1.0 Introduction

The game of rugby union is developing and evolving rapidly from the players to the coaching and management staff (Vivian *et al.,* 1997). The introduction of professionalism on the twenty sixth of August 1995 (Eaves *et al.,* 2001) has seen the expectations of standards within the sport to increase dramatically, with an emphasis being placed on a fast, dynamic and physical matches (Eaves and Hughes, 2003). The Rugby World Cup is held every four years and is the World's premier international rugby union event (Sports illustrated, 2007). Through the gradual development of rugby union and desire for success, a need for the evaluation and analysis of performance has grown. Hughes and Franks (1997) state that rugby union uses notation by using team profiling based on predefined performance indicators and also analysis of individual skill sets again based on predefined, but different, performance indicators. Parsons and Hughes (1997) suggest that possession is the key to successful rugby union, however through the use of analysis systems (such as Sportscode) the quality of actions whilst in possession can be evaluated, providing greater depth during the feedback process to players. Hughes and Franks (1997) continue by stating that the knowledge about the proficiency with which athletes perform a skill is critical to the learning process.

Rugby union teams consist of fifteen players, eight forwards and seven backs. These larger units can be further separated into smaller units of players. The front five, the middle five and the back five (Biscombe and Drewett, 1998). Within a forward pack each player has position specific roles to play, both at set piece and during open play. Although a forward's primary role is at the lineout and scrum, the modern game of rugby union now requires players to have universal skills that can exploit opposition.

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Despite previous research into rugby union performance and the Rugby World Cup (McCorry *et al* 1997; Potter and Carter 1997), limited research is available regarding the role of forwards and their effect within successful rugby union teams.

1.1 Purpose of The Study

Forwards spend significantly more time in high intensity work than backs, because of their greater involvement in rucking, mauling and scrummaging (Deustch *et al*., 2007). This study aims to evaluate the effectiveness of forwards using specific performance indicators to determine whether their success has an effect on the success of a team during the 2007 Rugby World Cup.

1.2 Hypothesis

The null hypothesis is that the forward's contribution within successful teams is the same as unsuccessful teams. Additional hypothesis have been devised in relation to the study;

H1 – Successful teams will have more possession opportunities from set piece

H2 – Successful teams will have a higher percentage of success from set piece

H3 – Successful teams will have a greater number of possessions from set piece in the opposition half

H4 – Successful teams will have a greater success percentage from lineout

H5 – Successful teams will have a greater success percentage from scrum

H6 – Successful teams forwards will make a greater number of tackles

H7 – Successful teams forwards will make a greater number of hit ups

H8 – Successful teams will commit a greater number of forwards in ruck support

H9 – Successful teams will commit a lower number of forwards in ruck steal

H10 – Successful teams will commit a greater number of forwards in maul suppor

H11 – Successful teams will commit a lower number of forwards in maul steal

H12 - Successful teams forwards will make a greater number of successful passes

H13 – Successful teams forwards will make a greater number of successful offloads

H14 – Successful teams forwards will have a greater number of jackles

H15 – Successful teams forwards will have a greater number of turnovers

H16 – Successful teams forwards will have a lower number of knock on's

H17 – Successful teams forwards will score more tries

1.3 Practical Issues and Limitations

There are several limitations that must be taken into account with regard to this study

- The quality of the television footage. It is not always possible to see which player is performing action during analysis process.

- Teams that failed to progress to the semi final stages will only have been observed twice (quarter final and a selected pool stage match) compared to teams that have progressed either to the final or third and fourth place play off.

- Variations in Sportscode software version 6 and version 7 may prolong data collection.

1.4 Delimitations

- Only one person will be coding games via Sportscode, increasing reliability and decreasing the chance of discrepancy with regard to performance indicators and operational definitions.

- Information will be saved onto two devices reducing the chance of losing collected data.

3.0 Methodology

3.1 Introduction

Selected televised matches from the Rugby World Cup 2007 were recorded using a Sky+ box. The footage was captured onto an Apple MacBook Pro laptop computer using the Sportscode Elite software package (version 7.0.54), and transferred onto an external hard drive (Freecom 500gig). A lapse time analysis was conducted using exclusively designed templates based on specific performance indicators. The information collected was used to assess the contribution of the forward unit in selected teams.

3.2 Subjects

The sample selected were the teams that progressed through to the knock out stages of the 2007 Rugby World Cup. These teams were Argentina, Australia, England, Fiji, France, New Zealand, Scotland and South Africa. Matches from the pool stages were also analysed to provide a larger data sample for comparison, these matches were Argentina v France, New Zealand v Scotland and Australia v Fiji. Each team had been analysed a minimum of twice, depending on their progression in the competition, up to a maximum of four performances.

3.3 Template Design

Two separate coding templates were designed to log the aspects for team play and individual play. The team play template was used to analyse forwards unit skills, whilst the individual template was used for individual forwards performance. The templates consist of a combination of code and text label buttons. Code buttons on the team play template represent an event during performance, whilst on the individual template code buttons represent the players under observation. On both templates the text label buttons represent different performance indicators with regard to the type of play under observation.
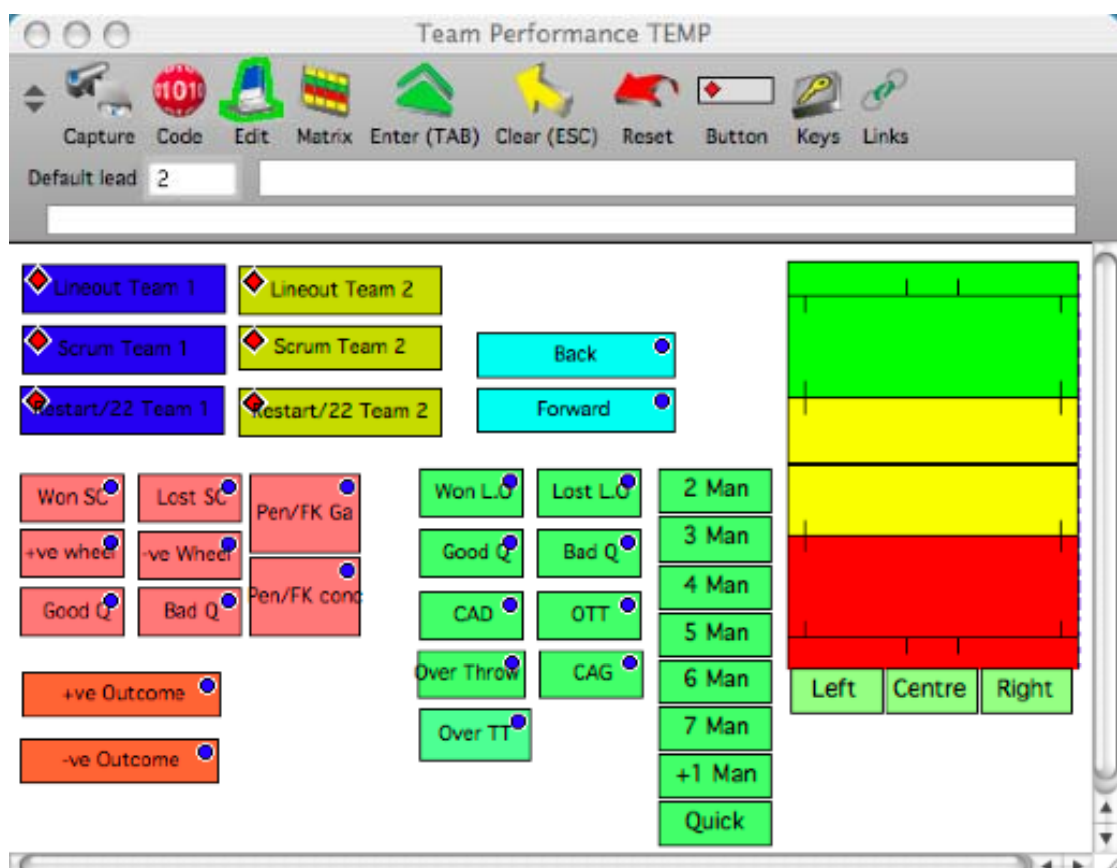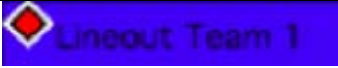
3.3.1 Team Performance Template

