hendricks *et al*., 2013). Research indicated that during the 2011 Rugby Wold Cup the key to minimise scoring opportunities for the opposition, is to reduce the penalty count- whilst defending in your own half. To conclude a territory-

based approach correlates with victory in rugby (Hughes *et al*., 2017). The International Rugby Board revealed that the southern hemisphere teams had the ability to score tries while maintaining adequate defence by manipulating strategy, vision and skills (World Rugby, 2015). A scoring profile will provide coaches with information on the mode of scoring of their team. Timing of these modes of scoring can also provide important strategic information.

However, team performances are commonly evaluated and monitored by creating a notational analysis (Vaz *et al*., 2010). In the professional era of rugby, it has become vitally important to analyse and monitor game play. In addition, circumstances could change between games and phases of play, these changes include weather conditions, strategies and tactics used during game play, the available personnel and lastly the leader board changes during the competition. Even though conditioning and skill improvements has been described in the professional rugby era the main aim of rugby remains the scoring of tries (Vaz *et al*., 2010).

The introduction to profesionalism led to further development on video-based performance analysis, improved equipment technology and training (Schoeman *et al*., 2017). Video-based performance analysis can be described as a in-depth analysis on behavioural aspects of rugby performancis often used to formulate performance profiles for teams and individuals, to identify patterns and create performance indicators (Hughes & Bartlett, 2002). More than ever, rugby players need coaching in weaknesses and strengths to create an even more conditioned individual as well as gameplan to perform in the professional era.

The current study on the Super Rugby Competition, a comepteiton that was established in 1996 with teams from South Africa, New Zealand and Australia. The tournament is governed by the South African (Blue Bulls, Lions, Sharks & Stormers), New Zealand (Blues, Chiefs, Crusaders, Highlanders & Hurricanes) and Australian (Brumbies, Rebels, Reds & Warathas) Rugby Unions (SANZAR) (Meiklejohn, 2010). The compettion have undergone various changes and since 2018, and included teams from Argentina (Jaguars) and Japan (Sunwolves). During the 2018 and 2019 season the competition was composed by 15 teams.

1.2. PROBLEM STATEMENT

Rugby is the most popular collision sport in the world. The last few years coaches focused more on defensive systems, thus improving overall defence and lead to teams scoring fewer tries. Thus, the findings of the current study could lead to new development and implementation of new attacking strategies for teams to manipulate defence in order to score more tries.

1.3. AIM OF THE STUDY

The primary aim of the study is to analyse the try scoring profile of the 2018 and 2019 Super Rugby competition.

1.4. OBJECTIVES OF THE STUDY

The specific objectives are to:

1. describe and compare the percentage contribution of tries being scored to the total points scored during the 2018 and 2019 Super Rugby tournament per year, match outcome, time period and home and away.
2. describe and compare the sequence of tries being scored to the total points scored during the 2018 and 2019 Super Rugby tournament per year, time period, match outcome, and home and away.
3. describe and compare the number of tries scored from set pieces during the 2018 and 2019 Super Rugby tournament per year, match outcome, zonal locations and time period.
4. describe and compare the number of tries score from general play match activities during the 2018 and 2019 Super Rugby tournament per year, match outcome, zonal locations andtime period.

1.5. MOTIVATION OF THE STUDY

Analysis on the amount of line breaks, tackles made and tries being scored, indicate that defensive strategies are currently being prioritised by coaches compared to attacking strategies (Schoeman *et al*., 2017). the origin of tries and the players who are influencial in a teams try scoring ability have seldomly been documented, evaluated and analyzed (Diedrick & Van Rooyen, 2011). A scoring profile will provide coaches with information on the mode of scoring of their team. Timing of these modes of scoring can also provide important strategic information to further help and develop attacking strategies that will lead to try scoring. To add, a systematic review on preformance analysis in rugby union indicated that there where few studies documenting the field location, number of players involved and period within a match as performance indicators (Colomer *et al*., 2020). Furthermore, there is not yet any study published regarding the origin of tries scored during the 2018 and 2019 Super Rugby Tournament. Allthough there is information avialable on previous years of the same tournament. This will thus help to continue further research on this tournamet and fill the gap.

1.6. STRUCTURE OF THE DISSERTATION

Chapter One: *Introduction*: This chapter introduces the theme and aim of the study, i.e., to describe and compare the try scoring profiles during the 2018 and 2019 Super Rugby competition. In addition, to understand the influences and build up that contribute to try scoring in different locations of the field during the 2018-2019 Super Rugby competition. This study analyse spcifically Super Rugby and the motivation for this study.

Chapter Two: *Literature review*: This chapter review previous literature which are relevant to the research aims stated in Chapter 1. An overview of the background of rugby and the changes in the modern game. This is followed by a discussion on the performance indicators related to try origin. Lastly video analysis and literature relevant to inform sound methodological approaches.

Chapter Three: *Research methodology*: This chapter elaborates on the methodology applied. The statistical analysis is described in detail and followed by a discussion of the results.

Chapter Four: *Results:* Reporting of the research results.

Chapter Five: *Discussion of results*: A discussion of the research results, along with the strengths and limitations of the study, conclusions and recommendations for future research.

Chapter Six: Conclusion, limitations, and future research.

Chapter Seven: Reflexion on the research journey.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

Rugby Union “rugby” is one of the most popular collision sports in the world (Brooks *et al*., 2005; Yeomans *et al*., 2018; Brown *et al.,* 2019), with an estimated 9.1 million players in 133 rugby unions (World Rugby, 2016). Try scoring profiles can be created and formed for various competitions, teams, or certain line ups. Regardless the setup try scoring profiles will help teams and coaches better understand where the try originated from, in what phase, player, and time of the match just to name a few. To conclude try scoring profiles is important to assist coaches and specialist coaches in creating new attacking strategies or to further improve defence against these strategies.

Performance analysis: looking into performance indicators (PI’s) (selection, reliability, validity, and research pertaining to your topic) and performance profiling. Performance analysis is often used to formulate performance profiles for teams and individuals to identify patterns and create PI’s. More than ever, rugby players need coaching in weaknesses and strengths to create an even more conditioned individual to perform in the professional era. Notational analaysis or match analysis can be described as a in-depth analysis on behavioural aspects of rugby performance.

Since rugby moved to a professional sport in 1995, further development on notational analysis, improved equipment technology and training followed (Schoeman *et al.,* 2017). Team performance is commonly evaluated and monitored by creating a notational analysis (Vaz *et al*., 2010). In the professional era of rugby, it has become vitally important to analyse and monitor game play. In addition, circumstances could change between games and phases of play, these changes include weather conditions, strategies and tactics used during game play, the available personnel and lastly the leader board changes during the competition. Even though conditioning and

skill improvements has been described in the professional rugby era the main aim of rugby remains the scoring of tries (Vaz *et al*., 2010). Keeping the PI's in mind (Table 2.1) it is therefore questioned which type of PI's precedes the try scoring ability of teams. The same question remains as to the origin of tries, who scores the try and where the try is scored. This chapter aims to review the available literature and to present it in the following sections: (1) rugby union; (2) performance indicators and performance profiling; and (3) try scoring specific performance indicators.

2.2 RUGBY UNION

History and background

Rugby originated in the town of Rugby in Warwickshire, England in 1823 during a game of school football (soccer) where a young man by the name of William Webb Ellis picked up the ball during the football game and ran towards the opposition's goal line (Guttmann, 2004; World Rugby, 2015), which then became known as rugby. The first set of rugby laws was only introduced in 1845 (Corson, 2009). Because of the increasing popularity of rugby, the International Rugby Board, now known as World Rugby (WR), was established in 1886 (Collins, 2016).

Rugby is a contact sport that includes bouts of physical collision that is interspersed with intermittent high-intensity running activity (Roberts *et al*., 2008; Roberts *et al*., 2013). It is also characterised by having four main phases of play: (1) tackles; (2) rucks and mauls; (3) set pieces, such as scrums and lineouts; and (4) open play (Kaplan *et al*., 2008). Rugby is played with a maximum number of 15 players per team (Table 2.1) and is played for 80 minutes in total with 40 minutes per side at senior level (Quarrie & Hopkins, 2007), and 70 minutes with 35 minutes per side at school level. There are eight forwards and seven backline players in each team (Kraak & Welman, 2014). There are eight forward (jersey numbers 1 to 8) players characterised by being taller and heavier. Their role is to contest possession of the ball. There are also seven back (jersey numbers 9 to 15), players characterised by generally being smaller and quicker and their role is to gain field positions and score points (Quarrie *et al*., 2007). Players can be divided into different positional groups for example tight forwards

(props no 1 and 3, locks no 2 hooker no 4 and 5) loose forwards (flanks no 6 and 7 and eighth men no 8), inside backs (scrumhalf no 9, fly half no 10), centres (no 12 and 13) and outside backs (wings no 11 and 14 and fullback no 15). A team is allowed a maximum of eight replacements (at professional level) and seven at amateur level. These replacements are only allowed to go onto the field when the ball is dead and/or with permission from the referee (World Rugby, 2020).

