CHAPTER 4: RESEARCH PROCESS AND OUTCOMES

4.1 INTRODUCTION

According to Babbie (1995:26) **scientific theory** "deals with the logical aspect of science; **research methods** deal with the observational aspect; and **statistics** offer a device for comparing what is logically expected with what is actually observed". The theory underpinning this study has already been covered in Chapters 1 and 2. Chapter 3 contains the context of the methodological approach, but the application of the chosen research methods and the resulting statistics are covered in Chapter 4.

4.2 RESEARCH APPROACH AND METHODOLOGY

The research was conducted in three main phases, namely the pre-understanding, constructing and testing phases.

4.2.1 Pre-understanding

At the start of the study, change management and its related dynamics, project management and instrument design literature were studied thoroughly. On the basis of the information gathered in the course of this process, the problem statement, research questions and the objectives of the study were formulated.

4.2.2 Construction

The initial research design and the verification of the inclusiveness of the change dynamics, dimensions and elements selected for this study were established by administering the Delphi technique. The information gathered by administering the Delphi technique formed the proposed dimensions of change management within the project management context. The Delphi technique is a research approach that is used to gain consensus through a series of iterations. The technique usually uses two or three iterations. Information and results are fed back to respondents between each round (Randall, 1998:1). The information gathered from administering the instrument was used to finalise the draft assessment tool containing change

management dynamics. Project managers and participants can use the assessment tool to improve the application of change management and therefore the success of their projects.

4.2.3 Testing

The information gathered by means of the Delphi technique resulted in the design of the questionnaire. The content validity technique developed by Lawshe (1975) was then used to evaluate the relevance of selected constructs.

The final verification of items in the framework was done by means of exploratory factor analysis. In the researcher's opinion, although the sample size was not as large as originally planned, the sample size was adequate to ensure rigorous testing for consistency, validity and reliability of the assessment tool.

Based on the process described above, an assessment tool was designed to analyse and measure change management within the project context by using the process stipulated by DeVellis (1991). After this process had been implemented, the reliability of the instrument was assessed by means of descriptive and inferential statistics to determine what the relationships (if any) between the different constructs were. The software package used for the statistical analyses was the BioMeDical Programs (BMDP) Statistical Software (release 7.1).

This research approach is depicted visually in Figure 4.1 overleaf.

