Table 5.16 – Sampling Stage 3 (Number of interviews per franchise system)

Segment	N franchisees (per selected franchisors)	% of total	N interviews (proportional)	Suggested N interviews	Allocation basis
FASA small	49	2.3%	15	30	Suggested to meet minimum cell size criteria
FASA medium	204	9.5%	62	83	Suggested to meet minimum cell size criteria
FASA large	1344	62.9%	409	363	Proportionally allocated based on the number of interviews available
Non-FASA small	109	5.1%	33	50	Suggested to meet minimum cell size criteria
Non-FASA medium	84	3.9%	25	30	Suggested to meet minimum cell size criteria
Non-FASA large	348	16.3%	106	94	Proportionally allocated based on the number of interviews available
Total	2138	100.0%	650	650	

It is important to note that a sample size of 800 was originally suggested for this research project. The duration (length) of the questionnaire increased from a 15 minute interview to a 35 minute interview, which had significant cost implications. In order to keep within the agreed budget, the number of interviews had to be reduced to 657.

The following table gives a summary of the franchise systems that agreed to participate in the research. Although 12 large FASA members should have been included in the research (as suggested in round two of the sampling), only 11 large franchisors agreed to participate in the research. No other large franchisors could be convinced to participate although all other large franchise systems were contacted. A substitution was therefore made and another medium FASA member was included. Substitutions were also made with some of the other categories. This was done due to the fact that the client (for which the research was done) required a minimum number of franchise systems in the research in order to do follow-up work with these systems. The number of franchisees per franchise system and the proposed sample size are shown in Table 5.17.

Table 5.17 – Proposed Sample Sizes per Franchise System and the Corresponding Response Rates per Franchise System

No.	Franchise group	N franchisees	Proposed sample
	FASA - small		30
1.	Beaux Arts	18	11
2.	Shine master	11	7
3.	Trappers franchising cc	20	12
	FASA - medium		83
1.	Coastal tool hire network	32	13
2.	Master Maths	39	16
3.	Re/max of Southern Africa	45	18
4.	Something fishy	88	36
	FASA - large		370
1.	7 Eleven Suprettes (Cape)	162	44
2.	Battery Centre	129	35
3.	Mr Exhaust Mr Tyre	76	21
4.	Pleasure foods (Mac Munch)	8	8
5.	Pleasure foods (Wimpy)	229	62
6.	Postnet SA	126	34
7.	Silverton radiators	115	31
8.	Spec-savers SA	86	23
9.	Spur	113	31
10.	Steers	122	33
11.	Supa-Quick	178	48
	NON-FASA - small		50
1.	Annique	31	14
2.	Barotti Stationers	19	9
3.	Gino's	11	5
4.	Lumber city	26	12
5.	Trellidor	22	10
	NON-FASA - medium		30
1.	Dream nails	42	15
2.	Harvey World Travel (Rennies Travel)	42	15
	NON-FASA - large		94
1.	King Pie	218	59
2.	Mica Hardware	130	35
	TOTAL		**657**

5.8.4 Determine the sample size

The sample size is determined by aspects such as the type of sample, the statistics in question, the homogeneity of the population, time, money and personnel available for the study (Gilbert and Churchill 1995:628).

Gay and Diehl (1992:140) suggest that the type of research plays a major role in the sample size. They give some basic guidelines in terms of sample size and state that: "*for descriptive research, a sample of 10% of the population is considered a bare minimum, ..., for correlation studies at least 30 subjects are needed to establish the existence or nonexistence of a relationship, ..., and for causal-comparative studies .... a minimum of 30 subjects per group is generally recommended.*"

The study in question is a combination of descriptive research and correlation research. Cooper and Schindler (1998:10) state that descriptive research attempts to describe or define a subject and answers questions such as who, what, when, where and how (and sometimes leads to the creation of a profile of people). Gay and Diehl (1992:15) define correlation research, as research that attempts to answer "whether" and "to what degree" a relationship exists between two or more quantifiable variables. Correlation research **does not** establish a cause-effect relationship, **but only** that a relationship exists. The existence of a strong relationship permits prediction.

If the basic guidelines offered by Gay and Diehl (1992:140) are followed, a sample of between 1844 (10% of franchisees) and 30 interviews would be sufficient for this type of research.

Dillon, Madden and Firtle (1990:279) also give basic guidelines for sampling and they state that for market studies a minimum sample of 500 is suggested. They further state that the typical range of sample sizes varies from 1000 to 1500 for market studies.

