CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The purpose of this study is to identify the generic competencies that a rugby union referee needs in order to become successful at the highest level and to assist the Blue Bulls Rugby Referees' Society to identify new referee recruits. The research will therefore focus on the identification of these core competencies. This chapter will explain the research procedure followed, and will also describe the statistical procedures and techniques used in the study.

Although the study is conducted in accordance with the requirements of the Blue Bulls Rugby Referees' Society, rugby union is such a global sport that the study had to be expanded to include other rugby unions in South Africa in order to generalize the final conclusions. For this reason, and to obtain a broader perspective, the insights of players were also sought.

The two main research strategies used are the quantitative and qualitative research methods. In this study, quantitative research is predominant, but qualitative research was also used to identify the competencies employed in the questionnaires.

Before discussing quantitative and qualitative research in more detail, it is necessary to note the differences between quantitative research and qualitative research. Neuman (2000: 123) summarised these differences in the following table:

Table 4.1: Differences between Quantitative and Qualitative research.

QUANTITATIVE	QUALITATIVE
Test hypothesis that the researcher begins with.	Capture and discover meaning once the researcher becomes immersed in the data.
Concepts are in the form of distinct variables.	Concepts are in the form of themes, motifs, generalisations and taxonomies.
Measures are systematically created before data collection and are standardized.	Measures are created in an *ad hoc* manner and are often specific to the individual setting or researcher.
Data are in the form of numbers from precise measurement.	Data are in the form of words and images from documents, observations and transcripts.
Theory is largely causal and is deductive.	Theory can be causal or noncausal and is often deductive.
Procedures are standard, and replication is assumed.	Research procedures are particular and replication is very rare.
Analysis proceeds by using statistics, tables, or charts and discussing how the results relates to the hypothesis.	Analysis proceeds by extracting themes or generalisations from evidence and organising data to present a coherent, consistent picture.

Neuman (2000: 123)

4.2 QUALITATIVE RESEARCH

Qualitative research was used to identify the competencies addressed in the questionnaire and to determine how the systems and policies at the Blue Bulls Rugby Referees' Society function. Quantitative research was used to measure these competencies and to obtain statistical results.

As mentioned in Table 4.1, qualitative research is data collection in the form of words or pictures. Qualitative research is categorised into:

- field research, where the researcher conducts case studies on a small group of people for some length of time, and
- historical-comparative research, which examines aspects of social life in a past historical era or across different cultures (Neuman 2000: 33).

In this study, qualitative research was used to gather data on the core competencies a rugby referee should possess. Although the Delphi technique, in the form of a questionnaire, was used to determine the competencies to be used throughout the study, interviews were also conducted with experts to identify a list of relevant competencies.

Interviews were conducted with management at the Blue Bulls Rugby Referees' Society, and with players (both senior and junior level), to gather their input based upon their knowledge. Interviews with approximately ten senior coaches were also conducted to obtain their views. Together with the information gathered from these interviews, personal experience and inputs from De Beer (2003: unpublished interview) were utilised to draw up a list of competencies. Existing research on rugby union referee competencies was studied to get an external viewpoint (the Dickson study, 2000: personal e-mail) on the applicable competencies.

Interviews were also conducted with Horn (2002: unpublished interview) and Rhoodt (2002: unpublished interview) to get a comprehensive picture of the problems experienced by the Blue Bulls Rugby Referees' Society. They provided useful insights into how the current processes and systems function within the Society.

4.3 QUANTITATIVE RESEARCH

In this study survey research was used, using the Delphi technique to determine what the Blue Bulls referees opinions are about the required competencies of a referee and to ensure that important competencies were not excluded.

As explained in Table 4.1, quantitative research is the collection of data in the form of numbers. This type of research can be conducted in various ways, with the most popular being:

- *Experiments:* Uses the logic and principles found in natural science research. Experiments can be conducted in laboratories or in real life. They usually involve a relatively small number of people and address a well-focused question. Experiments are most effective for explanatory research.
- *Surveys:* Often used in descriptive or explanatory research. In survey research, the researcher asks many people numerous questions in a short time period. The researcher typically summarizes answers to questions in percentages, tables or graphs. Surveys give the researcher a picture of what many people think or report doing.
- *Content analysis:* Is a technique for examining information, or content, in written or symbolic material.
- *Existing statistics:* A researcher locates a source of previously collected information, often in the form of government reports or previously conducted surveys (Neuman 2000: 33-36).

A largely used quantitative data gathering technique is the survey technique. The growth of survey research is discussed in section 4.3.1.

4.3.1 GROWTH OF SURVEY RESEARCH

The survey research technique is the most widely used data gathering technique in the social sciences. The history of the modern survey can be traced back to ancient forms of the census. A census includes information on characteristics of the entire population in a territory (Neuman 2000: 247).