TABLE 2.1: **JERSEY NUMBER AND POSITIONAL GROUPS**

Jersey numbers	**Primary positional group: Forwards**	**Secondary positional group**
1	Loose head prop	Tight five
2	Hooker	Tight five
3	Tighthead prop	Tight five
4	Lock	Locks
5	Lock	Locks
6	Blindside – flanker	Loose forwards
7	Open side – flanker	Loose forwards
8	Number 8	Loose forwards

Jersey numbers	Primary positional group: Backs	Secondary positional group
9	Scrum-half	Inside backs
10	Fly-half	Inside backs
11	Left wing	Outside backs
12	Inside centre	Inside backs
13	Outside centre	Outside backs
14	Right wing	Outside backs
15	Full back	Outside backs

Professionalism in rugby was first introduced in 1995 (Quarrie *et al*., 2007), which has led to an increased incidence of injuries (Posthumus & Viljoen, 2008) because of the increased demands on training and competition (Sedeaud *et al*., 2013). To meet these demands players needed to become bigger faster and stronger at junior and senior levels (Olds, 2001; Sedeaud *et al*., 2012; Sedeaud *et al*., 2013; Lombard *et al*., 2015). This was achieved through increased training, nutritional and conditioning programs (Olds, 2001; Sedeaud *et al.*, 2013; Lombard *et al*., 2015). The number of tackles and ruck events have also increased over time because of professionalism (Quarrie & Hopkins, 2007). For example, Gianotti (2009) observed that there was an increase in the number of rucks (160 ± 24) and tackles (270 ± 25) since the advent of professionalism in 1995 (Kraak, 2015).

Laws of the game

The laws of the game provide a framework that players, coaches and referees must adhere to, resulting in a game that is safer and more enjoyable to play and watch (Murray *et al*., 2014). WRs responsibility is to provide laws that lead to safe, enjoyable, and entertaining rugby events (Murray *et al*., 2014). Law changes are implemented in response to player behaviour, safety and to increase participation and enjoyment, promote continuity of the game, technological advancement, commercial pressures and to retain game integrity and development (Eaves *et al*., 2008; Kraak & Welman, 2014).

Foul play includes, but is not limited to obstruction, misconduct, repeated infringements, and dangerous and unfair play. The sanction for foul play is a red or yellow card according to the law book (WR, 2020). Dangerous play can occur anytime during the game and includes, but is not limited to late or early tackles, physical or verbal abuse, tackling players not in possession of the ball, not grasping or lifting a player off the ground during the tackle. The minimum sanction for dangerous play is a penalty kick for the opposition but can also results in a penalty kick with a yellow or a red card (WR, 2020).

2.3 FOCUS OF THE STUDY

Rugby has greatly been impacted over time when referring to the professional era. The main contributing factors to the above statement are specialised coaches, law changes, improved training, and technology; these evolutional changes can be traced by means of statistics (Schoeman *et al*., 2017). Statistics will be used to analyse the 2018 and 2019 Super rugby Tournament. The focus of the study will be to help and identify new attacking strategies for coaches and players to increase the try scoring opportunities.

2.4 PERFORMANCE INDICATORS (PI'S)

Video analysis is a branch of performance analysis, which merges biomechanical methods and notational analysis (Hughes & Bartlett, 2002; Glazier, 2010). Video analysis uses systematic observation and interprets videos to improve objectivity (McGarry *et al.,* 2013). Match footage is analysed according to a set and agreed PI's and operational definitions to identify and describe player and team actions (Borrie *et al.*, 2002; Mellalieu *et a*l., 2008) in relation to specific performance and injury outcomes (Vilar *et al.,* 2012). A PI is a selection of variables that aims to define performance behaviour and should relate to successful performance or outcomes (O'Donoghue, 2010). PI's can be beneficial if they are clearly defined (Hughes *et al*., 2012; Bremner *et al*., 2013), reliable and validated against successful and unsuccessful outcomes of games (Bremner *et al.,* 2013). PI's provide an understanding of game behaviour by explaining the game outcome (McGarry, 2009). There are a number of methods for the selection of PI's, namely: "using a panel of specialists (Choi, 2008); regression analysis that deals with outcome indicators (Choi *et al*., 2006a); neural networks (Choi *et al.,* 2006a); and inferential statistical tests that identify the PI's, which distinguish between winning and losing performances within matches (Choi *et al.,* 2006b; Csataljay *et al*., 2008; Hawkins & Choi, 2008)". However according to O'Donoghue (2010) is it important to note that there is no gold-standard for the selection of PI's. The methods mentioned above are used as guidance.

An advantage of performance analysis is to create performance profiles, which are created through a collection of PI's describing the performance as a whole (O' Donoghue, 2010). Performance profiles are also useful in describing individual and team patterns (Vaz *et al.,* 2010) and can be displayed in three ways: (1) single performance outcome; (2) typical outcome; and (3) performance process (Butterworth *et al*., 2013). A single performance profile that is based on the outcome and process is an objective representation of the player using PI's (Butterworth *et al*., 2013). These profiles can be used to highlight areas that need focusing on in order to improve future performance. Performance profiles are developed by collecting frequencies of PI's that show predictions of future performance (Hughes *et al*., 2001; Bracewell, 2003). Intra-positional variability in performance profiles was used in the study conducted by

James *et al*. (2005). They found that it was not necessary to have more than one profile per playing position in rugby because of the different playing styles within each position, which are all effective for the team. Therefore, a general profile can be created per playing position indicating the strengths and weaknesses (James *et al.,* 2005).

Tries

The number of tries scored has the biggest significance when comparing the impact it has on match outcome, when analysing data form different competitions including the: English Premiership 2016-2017, 2016-2017 Pro 12, 2016-2017 Top 14 and the 2017 Super Rugby tournaments (Schoeman *et al.,* 2019). Equally important is the fact that the competition where the most tries were scored is the Super Rugby competition. Thus, the Super Rugby competition leans to a running orientated game. An examination of the 2008 to 2013 Super Rugby tournaments indicated that the number of points scored during a match increased but was only due to an increase in penalty kicks, therefore the number of tries scored decreased (Kraak *et al*., 2016). The teams that scored the most tries during the 2007 Rugby World Cup, was most likely to win the game 81% of the time (World Rugby, 2007). This can also be viewed in the 2011 and 2012 Sevens World Series, where teams that scored more points won a greater number of games (Higham *et al*., 2014). To add, during the 2014 and 2015 Rugby Championship winning teams scored more tries than teams that lost (Sella *et al*. 2019). The Super 14 Rugby games of the Crusaders, Force and Lions between 2006-2008 were analysed, as they represented the top, middle and bottom of the log in every season. The aim of the study was to determine if team attacking superiority (TAS) could help to predict try scoring in the Super 14 Rugby season. Furthermore, results indicate that if a team achieves 3 consecutive TAS or less they are 67% probable to score a try. In addition, the odds ratio indicated that attacking teams are significantly more probable to score after maintaining 4 or more TAS periods (Lim *et al*., 2011).

Origin of tries

Set Pieces

A rugby try is defined by a player grounding the ball in the oppositions goal area and behind the goal line (World Rugby, 2019b). Tries can be scored from the following set pieces. The kick-off is the first phase a rugby match starts with, the ball is dropped kicked from the middle or halfway line. The team who is receiving the ball must be at least 10m away from the kicker.To add, the ball that is kicked should also travel a minimum of 10m towards the opponent's goal line before hitting the ground (World Rugby, 2019c). An Investigation considering the 2008 to 2013 Super Rugby season reported an increase in number of kick offs, the findings suggest that there was also an increase in points scored from scoring modes (Kraak *et al*., 2016). Therefore, the number of contestable restarts increased because, this places pressure on the opposing team in there defensive half so the attacking team can regain possesion to launch an attack and score.

The scrum can also be a way of restarting play after stoppage, due to laws that has been broken. Moreover, this includes forward play or a knock on and when the ball can't be played in a mall or ruck (World Rugby, 2019e). The scrum brings all the forwards and scrumhalves into one play, where an opportunity is created for the backline players to attack or work towards the opponents try line. Advantage is given if the stoppage of the game may cause the non-offending team's chances to score is lessen (World Rugby, 2019a).The law states that a penalty should be awarded for the non-offending team, this is true unless they can score a try. Thus, this can result in less scrums being awarded during a match. Examining the data from the 2017 Super Rugby season the researchers found that 18% of all tries originated from a scrum (Coughlan *et al*., 2019). Therefore, the scrum can be viewed as a good performance indicator when comparing winning and losing teams. Furthermore, winning teams tend to lose fewer balls in the scrum than losing teams and losing teams also have less scrums per minute compared to winning teams (Schoeman *et al*., 2017).

The lineout occurs when the ball exits the field of play at the touch line (World Rugby, 2019f). The lineout brings a few of the forwards of both teams near the touch line. The rest of the field can then be used by the backline players to launch an attack from. The lineout could be changed to fit the area of the field, this will contribute to greater try scoring success. The lineouts won from the opposition ball has been found to be an significant PI during the 2015 Rugby World Cup. The results devide winning and loosing teams from each other (Hughes *et al.,* 2017). An examination on winning teams during 2003 and 2006 international and regional matches revealed to be more effective in retaining the ball in their own lineouts (Vaz *et al.,* 2010). Moreover, an investigation of the four bottom and four top teams that participated during the 2016 and 2017 English premiership rugby season indicated greater lineout possession for the top four teams than the bottom four teams that led to scoring a try (Migdalski & Stone, 2019). However, the differential factor between these teams is that they were more effective in stealing the oppositions' ball in a lineout. Equally important is the fact that the lineout success was uneffected between these teams. To conclude, focus should shift to analysing the opposition's tactics with regards to lineout play, for the development of valuable strategies to convert possession in a lineout.

General play

An examination on international and regional matches indicated that the winning teams persistently kicked (including kick to touch) most of their possession away. The previously mentioned study involved the following competitions: World Cup, Six Nations, Tri Nations and Super 12 between 2003 and 2006 (Vaz *et al*., 2010). The above finding correlates with an analysis done on the 2011 Rugby World Cup, the results indicated that teams that won kicked the ball out of hand more frequent than teams that lost (Bishop & Barnes, 2013). However, rugby is constantly changing and evolving, an analysis on the Currie Cup competition in 2007 and 2013 indicated greater success and occurrence of penalty kicks (Vahed *et al.,* 2016). The ability to break through the oppositions defensive line plays a major role in the outcome of the game.