Another sample calculator (http://researchinfo.com/calculators) indicated that at a 99% confidence level and a 4% confidence interval the approximate sampling size should be 642. (This calculation is based on proportions)

Based on the discussions above, a sample size of 652 franchisees (from 27 different franchise systems) is sufficient. This study represents 3,12% of the total franchisee population and 7,54% of all franchise systems (franchisors) based on the published database sizes.

5.8.5 Collect the data from the designated elements

A well-equipped call-center with experienced staff was used for the data collection process. All call center personnel working on the campaign underwent comprehensive training on the questionnaire and received information pertaining to the background and reasons for the study. Various sessions of role-playing also took place to ensure that the call center personnel maintained a professional approach and knew the questionnaire by heart. All the call center personnel were familiar with the CATI software that was used in this research process and no additional training on the software package itself was necessary. Call center personnel were constantly monitored to ensure a high standard of interviewing.

Franchisees from the 27 specified franchise systems were contacted for a telephonic interview. Only franchisees within South Africa were included in this study. The data collection process lasted from 19 April to 7 May 1999 (3 weeks) and a total of 6786 telephone calls were made to obtain the 652 responses. At the end of the data collection process, the call centre exported the data from the CATI software package to an excel worksheet and this document was e-mailed to the researcher for data processing.

5.9 DATA PROCESSING

5.9.1 Check-in and editing procedure

This procedure involves the checking of all returned questionnaires for completeness and a count of the usable questionnaires. According to Churchill and Gilbert (1995:736) *"the basic purpose of editing is to impose some minimum quality standards on the raw data."*

All questionnaires were complete because the CATI software required an answer before continuing with the rest of the questionnaire and no questionnaires were therefore discarded. Respondents were able to indicate "don't know" as an answer and this was handled as a non-response. The occurrence of "don't know's" was very low and constituted the exception to the rule. Mean substitution was not used in cases where "don't know" was indicated and if a respondent had a "non-response" for a certain statement, that respondents statement would not be included in the analysis process.

A quality check was performed on the data by calculating a minimum and maximum value for each of the statements in the datafile to ensure that no values were outside the acceptable range.

5.9.2 Coding

Coding was not necessary for this project because a computer-based questionnaire was used and the answers given by respondents were captured as the questions were asked to them.

5.9.3 Data transformations

All the items in the questionnaire that had 11-point scales (from "0" to "10") were re-coded to index values (out of a 100). This was done because index values are easily understandable and make the results more easily interpretable.

Some of the questions were negatively worded and it was necessary to reverse-score these items.

5.10 HYPOTHESES (AND PROPOSITION) OPERATIONALISATION

In this section the operationalisation of the proposition and research hypotheses are discussed. A consistent format of discussion is used:

- The proposition or hypothesis is stated first,
- A summary of information is then given in table format and lastly
- The statistical notation of the hypothesis is given.

The table format contains information such as the number of variables, a description of the variables, the data types, the aspects that are measured, the method of measurement and the statistical technique used. A more detailed discussion of the statistical techniques are done in section 5.11 (vide page 161). The operationalisation is done in this manner because a clear picture of exactly what is done and how it is done can be obtained at a glance.

5.10.1 Operationalisation of the first proposition

Proposition 1 = There are distinctive phases in the relationship between franchisees and the franchisor that follow a typical life cycle format.

Table 5.18 – Proposition 1 - Operationalisation

Number of variables	1 (independent)	1 (dependent)
Variables	Phases – Self identification of life cycle stages according to re-classified Nathan phases (FLC phases)	Duration of franchisee relationship (measured in years and re-coded into nominal categories)
Data type	Non-metric Nominal	Non-metric Nominal
Measurement	"Distinctiveness"	
Method of measurement	Use Nathan's phases and thorough a process of combination, try to identify distinctive phases. Correspondence analysis was used to plot the different phases and years on a dimensional map	
Technique used	Correspondence analysis	

5.10.2 Operationalization of hypothesis 1

H_1 = There are significant differences in the commitment-trust dimensions representing the franchisee-franchisor relationship between each life cycle phase.