Figure 4. Original team performance template design

Table 1. Button key for team template

Button Type	Button Function
Lineout Team 1	Populated code button
Back	Text label. (Information added to the code buttons.

3.3.2 Lineout

When a lineout for the attacking team occurred during the review of footage, the lineout button would be switched on; the side and area of the pitch would also be selected along with number of players in the attacking lineout. Once the lineout had ended, its button was then turned off. An example of the information accompanied with each lineout is, lineout team 1, green zone, left (side of the pitch), 7 man, won (lineout), CAD (catch and drive), good quality.

3.3.3 Scrum

Similarly, when a scrum occurred for the attacking team, its button was turned on, as was its position on the pitch. The slow motion feature was again used to determine the result of the scrum and also whether or not the attacking forwards manipulated the scrum positively. An example of information accompanied with each scrum is, Scrum team 1, red zone, centre (of the pitch), won (scrum), +'ve (positive) wheel, good quality.

3.3.4 Restart

Forwards are not guaranteed to receive a restart therefore buttons for both forwards and backs were included on the template. This would then allow for a percentage to be calculated of total successful takes by a forward from a restart or 22metre restart. The only information associated with the restart is whether it is a back or forward who receives it and whether the outcome is positive or negative.

3.4 Operational Definitions of Team Performance Indicators

Table 2. Operational definitions for the team performance template (lineout)

| Performance Indicator (Lineout only)	Description
Lineout (team 1 or 2)	The IRB (2008) state that the purpose of a lineout is to restart play quickly, safely and fairly after the ball has left the field of play, with a throw in between two lines of players. A lineout requires a minimum of 2, any player not involved in the lineout must remain 10 metres behind until the lineout is over.
Won LO	The attacking team win possession from their own throw into the lineout.
Lost LO	The attacking team lose possession from their own throw into the lineout.
Good Quality	The attacking team win controlled possession from their own throw, providing immediate usable possession.
Bad Quality	The attacking team win possession from their own throw in, however possession was not won cleanly, e.g disrupted by the opposition
2 – 7 Man	The number of players in a lineout, dictated by the attacking team. The minimum number of players a lineout requires is 2, maximum 7.
+1	A forward was stood at the scrum half position
Quick	Any player can take a quick lineout, i.e prior to the formation of a formal lineout, ensuring the ball is thrown over the 5-metre requirement to either himself or a team member.
CAD (Catch and Drive)	The attacking team has won possession by catching the ball, it has been bought it to the floor and a maul was created with the opposing team immediately from a lineout.
CAG (Catch and Give	The ball was caught from the lineout, the catchers feet land on the ground and the ball is immediately passed to any player.
OTT (Off the Top)	Possession has been won and the ball has been delivered before the catcher's feet land back on the ground.
Over TT (Over the Top)	The ball has been thrown over the top of the lineout to a team mate.

Table 3. Operational definitions for the team performance template (scrum)

Performance Indicator (Scrum Only)	Description
Scrum (team 1 or 2)	The IRB (2008) state that the scrum is to restart play quickly, safely and fairly after a minor infringement or a stoppage. A scrum takes place at the point where the stoppage or infringement took place. The scrum consists of 8 players from both teams, bound together in a specific formation, colliding together to compete for possession.
Won SC	The attacking team wins possession from their own put into the scrum.
Lost SC	The attacking team loses possession from their own put into the scrum.
+'ve Wheel (positive)	The attacking team manipulate the scrum to their benefit.
-'ve Wheel (negative)	The defending team disrupt the attacking team by manipulating the scrum beneficially from a defensive point.
Good Quality	The attacking team maintains possession from their own put into the scrum and also manages to positively manipulate the scrum.
Bad Quality	The attacking team maintains possession from their own put into the scrum but the fails to positively manipulate the scrum.
Pen/FK Gained	The attacking team gains either a penalty or free kick from a scrum
Pen/FK Conceded	The attacking team concedes either a penalty or free kick from a scrum

Table 4. Operational definitions for the team performance template (restart)

Performance Indicator (Restart)	Description
Back/Forward	Defines whether a back or forward caught the ball from either a 22 metre restart, or restart from half way
Pve Outcome	The receiving team successfully secure possession from the restart.
Nve Outcome	The receiving team fail to secure possession from the restart.