Despite initial uncertainty, survey research grew through the 1970's. More researchers learned about survey research, and the method gained in popularity. Neuman (2000: 249) identified five factors that contributes to the growth of survey research:

i. *Computers:* Computer technology made the statistical analysis of large-scale data much easier and faster.
ii. *Organisations:* Organisations realised the importance of research.
iii. *Data storage:* The collection, storage and sharing of information of hundreds of variables for thousands of respondents expanded the use of surveys.
iv. *Funding:* More funds were made available for survey research by governments.
v. *Methodology:* Substantial research was conducted on ways to improve the validity of surveys. The survey technique advanced as errors were identified and eliminated.

There are also various types of survey research. The various types of survey research are discussed in section 4.3.2.

4.3.2 TYPES OF SURVEY RESEARCH

This study made use of mail and self-administered questionnaires to gather data. Face to face interviews, however, were also used in the initial phases of the study.

Neuman (2000: 271) identified the following types of surveys, and some of the advantages and disadvantages associated with each type:

- Mail and self-administered questionnaires:
  - *Advantages:* Researcher can give questionnaires directly to respondents or mail them to respondents who read instructions, then record their answers. It is an inexpensive way of gathering data and can be conducted by a single researcher. A researcher can send questionnaires to a wide geographical area, and mailed questionnaires offer anonymity and avoid interviewer bias.
  - *Disadvantages:* A slow response rate is usually the biggest drawback of mailed questionnaires. A researcher cannot control the conditions under which a mail questionnaire is completed, and the mail questionnaire limits the kinds of questions that a researcher can use.
- Telephone interviews:
  - *Advantages:* A popular survey method, because a large part of the population can be reached by telephone. This method is also very flexible.
  - *Disadvantages:* Relatively high costs and limited interview time are disadvantages of telephone interviews.
- Face to face interviews:
  - *Advantages:* Face to face interviews have the highest response rates and allow for comprehensive questionnaires. Well-trained interviewers can ask all types of questions, especially complex questions, and can probe more extensively.

- *Disadvantages:* High costs are the biggest disadvantage of face to face interviews, and interviewer bias is greatest in face to face interviews.

In section 4.4 the population and sample size used during the study will be discussed.

4.4 POPULATION AND SAMPLE

The knowledge of rugby referees and rugby players at the top level of South African rugby were utilised during this study. Section 4.4 discusses the population and sample size of the research study.

4.4.1 SIZE OF THE POPULATION AND SAMPLE

The decision was made to involve all the qualified referees of the various South African rugby unions, as well as the 2003 Currie Cup players within the country. The number of qualified referees within the various unions and societies is unknown. The Blue Bulls referees participated separately, so this required two questionnaires.

Players were involved in the study to get a more complete view of what the competencies needed by a top class referee to be successful are, and to avoid using only the viewpoint of the referees.

In the first questionnaire (attached as Appendix 1) that went to the Blue Bulls referees, 47 out of 54 active referees responded. During the second survey (second questionnaire attached as Appendix 2), using a similar questionnaire, which was updated using the results received from the initial survey, 32 of the Blue Bulls referees responded.

A total of 149 referees from all over South Africa responded, with a total of 42 players getting involved, excluding the Blue Bulls referees. Table 4.2 indicates the number of referee respondents from the Blue Bulls Rugby Referees' Society with Table 4.3 indicating the response rate of the referees within the other South African unions and societies. Table 4.4 indicates the response rate of the players that participated in the study.

Table 4.2: Response rate of referees within the Blue Bulls Rugby Referees Society (BBRRS).

Number of active referees within the BBRRS = 54	
Number of respondents for the first questionnaire sent out	**Percentage (%) of responses**
47	87%
Number of respondents for the second questionnaire sent out	**Percentage (%) of responses**
32	59%

Table 4.3: Response rate of the qualified referees within the other South African rugby unions and societies.

RUGBY UNION	NUMBER OF RESPONDENTS
Boland Cavaliers	1
Border Bulldogs	0
Eastern Province Elephants	5
North West Falcons	0
Griqualand West	5
Gauteng Lions	69
Free State Cheetahs	10
Leopards	0
Mpumalanga Pumas	0
Natal Sharks	3
Northen Free State Griffons	0
South Western District's Eagles	6
Western Province	50
TOTAL	**149**

This total excludes the responses from the Blue Bulls referees. The second questionnaire that went to the Blue Bulls referees is very similar to the questionnaire that went to the other referees and players from all over the country, and therefore this questionnaire's results were used to calculate the final weighted competency index. The total population of referees used in this study is therefore **181 referees.**

Table 4.4: Response rate of the players who partipated in the study.