Table 5.19 – Hypothesis 1 - Operationalisation

Number of variables	10 (dependent)	1 (independent)
Variables	Commitment-trust dimension index scores	The 4 FLC life cycle phases
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significant differences in commitment-trust index scores	
Method of measurement	The commitment – trust dimensions scores were analyzed with the FLC life cycle phases as identified in the correspondence analysis	
Statistical test	MANOVA	

Table 5.20 – Hypothesis 1 Stated in Statistical Notation

$$
H_1 \quad
\begin{bmatrix} \mu_{d1p1} \\ \mu_{d2p1} \\ \mu_{d3p1} \\ \mu_{d4p1} \\ \mu_{d5p1} \\ \mu_{d6p1} \\ \mu_{d7p1} \\ \mu_{d8p1} \\ \mu_{d9p1} \\ \mu_{d10p1} \end{bmatrix}
\neq
\begin{bmatrix} \mu_{d1p2} \\ \mu_{d2p2} \\ \mu_{d3p2} \\ \mu_{d4p2} \\ \mu_{d5p2} \\ \mu_{d6p2} \\ \mu_{d7p2} \\ \mu_{d8p2} \\ \mu_{d9p2} \\ \mu_{d10p2} \end{bmatrix}
\neq
\begin{bmatrix} \mu_{d1p3} \\ \mu_{d2p3} \\ \mu_{d3p3} \\ \mu_{d4p3} \\ \mu_{d5p3} \\ \mu_{d6p3} \\ \mu_{d7p3} \\ \mu_{d8p3} \\ \mu_{d9p3} \\ \mu_{d10p3} \end{bmatrix}
\neq
\begin{bmatrix} \mu_{d1p4} \\ \mu_{d2p4} \\ \mu_{d3p4} \\ \mu_{d4p4} \\ \mu_{d5p4} \\ \mu_{d6p4} \\ \mu_{d7p4} \\ \mu_{d8p4} \\ \mu_{d9p4} \\ \mu_{d10p4} \end{bmatrix}
$$

Notation used:

μ = Mean of variable (sample mean)

d= Commitment – trust dimensions (ranging from 1 – 10)

p = FLC life cycle phases (ranging from 1 – 4)

5.10.3 Operationalization of hypothesis 2

H_2 = There are significant differences in the relationship quality index levels representing the franchisee-franchisor relationship between each life cycle phase.

Table 5.21 – Hypothesis 2 - Operationalisation

Number of variables	1 (dependent)	1 (independent)
Variables	Relationship quality index levels	The FLC life cycle phases
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significant differences in the relationship quality index levels	
Method of measurement	The relationship quality index was calculated using specific commitment-trust statement scores and the satisfaction statements as discussed earlier in this chapter vide page 137. This relationship quality index was then analysed at all the FLC life cycle phases.	
Statistical test	ANOVA	

Table 5.22 – Hypothesis 2 Stated in Statistical Notation

$$H_2 \quad \mu_{r1p1} \neq \mu_{r1p2} \neq \mu_{r1p3} \neq \mu_{r1p4}$$

Notation used:

μ = Mean of variable (sample mean)

r= Relationship quality index levels

p = FLC life cycle phases (ranging from 1 – 4)

5.10.4 Operationalization of hypothesis 3

H_3 = Franchisees in the first life cycle phase will have significantly higher commitment–trust dimension scores than franchisees in the successive life cycle phases.

Table 5.23 – Hypothesis 3 – Operationalisation

Number of variables	10 (dependent)	1 (independent)
Variables	Commitment-trust dimension index scores	The FLC life cycle phases
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significantly higher commitment-trust dimension scores	
Method of measurement	A Scheffè test was performed to determine if the differences on each dimension score for each life cycle phase was significant and it was then determined if the dimensions scores were higher or lower.	
Statistical test	Scheffè test	

Table 5.24 – Hypothesis 3 Stated in Statistical Notation

$H_3 \quad \mu_{d1p1} > \mu_{d1p2} > \mu_{d1p3} > \mu_{d1p4}$

Notation used:

μ = Mean of variable (sample mean)

d= Commitment-trust dimensions

p = FLC life cycle phases (ranging from 1 – 4)

5.10.5 Operationalization of hypothesis 4

H_4 = Franchisees in the first life cycle phase will have significantly higher relationship quality index levels than franchisees in the successive life cycle phases.

Table 5.25 – Hypothesis 4 - Operationalisation

Number of variables	1 (dependent)	1 (independent)
Variables	Relationship quality index levels	The FLC life cycle phases
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significantly higher relationship quality scores	
Method of measurement	The results obtained in hypothesis 2 were used to show that significant differences did occur. The relationship quality index was then further analysed with the FLC life cycle phases (with a Scheffè test) to determine if the differences on the relationship index for each life cycle phase was significantly higher.	
Statistical test	Scheffè test	

Table 5.26 – Hypothesis 4 Stated in Statistical Notation

H_4 $\mu_{rp1} > \mu_{rp2} > \mu_{rp3} > \mu_{rp4}$

Notation used:

μ = Mean of variable (sample mean)

r= Relationship quality index levels

p = FLC life cycle phases (ranging from 1 – 4)

5.10.6 Operationalization of hypothesis 5

H_5 = There are significant differences in the commitment-trust dimensions of each life cycle fit category.