3.5 Individual Performance Template
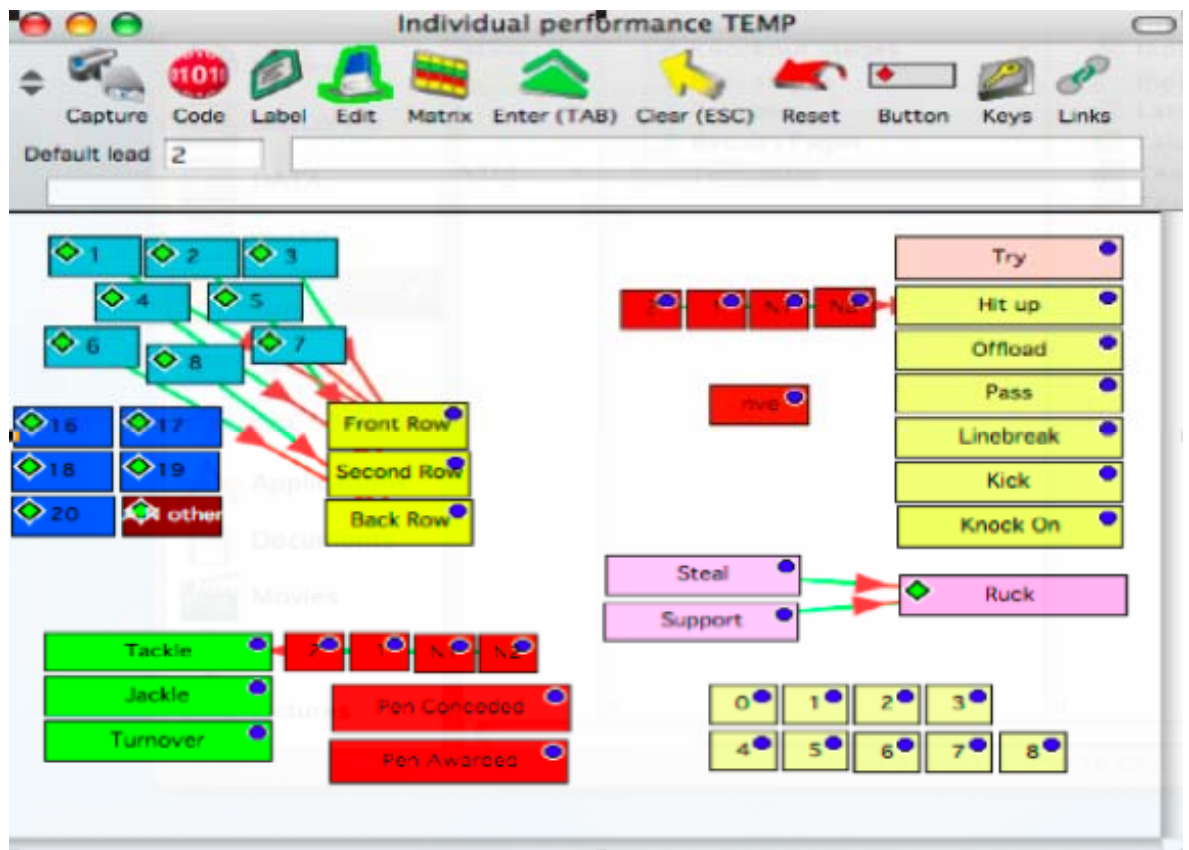
Figure 5. Individual performance template design

The observation and analysis of forwards individual performances were conducted separately to unit (team) performance. The aspects of play under observation for each forward are skills that are universal throughout a rugby team, and not specific to any one position.

Table 5. Button key for individual template

Performance indicator button type	Definition
	Code button (with a lead and lag time of 2 seconds).
	Text label.
	Activation link.
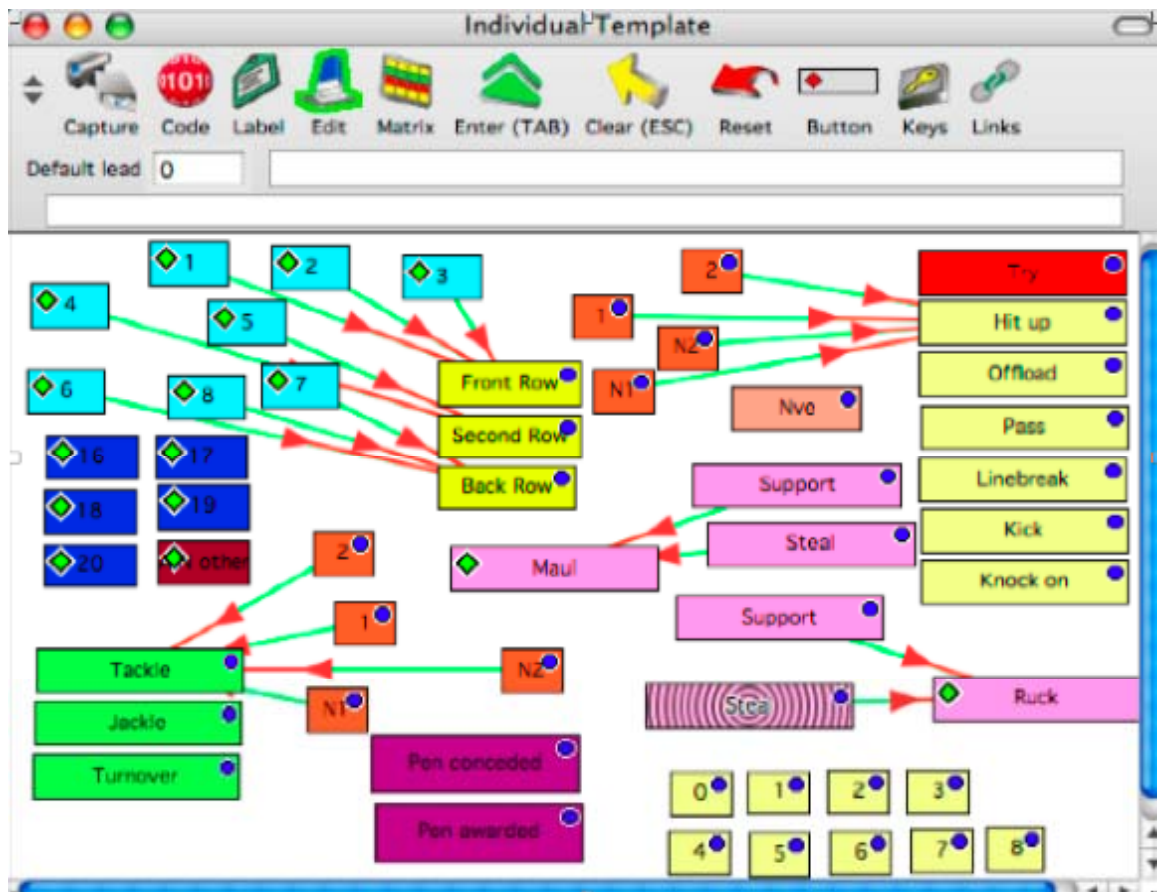
Figure 6. Individual performance analysis template (activation links viewable)

3.5.1 Activation Links

Figure 3 shows the same individual performance template with the buttons showing specific activation links that operate during the analysis process. An activation link allows for other buttons to be activated, saving time and increasing the depth of the data collected. For example as figure 3 shows, the individual player descriptors are linked to sub unit buttons allowing for the total actions for each sub unit to be calculated without activating each separate button.

3.6 Operational Definitions for Individual Performance Indicators

Table 6. Operational definitions for the individual performance template (player descriptors).

Performance Indicator (Player descriptions only)	Description
1-8 (Player Descriptors)	These numbers represent each player in a forward unit and their position.
16-20	These numbers represent the replacements that could be involved at any point in a match.
A.N Other	If the footage isn't clear on which forward performs an action, the A.N other button was used in order to keep the statistics as accurate as possible.
Front Row	Player buttons 1, 2 and 3 are linked to the front row descriptor allowing for their overall sub unit contribution and success levels to be calculated.
Second Row	Player buttons 4 and 5 are linked to the second row descriptor allowing for their overall sub unit contribution and success levels to be calculated.
Back Row	Player buttons 6, 7 and 8 are linked to the back row descriptor allowing for their overall sub unit contribution and success levels to be calculated.

Table 7. Operational definitions for the individual performance template (breakdown descriptors ruck/maul).