Since line breaks have a strong correlation with try scoring. Every match there is an average of two tries originating from line breaks (Diedrick *et al*., 2011). Therefore, line breaks are associated with try scoring opportunities and should be trained by getting the ball to the outside backs following a scrum (Wheeler *et al.,* 2010). Besides, line breaks significantly increased in numbers when analysing the 2008-2013 Super Rugby seasons (Kraak *et al*., 2016). Furthermore, analysing the 2007 Rugby World Cup researchers indicated that there were 47-line breaks that took place over the course of 11 matches. Firstly, the results indicated that more than half (51%) of line breaks led to a try scored. Secondly 30% of line breaks ended up being unsuccessful, they still managed to retain possession. Lastly, the remaining percentage of possession was lost (19%) (Diedrick *et al*., 2011). Examining the origin of the line breaks, 55% took place in the opponent's side of the field, the rest originated in the defending side of the field (45%). In addition, 89% of line breaks originated in the middle and on the left side of the field (Diedrick *et al*., 2011). The Winning teams created the majority of line breaks (68%) and they also originated in previously mentioned locations. The teams that lost, made use of line break interception for their tries. Most of the line breaks (32%) took place in the first (0-20min) of the game, teams tend to be more unsuccessful between the end (60-80-min) of the game (Diedrick *et al*., 2011). Possession and territory should not be the only two variables that influence points being scored. The focus should rather be on a more important factor at hand which is the quality and use of the possession (Schoeman *et al.,* 2017).

When referring to opposition error, penalty or goal line dropout during National Rugby League matches from 2010-2013, the results indicated that more than 65% of all tries originated from these variables (Kempton *et al*., 2015). Furthermore, a significant correlation has been found between losing games and penalties, when comparing the 2016-2017 English Premiership rugby regular season and the first 12 rounds of the 2017-2018 season (Bennett *et al*., 2018). Penalties occurred between the 50m (36%) and the opposition 22m (20%) for winning teams, when analysing the 2011 Rugby World Cup. Furthermore, a higher percentage of penalties were conceded by winning teams (Bishop *et al*., 2013).

Examination on the 2002-2010 Six Nation and 2003-2010 Tri Nations competitions revealed that most of the penalties occurred during ruck contest, when the expected recycle of the ball is disturbed by the defending players in the ruck (Williams *et al*.,2011; James & Hughes, 2011). The ruck can be defined as when the ball is grounded, usually after a tackle and players from both teams contest on their feet for the ball (World Rugby, 2019d). Inside the ruck players may only move the ball with their feet and the ball can only be picked up once behind the team's hindmost foot. The examination of ruck frequency during 2011 to 2015 Super Rugby Competition reported, a higher number of rucks was associated with losing teams (Schoeman *et al.,* 2017).

However, an examination of the 2007 Rugby world cup, Six Nations and Tri nations tournaments indicated that, teams with a greater amount of rucks in the pool stages was (58%) more likely to win. Contrary to the knockout stages of the world Cup where fewer rucks were associated with a 100% higer success rate (Van Rooyen *et al*., 2010). An analysis on the 2010 Six Nation Championship revealed that most successful rucks involved two attacking players (92%), and increased to (97%) when there were four attacking players. Defenders were more successful in defending the ball if they only had one defender involved at each ruck (Kraak *et al*., 2014). The prevously mentioned authors also reported that attacking teams were more effective if the defending team had one less player. Furthermore, fewer rucks were formed by the top three teams compared to than the bottom three teams. The duration of a ruck influences the match outcome, ruck quickness influences the match outcome in a possitive manner in the first 20min of the game and the last 20min of the game. Whereas slow rucks had a negative impact on the match outcome over all time intervals of the match (Bremner *et al*., 2013).

Early counter ruck is a successful method of retaining possession when ball is behind the advantage line. The early counter ruck occurred in 60% of turnovers during the 2011 Super Rugby season. Moreover, the early counter ruck is also a effective method in at winning possesion in wide attacking channels (18%). Lastly, the late counter ruck was the most ineffective method that will end in a penalty (Wheeler *et al*., 2013). The maul can be defined by the following actions, the player holding the ball is held up and

bound to atleast one of his own team players or the opposing players. The maul is mainly used to gain territory by driving there opposition back or to score a try (World Rugby, 2019d). In addition, the maul compliments effective line out play for attacking teams that can leed to a try being scored. However, for this tool to work efficiently teams should have strong forwards (Schoeman *et al*., 2017). Research especially indicated that a Lineout-maul combination originating from the attacking 22-m zone was a common approach that led to try scoring in the 2017 Super Rugby Competition (Molly et al., 2019). The results of the 2008-2013 Super Rugby contact profile indicated an increase in the number of rucks, mauls and tackles and a decrease in scrums and line-outs (Kraak *et al*., 2016).

The number of turnovers won is very important in Super Rugby and impacts the outcome of matches (Vaz *et al*., 2010). Research done on an elite rugby team found that errors and turnovers were both found to have a negative effect on match outcome and support the above-mentioned statement (Bremner *et al.,* 2013). This is not surprising because turnovers lost leads to loss of possession. Moreover, when comparing the 2007 and 2013 Currie Cup the results indicate that the number of turnovers decreased. Therefore, the number of successful rucks and mauls increase in 2017 from 90% to 95% in 2013.

Lastly, the majority of rucks and mauls occurred in second half of the game (Vahed *et al*., 2016). Comparing matches from: 2017 Super Rugby Competition, 2016 Aviva Premiership, 2016 French top 14 competition and 2016 Guinness Pro 12. The following PI's were identified to be meaningful predictors for points scored: number of turnovers won, percentage of rucks won, tackle breaks and mauls during the different competitions and seasons (Schoeman & Schall, 2019).

Zonal locations (vertical and horizontal)

The 5m lineout from goal line is used when there is a penalty or scrum. Teams that have ball possession within 20m of the oppositions goal line will score a try approximately once every three chances or 33% of the time. Furthermore, the researchers concluded that teams should avoid giving up penalties and turning over

possession as this will increase the likelyhood of the opposition scoring a try (Kempton et al., 2015). To add, during the 2011 Super Rugby competition the defending teams that used the early counter ruck strategie where more likely to turnover posetion in the wide attacking channels (Wheeler *et al*., 2013). The teams that won these matches kicked the majority of their possesion in the oppositions 22-50m when examining the 2015 World Cup. Hence, this was done to pressure the opposition and to win territory (Hughes *et al*., 2017).

Research regarding offloads from southern and northern hemisphere teams, reported that 24% of offloads from southern hemisphere teams led to tries orriginating form the attacking half op the pitch. This was considerably more than the northern hemisphere teams which came in around 15% (Pulling & Stenning, 2015). Explanation regarding figures used: Figure 2.1 and Figure 2.2 shows locations for try origin. These figures help to identify and explain where the try originated from and where it was scored.

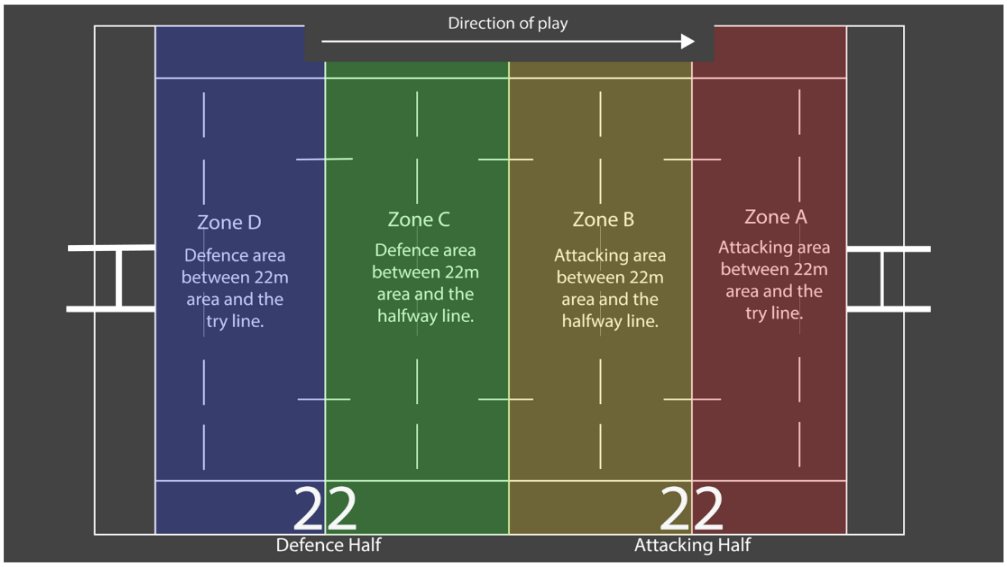

Figure 2.1: Vertical zonal locations for try origin

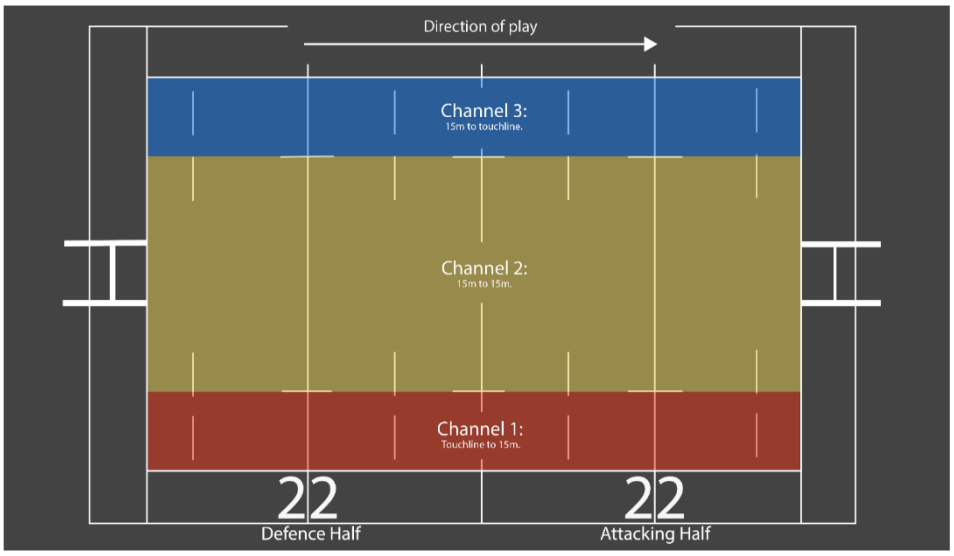

Figure 2.2: Horisontal zonal locations for try origin

Time periods

The duration of a rugby game is 80 minutes, divided in two halves with a 10 minutes or 12 minute break between when refering to international matches. Examination of the 2010 Six Nations championship the results indicated that 44% tries were scored in the first half of the game (World Rugby, 2010). Comparing New-Zealand and France during 2011 Rugby World Cup, the results indicated that they had very different means of scoring points. New-Zealand conceived most of their points through tries compared to France that scored most of their point through penalty kicks, France also tends to score most of their tries during the second half. In Comparison with New Zealand where an equal distribution of tries for both halves can be observed (Vaz *et al*., 2015).