Table 5.27 – Hypothesis 5 - Operationalisation

Number of variables	10 (dependent)	1 (independent)
Variables	Commitment-trust dimension index scores	The FLC life cycle fit categories
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significant differences of commitment-trust dimension index scores	
Method of measurement	The life cycle fit categories were calculated by assigning a fit code (exact, premature and lagged) to a franchisee, based on the phase of the relationship that a franchisee was classified into and the duration of the relationship. If for example, a franchisee was classified as belonging to the "Courting" phase and the relationship duration was 5 years, the franchisee would have been classified as premature fit. The duration of a phase was operationalised as 1 year. The life cycle fit categories and the commitment-trust dimension index scores were then used in the statistical analysis.	
Statistical test	MANOVA	

Table 5.28 – Hypothesis 5 Stated in Statistical Notation

$$H_5 \quad \begin{bmatrix} \mu_{d1f1} \\ \mu_{d2f1} \\ \mu_{d3f1} \\ \mu_{d4f1} \\ \mu_{d5f1} \\ \mu_{d6f1} \\ \mu_{d7f1} \\ \mu_{d8f1} \\ \mu_{d9f1} \\ \mu_{d10f1} \end{bmatrix} \neq \begin{bmatrix} \mu_{d1f2} \\ \mu_{d2f2} \\ \mu_{d3f2} \\ \mu_{d4f2} \\ \mu_{d5f2} \\ \mu_{d6f2} \\ \mu_{d7f2} \\ \mu_{d8f2} \\ \mu_{d9f2} \\ \mu_{d10f2} \end{bmatrix} \neq \begin{bmatrix} \mu_{d1f3} \\ \mu_{d2f3} \\ \mu_{d3f3} \\ \mu_{d4f3} \\ \mu_{d5f3} \\ \mu_{d6f3} \\ \mu_{d7f3} \\ \mu_{d8f3} \\ \mu_{d9f3} \\ \mu_{d10f3} \end{bmatrix}$$

Notation used:

μ = Mean of variable (sample mean)

d= Commitment – trust dimensions (ranging from 1 – 10)

f = life cycle fit categories (ranging from 1 – 3)

5.10.7 Operationalization of hypothesis 6

H_6 = There are significant differences in the relationship quality index levels between each life cycle fit category.

Table 5.29 – Hypothesis 6 - Operationalisation

Number of variables	1 (dependent)	1 (independent)
Variables	Relationship quality index levels	The FLC life cycle fit categories
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significant differences between relationship quality index scores	
Method of measurement	The life cycle fit categories and the relationship quality index scores were used in the statistical analysis.	
Statistical test	ANOVA	

Table 5.30 – Hypothesis 6 Stated in Statistical Notation

$$H_6 \quad \mu_{rf1} \neq \mu_{rf2} \neq \mu_{rf3}$$

Notation used:

μ = Mean of variable (sample mean)

r= Relationship quality index levels

f = life cycle fit categories (ranging from 1 – 3)

5.10.8 Operationalization of hypothesis 7

H_7 = Franchisees that move through the life cycle phases in the expected time (exact fit) will have significantly higher relationship quality levels than those that move slower or faster.

Table 5.31 – Hypothesis 7 - Operationalisation

Number of variables	1 (dependent)	1 (independent)
Variables	Relationship quality index levels	The FLC life cycle fit categories
Data type	Metric Ratio	Non-metric Nominal
Measurement	Significantly higher relationship quality index levels	
Method of measurement	The life cycle fit categories and the relationship quality index scores were used in the statistical analysis. The differences between each of the phases were tested in order to see franchisees in exact fit had a significantly higher relationship quality index.	
Statistical test	Scheffè test	

Table 5.32 – Hypothesis 7 Stated in Statistical Notation

$$H_7 \quad \mu_{rf1} < \mu_{rf2} > \mu_{rf3}$$

Notation used:

μ = Mean of variable (sample mean)

r= Relationship quality index levels

f = life cycle fit categories

(ranging from 1 = lagged, 2 = exact and 3 = premature)

5.11 DATA ANALYSIS AND STATISTICAL TECHNIQUES

After the editing and data transformation process, the data file was ready to important into Statistica for Windows, which was used for data analysis purposes. The research findings and results will be discussed in chapter 6. Before discussing the research findings, the statistical techniques that were used in chapter 6 will be briefly discussed.