Performance Indicator (Breakdown only Ruck/Maul)	Description
Ruck	A ruck ia a phase of play where one or more players from each team, who are on their feet, in physical contact, close around the ball on the ground. IRB (2008)
Support (ruck)	A forward from the team in possession of the ball enters a ruck attempting to maintain possession.
Steal (ruck)	A forward from the team not in possession enters a ruck attempting to regain possession
Maul	Mauls occur when one or more opponents hold a player carrying the ball and one or more of the ball carriers team mates bind on the ball carrier. A maul therefore consists of at least three players, all on their feet; the ball carrier and one player from each team. All players involved must be caught or bound to the maul and must be on their feet and moving towards a goal line. IRB (2008)
Support	Any forward from the team in possession enters a maul attempting to maintain possession.
Steal	Any forward from the team not in possession enters a maul attempting to regain possession
0-8 (Breakdown Descriptors)	The number of forwards involved in each ruck and maul (support and steal) was coded to calculate the average number of forwards per contact area (ruck or maul)

Table 8. Operational definitions for the individual template (player actions)

Performance Indicators (Player Actions Only)	Description
Tackle – 2, 1, N1, N2	**Grade 2 tackle** – The defender has successfully tackled an attacker and prevented him from offloading the ball out of contact. Additionally 1. Behind the gainline 2. Dominated the contact and driven the opposition backward or 3. Has created a potential opportunity to turnover possession. **Grade 1 tackle** – The defender has stopped the attacker on the gain line and prevented any offload out of contact. **Negative 1 (N1) tackle** – The attacker manages to make yards over the gain line but cannot offload out of contact. **Negative (N2) tackle** – The attacker breaks the defending tackle and is able to offload possession out of contact OR continue carrying the ball.
Jackle	A defending player challenges for possession after a tackle has been made.
Turnover	A defending player retrieves possession at any breakdown or open play (interception).
Hit Up – 2, 1, N1, N2	**Grade 2 hit up** – The attacking forward breaks a defending tackle and EITHER makes an offload OR continues to carry the ball. **Grade 1 hit up** – The attacking forward gets stopped on the tackle line and manages to retain good quality possession. **Negative (N1) hit up** – The attacking forward gets driven back from initial contact but manages to retain slow possession. **Negative (N2) hit up** – The attacking player loses possession during contact OR gets tackled into touch (losing possession).

Table 8. (Continued): Operational definitions for the individual template (player actions)

Offload	An attacking player, during a contact situation manages to pass the ball to a supporting player.
Ofload (Nve)	The attacking player attempts to offload the ball in a contact situation to a supporting player but is not successful due to poor quality of offload.
Pass	Each time a forward from the unit under observation made a pass it was recorded. (Not including passing the ball off the top of a lineout).
Pass (Nve)	A pass from any forward that was poor quality was recorded as a Nve pass.
Line break	When a forward broke the defensive line cleanly with no tackle attempts. If a weak tackle was broken this would be classed a grade 2 hit up.
Kick	A player from the attacking forward unit strikes the ball with their foot.
Knock On	In any situation when a player loses control of the ball in a forward direction.
Pen conceded	A player has a penalty awarded against him for infringement of the rules.
Pen awarded	A player has a penalty awarded to them as the result of an action (usually at the tackle area e.g jackle).

As these are not discrete variables, a general rule was applied to grade the quality of the hit up or tackle as the lower of the two scores in question. This was aimed at attempting to maintain consistency throughout coding and to improve data reliability.

3.7 Analysis Procedure

The team analysis for both forward units was conducted on the original timeline produced during the capture process in Sportscode. Two additional timelines were created, one for each teams individual analysis and saved within separate packages for each match using the Sportscode software.
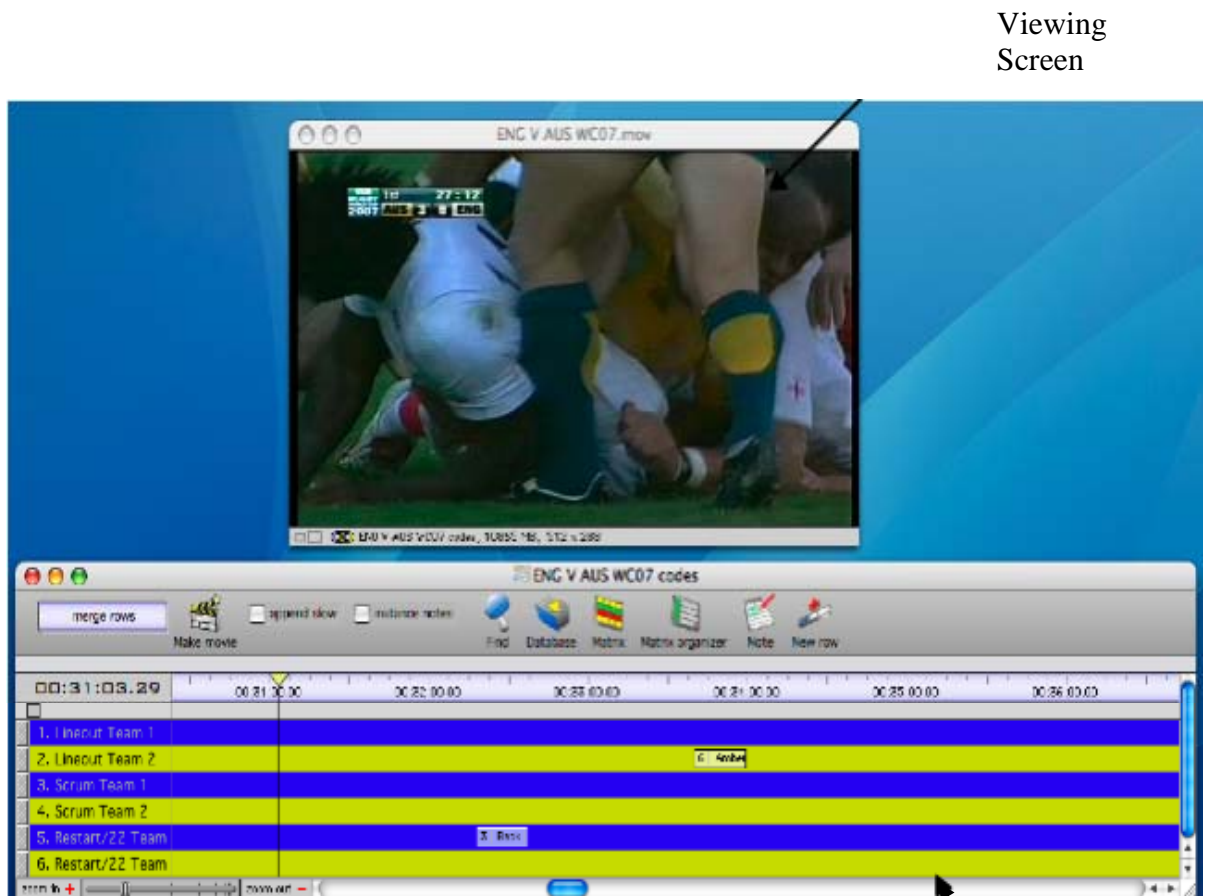
Viewing Screen