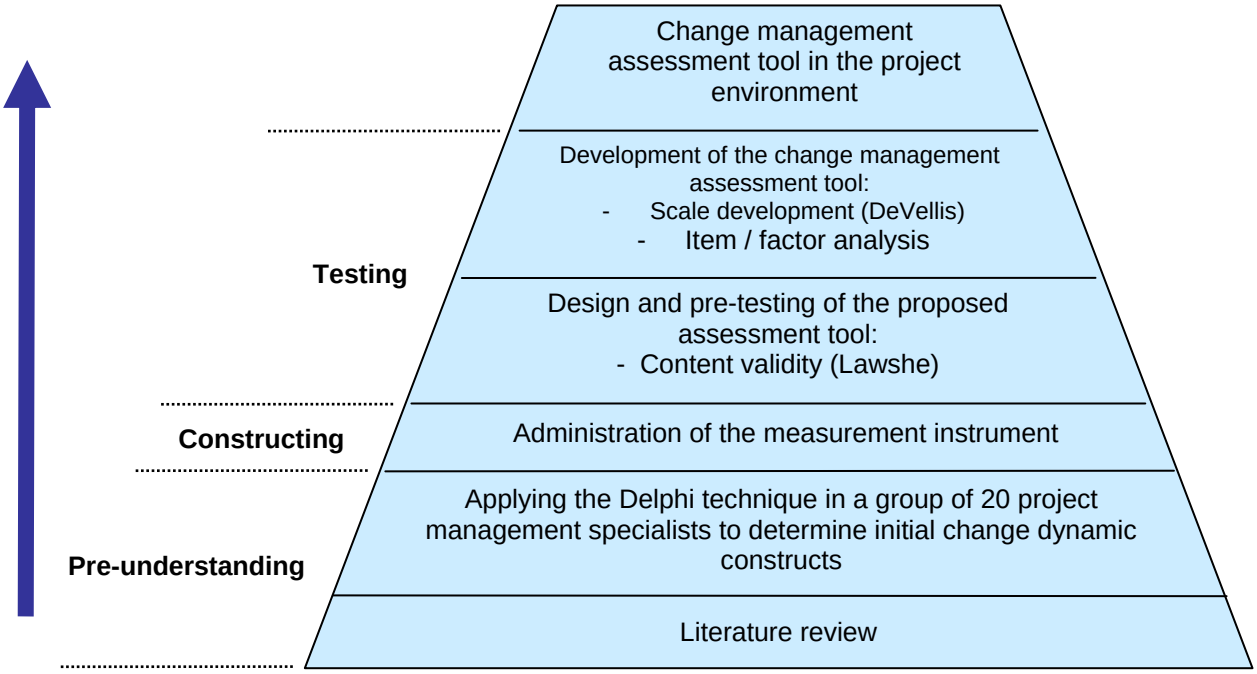


Figure 4.1: Research approach

4.2.4 Electronic administration of questionnaires

An emerging technique for exploratory research is the approximation of group dynamics using e-mail, websites, Usenet newsgroups or Internet chat rooms (Cooper & Schindler, 2003:144). Nicholls *et al*. (cited in Babbie & Mouton (2001:260)) assert that electronic techniques are more efficient than conventional techniques and, claim that they do not appear to result in a reduction of data quality. In this study, both electronic communication media and personal interaction were therefore used to gather data and information.

Due to the nature of the research objectives, information was obtained through structured questionnaires which were administered electronically and, in some instances, to maximise the response rate, in hard copy. This survey method to collect data allows a high level of standardisation and therefore, high reliability, as proposed by Singleton *et al*. (1988:235). It is relatively inexpensive, not too time consuming and matches the proposed sampling design as discussed in more detail in Section 4.5 below. Electronic administration of the questionnaire has the added benefit that it can be sent, completed and returned in real time and that respondents can easily be reached through electronic communication, irrespective of their geographic location. There are also, apart from network use, no costs involved for the respondents.

4.3 VERIFICATION OF ELEMENTS (PHASE 1)

An exercise involving 20 project management experts (Master's degree students in project management at the University of Pretoria), using the Delphi technique, was conducted to establish what constitutes change dynamics within the project management domain.

This session was arranged to ascertain what, according to these students, constitutes change dynamics in a project management context. Data was captured in real time during the session. Because of the time constraints imposed by such a session, the information that was captured was then sent to the same target audience to elaborate and build on the information gathered during the session. Two iterations were done electronically which influenced the first draft of the assessment instrument.

Subsequent to the process described above, a draft framework questionnaire was designed, containing multiple measurement items relating to all the change constructs identified for measurement. The framework questionnaire was **pre-tested** and verified by a group of 37 project management professionals registered with the Institute for Project Management of South Africa (IPMSA) on its data base (a setting similar to the eventual sample) to ensure the necessary validity, reliability, relevance, conciseness and clarity by the application of Lawshe's content validity methodology (Lawshe, 1975). Furthermore, the questionnaire was posted on the IPMSA website and, the researcher attended one of the institution's meetings and handed out copies of the questionnaire. Questionnaires were completed at the meeting using hard copies. A copy of this questionnaire is contained in Appendix A. Lawshe's content validity methodology was then applied to the responses to eliminate irrelevant items.

4.3.1 Lawshe's technique / content validity methodology

In this approach, a panel of subject matter experts, knowledgeable about a specific area of expertise, function or discipline, is asked to indicate whether or not a measurement item in a set of other measurement items is "essential" to the functionality of a theoretical construct. This methodological approach measures the extent to which the subject matter experts agree on the contributions of each measurement item to the overall content that the instrument is intended to measure. The subject matter experts' input is then used to compute the Content Validity Ratio (CVR) for each i^{th} candidate item in a measurement instrument as follows:

$$CVR_i = \frac{n_e - \left(\frac{N}{2}\right)}{\left(\frac{N}{2}\right)}$$

where

CVR_i = CVR value for the i^{th} measurement item

n_e = number of subject matter experts indicating that a measurement item is "essential"; and

N = total number of subject matter experts on the panel.

The CVR is a quasi-quantitative approach to content validity commonly used to facilitate "the rejection or retention of specific items" (Lawshe, 1975:568). One can infer from the CVR equation that it takes on values between -1.0 (where none of the subject matter experts think that a particular measurement item is "essential") and +1.0 (where all the subject matter experts think that a particular measurement item is "essential"). Where a CVR = 0.0 it means that 50% of the subject matter experts in the panel of size N believe that the measurement item is "essential". Therefore a CVR > 0.0 would indicate that more than half of the subject matter experts believe that a particular measurement item is "essential".