Home and away matches

One of the biggest match indicators is the advantage teams get from playing at home. Teams score 50% or more points when they play at home compared to away games, when comparing 75 matches from the 2005-2009 seasons of the Six Nation Rugby Championship (Vaz *et al*., 2012). In correlation with the above-mentioned finding, 67% of games were won when teams played at their home venue, when analysing home and away advantage in professional rugby players that competed in the European Cup

(Cunniffe *et al*., 2015). Furthermore the 2012, 2013 and 2014 European Super League seasons were analysed, the researchers discovered that, if a home team scored first, they are 74.4% more likely to win the match (Parmar *et al.,* 2017).

2.5. SUMMARY

Defensive systems have improved in professional rugby with increased tackle percentage and structure, these factors differentiate winning and losing teams from each other (Schoeman *et al*., 2017). Improved defensive structures also led to less line breaks resulting in fewer tries being scored. In fact an analysis done on the 2008 to 2013 Super Rugby seasons indicated fewer kicks and scrums and more tackles and ball carries (Kraak *et al*., 2016). Defensive strategies of a team plays a significant role in there overall sucsess (Hendricks *et al.,* 2013). Research indicated that during the 2011 Rugby Wold Cup the key to minimise scoring opportunities for the opposition, is to reduce the penalty count- whilst defending in your own half. The results indicate that a territory-based approach correlates with victory in rugby (Hughes *et al*., 2017). According to World Rugby the southern hemisphere teams had the ability to score tries while maintaining adequate defence by manipulating strategy, vision and skills (World Rugby, 2015). Furthermore the number or tries scored decreased over the past years, as development increased for defensive strategies. By keeping the PIs in mind and analysing the two Super Rugby competitions, to indicate and reveal trends for new attacking strategies based on the current defensive strategies. To conclude, this information will to help researchers, coaches and supporting staff to develop and implement new attacking strategies to increase try scoring opportunities.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. INTRODUCTION

Research methodology can be defined by the process used to conduct a study (Mouton, 2001). Thomas *et al*. (2011) defines research as the systematic process that leeds to the collection and logical analyses of data to solve problems and to make valuable contributions in the field of science. Furthermore Bryman *et al*. (2016) agreed with Thomas *et al*. (2011) that research involves the application of various methods, techniques and approaches for investigating a problem or answering a research question. Lastley, in the context of this study, the phrase research process can be described by how the imperical investigation will be executed.

3.2. STUDY DESIGN

A quantitative cross-sectional study was conducted utilizing video analysis software, for the investigation of try origins during the 2018 and 2019 Super Rugby season. The study made use of retrospective data. This means that the data is already available and does not need to be collected but it must still be analysed to get the necessary data (Salkind, 2010). The current study used Nacsport Scoutplus video analysis software as the data collection tool. The collection process is different for qualititave than quantitative research (Creswell, 2009). Lastly, the study used quantitative research method and the mean count of the PI's.

3.3. SAMPLE

Non-random convenience sampling was used for this study. In addition convenience sampling can be described as a group of participants that are in the right place and time (Polit & Beck, 2014). For this study all televised matches of the 2018 and 2019 Super Rugby tournaments were analysed, equating to 254 games. The video

recordings was supplied by the South African Rugby Union technical department. The inclusion criteria consisted of all the modes of scoring during the 2018 and 2019 Super Rugby tournament.

3.4. DATA COLLECTION PROCESS

All the matches played during the 2018 and 2019 Super Rugby tournament were analysed for the purpose of the study. Video footage was supplied by the South African Rugby Union technical department. All videos was analysed according to set PI's (Table 3.1) using Nacsport Scout plus video analysis software. All data was captured on a data Microsoft Excel Spreadsheet. Data was statistically analysed by a biostatistician from The University of the Free-State Statistical Consultation Unit.

Performance indicators

Performance indicators selection

TABLE 3.1: **PERFORMANCE INDICATORS AND OPERATIONAL DEFINITIONS USED FOR THE AIM OF THE STUDY**

Performance indicator	**Operational definition**
Try (World Rugby, 2020) (Including penalty try)	A try is scored when an attacking player grounds the ball in the opponents' in-goal area, against the opponents' goal post or the surrounding padding of the post. A try can also be scored when the ball is grounded by the attacking team in the oppositions in-goal area after a maul, scrum or ruck carries over to the goal line. The attacking player is tackled before he reaches the goal line and the defending player's momentum helps the attacking player to ground the ball in the opponents' in-goal area. The attacking player is tackled near the opponents' goal line and reaches out and grounds the ball immediately. Lastly, when the attacking player places the ball in the

Performance indicator	**Operational definition**
	oppositions in goal area without the defending player obstructing the ball from making contact with the ground. The penalty try is awarded between the posts for foul play by the opposing team. This can occur when the defending team prevents the attacking team from scoring a try by means of foul play. The guilty player must be warned, suspended or sent off.
Venue	Home: Home team venue Away: Visiting team
Scored 1st	Home team Away team
Tries based on match outcome	Winning team: More tries Winning team: Same number of tries Winning team: Less tries
Methods of scoring	Try (including penalty tries) Conversion kicks Penalty kicks Drop goals
Time periods	Half 1 – 0 ->40min

Performance indicator	**Operational definition**
	Half 2: 40->80min Quarter 1: 0-20min Quarter 2: 20min 1sec - >40min Quarter 3: 40-60min Quarter 4: 60min 1sec - >80min
Zonal location (Van Rooyen *et al*., 2010)	***Vertical*** "Zone A: Attacking area between 22m area and the try line. Zone B: Attacking area between 22m area and halfway line. Zone C: Defence area between 22m area and the halfway line. Zone D: Defence area between 22m area and the try line. ***Horizontal*** Channel 1: From left touchline to 15m line Channel 2: In between the 15m Channel 3: 15m to touchline line
Type of play from set pieces	Structured play: (set piece up until three rucks) Unstructured play: (four rucks and try scored)

Performance indicator	**Operational definition**
Possession platform	*Set piece preceding the try* • Scrum • Lineout • Kick off (start of half) • 50m Drop out (after try, place kick) • 50m Drop out (dead ball) • Quick throw in at lineout • Quick tap (PK & FK) *General play activity preceding the try* • Kick received (punt kick, box kick, chip, up and under, cross-kick, grubber • Kick retained (box kick, chip, up and under, cross kick, grubber) • Turnovers won (ruck, maul, set piece; charge down, knock-on, pass that went to deck, drop kick ball, missed tackle)
Player numbers (based on yellow/red cards)	One more than the defending team Two more than the defending team Even numbers as defending

Performance indicator	**Operational definition**
	One less than the defending team Two less than the defending team

Equipment

Nacsport is a video analysis software program that allows you to create events based on your PI's. Various researchers have used Nacsport Scoutplus as a data collection tool and is considered a very accurate measuring tool to use (Kraak *et al*., 2019). Nacsport was founded in 2008 and since been used in over 60 countries as a reliable source for formulating statistics for sport. The primary researcher used a laptop with Nacsport Souct plus video analysis software.

Reliability

The re-analysis method for inter-rater reliability, was used to determine the reliability of the coding (James *et al*., 2013). The procedure for this method requires a different analyst to do a re-analysis of the tries after the original analysis has been done. The Inter rater reliability test will be condcuted to examine the reliability of tries scored. After the initial coding, the primary researcher and an external coder re-coded 25% of the tries scored. Next the statistician performed a random selection that was used for the intra and inter-rater reliability (Franken *et al*., 2017). The reliability between the different coding agreements was measured using Cohen's kappa statistic (κ). The study revealed a very good intra and inter-coder agreement for all the PIs (>κ = 0.96) analysed.

3.5. LIMITATIONS

The analysis of the recorded games can be effected by picture quality, if the quality is video quality is poor it will be dificult to analyse specific PI's of the game. The study showed that th strength of the agreement between all PIs was perfect (>κ = 0.96), and thus very agreeable.

3.6. PILOT STUDY

No pilot study will be needed as Nacsport Scout+ video analysis software has been validated, confirming the usefullness of the system in rugby analysis (Kraak *et al*., 2019; Hopkinson *et al*., 2021; Williams, 2013)

3.7. STATISTICAL ANALYSIS

Descriptive statistics were calculated for all PIs. The number of points scored (total of both teams in each match) was analyzed using a linear mixed model fitting Year as fixed effect and Home Team, Away Team, Home Team by Year and Away Team by Year as random effects. From this model the least squares means per year, and a point estimate, 95% confidence interval (CI) and p-value for the mean difference between years was calculated. Some indicators are expressed as percentages, which according to Hughes and Bartlett (2002) provides a more accurate analysis of performance. The least squares means, mean difference and 95% CI were transformed by the anti-log, to obtain geometric least squares means for each year, and a point estimate and 95% CI for the rate ratio between years. Cohen's d effect sizes (Thomas et al., 1997) were calculated, using the difference in means divided by the pooled standard deviation, to characterize the differences between the years. The magnitude of Cohen's d effect sizes evaluated according to the following criteria: trivial (<0.2), small (≥0.2 and <0.6), moderate (≥0.6 and <1.2), large (≥1.2 and <2.0) and very large (≥2.0) (Hopkins, 2011). The analysis were carried out using SAS procedure GLIMMIX (SAS, 2017).