Figure 7. Diagram showing a timeline and viewing screen during analysis

Timleine

3.8 Statistical Analysis

Once all the data had been collected the results were entered into SPSS version 12 for windows. The data was then tested for normality using the Shapirowilk test with significant levels greater than 0.05. Data that was deemed significant (normally distributed) was then subjected to Non Parametric testing via the Wilcoxon test.
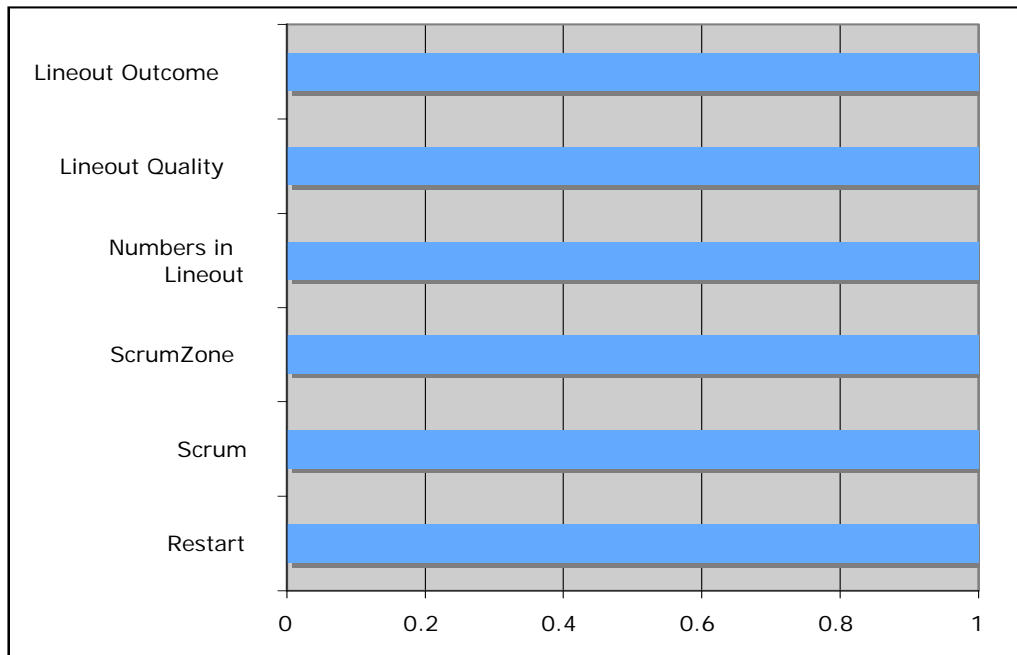
3.9 Reliability

Prior to any data collection, an **Intra Observer reliability** test was conducted on the first half of the match between U.S.A and Tonga from the Rugby World Cup 2007. Two observations were conducted with a seven-day interval between them. The sequential data was tested using **Kappa** to determine the level of reliability according to Altman (1991). Hughes and Franks (2004) state that the reliability of any system is imperative. An unreliable system will produce defective data, creating a false representation of a matches proceedings, and is therefore of little analytical value. Taking this into consideration both templates (team and individual) were tested for reliability purposes before any official analysis took place using separate footage from the 2007 Rugby World Cup. The results were then entered into kappa tables to determine whether the results produced from both analysis templates were reliable. Altman (1991) states that the significant kappa levels are;

Table 9. Table showing the KAPPA values and their reliability strength

Kappa Grade	Strength of Agreement
0.0 – 0.2	Poor Strength of agreement
0.2 – 0.4	Fair Strength of Agreement
0.4 – 0.6	Moderate Strength of Agreement
0.6 – 0.8	Good Strength of Agreement
0.8 - 1	Very Good Strength of Agreement

3.9.1 Team Reliability Results

Figure 8. Graph to show the team KAPPA performance indicator reliability test results

3.9.2 Individual Reliability Results
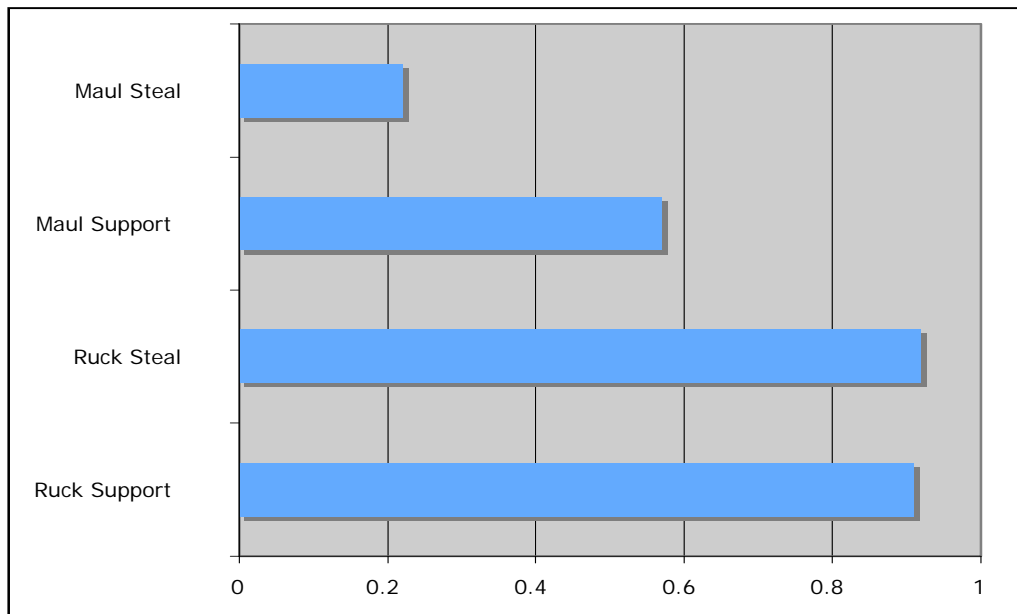
Figure 9. Graph to show the KAPPA results for individual performance reliability test (ruck/maul only)

Figure 10. Graph to show the KAPPA results for individual performance reliability test (**other** includes Kick, Jackle, Linebreak, Knock On, Turnover, Penalty Conceded and penalty Awarded)