According to Lawshe (1975:567) two assumptions can be made, namely:

- any item which is perceived as "essential" by more than half of the subject matter experts, has some degree of content validity; and
- the more subject matter experts (above 50%) who perceive the item as "essential", the greater the extent or degree of its content validity.

On this basis, content validity is achieved when an item is considered "essential" by more than 50% of the subject matter experts. Lawshe (1975) has further established minimum CVRs for different panel sizes based on a one-tailed test at the α = 0.05 significance level. Table 4.1 indicates the minimum required CVR values as determined by Lawshe (1975:568).

Table 4.1: Minimum CVR values for different subject matter expert panel numbers

Number of panelists	5	10	15	20	25	30	35	40
Minimum CVR value	0.99	0.62	0.49	0.42	0.37	0.33	0.31	0.29

For example, if 25 subject matter experts constitute a panel, then the measurement items for a specific construct whose CVR values are less than 0.37 would be deemed not "essential" and would be deleted from subsequent consideration. The CVR required for items to be included in the next phase of this particular measurement instrument development would therefore be between 0.29 (regarded as essential by 40 subject matter experts) and 0.31 (regarded as essential by 35 subject matter experts). With a panel size of 37 for Phase 1 of the study, the more conservative CVR threshold level of 0.31 was used for testing content validity. All items with CVR values of less than 0.31 were rejected.

Thereafter, the means of the CVR were calculated and included in the Content Validity Index (CVI). To determine the CVI for the survey, it was necessary to

- identify those determinants which have significant CVR values for the survey; and
- compute the mean CVI for the whole survey.

4.3.2 Lawshe's technique result tables

The results of using Lawshe's technique for Phase 1 of the assessment tool development in this study for each of the sections of the project management life cycle are presented below.

Table 4.2: Lawshe test results: Section A - conceptualisation / initiation phase

(pre-feasibility assessment of the project and its parameters / scope)

Item	Elements	Endorsements of statement			CVR	Retain (yes / no)	CVI
		Essential	Useful, but not essential	Not necessary			
Creating the need for change, by							
A-1.1	Creating awareness of the need	26	8	3	0.405	Yes	**0.446**
A-1.2	Making a case for change	28	7	2	0.514	Yes	
A-1.3	Ensuring the need for change (creating a "burning platform")	16	13	8	-0.135	**No**	
A-1.4	Internalising / energising for change	25	8	4	0.351	Yes	
A-1.5	Comprehending complexity	27	8	2	0.459	Yes	
A-1.6	Communicating strategic issues and objectives	32	4	1	0.730	Yes	
A-1.7	Establishing a sense of urgency	25	12	0	0.351	Yes	

A-1.8	Forming a guiding coalition of stakeholders	26	9	2	0.405	Yes	
A-1.9	Motivating employees	25	9	3	0.351	Yes	
A-1.10	Developing a critical mass support base	25	6	6	0.351	Yes	
Assessing the readiness for change, by							
A-2.11	Assessing management competence and experience	25	10	2	0.351	Yes	
A-2.12	Diagnosing the organisational environment	26	9	2	0.405	Yes	
A-2.13	Identifying problems and priorities	29	8	0	0.568	Yes	
A-2.14	Assessing readiness for change	27	7	3	0.459	Yes	
A-2.15	Identifying and planning for barriers and resistance to change	27	9	1	0.459	Yes	
A-2.16	Assessing the level of change fatigue	15	15	7	-0.189	**No**	
A-2.17	Developing change readiness / resilience	25	9	3	0.351	Yes	
A-2.18	Developing measurement criteria for success	26	9	2	0.405	Yes	
A-2.19	Assessing the propensity for risk	27	8	2	0.459	Yes	
A-2.20	Assessing cost, morale and other related implications	30	6	1	0.622	Yes	
A-2.21	Aligning change intervention with overall business strategy	26	8	3	0.405	Yes	
A-2.22	Ensuring adequate management understanding of change management	28	7	2	0.514	Yes	
Average no. of endorsements:		**25.7**	**8.6**	**2.7**			**26.8**
Average (in %):		**69.5%**	**23.2%**	**7.2%**			**72.3%**

Table 4.3: Lawshe test results: Section B - planning phase

(planning the execution of the project scope, deliverables, timeframe and resource requirements)