PROVINCE	NUMBER OF RESPONDENTS
Blue Bulls	35
Boland Cavaliers	0
Border Bulldogs	0
Eastern Province Elephants	0
North West Falcons	0
Griqualand West	0
Gauteng Lions	0
Free State Cheetahs	1
Leopards	0
Mpumalanga Pumas	0
Natal Sharks	6
Northen Free State Griffons	0
South Western District's Eagles	0
Western Province	0
TOTAL	**42**

The total number of players that responded, after the questionnaire was sent to all the unions, is 42 players.

Between the 181 referees and the 42 players, the total responses that were used to calculate the final weighted competency is **223**.

From the first questionnaire (initial questionnaire attached as Appendix 1) certain biographical details were obtained. These details are discussed in section 4.4.2.

4.4.2 CHARACTERISTICS OF THE 47 BLUE BULLS REFEREES WHO RESPONDED

The biographical details of the Blue Bulls referees who participated in the first questionnaire were obtained to get an indication of the make-up of the referees within this society. This questionnaire included the following biographical details:

- Age
- Gender
- Years involved as a Blue Bull referee
- Level at which referees

The results of the biographical details are put forward in Table 4.5:

Table 4.5: Biographical details of the Blue Bulls referees.

									TOTAL
AGE	**15-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46 >**		
	5	3	7	9	2	7	14		47
GENDER	**MALE**	**FEMALE**							
	45	2							47
YEARS INVOLVED	**1-3**	**4-6**	**7-10**	**11-15**	**16-20**	**21-30**	**31 >**		
	14	11	9	2	3	4	4		47
LEVEL OF REFEREEING	**CARLTON (PROVINCIAL AND INTERNATIONAL)**	**SENIOR RESERVE**	**RESERVE**	**2A**	**2B**	**3A**	**3B**	**4TH**	
	15	8	2	2	3	3	11	3	47

The above table indicates that 32% (15 out of the 47 respondents) are at either international or provincial level, or that they referee at top club level within their region. This makes their contribution more reliable to the study. A small percentage

of the referees are at a low level, which also indicates that the results obtained from the Blue Bulls referees should be reliable based on the referee's level of experience.

It is clear that, at this stage, males dominate the refereeing scene but with the interest in women's rugby increasing, more female referees are sure to become involved in the future. The age distribution among the Blue Bulls referees is fairly even as is the years of experience. Only 14 out of the 47 referees (29,78%) have less than 4 years experience which, again, helps with the reliability of the input from the referees study.

4.5 CONSTRUCTING THE QUESTIONNAIRES

4.5.1 INTRODUCTION

The expert opinion of the qualified referees from the various unions and societies and the 2003 Currie Cup players, were gathered by means of a questionnaire. A questionnaire was used for the following reasons:

- It is a cheap way of getting the opinions of the participants, as not all of the unions and societies are easily accessible.
- The competencies used are easy to define and explain in the form of a questionnaire.
- Data capture is more precise and effective.

The final questionnaire (attached as Appendix 3), and the competencies included, was compiled after two questionnaires (attached as Appendix one and Appendix two) went to the Blue Bulls referees. The first two questionnaires served to establish which competencies to include in the final questionnaire and to help define the final competencies in the most effective way. The final questionnaire

(third questionnaire) did not show any significant changes from the second questionnaire that went to the Blue Bulls referees and, therefore, the 32 Blue Bulls referee respondents were also included in the sample for the final weighted competency index.

Certain guidelines should be followed before the compilation of questionnaires. A good questionnaire forms an integrated whole, according to Neuman (2000: 251). The researcher should include introductory remarks and instructions for clarification, and measure each variable with one or more survey questions. Neuman (2000: 251) points out that there are two key principles for good survey questions:

I. Avoid confusion, and
II. Keep the respondent's perspective in mind.

Good survey questions give the researcher valid and reliable measures. Good questions also help respondents to understand the question and to feel that their answers are meaningful. There are ten things to avoid when writing survey questions, although Newman's list does not include every possible error:

i. Avoid jargon, slang and abbreviations
ii. Avoid ambiguity, confusion and vagueness
iii. Avoid emotional language and prestige bias
iv. Avoid double-barrelled questions
v. Avoid leading questions
vi. Avoid asking questions that are beyond respondent's capabilities
vii. Avoid false premises
viii. Avoid asking about future intentions
ix. Avoid double negatives
x. Avoid overlapping or unbalanced response categories

The results of the questionnaires were captured and analysed using the software programmes Excel 2000 Professional and SPSS Version 11,5.

4.5.2 RESEARCH PHASES OF THE STUDY

This study was conducted in three phases. The first two phases included only the Blue Bulls referees, whereas the last phase surveyed all the other qualified referees in South Africa, as well as players who participated in Currie Cup rugby or higher during the 2003 season.

4.5.2.1 PHASE 1 AND 2 OF THE EMPIRICAL STUDY: DETERMINING THE CONTENT OF THE QUESTIONNAIRE (DELPHI TECHNIQUE)

The Delphi technique was applied to determine which competencies to include in the study's final questionnaire.