3.8. IMPLEMENTATION OF FINDINGS

The data from the 2018 and 2019 Super Rugby Tournament can provide the necessary information to coaches, for formulating new attacking strategies and identification of the latest game trends when analysing matches.

3.9. ETHICAL ASPECTS

The research study does not involve any contact with participants, nor does it implement an intervention. Data was analysed using Nacsprot Scoutplus video. The study wasconsidered low risk as the match footage is available in the public domain. No player and team teams will be used. The study was approved by Health Sciences Research Ethics committee of the University of the Free-State (+27 51 401 3047)

CHAPTER 4: RESULTS

4.1. INTRODUCTION

This chapter presents the results of the study. The primary aim of the study is to analyse the try scoring profile of the 2018 and 2019 Super Rugby competition.

The specific objectives are to:

1. describe and compare the percentage contribution of tries being scored to the total points scored during the 2018 and 2019 Super Rugby tournament per year, match outcome, time period and home and away.
2. describe and compare the sequence of tries being scored to the total points scored during the 2018 and 2019 Super Rugby tournament per year, time period, match outcome, and home and away.
3. describe and compare the number of tries scored from set pieces during the 2018 and 2019 Super Rugby tournament per year, match outcome, zonal locations and time period.
4. describe and compare the number of tries score from general play match activities during the 2018 and 2019 Super Rugby tournament per year, match outcome, zonal locations andtime period.

This chapter will present the results from the study under two headings:

Part 1: Tries in relation to other modes scoring and points obtained from modes of

scoring (objective one and two), and

Part 2: Try scoring profile (objective three and four).

The interpretation and the discussion of the results will follow in Chapter 5. It is important to note that for the purpose of the current study, penalty tries awarded is not included in the tries scored.

4.2. PART 1: TRIES IN RELATION TO OTHER MODES SCORING AND POINTS OBTAINED FROM MODES OF SCORING (OBJECTIVE ONE AND TWO)

Table 4.1 presents the number of observations with standard deviations, means and 95% CI for each mode of scoring in 2018 and 2019. On average 15.45±4.64 modes were utilised in 2018 and 14.00±3.57 in 2019, respectively. The differences between the two seasons were statistically significant (p=0.0.2) and a small practical significant difference (d=0.35) was revealed.

Figure 4.1 provides the percentage contribution for each mode of scoring in 2018 and 2019, respectively. The data revealed that during 2018 the percentage contribution of tries was 47% (914 out of 1,963) and during 2019 it was 46% (811 out of 1,779). On average during the 2018 season, 55.66±13.36 points were scored when compared to the 50.25±12.65 points scored in 2019 per match. This is considered statistically significant (p=0.001), and a small practical significant difference (d=0.37) was revealed. Figure 4.2 provides the percentage contribution for points from each mode of scoring in 2018 and 2019, respectively. The data revealed that during 2018 the percentage points contribution of tries was 65% (4,570 out of 7,069) and during 2019 it was 46% (811 out of 1,779).

The analysis revealed that during the 1st and 2nd half of the 2018 matches, 457 and 457 points were scored from all the scoring modes, compared to 387 and 419 points scored in 2019, respectively. When looking at points scored from tries 3,566 and 3,503 points were attained compared to 3,179 and 3,203 points in 2019, respectively. In 2018 and 2019, the 1st and 2nd half seem to mirror each other with the most prominent mode of scoring being tries, followed by conversion kicks and penalty kicks (Table 4.1).

When comparing the 1st half and 2nd half for the two seasons for the scoring modes combined and points scored from all scoring modes and for the 1st half for tries as a mode of scoring and points scored from tries a statistical significance difference and small practical significance was revealed. Furthermore, the 2018 matches reported no drop goals in comparison with 2019. Both the 2018 and 2019 matches revealed more tries and conversion kicks in the 2nd half compared to the 1st half.

In 2018, the home teams won 86 out of 127 matches (68%) and 77 out of 127 matches (61%) in 2019. In 2018, the home teams scored 3889 (3889 out of 7069) points compared to the 3180 (3180 out of 7069) points obtained by away teams. In 2019, a similar trend was observed with the home team scoring 3414 (3180 out of 7069) points, compared to 2968 points for the away teams. Table 4.1 compares the home teams between 2018 and 2019, as well as the away teams between 2018 and 2019. When comparing the contribution of tries in relation to all the other modes of scoring a statistical and practical significance was revealed for the home teams (Table 4.1). No statistical significance was revealed for the away team during the two seasons. Additional analysis revealed (not included for the purpose of the current study), when teams played home in 2018 and 2019, scored more tries, conversion kicks, penalty tries and penalty kicks, than playing at home.

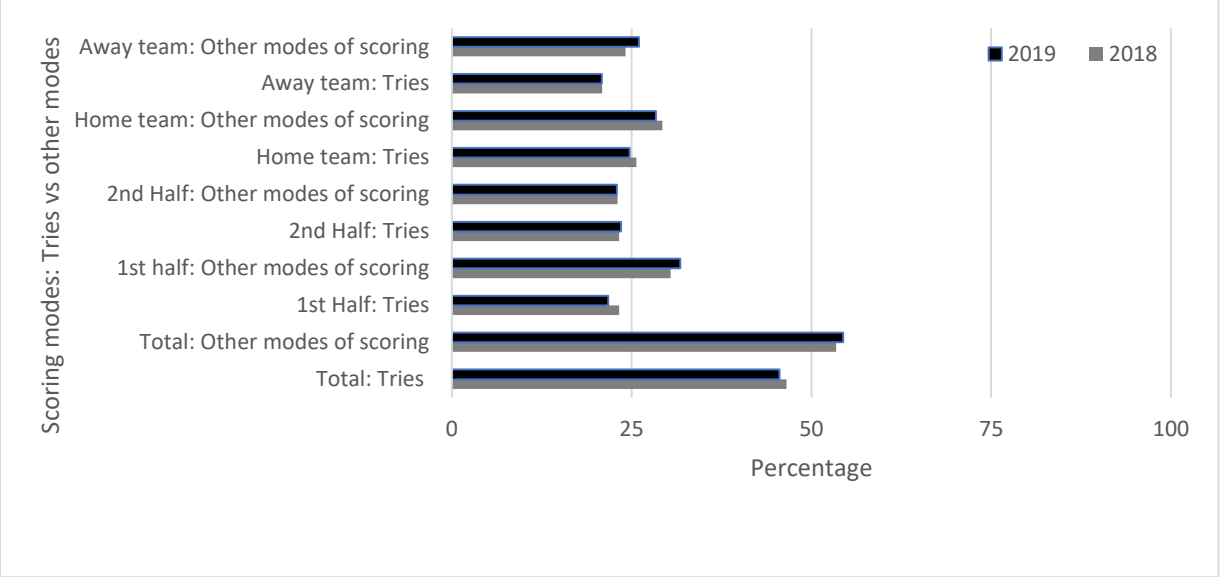

FIGURE 4.1: *THE TOTAL TRIES SCORED (EXPRESSED AS A %) IN COMPARISON TO OTHER MODES OF SCORING FOR 2018 (GREY) AND 2019 (BLACK) SUPER RUGBY SEASONS. (PENALTY TRIES AWARDED IS INCLUDED IN THE OTHER MODES OF SCORING).*

***TABLE 4.1**: MODES OF SCORING UTILIZED, AND POINTS SCORED (PER MATCH) PRESENTED AS FREQUENCIES OF SCORING MODES AND POINTS SCORED FOR TRIES, AND CONFIDENCE INTERVALS FOR THE BOTH THE 2018 AND 2019 SUPER RUGBY SEASONS*.

Performance indicators	2018 (n=127)			2019 (n=127)			Differences	
	f	M±SD	95% CI	f	M±SD	95% CI	p-value	d-value
Mode of scoring (All)								
Total All	1963	15.45±4.64	15 to 16	1779	14.00±3.57	13 to 15	**00.2**	0.35 (Small)
1st Half	1054	8.29±3.06	8 to 9	952	7.49±2.53	7 to 8	**0.01**	0.29 (Small)
2nd Half	909	7.15±2.69	7 to 8	827	6.51±2.60	6 to 7	**0.02**	0.24 (Small)
Home Team	1079	8.49±3.51	8 to 9	945	7.44±3.12	7 to 8	**0.006**	0.32 (Small)
Away Team	884	6.96±3.10	6 to 8	834	6.56±3.11	6 to 8	**0.15**	0.08

Mode of scoring (Tries)^								
Total Tries	914	7,19±2,56	7 to 8	811	6,38±2,03	6 to 7	0**.004**	0.34 (Small)
1st Half	457	3,96±2,03	3 to 4	387	3,46±1,81	1 to 2	**0,01**	0.26 (Small)
2nd Half	457	3,22±1,58	3 to 4	419	2,92±1,77	3 to 3	0,07	0.18
Home Team	504	3,96±2,03	2 to 4	440	3,46±1,81	3 to 4	**0.01**	0.26 (Small)
Away Team	410	3,22±1,58	3 to 4	371	2,92±1,177	3 to 3	0.07	0.18
Points scored (All scoring modes)								
Total	7069	55.66±13.36	53 – 59	6382	50.25±12.65	48 – 52	**0.001**	0.37 (Small)
1st Half	3566	28.07±9.66	26 – 30	3179	25.03±8,71	24 – 27	**0.004**	0.33 (Small)
2nd Half	3503	27,58±11,25	26 – 30	3203	25,22±9.90	23 – 27	**0.03**	0.22 (Small)
Home Team								