Item	Elements	Endorsements of statement			CVR	Retain (yes / no)	CVI
		Essential	Useful, but not essential	Not necessary			
Communication and engagement, by							
B-1.1	Visible commitment and leadership presence	27	10	0	0.459	Yes	**0.425**
B-1.2	Sponsorship of change project by top management	26	8	3	0.405	Yes	
B-1.3	Leadership that is aligned to potential project outcomes	27	9	1	0.459	Yes	
B-1.4	The development of appropriate leadership behaviour	25	8	4	0.351	Yes	
B-1.5	Sustained leadership behaviour	17	13	7	-0.081	**No**	

B-1.6	Candid communication by leadership to staff on the scope of change	27	7	3	0.459	Yes
B-1.7	Open discussion on the planned changes and potential problems	20	8	9	0.081	**No**
B-1.8	Open communication and synergy between the project team and line management	29	8	0	0.568	Yes
B-1.9	Encouragement of the use of an adequate variety of communication channels	25	11	1	0.351	Yes
B-1.10	Messages about the vision from the leadership should be consistent	28	7	2	0.514	Yes
B-1.11	Alignment of staff to potential project outcomes	12	16	9	-0.351	**No**
B-1.12	Engaging in two-way communication	19	10	8	0.027	**No**
B-1.13	The development of focused engagement plans with stakeholders	27	10	0	0.459	Yes
B-1.14	The involvement of all stakeholders (employees, line management and labour)	25	9	3	0.351	Yes
B-1.15	Managed, meaningful and integrated participation	25	11	1	0.351	Yes
B-1.16	Transparent decision-making processes	27	10	0	0.459	Yes
B-1.17	The development of consensus and a shared vision	25	10	2	0.351	Yes
B-1.18	Management of the career expectations of project members	20	12	5	0.081	**No**
B-1.19	Ensuring that people and infrastructure support changes in business procedures	16	9	12	-0.135	**No**
B-1.20	The establishment of a dedicated team for change management and communication	15	16	6	-0.189	**No**
B-1.21	Avoiding alienation of the organisation by understanding the company culture	26	10	1	0.405	Yes
B-1.22	Orienting team members with regard to change management and dynamics	25	9	3	0.351	Yes
B-1.23	Celebrating and communicating “quick wins” throughout	25	6	6	0.351	Yes
Creation of an enabling environment, by						
B-2.24	Inspiring leadership	20	13	4	0.0811	**No**
B-2.25	Addressing organisational power and political dynamics	25	11	1	0.3514	Yes
B-2.26	Creating an enabling environment and project structures	26	8	3	0.4054	Yes
B-2.27	Staffing the project team with credible people	28	7	2	0.5135	Yes

B-2.28	Ensuring role clarity for everyone involved	27	9	1	0.4595	Yes	
B-2.29	Conducting risk analysis to inform mitigation strategies	26	9	2	0.4054	Yes	
B-2.30	Redefining the business	14	13	10	-0.2432	**No**	
B-2.31	Identifying the necessary tools and know-how required	27	4	6	0.4595	Yes	
B-2.32	Evaluating the training needs for the use of new tools and technology	25	10	2	0.3514	Yes	
B-2.33	Transitioning project members from a functional role to a project role	25	8	4	0.3514	Yes	
B-2.34	Managing the workload of project members	26	9	2	0.4054	Yes	
B-2.35	Continuous involvement of stakeholders to ensure alignment of agendas	26	8	3	0.4054	Yes	
B-2.36	Adopting a systems engineering approach in the design and planning of the project	20	12	5	0.0811	**No**	
B-2.37	Timely training in new requirements to ensure that capacity is built and fear is reduced	27	9	1	0.4595	Yes	
B-2.38	Creating a learning project environment	25	10	2	0.3514	Yes	
B-2.39	Managing differences in cultures between contractors, suppliers, operations and the project team	26	6	5	0.4054	Yes	
B-2.40	Capacity building for the changes through both generic and job-specific training	26	9	2	0.4054	Yes	
B-2.41	Promoting and facilitating a learning environment	25	12	0	0.3514	Yes	
B-2.42	Placing credible change agents in the organisation	25	10	2	0.3514	Yes	
B-2.43	Aligning corporate strategy and project outcomes	28	8	1	0.5135	Yes	
B-2.44	Allocating adequate budget and resources	29	5	3	0.5676	Yes	
B-2.45	Managing and monitoring progress at a strategic and senior level	19	11	7	0.0270	**No**	
B-2.46	Forming multi-disciplinary teams with participation from all stakeholder groupings	25	7	5	0.3514	Yes	
B-2.47	Including a change management expert in the project team	15	10	12	-0.1892	**No**	
B-2.48	Quantitative and qualitative measurement of project success	26	10	1	0.4054	Yes	
B-2.49	Cooperating across function areas	27	7	3	0.4595	Yes	
B-2.50	Prioritising and removing potential competing issues	25	10	2	0.3514	Yes	