A short cover letter, explaining the research objectives, was sent to all 54 active referees within the Blue Bulls Rugby Referees' Society. Together with this letter a draft questionnaire containing 41 competencies, established by means of qualitative research, was attached. An open-ended section was included for referees to add any relevant competency they felt had been left out of the list provided.

Forty-seven of the Blue Bulls referees participated in the first round of the study, which helped to exclude some irrelevant competencies and to add more of the required competencies. The contribution of these referees helped the competencies to be defined in a more understandable way.

The second questionnaire contained a list of 36 competencies, and it was again sent to all Blue Bulls referees. A number of 32 of the 54 active referees responded during this round. This questionnaire, again, provided opportunity for the referees to include any additional competencies they felt were important.
The results of both questionnaires sent to the Blue Bull referees were analysed and certain conclusions were reached. The end result of this process was a list of competencies, which according to the Blue Bull referees, are the most important competencies for a referee to possess. These above-mentioned phases contributed to the drafting of a third questionnaire, which was very similar to the last questionnaire sent to the Blue Bull referees.

4.5.2.2 PHASE 3: FINAL QUESTIONAIRE OF THE STUDY

During the third phase of the study the final questionnaire, compiled after all the above processes had been completed, was sent to all the referee unions and societies within South Africa. This final questionnaire was also sent to all the Currie Cup teams for 2003.

Reliability, and an effort to obtain only expert opinion, are the reasons why only Currie Cup players, and higher, within South Africa were chosen for the study. These players know the game best and are the most experienced players in the country.

4.5.3 QUESTIONNAIRES TO BLUE BULLS REFEREES

The first draft of the questionnaire, together with an explanatory cover letter, was sent to the 54 active referees within the Blue Bulls Rugby Referees' Society. The purpose of this questionnaire was to find out which competencies are important, according to the respondents, but also to narrow down the list of competencies to be used in the study. This survey also helped to define more accurately the competencies to be used in the study.

The first questionnaire included a section for the participants to include biographical information, namely, age, gender, years involved as a qualified referee and the level at which the respondent is officiating.

A total number of 41 competencies, with a short definition of each, were included in the first questionnaire. An open space was included at the end of the questionnaire for additional competencies perceived as important, but not listed. The participants were asked to rate on a 5 point Likert scale the relative importance of each competency listed. The scale used for this questionnaire was:

1 - irrelevant
2 - less important
3 - average
4 - more important
5 - very important

This questionnaire, including the list of 41 competencies, is attached as Appendix 1.

The second questionnaire (attached as Appendix 2) that was sent to the Blue Bulls referees was compiled after taking into consideration the results and comments from the first questionnaire. Again, a cover letter was attached to explain the process. Thirty-two of the 54 active Blue Bulls referees completed this questionnaire.

This questionnaire consisted of 36 competencies (after analysis of the results obtained from the first questionnaire) that had to be rated by the referees. Some of the definitions used in the first questionnaire were improved upon to promote better understanding of the terms. Certain competencies used in the first questionnaire were excluded, and certain competencies given as additional competencies by the Blue Bulls referees were added. The scale used to rate the competencies also changed slightly to make it more understandable for the participants.

Again, a 5 point Likert scale was used with the values being:

1 - irrelevant
2 - less important
3 - important
4 - very important
5 - a definite competency to possess

The second questionnaire is attached as Appendix 2. This questionnaire was used to compile the final questionnaire for purposes of this study. Only slight changes were made and, therefore, the results of this second questionnaire were used for comparative purposes and were added to the data for the final weighted competency index.

4.5.4 FINAL QUESTIONNAIRE OF THE STUDY

The last questionnaire (attached as Appendix 3) used in this study was compiled from the data received during the first two surveys sent to the Blue Bulls referees. This questionnaire was sent to all the other rugby referee's societies in South Africa, with the request that all their active referees complete the questionnaire. A total of 149 referees responded. All the players taking part in Currie Cup rugby during 2003 were also requested to participate in the study. A total of 42 players responded to the request.

Again a 5 point Likert scale was used with only the last value changing from "a definite" to "essential".