Away Team	3889	30.62±12.72	28 – 33	3414	26,88±11.14	25 – 29	**0.006**	0.31 (Small)
	3180	25.03±10.85	23 – 27	2968	23.37±11.17	21 – 25	0.11	0.15
Points scored (Tries)^								
Total	4570	35.98±12.84	34 to 38	4055	31.92±11.32	30 to 34	**0.004**	0.34 (Small)
1st Half	2375	19.88±9.05	18 to 22	1935	17.32±9.05	16 to 19	**0.01**	0.27 (Small)
2nd Half	2375	16.14±7.92	15 to 18	2095	14.69±8.87	13 to 16	0.07	0.18
Home Team	2520	19.84±10.15	18 to 22	2200	17.32±9.05	16 to 19	**0.01**	0.26 (Small)
Away Team	2050	16.14±7.92	15 to 18	1845	14.60±8.87	13 to 16	0.07	0.18

Note: ^ penalty tries awarded not included; ***Statistical significant (p=0.05);*** *SD - Standard deviation, M – mean, CI – confidence intervals, Practical significance (Hopkins, 2011): small = practical significant difference between 2018 and 2019 (d ≥0.2 and d < 0.6), moderate = practical significant difference between 2018 and 2019 (d ≥ 0.6 and d < 1.2), large = practical significant difference between 2018 and 2019 (d ≥ 1.2 and d < 2.0) and very large = practical significant difference between 2018 & 2019 (d ≥ 2.0).*

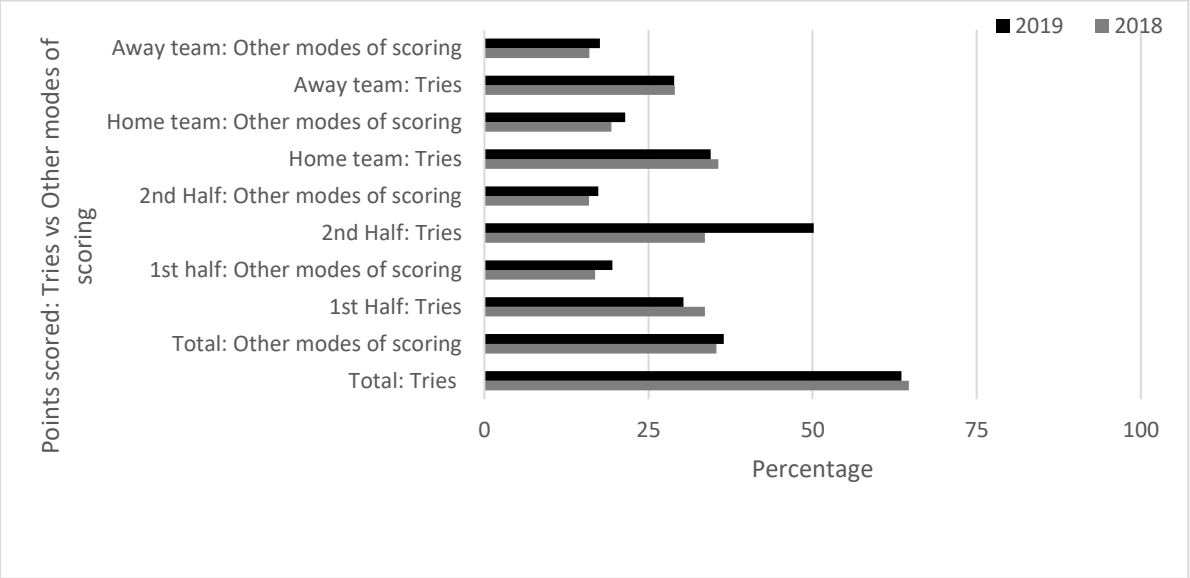

FIGURE 4.2: *THE TOTAL POINTS SCORED FROM TRIES (EXPRESSED AS A %) IN COMPARISON TO OTHER MODES OF SCORING FOR 2018 (GREY) AND 2019 (BLACK) SUPER RUGBY SEASONS. (PENALTY TRIES AWARDED IS INCLUDED IN THE OTHER MODES OF SCORING).*

4.3. TRY SCORING PROFILE (OBJECTIVE THREE AND FOUR)

Table 2.2 presents the contextual factors that describes the tries scored during the 2018 and 2019 Super Rugby seasons. When looking at the time period for the tries scored in 2018 both halves accounts for 457 tries when looking at 2019, 420 tries were scored in the 1st half (quarter 1 and 2) when compared to the 391-2nd half (quarter 1 and 2). When comparing 2018 with 2019 a statistically significant increase was observed for tries scored in “Quarter 1” (p=0.01), a statistically significant decrease in tries in “Quarter 3” (p=0.001) and “Quarter 4” (p=0.004).

The zonal locations where the tries originated from is presented in Table 2.2. The results revealed that most of the tries for the 2018 and 2019 seasons originated from the attacking half of the field (Zone A & B) and 64% Channel 1. When comparing the vertical zonal locations across the two seasons a statistically significant was revealed “Zone A” (p=0.01), Zone B (p=0.001) and Zone C (p=0.01). When looking at the number of players on the field when tries are being scored in both season, most of the tries were scored when both teams had 15 players on the field.

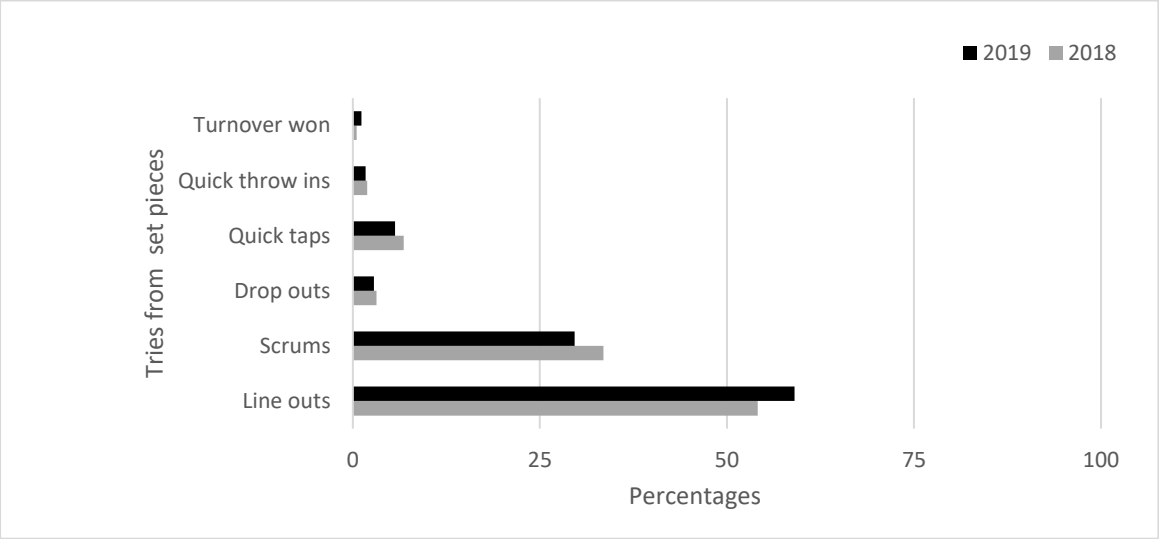

FIGURE 4.3: *SET PIECE AS A TRY ORIGIN FOR TRIES SCORED DURING THE 2018 AND 2019 SUPER RUGBY SEASONS EXPRESSED AS A PERCENTAGE.*

Figure 4.3 presents the tries scored from set pieces as an origin a total of 573 tries were scored in the 2018 season which accounts to 63% (573 out of 914) of the tries. During the 2019 season of 530 tries were scored which accounts to 65% (530 out of 914) of the tries. In both seasons, lineouts were revealed as the major source of tries from set pieces with 54% (310 out of 573) and 59% (313 out of 530) 2018 and 2019 respectively. The increase that was observed in 2019 were considered to statistically significant (p=0.001) and a small practical significant (d=0.37). Scrums were considered the second source of tries of set pieces with 34% (192 out of 573) in 2018 and 30% (157 out of 530) in 2019, however a decrease was observed in the 2019 season this decrease was not statistically or practically significant.

The total tries scored from general play was presented in Figure 4.4 The tries scored from general play as an origin a total of 341 tries were scored in the 2018 season which accounts to 37% (341 out of 914) of the tries. During the 2019 season of 281 tries were scored which accounts to 35% (281 out of 811) of the tries. In both seasons, “turnovers won” were revealed as the major source of tries from general play with 60% (203 out of 341) and 62% (175 out of 281) 2018 and 2019 respectively. The increase that was observed in 2019 were considered to statistically significant (p=0.002) and a small practical significant (d=0.36). Kick received was considered the second source of tries of general play with 33% (114 out of 341) in 2018 and 34% (96 out of 281) in 2019, however an increase was observed in the 2019 season this increase was not statistically or practically significant.