B-2.51	Building a supportive infrastructure around the change agents	25	10	2	0.3514	Yes	
B-2.52	Developing a clear migration plan	30	7	0	0.6216	Yes	
B-2.53	Focusing on "softer" skills capacity building	25	8	4	0.3514	Yes	
B-2.54	Harnessing organisational values such as collaboration, openness, trust and supportiveness	26	10	1	0.4054	Yes	
B-2.55	Creating an environment supportive of innovation	25	10	2	0.3514	Yes	
B-2.56	Taking quick remedial action to solve emerging problems	28	7	2	0.5135	Yes	
B-2.57	Fostering continuous cooperation between line and project management	26	8	3	0.4054	Yes	
B-2.58	Maintaining enthusiasm and comprehension for the project	27	10	0	0.4595	Yes	
B-2.59	Allowing managed risk taking	25	7	5	0.3514	Yes	
B-2.60	Managing resistance to change	26	9	2	0.4054	Yes	
B-2.61	Paying attention to understanding project objectives and quality of communication	31	6	0	0.6757	Yes	
B-2.62	Investigating alternatives and establishing action plans	18	10	9	-0.0270	**No**	
B-2.63	Focusing on data collection and feedback	26	9	2	0.4054	Yes	
B-2.64	Determining the future state of the company	28	5	4	0.5135	Yes	
B-2.65	Allowing top management to have a medium to long term focus	25	7	5	0.3514	Yes	
B-2.66	Avoiding unreasonable expectations of the project outcome as a "fix-all" solution	26	10	1	0.4054	Yes	
B-2.67	Utilising an appropriate change management methodology	25	9	3	0.3514	Yes	
B-2.68	Addressing fears surrounding potential job losses to minimise resistance to change	25	12	0	0.3514	Yes	
B-2.69	Contextualising the project within organisational systems, structures and processes	33	2	2	0.7838	Yes	
Average no. of endorsements:		**24.7**	**9.1**	**3.2**			**26.4**
Average (in %):		**66.6%**	**24.6%**	**8.8%**			**71.2%**

Table 4.4: Lawshe test results: Section C - implementation phase

(executing the stated outcome and objectives)

Item	Elements	Endorsements of statement			CVR	Retain (yes / no)	CVI
		Essential	Useful, but not essential	Not necessary			
C-1.1	Functional area ("silo") mentality and fragmented departmental interests should be dealt with	26	7	4	0.405	Yes	**0.445**
C-1.2	Organisational integration should be fostered	27	7	3	0.459	Yes	
C-1.3	A transparent decision-making should be instituted	26	9	2	0.405	Yes	
C-1.4	Proper change management should be followed throughout	29	8	0	0.568	Yes	
C-1.5	New values should be promoted	25	5	7	0.351	Yes	
C-1.6	"Quick wins" as tangible short term results must be targeted	12	16	9	-0.351	**No**	
C-1.7	Perception management should receive adequate focus	26	10	1	0.405	Yes	
C-1.8	Continuous staff motivation should be a priority	30	5	2	0.622	Yes	
C-1.9	Communication should focus on mindsets and cultural shifts of all involved	26	10	1	0.405	Yes	
C-1.10	Anxiety surrounding potential job loss, loss of autonomy or authority should be managed	25	9	3	0.351	Yes	
C-1.11	Behaviour patterns and feelings should be closely monitored	25	8	4	0.351	Yes	
C-1.12	Employees should be empowered to act on the new vision	29	5	3	0.568	Yes	
C-1.13	New symbols should be created to further embed the change	11	20	6	-0.405	**No**	
C-1.14	Interventions to entrench new organisational culture and values should be undertaken	17	11	9	-0.081	**No**	
C-1.15	Continuous measurement and feedback on progress should be done	20	6	11	0.081	**No**	
C-1.16	Changes effected during the project should be consolidated	18	11	8	-0.027	**No**	
C-1.17	The systems nature of the organisation should continuously be emphasized	15	12	10	-0.189	**No**	
C-1.18	The necessary changes in HR and other policies should be made to sustain the change	19	9	9	0.027	**No**	
C-1.19	Appropriate, flexible organisational structures must be implemented	17	9	11	-0.081	**No**	