The 36 competencies used in this questionnaire, with their definitions, were:

i) **Trustworthiness**
(ability to make the players trust you and know that the laws will be applied consistently and fairly)

ii) **Concentration/Focus**
(ability to stay focused during a match and not to allow the mind to wander/fluctuate)

iii) **Objectivity/Impartiality**
(being able to treat both sides the same; not to pick sides)

iv) **Honesty/Integrity**
(the ability to be honest with players, on and off the field)

v) **Self-confidence**
(belief in own ability to select appropriate courses of action)

vi) **Commitment**
(dedication to do best when preparing for games; know the rules; always giving best when refereeing a match)

vii) **Composure**
(to be calm during difficult situations)

viii) **Consistency**
(consistency in the way rules are applied during a match)

ix) **Decisiveness**
(the ability to reach quick and firm decisions)

x) **Fitness**
(fitness in terms of physical ability to keep up with play during a match)

xi) **Judgment**
(ability to evaluate and judge situations during a match correctly)

xii) **Resoluteness**
(the ability to stand by a decision after it has been made, right or wrong)

xiii) **Conflict handling**
(ability to manage conflict situations on the field, e.g. fights during play)

xiv) **Flexibility**
(in terms of using the laws, applying the advantage rule)

xv) **Player control**
(getting the players to conform and play according to the rules of the game)

xvi) **Respect**
(treating the players on and off the field with the dignity they deserve as human beings)

xvii) **Athleticism**
(athletic ability, e.g. speed, agility, etc.)

xviii) **Authority**
(demonstrate authority; show that referee is in charge and the players accept the rulings unconditionally)

xix) **Problem analysis**
(ability to consider all the facts and quickly analyse situations on the field)

xx) **Technical skills in terms of law application**
(all the detail regarding the laws and their application during play)

xxi) **Communication on the field - oral**
(ability to communicate in a manner that the message is very clear / the players know exactly what is expected of them)

xxii) **Ambition**
(a strong desire to be a successful referee)

xxiii) **Stress tolerance**
(ability to handle stress on and off the field of play)

xxiv) **Eyesight**
(being able to see the action on the field, “broad” vision during a match)

xxv) **Preparation**
(spend time to prepare mentally and physically before matches and in the lead up to big games)

xxvi) **Technical skills in general**
(e.g. knowledge on scrum techniques in general, and not only in terms of rugby laws)

xxvii) **Leadership**
(leadership ability of the referee on and off the field of play)

xxviii) **Initiative**
(the ability to take initiative on the field; act before something happens)

xxix) **Persuasiveness**
(the ability to be convincing)

xxx) **Frustration tolerance**
(being able to handle frustrating situations by staying calm)

xxxi) **Rapport with players**
(ability to make real interpersonal contact and form relationships with players off the field)

xxxii) **Dynamism**
(the ability to be dynamic and to stand out on the field)

xxxiii) **Competitiveness**
(the referee should care how well he performs in relation to other referees: "he should want to be the best referee")

xxxiv) **Creativity/Innovation**
(creative and innovative in terms of how issues are resolved)

xxxv) **Mental toughness**
(strong character of mind)

xxxvi) **Influence on players**
(the ability to influence player's attitudes positively)

The Delphi technique was used to ensure high content validity of the above competencies that were included in questionnaire three (attached as Appendix 3). The Delphi technique is discussed in section 4.5.5.

4.5.5 UTILISING THE DELPHI TECHNIQUE TO ENSURE HIGH CONTENT VALIDITY OF FINAL QUESTIONNAIRE

The Delphi technique was utilised to ensure that the final questionnaire of this study had a high content validity. This is established by the expert opinion of the referees that participated in the study.

"The Delphi technique was developed in the late 1940's by Rand Corporation, an independent think-tank. The Delphi technique has a unique method for eliciting and refining group judgment as it is based on the notion that a group of experts is

better than one expert, when exact knowledge is not available. A small group of experts selected from a particular industry have to respond independently, in a designated time frame, to a problem scenario. After each round, the information is consolidated and edited. Unlike focus groups, the respondents do not converse with the other study participants, but they are given feedback from the other respondents after each set of questions" (Kaynak *et al* 1994: 18-29).

Dick (2000: http://www.scu.edu.au) defined the Delphi technique on the *Resource Papers in Action Research* website, 2000, as "a process which uses an expert panel to make complex decisions". He is of the opinion that the Delphi technique's most common use is for future forecasting by a panel of experts. It typically employs several rounds of a mailed survey.

Nehiley (2000: http://www.scu.edu.au) writes that the Delphi approach is a technique for gathering data that is similar to focus groups. One of the advantages of the Delphi approach is that, unlike focus groups, the Delphi groups do not have to meet. Nehiley defines the technique as "a method of generating ideas and facilitating consensus among individuals who have special knowledge to share, but who are not always in contact with each other. A Delphi study carefully selects individuals who have knowledge necessary to analyse a specific problem." He went further by stating that the Delphi technique tries to choose the necessary participants purposively and puts them together for the purpose of analysis.

In his 2000 paper, Nehiley provides the following steps on how to conduct an effective Delphi study:

i. First a panel of experts must be identified to serve on the Delphi panel. The panelist's primary qualification should be their special knowledge. This knowledge can be gained through experience or advanced education. Another key qualification is that panelists be willing to share their information.