5.11.1 Reliability analysis

According to Cooper and Emory (1995:148) "*reliability has to do with the accuracy and precision of a measurement procedure.*" Cooper and Schlinder (1998:171) state that "*reliability is concerned with estimates of the degree to which a measurement is free of random or unstable error.*" Gay and Diehl (1992:164) concur and state that reliability "*is the degree to which a test consistently measures whatever it measures.*"

There are three perspectives on reliability namely stability (test-retest reliability), equivalence and internal consistency. Internal consistency uses only one administration of a test or instrument to determine the consistency or homogeneity among the items, and is the relevant approach to use for determining the reliability of this study.

Cronbach's Alpha is a frequently used technique used to determine internal consistency and according to Cooper and Schindler (1998:173) it has the most utility for a multi-item scale at the interval level of measurement. This is the reason why Cronbach's Alpha was used rather than the Kuder-Richardson Formula 20, which is more suitable for dichotomous items.

Malhotra (1993:305) state that Cronbach's Alpha (coefficient alpha) "*is the average of all possible split-half coefficients resulting from different ways of splitting the scale items.*" The Cronbach Alpha value can vary from "0" to "1", with values below 0.6 indicating unsatisfactory internal consistency reliability.

(The higher the coefficient, the higher the reliability of the instrument. A coefficient of 1.00 therefore being perfectly reliable).

5.11.2 Validity analysis

"*Validity refers to the extent to which a test measures what we actually wish to measure*" (Cooper and Schindler 1998:166). There are various types of validity namely content, criterion-related (concurrent and predictive) and construct validity.

Construct validity was used in this study because it is the most sophisticated type of validity measure (Malhotra 1993:307). According to Malhotra (1993:307) construct validity addresses the question of what construct the scale is measuring.

The technique used to measure construct validity is called factor analysis, which is a general name used to identify a class of procedures primarily used for data reduction and summarization. There is no distinction between dependent and independent variables in factor analysis and the whole set of interdependent relationships between variables is examined to identify underlying dimensions or factors (Malhotra 1993:643).

The specific type of factor analysis that was used in this study is called "principal components analysis". This type of factor analysis is recommended when the main concern is to determine the minimum number of factors that will account for maximum variance in the data for use in subsequent multivariate analysis (Malhotra 1993:643). Cooper and Schindler (1998:577) state that principal component analysis transforms a set of variables into a new set of principal components (composite variables) that are not correlated with one another. These linear combinations of variables (factors) account for the variance in the data as a whole. The first factor is a combination of the variables that provides the best linear combination of variables for explaining the variance in the whole dataset. The second factor is the best linear combination of variables for explaining of the variance that was not explained by the first factor. There might be several factors and this process continues until all the variance is explained.

When a factor analysis is performed, the results are given in a table containing correlation coefficients, commonly referred to as loadings. Correlation coefficients are discussed in more detail in section 5.11.6 page 172 and will therefore not receive more attention here. Another term used in factor analysis is called an Eigenvalue. The Eigenvalue is the sum of the variances of the factor values and when this value is divided by the number of variables, it gives an indication of the amount of total variance explained by the factor (Cooper and Schindler 1998:577).

If a factor analysis is performed and many cross-loadings are obtained, (meaning that one variable has high correlation coefficients with more than one factor) a rotation can be done. Rotation tries to secure a less ambiguous condition between factors and variables so that only one variable loads with one factor. The rotation technique used in this study is called Varimax normalized.

5.11.3 Correspondence analysis

According to Malhotra (1996:696) correspondence analysis is a multidimensional scaling technique used for scaling qualitative data. Multidimensional scaling (MDS) is the name given to a class of procedures used to represent perceptions or preferences of respondents spatially by means of a visual display, usually called a spatial map.

Hair et al (1995:17) state that correspondence analysis differs from other interdependence techniques because of it's ability to accommodate non-metric data and non-linear relationships and it provides a multivariate representation of interdependence for non-metric data not possible with other methods.

Correspondence analysis is therefore an exploratory technique that can be used to analyze simple cross tabulation tables. It assumes that the analyst wants to investigate some measure of correspondence between the rows and columns of a table (Greenacre 1984: 35 in Statistica).

Relationships among stimuli are represented as geometric relationships among points in a multidimensional space. The axes of the spatial map represent the dimensions that respondents use to form perceptions or preferences for certain stimuli (Malhotra 1996:696). The spatial maps are interpreted in terms of proximity, and categories that are grouped closer together than others are more similar in their underlying structure.

There are a few terms (and specific statistics) used in correspondence analysis that need clarification. These terms will be mentioned and shortly discussed in the next few paragraphs (Statistica help file):

- **Dimensions and coordinates.**

The number of dimensions (that are chosen by the researcher) and coordinate values for each dimension will be shown.