4.0 Results

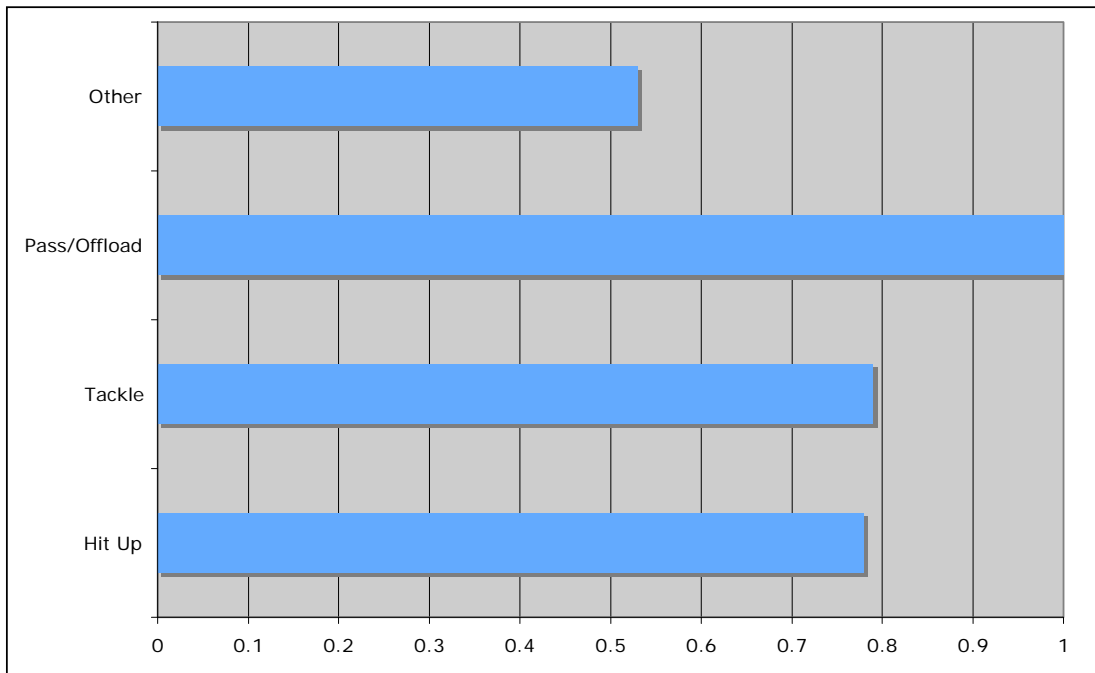### 4.1 Results from Data Collection

Table 10. Winning and losing median and interquartile ranges for individual performance

Performance indicator	Winning Median (Interquartile range)	Losing Median (Interquartile range)
Tackles	57.0 (22.0)	50.0 (14.0)
Hit Ups	39.0 (14.0)	39.0 (21.0)
Total Forwards Ruck Support	141.0 (62.0)	179.0 (49.0)
Total Forwards Ruck Steal	83.0 (39.5)	75.0 (24.5)
Total Forwards Maul support	36.0 (21.0)	37.0 (30.0)
Total Forwards Maul steal	25.0 (23.0)	26.0 (19.0)
Successful Passes	10.0 (5.5)	13.0 (7.0)
Successful Offloads	1.0 (1.5)	4.0 (3.5)
Jackles	17.0 (10.5)	12.0 (7.5)
Turnovers	2.0 (1.5)	2.0 (2.5)
Knock On's	2.0 (1.5)	3.0 (2.5)
Try's Scored	1.0 (1.0)	0.0 (0.0)

Table 11. Winning and losing median and interquartile ranges for team performance

Performance indicator	Winning Median (Interquartile range)	Losing Median (Interquartile range)
Scrums Won	8.0 (5.5)	7.0 (3.5)
Lineouts Won	12.0 (3.5)	10.0 (4.5)
Positive Restart Forward	5.0 (1.5)	5.0 (3.5)
Total Possession Opportunities from Set Piece	25.0 (6.5)	25.0 (8.0)
Total Possessions from Set Piece in Opp Half	12.0 (4.5)	10.0 (4.0)
Set Piece Success Percentage	83.3 (18.8)	83.3 (13.9)

Table 12. Highlighting the teams with the greatest value of each team performance variable in each match

	Scrums Won	Lineouts Won	Positive Restart Forward	Total Possession Opportunities from Set Piece	Total Possessions from Set Piece in Opposition Half	Set Piece Success Percentage
Successful	6	7	5	7	8	6
Unsuccessful	5	4	5	4	2	5
Equal	0	0	1	0	1	0
Percentage Of Successful Performances	54.5%	63.6%	45.5%	63.6%	72.7%	54.5%

Table 13. Successful and unsuccessful median values for scrum

	Won in Red Zone	Won in Amber Own	Won in Amber Opp	Won in Green Zone	Total Won	Total Lost	Percentage Success
Successful	1 (1.0)	3 (2.0)	2 (1.0)	1 (1.0)	8 (3.5)	0 (0.0)	100% (21.0)
Unsuccessful	1 (1.5)	2 (2.5)	2 (1.0)	1 (1.0)	7 (4.0)	1 (1.0)	88.2% (18.3)

Table 14. Successful and unsuccessful median values for lineout

	Won in Red Zone	Won in Amber Own	Won in Amber Opp	Won in Green Zone	Total Won	Total Lost	Percentage Success
Successful	1 (1.0)	3 (2.0)	6 (2.0)	2 (1.5)	12 (3.5)	1 (3.0)	94% (20.5)
Unsuccessful	1 (1.0)	2 (1.5)	4 (4.5)	1 (0.0)	10 (4.5)	2 (4.5)	76.9% (13.9)

Table 15. Median value of lineout actions

	CAD	CAG	OTT	Over TT
Successful	7 (3.0)	1 (1.0)	4 (3.0)	0 (0.5)
Unsuccessful	4 (3.0)	1 (1.0)	3 (4.5)	0 (0.5)

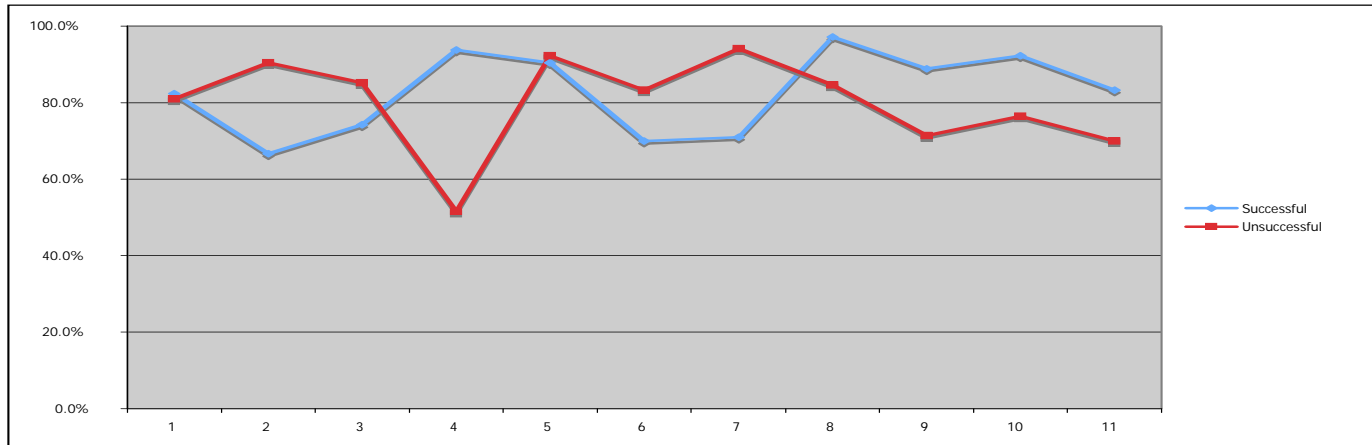**Table 16.** Highlighting the teams with the greatest values for each lineout outcome indicators

	CAD	CAG	OTT	Over TT
Successful	8	5	8	3
Unsuccessful	2	4	3	3
Equal	1	2	0	5
Percentage Of Successful Performances	72.7%	45.5%	72.7%	27.3%