TABLE 4.2: *CONTEXTUAL FACTORS FOR TRIES SCORED (PER MATCH) PRESENTED AS FREQUENCIES AND PERCENTAGES FOR THE BOTH THE 2018 AND 2019 SUPER RUGBY SEASONS.*

Performance indicators	2018 (n=127) Tries (n=914)	2019 (n=127) Tries (n=811)	2019 (N=254) Tries (N=1725)	Differences 2018 vs 2019			
	n	%	n	%	n	%	p-value
Quarter							
1	213	23	199	25	412	24	**0.01**
2	244	27	221	27	465	27	0.07
3	231	25	198	24	429	25	**0.001**
4	226	25	193	24	419	24	**0.004**
Vertical Zonal location (origin of try)							
Zone A	375	41	350	43	725	42	**0.01**
Zone B	294	32	270	33	564	33	**0.001**
Zone C	204	22	166	20	370	21	**0.01**
Zone D	41	4	30	4	71	4	00.7
Horizontal Zonal location (origin of try)							
Channel 1	588	64	536	64	1124	65	0.06
Channel 2	307	35	265	35	572	33	0.07
Channel 3	19	2	10	2	29	2	0.07
Player numbers							
1 more than defending team	75	8	62	8	137	8	0.07
2 more than the defending team	3	0	2	0	5	0	0.007
1 less then defending team	19	2	13	2	32	2	0.006
2 less then defending team	2	0	0	0	2	0	0007
Even numbers	815	89	734	90	1549	90	0.01

Note: Statistically significant (p=0.05); draws were not included; penalty tries awarded not included

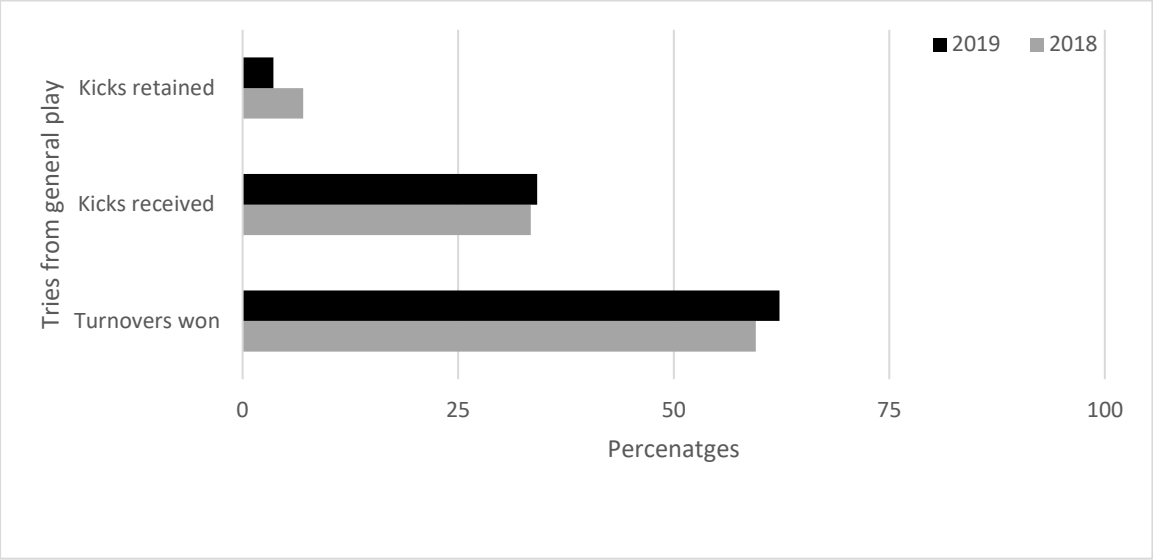

FIGURE 4.4: *GENERAL PLAY AS A TRY ORIGIN FOR TRIES SCORED DURING THE 2018 AND 2019 SUPER RUGBY SEASONS EXPRESSED AS A PERCENTAGE.*

CHAPTER 5

DISCUSSION OF RESULTS

5.1. INTRODUCTION

To date, this is the first rugby study that specifically focuses on mode of scoring utilised (part 1 of the study addressing objective one and two) and specifically a try scoring profile (part 2 of the study addressing objective three and four) at professional level to determine the changes on game dynamics during match-play during the 2018 and 2019 Super Rugby seasons.

The key findings from the study are as follows:

1. A decrease in scoring modes utilised from 2018 to 2019.
2. The number of tries decreases from 20218 to 2019 which led to a decrease in the number of conversion kicks.
3. Even number of tries were scored between the 1st and 2nd half for 2018 and in 2019, however more tries were scored in the 1st half compared to the 2nd half.
4. Majority of the tries originated from the attacking half (Zone A & B) and channel 1 of the field for both the 2018 and 2019 seasons.
5. Lineouts were the set piece origin for majority of the tries for 2018 and 2019 with an increase in 2019.
6. Turnovers won were the general play origin for majority of the tries for 2018 and 2019 with an increase in 2019.

The discussion of the key results will be presented in 2 parts:

1. Part 1 focussing on the modes of scoring and the points derived from each mode across the two seasons.
2. Part 2 will be specially focused on the try scoring profile across the two seasons.

5.2. PART 1: TRIES IN RELATION TO OTHER MODES SCORING AND POINTS OBTAINED FROM MODES OF SCORING (OBJECTIVE ONE AND TWO)

When addressing objective one and two of the study the key findings from the study revealed a decrease in modes of scoring used to score points from 2018 to 2019. During 2019 there was a decrease in the number of tries scored that has led to a decrease in the number of successful conversions kicks subsequently. The mean penalty kicks stayed consistent across the two seasons. No drop kicks were observed in 2018 and only 3 in 2019. Please note that for the aim of this study penalty tries awarded were not included as tries.

The current study revealed that tries were responsible for most of the modes of scoring and points for both the 2018 and 2019 rugby seasons. A reason for this finding could be the approach to the game as university level coaches in South Africa indicated that there is a trend in rugby that when attacking teams receives a kickable penalty the trend was that they will kick for touch to set-up a line-out to create a try scoring opportunity, or they will take a quick penalty kick to gain an extra 10m. This indicates that attacking teams would rather kick a potentially kickable to touch to set-up a lineout and maul to score (Kraak *et al*., 2017). Smith (2017) agrees and state that this is an aspect of the game that is seemingly becoming more common in rugby across different levels of play.

The study revealed significant differences in the number of modes of scoring and points scored from these modes from the 2018 to 2019 seasons. A decrease of tries and successful conversion kicks was observed from 2018 to 2019. A possible reason for the decrease in the number of scoring modes could be the improvement in the defensive systems utilised by teams. According to Schoeman *et al*. (2017) at proffessional level rugby defensive systems has improved in professional rugby with increased tackle percentage and stucture, these factors differentiate winning and losing teams from each other. This is supported by Hendricks *et al*. (2013) that stated defensive strategies of a team plays a significant role in there overall sucsess. Improved defensive structures also led to less line breaks resulting in fewer tries being scored (Kraak *et al*., 2016). Den Hollander *et al*. (2016) analysed the 2013 Super

Rugby competition and observed that the ability of the attacking team to break through the defensive line is a KPI of success as it creates opportunities to score tries. The study further highlighted that linebreaks were associated with success in the competition. In order for coaches and specialist attack coaches to breach his defensive systems, we need to work on technical and tactical skills to utilise space better and use decoy or dummy runners on attack.

Home advantage can be quantified by the number of points scored at home expressed as a percentage of all points at home and away (Pollard, 1986; Pollard & Gómez, 2014; Pollard & Gómez, 2015). It is a well-studied phenomenon in football but not too popular in a rugby environment. The current study revealed a significant difference between the performance of home and away teams during the 2018 and 2019 seasons. In 2018 as the home teams won 86% of their matches in 2018 and in 2019 a similar trend was observed with regards to winning for the home and away teams with the home teams winning 77% of the matches. A decrease (86% to 77%) in the number of matches won by the home team was observed with an increase of matches won by the away team (40% to 45%) however these changes were not significant. A study by Vaz *et al*. (2017) on the Six Nations tournament between 2005 and 2009 revealed that there is a tendence that teams playing at home achieve better results. Based on these findings, the data of the study indicated that teams playing more rugby matches at home in a season of the Super Rugby tournament will have an increased chance of doing well in the competition. Due to structure of the competition at the time the findings of the current study could be of value to coaches and conditioning coaches pertaining to the log position of the team, fatigue due to traveling, the mental state of the players, the effect of the home crowd as well the referee's interpretation and performance (Bray, 1999). According to Greer (1983) and Pollard and Gómez (2014) the home teams crowd will also affect the away team and not only the referee. An explanation for this could be that in 2018 the stronger teams might have played all the weaker teams away and this might have changed in 2019, where they played all the weaker teams at home. Similar trends were revealed by Morton (2006) who found that during the 2000–2004 Super12 tournament the teams that possess a high home advantage the one year do not tend to carry it over into the next year, neither does a team with a home disadvantage tend to carry it over. The study by Morton (2006)

further revealed that the stronger teams based on rankings do not necessarily have a high home advantage. However, the coaches felt that when you play at home, you had a psychological advantage over the visiting teams, but away teams can also use this as an advantage. Typically, away teams will try and score points early during the match to put pressure on the home team.

5.3. PART 2: TRY SCORING PROFILE (OBJECTIVE THREE AND FOUR)

The current study observed more tries being scored in the 1st half of the 2019 season when compared to 2nd half, however no differences was observed for the season 2018. Possible reasons for this could be:

1) the attacking team would like to score earlier in the match and build pressure, or

2) the competition structure contributed that the higher ranked teams played lower rank teams in the 2019 season.

Findings from University level rugby in South Africa revealed that more tries were scored in the 2nd half of the match (Kraak *et al*., 2017). However, in a soccer study by Mitrotasios and Armatas (2014) “during the European Soccer Champions in 2012, 58% of the goals were scored in the 2nd half and 21% of them in the last 15-minute period. Firstly, it was suggested that goals scored were not time dependent. Although no statistical difference were observed that more goals scored in the 2nd half of the matches, while 15-minute period analysis revealed that more goals were scored in the beginning and in the end of the 2nd half”.