- **Judging the quality of a solution.**

This aspect pertains to the evaluation of the quality of representation of the respective chosen numbers of dimensions. "*The general concern here is that all (or at least most) points are properly represented by the respective solution, that is, that their distances to other points can be approximated to a satisfactory degree.*"

A low quality means that the current number of dimensions does not represent the respective row (or column) very well. If the quality level is less than 0.1, it indicates that this row (or column) point is not well represented by the one-dimensional representation of the points. The quality of a point is similar in its interpretation to the communality for a variable in factor analysis.

- **Mass**

The term "mass" is used to indicate entries in the two-way table of relative frequencies (i.e. each entry is divided by the sum of all entries in the table). The sum of all entries in the table of relative frequencies is equal to 1.0 and it can be said that the table of relative frequencies shows how one unit of mass is distributed across the cells of the table. The row and column totals of the table of relative frequencies are called the row mass and column mass, respectively.

- **Inertia**

"*The term inertia is used by analogy with the definition in applied mathematics of "moment of inertia," which stands for the integral of* ***mass*** *times the* ***squared distance*** *to the centroid (Greenacre in Statistica). Inertia is defined as the total Pearson Chi-square for a two-way frequency table divided by the total sum of all observations in the table.*"

- **Relative inertia.**

"The relative inertia represents the proportion of the total inertia accounted for by the respective point, and it is independent of the number of dimensions chosen by the user. Note that a particular solution may represent a point very well (high quality), but the same point may not contribute much to the overall inertia" (Greenacre in Statistica).

- **Relative inertia for each dimension.**

This is the relative contribution of the respective (row) point to the inertia "accounted for" by the respective dimension. This value will therefore be reported for each (row or column) point, for each dimension.

The information provided by MDS techniques (such as correspondence analysis) has been used for a number of applications such as:

- Image measurement
- Market segmentation
- New product development

- Assessing advertising effectiveness
- Pricing analysis
- Channel decisions
- Attitude scale construction

Correspondence analysis was used in this study for market segmentation purposes, because the franchisee life cycle stage and the number of years that the franchisee has been in operation can be positioned in the same space and respondents with relatively homogeneous perceptions can be identified.

5.11.4 Simple analysis of variance (ANOVA) / One-way analysis of variance

This technique is useful for studies involving two or more groups. ANOVA is used to determine if there are significant differences between two or more means at a selected probability level (Gay and Diehl 1992:513). Cooper and Schindler (1998:492) state that ANOVA "*uses a single-factor, fixed effects model to compare the effects of one factor on a continuous dependent variable.*" A "fixed-effects" model means that the factors are specified in advance and the results are therefore not generalizable to other levels of treatment that were not specified in advance.

In order to use ANOVA the following conditions must be met:

- Samples must be randomly selected from normal populations with equal variances,
- The distance from one value to its group's mean should be independent of the distances of other values to that mean,

If the "F" ratio (which is the test statistic for ANOVA) is determined to be significant in the analysis, it is necessary to complete a multiple comparison technique in order to determine which means are significantly different from which other means.

There are two types (classes) of tests that can be used to determine which means differ from which other means. The first type is called a "priori contrasts." This type of test is used if the decision was made in advance that a comparison of specific populations was important. The other class of test is called "multiple comparison" tests or "post hoc" tests. This type of test is used when there is no theoretical reason for a priori contrast, but on examination of the data it is revealed that further tests would be necessary. One of the tests that could be used (post hoc) is called the Scheffé test. This test provides the researcher with tests of each combination of groups and indicates which comparisons across groups are significant. This test is conservative and robust to assumption violations and was used in this study (Gay and Diehl 1992:513, Cooper and Schindler 1998:497, Hair et al 1995:282).

5.11.5 Multivariate analysis of variance (MANOVA)

This technique is an extension of ANOVA and is used when more than one dependent variable and one or more independent variable is involved in a study (Gay and Diehl 1992:513). Hair et al (1995:14) describe MANOVA as *"a statistical technique that can be used to simultaneously explore the relationship between several categorical independent variables and two or more metric dependent variables.*" According to Cooper and Schindler (1998:567) MANOVA "*examines similarities and differences among the multivariate mean scores of several populations."*

The process of performing a multivariate analysis of variance is further discussed in the this section:

The **first** step in the process is to specify the research problem. There are three categories of multivariate problems, of which each employs different aspects of MANOVA. The categories are as follow (Hair et al 1995:268):

- **Multiple univariate questions:**

A number of separate dependent variables (e.g age, income, etc) are analysed separately. MANOVA is used to determine if there are overall differences between groups and then separate univariate tests are employed to address the individual differences for each dependent variable. This is the question used in the present study.