In this study the active and qualified Blue Bulls referees were used as a panel of experts. Their knowledge was gained through experience as well as training courses. These referees were all willing to share their thoughts and opinions on the topic of competency.

ii. Invite an appropriate number of panelists to participate. This follows the identification stage.

All 54 active Blue Bull referees received the two rounds of questionnaires. Only 47 of the referees responded.

iii. Prepare and distribute the initial survey instrument. The initial survey may contain open-ended probes or specific closed-ended questions, depending on the focus of the research.

iv. Receive and analyse the initial wave of data.

The first questionnaire was analysed, and certain important competencies identified by the panel of experts were added, while other less important competencies were excluded.

v. Prepare and distribute the second survey instrument. Most often panelists are asked, with the second wave, to clarify and rank order survey items suggested during the first wave. When panelists receive the second survey instrument, it will be the first time they will have seen the responses of the other panel members. It is often appropriate at this time to ask for additional ideas, clarification, and elaborations based on the initial survey responses.

At the conclusion of the second questionnaire that was sent to the Blue Bulls referees, the participants were asked to indicate any uncertainties or unclear definitions in the questionnaire.

vi. Receive and analyse the second wave of data. Care should be exerted to include all of the new ideas and suggestions, for the main purpose of the Delphi study is to generate new ideas.

vii. Repeat the process with additional questionnaires, if necessary.

viii. Prepare and distribute a final report to panel members. One of the motivations for participating in a Delphi panel, particularly for specialists, is to learn firsthand, before others, what the results of the Delphi study are.

“Delphi is not a procedure intended to challenge statistical or model-based procedures, against which human judgment is generally shown to be inferior: it is intended for use in judgment and forecasting situations in which pure model-based statistical methods are not practical or possible because of the lack of appropriate historical/economic/technical data, and thus where some form of human judgmental input is necessary. Four key features may be regarded as necessary for defining a procedure as a “Delphi”. These are: anonymity, iteration, controlled feedback and the statistical aggregation of group response” (Rowe and Wright 1999: 353-375).

4.6 COMPUTATION OF DATA

Weighted indexes were used to establish final lists of competencies for the various response groups. This section discusses the index compilation process, how to work with the exponential function and the final calculation of the weighted indexes.

4.6.1 UTILISING WEIGHTED INDEXES TO IDENTIFY THE REQUIRED COMPETENCIES OF REFEREES

In this study, weighted indexes were used to compare and establish a final list of important competencies for rugby referees to possess. This section will provide an example of how such an index is calculated and will also include the reasoning behind the method used.

Neuman (2000: 176) is of the opinion that weighted scales and weighted indexes are interchangeable. He defines a scale as a measure in which a researcher captures the intensity, direction, level, or potency of a variable construct. It arranges responses or observation on a continuum. A scale can use a single indicator or multiple indicators. Most are at the ordinal level of measurement.

Neuman (2000: 176) defined an index as follows:”An index is a measure in which a researcher adds or combines several distinct indicators of a construct into a single score. This composite score is often a simple sum of the multiple indicators. Indexes are often measured at the interval or ratio level”.

4.6.1.1 INDEX COMPILATION

In a weighted index, a researcher values or weighs some items more than others. The size of weights can come from theoretical assumptions, the theoretical definition, or a statistical technique such as factor analysis. Weighting changes the theoretical definition of the construct Neuman (2000: 179).

In this study indexes were drawn up using the frequencies from the various competencies included in the questionnaires. Tables were compiled after analysis of the frequencies, which indicated the exact number of responses for each competency within the various scales (these tables are provided in Chapter 5). In the first questionnaire to the Blue Bulls referees, for example, the following results, as can be seen in Table 4.6, were obtained for the competency “ambition”.

Table 4.6: Results for competency “Ambition”.

COMPETENCY	IRRELEVANT	LESS IMPORTANT	AVERAGE	IMPORTANT	VERY IMPORTANT
Ambition	1 referee	5 referees	2 referees	10 referees	29 referees

All the questionnaires, within the certain categories, were analyzed as such and similar tables compiled. These tables can be seen as individual matrixes, which mean that it is a table used to represent data in an orderly way
(Vivier, Swanepoel & Swart, 1994: 146).

4.6.1.2 WORKING WITH THE EXPONENTIAL FUNCTION (NOT NORMAL DISTRIBUTION)

After analysis of the data from the questionnaires received, it is clear that the data will not meet the characteristics of a normal distribution function.

Before any analysis of the data is done it is reasonable to predict that this data will form a normal distribution, because a representative sample was used, that is, a high number of qualified referees and players in the selected category. The rule of comparative judgment states that it is impossible to identify the "most common response" for each object or concept being judged. Although different people arrive at somewhat different judgments, the individual judgments cluster around the single most common response. The dispersion of individual judgments around the common response follows a general statistical pattern called the normal distribution (Neuman 2000: 185).