C-1.20	Line managers should be receptive to change and innovation	19	11	7	0.027	**No**	
Average no. of endorsements:		**22.1**	**9.4**	**5.5**			**26.7**
Average (in %):		**59.7%**	**25.4%**	**14.9%**			**72.2%**

Table 4.5: Lawshe test results: Section D - post implementation phase

(embedding and institutionalising the changes effected through the project)

Item	Elements	Endorsements of statement			CVR	Retain (yes / no)	CVI
		Essential	Useful, but not essential	Not necessary			
D-1.1	Change(s) should be institutionalised through processes	29	8	0	0.568	Yes	**0.446**
D-1.2	New culture and behaviour should be reinforced through incentives	25	10	2	0.351	Yes	
D-1.3	Performance management should reward new behaviour and outputs	26	7	4	0.405	Yes	
D-1.4	The impact of change should be measured	29	7	1	0.568	Yes	
D-1.5	Continuous behavioural / output training should be done	26	6	5	0.405	Yes	
D-1.6	The organisation should be stabilised	26	9	2	0.405	Yes	
D-1.7	The new state should be formalised	25	9	3	0.351	Yes	
D-1.8	Adherence to the new state should be monitored	18	9	10	-0.027	**No**	
D-1.9	Reverting to the old order should be discouraged	28	4	5	0.514	Yes	
Average no. of endorsements:		**25.8**	**7.7**	**3.6**			**26.8**
Average (in %):		**69.7%**	**20.7%**	**9.6%**			**72.3%**

The results indicate that the majority of the measurement items are valid, as the CVRs were higher than or equal to the α = 0.05 significance level of 0.31. The large majority of measurement items were therefore essential and were thus retained for the next phase of the quantitative statistical analysis.

4.3.3 Item exclusions resulting from the application of Lawshe's technique

Based on the results achieved through the two iterations of the Delphi technique and the application of Lawshe's content validity technique to the items included in the questionnaire, the

following changes were effected (items eliminated from the next phase of the assessment tool development).

Table 4.6: Summary of measurement items omitted during the next phase of the assessment tool development

Section	Item	Measurement item description
A	A-1.3	A critical need ("burning platform") should exist for the change
	A-2.16	The level of change fatigue should be assessed
B	B-1.5	Leadership behaviour should be sustained
	B-1.7	Openly discuss planned changes and potential problems
	B-1.11	Staff should be aligned to potential project outcomes
	B-1.12	Engaging in two-way communication should be a priority
	B-1.18	Career expectations of project members should be managed
	B-1.19	Changes in business procedures due to project implementation should be communicated to ensure that people and infrastructure support it
	B-1.20	A dedicated team for change management and communication should be established
	B-2.24	Leadership should be inspiring
	B-2.30	The business should be redefined
	B-2.36	A systems engineering approach is advisable. People, systems and processes affected by the project should be included in the design and planning of the project
	B-2.45	An internal team comprising of senior executives should be set up to manage and monitor progress at a strategic level
	B-2.47	A change management expert should be part of the project team
	B-2.62	Alternatives and establishing action plans should be investigated
C	C-1.6	"Quick wins" should be targeted as tangible short-term results
	C-1.13	New symbols should be created to further embed the change
	C-1.14	Multiple interventions to entrench new organisational culture and values should be undertaken
	C-1.15	Continuous measurement and feedback on progress should be done rigorously
	C-1.16	Changes effected during the project should be consolidated
	C-1.17	The systems nature of the organisation should be continuously emphasised
	C-1.18	The necessary changes in HR and other policies should be made to sustain the change
	C-1.19	Rigid hierarchical structures should be replaced by more appropriate organisational structures
	C-1.20	Line managers should be receptive to change and innovation
D	D-1.8	Monitoring of adherence of the new state should be ongoing

Subsequent to the above process, the draft assessment tool was also analysed by two project management experts to enhance it further in terms of its readability and content. The inputs from the two subject matter experts were included in the penultimate draft of the measuring instrument.