- **Structured multivariate questions**

Two or more structured dependent measures that have a specific relationship between them are analysed. (usually used in repeated measures).

- **Intrinsically multivariate questions**

This question involves a set of dependent measures. The question asked is how these dependent measures differ as a whole across the groups.

According to Hair et al (1995:268) the **second** stage in the process is to consider issues relating to the research design. There are several issues that must be considered such as sample size requirements, factorial designs and the use of covariates.

- **Sample size requirements**

MANOVA requires minimum sample sizes for each group included in the analysis. The sample for each group (cell) must be greater than the number of dependent variables included. In this study 10 (ten) dependent variables were used and the sample size per group included in the analysis was never smaller than 27, which is therefore sufficient.

- **Factorial design**

When a researcher wants to examine the effects of several independent variables or treatments a factorial design is needed. This is however not the case in this research and this issue will therefore not be discussed any further.

The **third** stage of the MANOVA decision process considers the assumptions on which MANOVA analysis is based. These assumptions are briefly discussed (Cooper and Schindler 1998, Hair et al 1995):

- **Assumption 1: Independence:**

There should be independence between observations and respondents. This was largely ensured by the random sampling plan and the fact that no group completion questionnaires were used (respondents were therefore not placed in the same setting where a common experience could lead to their answers being correlated).

- **Assumption 2a: Homogeneity of variance - Univariate assumption of homogeneity of variance:**

The results of analysis are only valid if the dependent variable is normally distributed and the variances of groups are equal. This assumption is tested by using significance levels of the Cochran and Bartlett-Box F tests (done on dependent variables). If the methods have equal variances in each dependent variable (and therefore a significant p-level) then the univariate assumption of homogeneity is fulfilled. In the Statistica help file it is stated however, "*that the consequences of even quite major violations of the homogeneity of variances assumption are not that critical.*"

Table 5.33 – Univariate assumption of homogeneity of variance test

	Hartley F-max	Cochran C	Bartlett Chi-sqr	df	p
COMG	3.3	0.3	39.4	3	0.000
COMTG	3.0	0.4	34.4	3	0.000
OPPBEG	1.6	0.3	4.4	3	0.218
TRUSTG	4.4	0.4	54.9	3	0.000
ACQUI1	5.1	0.5	52.7	3	0.000
RELBENG	2.2	0.4	19.7	3	0.000
FCONFL1	1.5	0.3	3.1	3	0.378
UNCERTG	1.9	0.3	8.6	3	0.035
COOPG	2.0	0.3	17.9	3	0.001
PTL	1.4	0.3	2.8	3	0.417

Three of the dimensions did not conform to the univariate assumption of homogeneity of variance, but it was decided that these dimensions would be included in the rest of the analysis based on the fact that (as stated in the previous paragraph) even major violations of this assumption are not that critical.

- **Assumption 2b: Homogeneity of variance - Multivariate assumption of homogeneity of variance**

The variances and covariances must be considered simultaneously with Box's M, to satisfy the multivariate assumption of homogeneity of variance. This Box M was calculated and a significant p-value was obtained, indicating that this assumption has been fulfilled.

- **Assumption 3: Sphericity / Linearity of dependent variable:**

Bartlett's test of sphericity is used to determine if a researcher should continue to use MANOVA for data analysis or return to separate univariate tests. The test tries to determine if one or more dependent variables are a linear function of another. If a significant p-value is obtained, then it means that there are dependencies among the dependent variables and this assumption has therefore been fulfilled.

Data analyses using MANOVA should only proceed if the assumptions are all met.

Stage **four** of the MANOVA decision process is the estimation of the MANOVA model and the assessing of the overall fit. The most important aspect in this stage is therefore the criteria and tests used for significance testing. Hotellings, Pillais and Wilks's tests are used to determine the equality of means (of different groups). These tests are similar to t or F tests for multivariate data. A significant p-value indicates that the independent variables do not provide equal results (therefore the groups are considered different across the mean vectors). The most commonly used test statistic for overall significance is called Wilks' Lambda and this statistic was used in the current study. The smaller the value of Wilks' Lambda, the greater the implied significance (Hair et al 1995).

Interpretation of the MANOVA results takes place in stage **five** of the process. Once statistical significant results have been obtained with the analysis, a researcher might want to examine the results further. This can be done using three methods:

- **Interpreting the effects of covariates employed**

Owing to the fact that no covariates were employed in this study, this aspect will not be discussed.