**Table 17.** Successful and unsuccessful median values for restart

	Back Positive	Back Negative	Forward Positive	Forward Negative	Forwards Success Percentage
Successful	1 (1.0)	1 (1.0)	3 (1.5)	2 (1.5)	50% (21.9)
Unsuccessful	1 (1.0)	1 (1.0)	3 (3.5)	0 (1.5)	83.3% (58.6)

Table 18. Successful and unsuccessful median values for set piece

	Possession Opportunities from Set Piece	Possessions from Set Piece in Opposition Half	Possessions from Set Piece in Own Half	Set Piece Success Percentage
Successful	25 (6.5)	12 (4.5)	8 (4.5)	83.3% (18.8)
Unsuccessful	25 (8.0)	10 (4.0)	7 (2.5)	83.3% (13.9)

Figure 11. Set piece success percentage for each team in each match
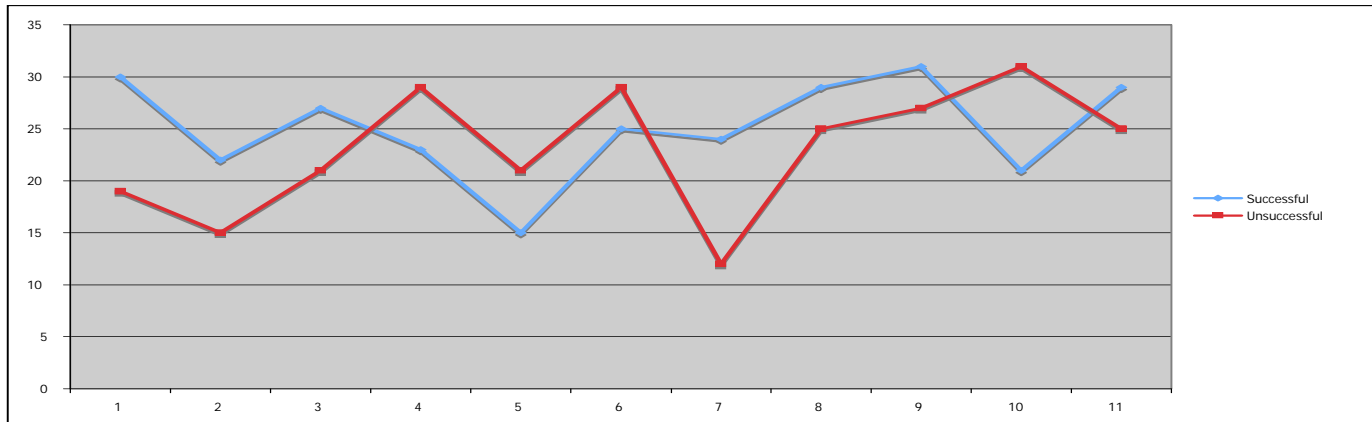
Figure 12: Possession opportunities from set piece for each tam in each match

Table 19. Highlighting the team with the greatest value of each individual performance variable in each match

	Total Tackle	Total Hit Up	Total Forwards Ruck Support	Total Forwards Ruck Steal	Total Forwards Maul Support	Total Forwards Maul Steal	Pass	Offload	Jackle	Turnover	Knock on	Try
Successful	8	3	4	5	8	4	3	4	7	4	2	4
Unsuccessful	3	7	7	6	3	7	7	5	3	3	5	0
Equal	0	1	0	0	0	0	1	2	1	4	4	7
% Of Successful Performances	72.7%	27.3%	36.4%	45.5%	72.7%	36.4%	27.3%	36.4%	63.6%	36.4%	18.2%	36.4%

Table 20. Breakdown of individual tackle scores for successful and unsuccessful performance

	Tackle 2	Tackle 1	Tackle -1	Tackle -2
Successful	4	8	4	9
Unsuccessful	4	3	5	2
Equal	3	0	2	0
% Of Successful Performances	36.4%	72.7%	36.4%	81.8%
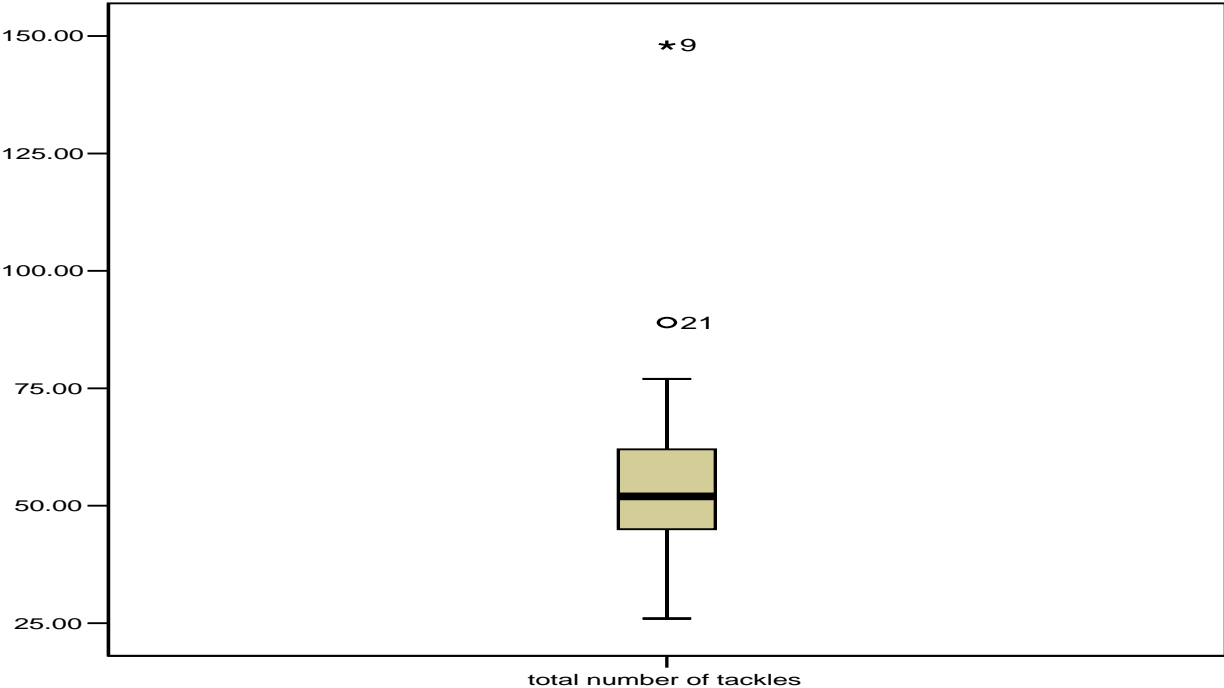
Figure 13. Box plot graph showing the 25th and 75th percentile and outliers for tackle scores

Table 21. Breakdown of individual hit up scores for successful and unsuccessful performance