4.4 ASSESSMENT TOOL DEVELOPMENT (PHASE 2)

The draft assessment tool was discussed with the Department of Statistics at the University of Pretoria to assess the format and categorisation of the questions. Since the concepts tested may have a number of states, or the data may contain a number of values that can be rank ordered to determine the significance of each item, a Likert scale was used. A five-point scale was used to maximise the number of possible deductions from the data. Walliman (2001:79) argues that the "ordinal level of quantification" applies to concepts that vary from those different states of the concept that they can be rank ordered in respect of a certain characteristic. More statistical techniques can be applied to data when using an ordinal scale of measurement, such as testing by Chi-square, indicating relationships by means of rank correlation, determining the mode, median and percentage or percentile rank. This technique was also applied in the case of this study. Accordingly, the respondents were asked to express their degree of agreement or disagreement with a series of statements. A five-point agreement scale was used and ranked as follows:

- 1 – strongly disagree;
- 2 – disagree;
- 3 – neither disagree nor agree;
- 4 – agree; and
- 5 – strongly agree.

A detailed memorandum containing the research context, objectives and comprehensive instructions on how to complete it was compiled and was sent with the questionnaire to the target population. Confidentiality was guaranteed and respondents will be privy to the outcome and results of the research. The context within which these concepts were measured was described at the beginning of the measuring instrument to ensure a consistent and correct understanding amongst all respondents.

The questionnaire was also divided into the following sections:

- **Section A** - questions related to the conceptual or initiation phase of the project, with a total of 25 items;
- **Section B** - questions regarding the planning phase of the project, with a total of 73 items;
- **Section C** - questions regarding the implementation of the project, with a total of 11 items;
- **Section D** - questions in relation to the post implementation phase of the project, with a total of 9 items; and
- **Section E** - an open question regarding any other aspect that the respondent considered relevant to the measurement of change dynamics in the project management domain that runs continuously throughout all the project phases, such as communication and risk management.

Apart from measuring items in each of the project life cycle phases mentioned above, the questionnaire contained a section on relevant demographic details which enabled the researcher to establish whether certain patterns or tendencies are present in certain sectors or categories within which the respondents are working. **The final section** contains the following biographical information:

- age;
- gender;
- length of time spent in the sector;
- economic sector;
- qualifications;
- organisational level;
- home language;
- number of years of project management experience as a team member; and
- number of years of project management experience in the role of project manager.

The questionnaire used in this part of the study is contained in Appendix B.

4.5 TESTING (PHASE 2)

It was initially envisaged that the measuring instrument would only be administered to South African project managers, but the study was expanded also to include some project managers from abroad.

The testing process involved administering the second phase questionnaire electronically on past and present databases of project management Master's degree students at the University of Pretoria, as well as on a group of international project management experts from the following databases:

- The Project Management Institute of the United Arab Emirates Yahoo group, with approximately 430 members – mostly from the United Arab Emirates but about 20% to 30% of these members come from various countries in the Middle East with only a few members from outside this region;
- The Project Management Professionals of Dubai group, with approximately 200 members – mostly from the United Arab Emirates but including some members from Egypt;
- The Saytam Yahoo group, with approximately 500 members – this is an India-based organization, but with members and operations from around the globe; and
- The class at the National Bank of Abu Dhabi, with approximately 30 participants – most participants are in the information technology (IT) or banking sectors (there was only one respondent from the oil sector and a single other respondent from the gas sector).

Respondents were chosen based on their previous experience in the project management field. In all cases the target audience was project management institute (PMI) and project management professional (PMP) members or respondents who aspire to be PMP members. The Saytam Yahoo group is more IT focused but, the other groups are from various industries (including airlines). The rationale for choosing these respondents was that most are PMI members and have years of project management experience.

In addition to this, the questionnaire was also distributed to reputable companies responsible for the management of sizeable projects as convenience sampling to enhance the response rate further.

The second phase was the administration of the amended measuring instrument to a target populated from the databases as mentioned above. A total of 1200 questionnaires were sent out with a response rate of 172 unspoilt questionnaires. This represents a response rate of 14.33%.

4.6 STATISTICAL ANALYSIS OF DATA COLLECTED

4.6.1 Initial Item Analysis

The statistical analysis process commenced with the verification of data captured against information contained in the questionnaires to ensure the integrity of the data. Subsequent to this, the ITEMAN™ Conventional Item and Test Analysis Program, version 3.6 was used to conduct the statistical analysis for each of the two target audiences. This was done to determine the initial item mean, item variance, standard deviation, item-scale correlation and the number of respondents (as a percentage) per item in order to analyse the distribution of the values of each item included in the different factors. In addition, measures of shape (skewness and kurtosis) were calculated.