- **Assessing which dependent variables showed differences across groups**

The dependent variate must be assessed in order to determine which of the dependent variables contribute to the overall differences indicated by the statistical tests. Some of the tests that can be used to better understand the data are shown in table Table 5.34.

Table 5.34 – Additional Tests To Understand MANOVA Data Better

Type of tests to consider	Used on the following variables
Univariate F tests	Dependent variables
Simultaneous confidence intervals tests	All the variables
Step-down analysis (e.g. stepwise regression)	Successive F values - each value is computed after the effects of the previous dependent variable is eliminated
Multiple discriminant analysis	

Adapted from: Cooper DR, and Emory CW. 1995. Business Research Methods. Irwin: USA. p. 527.

- **Identifying which groups differ on a single dependent variable or the entire dependent variate**

"Post hoc" methods and a "priori" (or planned comparisons) methods can be used to determine which groups differ from other groups. These methods have already been discussed in section 5.11.4 (page 166), and will therefore not be discussed again.

5.11.6 Other terms and definitions used:

- **Correlation coefficient**

In correlation research, a correlation coefficient is used to determine **whether or not,** and **to what extent** a relationship exists between variables. When two variables are correlated, the result is a correlation coefficient. Correlation coefficients range from .00 to +1.00 (positively correlated) or .00 to –1.00 (negatively correlated). A correlation coefficient squared indicates the amount of common variance shared by the variables. Therefore a correlation coefficient of .5 would mean that a $(.5)^2$ or (.25) or 25% common variance exists. If variables are not related to one another (i.e. no relationship between variables) then the variability of one set of scores has nothing to do with the variability of the other set. This would lead to a low percentage common variance. The inverse is also true, if there is a relationship between variables, this would lead to a higher common variance. The higher the common variance, the stronger the relationship between variables. The common variance therefore gives an indication of the strength of the relationship (Gay and Diehl 1992:320 - 324).

Interpretation of the significance of correlation coefficients depends on the required confidence level and the degrees of freedom (The degrees of freedom is calculated by subtracting "2" from the sample size i.e. "N" – 2). With this information the required correlation coefficient to indicate significance can be obtained from a table (Gay and Diehl 1992:320 - 324). The level of significance only indicates the probability that a given relationship is a true one, but it does not indicate whether the relationship is strong or weak (Gay and Diehl 1992:320 - 324).

Table 5.35 – Commonly Used Techniques To Determine Correlation Coefficients:

Technique	Also know as …	Appropriate / Applied when …
Pearson *r*	Product moment correlation coefficient	The variables are expressed as interval or ratio data
Spearman rho	Rank difference correlation coefficient	The variables are expressed as ordinal data

Adapted from: Gay LR, and Diehl PL. 1992. Research Methods for Business and Management. Macmillan Publishing Company: USA. p 326.

- **Standard deviation ("σ")**

This is an index of variability. A small standard deviation indicates that scores are close together and a large standard deviation indicates that the scores are more spread out. The importance of knowing the standard deviation is that it gives a very good indication of the distribution of the data (Gay and Diehl 1992:473).

- **Standard error of measurement (sem)**

The standard error of measurement allows a researcher to determine how much difference there probably is between a person's "obtained score" and "true score." The size of the difference is a function of the reliability of the test. To determine the standard error of measurement, the reliability coefficient and standard deviation of the test scores are needed. Less error is indicated by a low standard error of measurement and low standard errors of measurement are therefore preferred (Gay and Diehl 1992:171).

- **Confidence limits (intervals)**

An estimation can be made of the probable limits within which a population mean would fall.

- **Confidence level / Significance level / Probability level ("α")**

The significance level chosen, has an effect on the probability of making an error. If a significant level of 0.05 is chosen, there is a 5% probability of making an error, while if 0.01 is chosen, there is only a 1% chance of making an error. A confidence interval of 0.05 (in other words 95%) has been chosen for the study in question and this confidence level will be used in our statistical process of hypothesis testing.

- **Degrees of freedom**

According to Gay and Diehl (1992:506) degrees of freedom "*are a function of such factors as the number of subjects and the number of groups.*" Each of the different significance tests has it's own method of determining the degrees of freedom.

5.12 SUMMARY

This chapter aimed at giving a description of the methodology used in the execution of this study in order to show the scientific basis on which the research was founded. Aspects such as the research problem, research objectives and hypotheses, theory on hypothesis testing, instruments used, sampling design, data collection and various statistical techniques and terms were discussed.

Chapter 6 will discuss the research findings and conclusions, using the statistical techniques that were discussed in chapter 5.