The assumption that the data used in this study will form a normal distribution can be tested by looking at the characteristics of a normal distribution. Steyn, Smit, Du Toit & Strasheim (1994: 345) define the function of the normal distribution, with the average being μ and the standard deviation being σ, as follows:

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)}$$

According to Steyn *et al* (1994: 345) the characteristics of a normal distribution are as follows:

- the normal distribution is bell-shaped and symmetrical around the average μ
- about 68% of the total surface lies between $\mu - \sigma$ and $\mu + \sigma$
- about 95% of the total surface lies between $\mu - 2\sigma$ and $\mu + 2\sigma$
- about 99,7% of the total surface lies between $\mu - 3\sigma$ and $\mu + 3\sigma$
- the normal distribution is asymptotic to the *x*- axis.

After the data from the final questionnaire was analysed it was clear that the data did not meet the characteristics of a normal distribution function. This proof is provided in Chapter 5 of the study, but an example is given below:

In the first questionnaire that was sent to the Blue Bulls referees, one referee rated the competency “ambition” as irrelevant, while five referees rated the same competency as less important for a referee to possess. Two of the Blue Bulls referees indicated that the competency is of only average value, and ten referees stated that “ambition” is more important to possess. Twenty-nine Blue Bull referees indicated that ambition is very important to possess.

As the data did not adhere to the characteristics of a normal distribution function, and consequently could not be standardized, the exponential function had to be used in the calculation of indexes. The equation of a quadratic function could therefore not be used for this study’s purposes (Vivier *et al* 1994: 43).

In the responses on the importance of various competencies, an upward curve was detected for most of the competencies. Underlying this curve is the exponential function:

$$y = ae^{bx}$$

with “*a”* and “*b”* being constants and “*e”* being the universal constant. *“y”* is the exponential function (Vivier *et al* 1994: 43).

4.6.1.3 CALCULATION OF WEIGHTED INDEXES

Since an exponential equation does not have a median value (average), one side of the curve will always be used as the base value, in most cases 1. For the purposes of this study “one” will be used as the base value in all instances (Vivier *et al* 1994: 44).

In this study as mentioned earlier a 5 point Likert scale was used. The total of any scale will always be 100, and therefore each scale will have a value of 20. This can be seen in Table 4.7.

Table 4.7: Estimated values for each scale used in the 5 point Likert scale.

SCALE	20	20	20	20	20	100
For example	1 (irrelevant)	2 (less important)	3 (average)	4 (more important)	5 (very important)	

To compile an index, the real distance between the scales must be determined.
The first step in the compilation of the indexes is to calculate the *y*-axis of the matrixes (columns determined from the frequency tables attached as Appendix 4). The total will be known as the matrix totals. The totals of these *y*-axis are then divided with each other (the total on the right with the total on the left) to determine an estimated value for each scale. Table 4.8 is provided as an example.

Table 4.8: Example of a matrix total.

Irrelevant	Less important	Average	More important	Very important
27	62	154	510	1152

- The estimated distance of the first scale will be one, because one is used as the base in an exponential equation.
- The difference between scale 1 and 2 will be determined by 62 ÷ 27 = 2.3, meaning the estimated difference between the two scales is 2.3.
- Estimated distance between 2nd and 3rd scale: 154 ÷ 62 = 2.5.
- Estimated distance between 3rd and 4th scale: 510 ÷ 154 = 3.3
- Estimated distance between 4th and 5th scale: 1152 ÷ 510 = 2.25.

The real distances of the matrix are then determined by multiplying the estimated distances with each other. Using the above example, the real distances between the scales will be:

- 1st scale: One, with one being the base
- 2nd scale: 2.3 x 1 = 2.3
- 3rd scale: 2.3 x 2.5 = 5.75
- 4th scale: 5.57 x 3.3 = 18.3
- 5th scale: 18.3 x 2.25 = 41.17

The last step in determining the index is to take the *x*-axis in the matrix and multiply this number (the frequency of the particular scale and competency) with the real distance between the scale, as was calculated above. Using the above examples, real distances and the example of three *x*-axis out of a fictionary matrix, the totals can be calculated as such.

Table 4.9: Three *x*-axis out of a matrix multiplied by the real distance of each scale.

Competency 1	1 x 1 = **1**	5 x 2.3 = **11.5**	2 x 5.75 = **11.14**	10 x 18.3 = **183**	29 x 41.17 = **1193.93**	**1400.57**
Competency 2	0 x 1 = **0**	4 x 2.3 = **9.2**	15 x 5.57 = **83.55**	18 x 18.3 = **329.4**	11 x 41.17 = **452.87**	**875.02**
Competency 3	0 x 1 = **0**	2 x 2.3 = **4.6**	14 x 5.57 = **77.98**	17 x 18.3 = **311.1**	25 x 41.17 = **1029.25**	**1422.93**

The index for the above table will be in the following order after the totals for each cell are calculated: the biggest total will indicate the most important competency, in the case of the example competency three. The least important competency will be the competency with the lowest total, in this case competency two.