	Hit Up 2	Hit Up 1	Hit Up -1	Hit Up -2
Successful	6	4	4	2
Unsuccessful	5	6	6	8
Equal	0	1	1	1
% Of Successful Performances	54.5%	36.4%	36.4%	18.2%
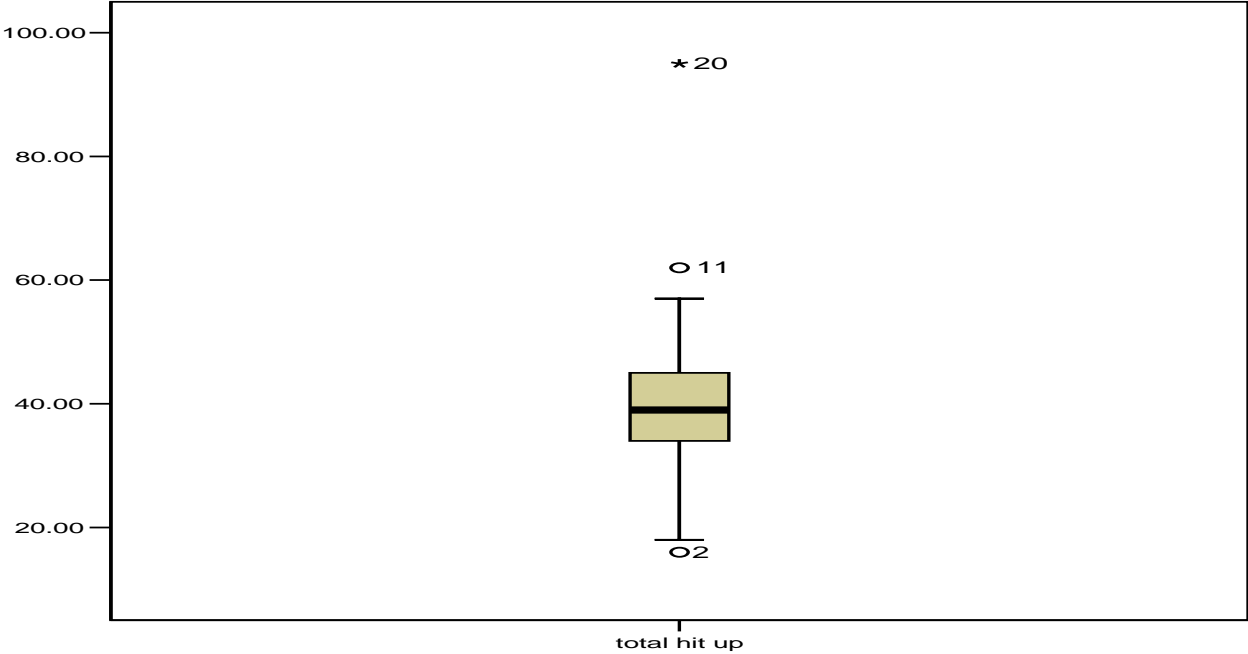
Figure 14. Box plot graph showing the 25th and 75th percentile and outliers for hit up scores

Table 22. Median value for the average number of forwards at ruck and maul

	Ruck Support	Ruck Steal	Total Number of Rucks (Support)	Maul Support	Maul Steal	Total Number of Mauls (Steal)
Successful	2.7 (0.3)	1.3 (0.3)	58 (19.5)	5.5 (1.5)	4.2 (1.4)	6 (3.5)
Unsuccessful	2.6 (0.3)	1.4 (0.3)	71 (19.5)	5.2 (1.6)	4.2 (1.1)	5 (4.5)

4.2 Results from the Wilcoxon Signed-Rank Test

Table 23. Results of the Wilcoxon signed rank test on individual performance variables

Performance Indicators Measured	Z	Asymp. Sig. (2-tailed)	Significance
Total Number of Tackles Lose - Total Number of Tackles Win	-1.24	0.21	NS
Total Hit up Lose - Total Hit Up Win	-1.27	0.20	NS
Total Forwards Ruck Support Lose - Total Forwards Ruck Support Win	-1.77	0.07	NS
Total Forwards in Ruck Steal Lose - Total Forwards in Ruck Steal Win	-0.62	0.53	NS
Total Forwards in Maul Support Lose - Total Forwards in Maul Support Win	-0.17	0.85	NS
Total Forwards in Maul Steal Lose - Total Forwards in Maul Steal Win	-0.57	0.56	NS
Pass Successful Lose - Pass Successful Win	-1.22	0.22	NS
Offload Successful lose - Offload Successful Win	-1.51	0.12	NS
Jackle Lose - Jackle Win	-1.68	0.09	NS
Turnover Lose - Turnover Win	-0.08	0.93	NS
Knock On Lose - Knock On Win	-1.27	0.20	NS
Try Lose - Try Win	-1.88	0.05	SIG

Table 24. Results of the Wilcoxon signed rank test on team performance variables

Performance Indicators Measured	Z	Asymp. Sig. (2-tailed)	Significance
Scrums Won Lose - Scrums Won Win	-0.35	0.72	NS
Lineout Won Lose - Lineout Won Win	-1.91	0.05	SIG
Restart Forward Positive Lose - Restart Forward Positive Win	-0.31	0.75	NS
Total Possession Opp's from Set Piece Lose - Total Possession Opp's from Set Piece Win	-0.85	0.39	NS
Total Possessions in Opp's Half from Set Piece Lose - Total Possessions in Opp's Half from Set Piece Win	-1.37	0.16	NS
Success Percentage Set Piece Lose - Success Percentage set Piece Win	-0.31	0.75	NS

NS = Non Significant value

SIG = Significant value

6.0 Conclusion

The methods of analysis described in this study have enabled a subjective and detailed analysis of forwards roles within rugby union teams and the effect they have on successful performance on teams in the 2007 Rugby World Cup. The results from the study largely coincide with the hypothesis stated in chapter one.

Primary findings of the study are that successful teams have a higher percentage of success and greater values across all the team performance indicators, with an exception to restart that saw both successful and unsuccessful teams having equal amounts of success. Forwards ability to perform as a unit is crucial as it has an effect on the amount of possession a team has and therefore teams ability to score tries. Unlike successful teams dominance in team variables, success from individual performance is difficult to evaluate generally. Successful teams made more tackles and threatened possession (jackle) more frequently. Successful teams failed to make as many hit ups, which could suggest they were under pressure rather than applying it for the majority of the match. Another significant result discovered from the analysis, was that successful teams forwards scored a significant number of tries compared to unsuccessful teams forwards.

Finally, this study has shown that successful teams forwards are dominant at scrum and lineout, especially in the oppositions half. The ability to perform at set piece could be primary criteria for selection, as opposed to open play abilities. Successful teams forwards also have the ability to score tries, where as other performance indicators could not be differentiated significantly.

Further Recommendations

- Time motion analysis could be applied alongside the existing methods allowing for a percentage of forwards possession to be calculated. This would also provide information regarding the position of forwards during play and the positions from which forwards score tries. It would further provide an insight of how teams use their forwards within there playing styles and tactics.

- Forwards individual effectiveness at ruck and maul steal and support could be added to the individual performance template that could then provide even more specific data with regard to the success of forwards individually.

- Performance templates for back play could be designed which would allow for the success of a teams back and forward units to be compared, in order to see if trends occur. For example successful teams have both successful forwards and backs or successful teams forwards are more successful than their backs.

- Analysing every match in the 2007 Rugby World cup instead of just the knockout stages could increase the data sample.

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