Our study found that most of the tries originated from the attacking half of the field (Zone A and B). This agrees with findings from Coughlan *et al*. (2019) and Ortega *et al*. (2009) that revealed the lineout–maul combination commencing from the attacking 22-m zone was found to be the most prominent pattern. The two-studies support observation of the current study that majority of the tries were scored from lineouts where the team that will get a penalty, will kick to touch to create a platform to score a try, in order to have an opportunity to receive 7 points rather than 3 points for a

successful penalty kick. The current study (even though this was not included in this dissertation) observed an increase in the number of lineouts and mauls, as well as tries scored from successful mauls. This suggested that the teams were using these facets of play to score tries.

Our study also revealed that lineouts are the major source of tries from set pieces and is highlighted as a major contribution to success at rugby across various levels. Sasaki *et al*. (2007) conducted a review of scoring profiles in the Japanese domestic rugby competition from 2003 to 2005 and found that "lineouts and scrums contributed to 54% (on average) of all tries analysed. Migdalski and Stone (2019) investigated lineout performance during the English Premiership between 2016 and 2017 and found that despite more tries being scored from lineouts by successful teams, lineout success was not significantly different between the top (87%) and bottom four teams (85%) supporting previous research by Bishop and Barnes (2013) and Vaz *et al*. (2010) that lineout success is not a discriminatory factor in the outcome of match-play. However, lineouts are seen as a great attacking platform for teams to restart play after the ball went into touch. Sayers (2011) agrees that lineouts are an important aspect of a team's attacking game, and approach lineouts as an excellent try scoring platform". Our study support and strengthen this view.

Studies (Hughes & White, 1997; Jones *et al*., 2004; Vaz *et al*., 2011) revealed that success is a contributing factor to winning a match, however, various researchers found contradictory information that indicates that lineout performance is not always a key PIs determining match outcome. The study Franken *et al.* (2017) concluded that most lineouts during the 2013 Rugby Championship and Six Nations occurred in the attacking zone between the 22m line and the halfway line "Zone B" with mauls and followed by a pass being the most utilised formats to launch attacks. In the current study, only a few lineouts turnovers were observed that led to tries, however, Vaz *et al*. (2010) on lineouts, found that winning teams have a greater match success when they turn over the ball at the lineout, due to space provided to the team that regains the ball. Furthermore, according to Vaz *et al*. (2010) with the increase in lineouts in the modern game, and lineouts a platform to launch attacking plays, more research must be conducted into contesting strategies used by opposition teams. When coaching, it

is important for lineout coaches to identify and prioritise specific areas in the lineout that can be trained to improve performance.

Sasaki *et al*. (2007) also conducted a review of scoring profiles in the Japanese domestic rugby competition from 2003 to 2005 and found that “lineouts and scrums contributed to 54% (on average) of all tries analysed. It was also found that there was an increase in the number of tries sourced from ruck turnovers (9–11%) and that turnover tries tended to originate further from the try line when compared to set piece tries. In addition, ruck turnover tries took on average 19.1s of possession time as opposed to set piece tries where possession time averaged over 30s (Sasaki *et al*., 2007). This indicated that defensive pressure in the two scenarios was different, and that the defending team might not be prepared for a turnover situation which placed the attacking team in a favourable position (Sasaki *et al*., 2007). Ortega *et al*. (2009), Vaz *et al.* (2010), Vaz *et al*. (2011) and Kraak *et al.* (2016) contrasted differences in rugby match statistics in various international competitions between winning and losing teams”.

In summary, our study suggested that tries were scored originating from all over the field, but more tries were scored in Zone A. Tries originated also from several different possession platforms, where set pieces: lineouts and general play: turnovers won were the main platforms in both 2018 and 2019 seasons. Fundamentally, coaches and specialist attacking coaches will be able to use these try scoring profiles to improve technical and tactical skills and develop a framework to plan and execute effective plays and tactics in training to score more tries and concede less tries in matches.

In conclusion, lineouts and turnovers won were highlighted as common modes of scoring tries in 2018 and 2019 Super Rugby tournament. In addition, the lineout–maul combination was a key attacking pattern identified. Coaches and specialist coaches can also use these findings of the current study to develop and implement effective attacking strategies from set pieces and from general play. It is also important that coaches do no practice attack and defence in isolation in order to improve the players ability to transition from attack to defence, and from defence to attack.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

1. INTRODUCTION

The primary aim of the study is to analyse the try scoring profile of the 2018 and 2019 Super Rugby competition. This was done through performance analysis of the Super Rugby tournament based on set PIs presented in Chapter 3. The study was conducted to reveal trends and try origins. Chapter two elaborated on all research that was previously available and the impact of the different performance indicators in rugby union. This study on Super Rugby teams from the 2018 and 2019 season, is one of the first to investigate try origin and will help to develop a try scoring profile. This chapter will elaborate on the conclusion and limitations of this study and future research avenues.

2. CONCLUSION

The key findings from the study are as follows:

1. A decrease in scoring modes utilised from 2018 to 2019.
2. The number of tries decrease from 20218 to 2019 which led to a decrease in the number of conversion kicks.
3. Even number of tries were scored between the 1st and 2nd half for 2018 and in 2019, however more tries were scored in the 1st half compared to the 2nd half.
4. Majority of the tries originated from the attacking half (Zone A & B) and channel 1 of the field for both the 2018 and 2019 seasons.
5. Lineouts were the set piece origin for majority of the tries for 2018 and 2019 with an increase in 2019.
6. Turnovers won were the general play origin for majority of the tries for 2018 and 2019 with an increase in 2019.

3. LIMITATIONS AND FUTURE RESEARCH

A limitation to the current study, this was also identified by Coughlan et al. (2019), that only data from tries were collected no data on success rates of different facets were included. The success rates of facets could have added a different dimension to the study. The second limitation was that the study only included quantitative data insight from coaches and specialist could have given more context to the data. Future studies should compare the findings with that of other professional rugby tournaments for the example the United Rugby Championships, Top14 and the newly formed Super Rugby tournament. Further research should focus on the try scoring profile in women's rugby to see if similar trends are evident.

CHAPTER 7

Reflection on the research process

7.1. INTRODUCTION

This chapter provides the overview of the difficulties, personal experiences and reflections of the study, in order to completely understand the full impact of the research process and the importance the data analysis and conclusions from this study. This study will give meaningful information for coaches and supporting staff to implement improved tactics in preparation for further development and positive game outcomes. The reflection of the research process and personal experiences during the process, is valuable for further studies and puts this whole study into perspective.

7.2. REFLECTION ON THE RESEARCH PROCESS

A well-known Greek philosopher, Heraclitus once said “The only things constant is change, so you have to learn to embrace it”. In this day and age, it is necessary to be adaptable to change your mindset and approach in various aspects. Throughout this study there were many challenges. The biggest of these was the global pandemic of COVID-19 that has and will continue to have a huge effect on current and future research projects and their outcomes. After I completed my Honours degree, I had the opportunity to work at Kovsie-Fit as part of an internship program. The university of the Free-State provided me with the funds necessary to register for a post graduate qualification.

During my time there I decided to take the opportunity to investigate a possible topic for a master’s degree. I followed up with my Honours study leader, Prof. Riaan Schoeman, we decided on the 2018 and 2019 Super Rugby season due to continuous analysis of KPI’s. During the study, Prof. Derik Cetzee took over the responsibility of being my study leader, and Prof. Wilbur Kraak as the co-supervisor. The start of my master’s degree was daunting but luckily, we had classes to help us with the first three

chapters. This helped me considerably to stay motivated and work on time for each chapter. The first three chapters where when evaluated by the internal committee of the Department of Exercise and Sport Science and suggestions were implemented to improve the quality of the project. The submission to the HSREC went well, since no humans involved in the analysis of this study and further changes where implemented.

The data collection process started off optimistic, with my study not requiring any human testing. The COVID–19 pandemic had a larger effect than I anticipated and everything came to a hold, this included the communication to the supporting staff of SA Rugby that would provide me with the data necessary to go forth with the data cleaning process. Therefore, my study was extended to 3 years past the intended 2-year period which I hoped to finish. The time was running out and there were still a lot of data collection and writing left. The final editing and submission felt surreal, after three years of hard work and late nights it came together, and the feeling of relief came over me. I cannot thank my study leader and co - study leader enough. Their support, dedication, and motivation they provided. Lastly, to complete my study in the set-out time frame.

7.3. PERSONAL REMARK

Throughout the period of study, I have learned a lot and gained a lot of insight regarding the certain topic. I also grew as a person and learned what it means to have faith in the lord through his promises. I am therefore great full that this study will help contribute to information available on try origins and form part of previous studies on the Super Rugby tournament.

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Addendum A: Turnitin report: **Mr Gabrie Greeff - Analysis of tries scored during the 2018 and 2019 Super Rugby tournaments**

Addendum B: Health Sciences Research Ethics Committee

ADDENDUM B

Health Sciences Research Ethics Committee

18-Jan-2021

Dear **Mr Gabrie Greeff**

Ethics Clearance: **Analysis of tries scored during the 2018 and 2019 Super Rugby tournaments** Principal Investigator: **Mr Gabrie Greeff**

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

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-HSD2020/2002/2601**

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.

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

Yours Sincerely

Prof. A. Sherriff
Chair : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee
Office of the Dean: Health Sciences
T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za
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12 October 2020

Health Sciences Research Ethics Committee
UFS

Project title: **ANALYSIS OF TRIES SCORED DURING THE 2018 AND 2019 SUPER RUGBY TOURNAMENTS**

Researcher: **Gabriel Pieter Greeff (2014103523)**

Supervisor: Prof D Coetzee
Co-supervisor: Dr R Schoeman
Dr W Kraak

I herewith confirm that I have reviewed the research proposal for this study. I have discussed the proposal with the researcher and have provided input into the study design and analysis. After data collection I will assist the investigator with data analysis and interpretation.

Sincerely

Robert Schall
Professor: Statistical Consultation Unit

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