Described and explained above, using examples, are the processes to be followed for each of the indexes that will be used in this study.

4.6.1.4 STATISTICAL PROCEDURES AND METHODS

With the help of SPSS, Version 11,5, frequencies will be determined for each item (competency) in the questionnaires received back. These frequencies will be used to compile a table in Excel 2000 Professional indicating exactly how many responses were received per competency.

A factor analysis will be completed for all the respondents to determine how many categories, or factors, of competencies can be identified. Cooper and Schindler (1998: 560) provided the following definition of a factor analysis: “Factor analysis looks for patterns among the variables to discover if any underlying combination of the original variables (a factor) can summarise the original set.”

4.7 COMPARING THE DATA FROM DIFFERENT QUESTIONNAIRES

The main objective of this study is to compile a competency index for rugby referees to be successful at the highest level. It is also necessary to compare some of the individual weighted competency indexes with each other to form an idea of the various perceptions of referees and players from all over the country. This comparison was done graphically and by using analysis of variance (ANOVA). This comparison procedures are discussed below.

4.7.1 GRAPHIC COMPARISON

The weighted competency indexes, compiled up to this point in the study, cannot be compared with each other because the weighted scores are not on the same scale. This difference in weighted scores is because of the different response rates from the referees and players. The Gauteng Lions referees had the highest number of respondents, with a total of 69 referees. The weighted competency index with the least number of respondents was the Free State, with ten respondents. Therefore all the other weighted indexes must be adjusted before any comparisons can be made. All the weighted indexes will be adjusted to the highest response rate, in this case the Gauteng Lions referees.

This calculation will be done as follows:

- The number of respondents from the weighted competency index with the least number of respondents will be divided with 69 (the number of respondents from the Gauteng Lions referees).
- This number will be multiplied by 100 to calculate a percentage.
- The percentage will be divided with 100 to calculate the difference between the original amount and the 69 Gauteng Lions referees.

- This number will be multiplied by the weighted score of each competency in the original weighted competency index, to calculate a “new” weighted score that can be compared across all the weighted competency indexes.
- This calculation can be verified by multiplying the final result of the above calculation with the number of respondents from the weighted competency index with the least respondents. The answer should be 69 or very close to this figure.

After the above calculations are made, all the weighted competency indexes in this study can be compared with each other graphically. It is also necessary to compare the various groups with each other statistically. In this study, analysis of variance (ANOVA) was used.

4.7.2 COMPARISON OF DATA UTILISING ANOVA

Analysis of variance (ANOVA) will be used as the statistical method to compare the data. ANOVA is a parametric test and compare the effects of one factor on a continuous dependent variable (Cooper and Schindler, 1998: 492). To use ANOVA certain conditions must be met (Cooper and Schindler, 1998: 492), namely:

- the samples must be randomly selected from normal populations.
- the populations should have equal variances.
- the distance from one value to its group’s mean should be independent of the distances of other values to that mean (independence of error.)

In this study ANOVA, using SPSS, Version 11,5, will be used to compare the data. ANOVA will be used for the following reasons:

- The data do not fit into a normal distribution
- The size of the groups being compared are fairly even
- ANOVA uses squared deviations of variance unlike *t* tests which use sample standard deviation

4.8. SUMMARY

This chapter contained the research procedure followed and the statistical procedures and techniques used. The difference between quantitative and qualitative research was highlighted, because both techniques were utilised in the study.

Qualitative research was used to gather data on the core competencies a rugby referee should possess. Although the Delphi technique, in the form of a questionnaire, was used to finalising the competencies to be used throughout the study, interviews were conducted with experts to identify a list of relevant competencies. Quantitative research was done by means of various questionnaires, using a 5 point Likert scale, to obtain the relevant data.

Survey research and the different types of survey research were discussed. This study made use of self-administered questionnaires to gather data and face to face interviews were held.

Phases one and two of the study were in the form of questionnaires that went to the Blue Bulls referees to obtain their opinion. The Delphi technique was used to compile a final list of competencies, with their definitions, for use in the study.

In phase three another questionnaire, compiled from the results obtained in the initial two surveys of the Blue Bulls referees, was utilised (attached as Appendix 3). This questionnaire was distributed among all the other rugby unions in South Africa, for their referees and the 2003 Currie Cup players to complete. The response rates were discussed in this chapter.

The way the various questionnaires were compiled was discussed, and all the competencies and their corresponding definitions that were used in the questionnaires were provided.

The measurement techniques, the Delphi technique and indexing, were discussed. The statistical methods that were used and, the various methods for comparing the indexes were presented. The method used to construct the indexes was also discussed.