Item-scale correlation values were calculated using the Pearson (product moment) correlation coefficient (*r*), which varies across a range of -1.0 through 0.0 to +1.0 (Cooper & Schindler, 2003:533). Correlation coefficients provide information on the magnitude (the degree to which variables move in unison or in opposition to each other) and the direction (either positive or inverse) of the relationships between the variables. The following formula cited in Hall (1998) was used to calculate Pearson's correlation coefficient (*r*):

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{(n)(\sigma_x)(\sigma_y)}$$

where

$$\sigma_x = \sqrt{\frac{\sum (x - M_x)^2}{N}} \qquad \text{and} \qquad \sigma_y = \sqrt{\frac{\sum (y - M_y)^2}{N}}$$

and

x = individual scores in group X;

y = individual scores in group Y;

n = number of score pairs;

M = mean; and

N = number of scores in the group.

The statistical significance of *r* can be tested, based on probability table values, depending on the degrees of freedom (df = n - 2) and the probability value required (typically $p < 0.05$).

According to Cooper and Schindler (2003:472-477), the mean and standard deviation are called dimensional measures (in other words, they are expressed in the same units as the measured quantities). By contrast, skewness (sk) and kurtosis (ku) are regarded as non-dimensional measures. Skewness is an index that characterizes the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending towards positive infinity, including more positive values. Negative skewness indicates a distribution with an asymmetric tail extending towards negative infinity, including more negative values. Normal distributions produce a skewness statistic of approximately zero, ("approximately" because small variations may occur merely by chance). As the skewness statistic departs further from zero, a positive value indicates the possibility of a positively skewed distribution (that is, with scores bunched up at the low end of the score scale) or a negative value indicates the possibility of a negatively skewed distribution (that is, with scores bunched up at the high end of the scale). Values of two standard errors of skewness (*ses*) or more (regardless of sign) are probably skewed to a significant degree. The *ses* can be estimated using the following formula, according to Tabachnick and Fidell (1996):

$$ses = \sqrt{\frac{6}{N}}$$

Kurtosis characterises the relative shape of a distribution in terms of how peaked or flat the distribution is, compared to the normal distribution. According to Cooper and Schindler (2003:472), there are three different types of kurtosis

- peaked or leptokurtic distributions - scores cluster heavily in the centre (indicated by a positive ku value);
- flat or platykurtic distributions - evenly distributed scores and facts flatter than a normal distribution (the ku value is negative); and
- intermediate or mesokurtic distributions - neither too peaked nor too flat and very similar to the normal distribution (the ku value is close to 0).

As with skewness, the larger the absolute value of the index, the more extreme the characteristic of the index. Values of two standard errors of kurtosis (*sek*) or more (regardless of sign) probably differ from the mesokurtic distribution to a significant degree. The *sek* can be roughly estimated using the following formula (Tabachnick and Fidell, 1996):

$$sek = \sqrt{\frac{24}{N}}$$

4.6.2 Initial reliability analysis

Internal consistency is typically equated with Cronbach's (1951) alpha coefficient α, and is concerned with the homogeneity of the items comprising a scale (DeVellis, 1991:25; Clark & Watson, 1995). The alpha coefficient is widely used as a measure of reliability and it also reflects important information about the proportion of error variance contained in a scale. According to Cortina (1993), the alpha coefficient is a sound measure of error variance and can be used to confirm the unidimensionality of a scale, or to measure the strength of a dimension once the existence of a single factor has been determined. A scale is internally consistent to the extent that its items are highly intercorrelated, since high inter-item correlations indicate that the items all attempt to measure similar elements. Alpha is defined as the proportion of a scale's total variance that is attributable to a common source, presumably the true score of a latent variable underlying the items. The following expression was used to calculate alpha (DeVellis, 1991:27-30):

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_{yi}^2}\right)$$

where

k	=	number of items on the diagonal of the covariance matrix;
$\sum \sigma_i^2$	=	sum of all **unique** variances (all diagonal elements in the covariance matrix); and
σ_{yi}^2	=	sum of variances and covariances (total of all elements in the covariance matrix).

4.6.2.1 Initial item and reliability analysis results (South African responses)

The dimensional and non-dimensional measurement results for the South African target population are presented in Tables 4.7 to 4.12 below.

Table 4.7: Item analysis of the South African responses for Section A (n = 85)

Section A question number (items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
A1	1.2%	32.9%	22.4%	35.3%	8.2%	3.165	1.032	0.69
A2	1.2%	23.5%	14.1%	45.9%	15.3%	3.506	1.097	0.67
A3	1.2%	10.6%	20.0%	55.3%	12.9%	3.682	0.758	0.50
A4	2.4%	12.2%	28.0%	30.5%	26.8%	3.671	1.148	0.55
A5	1.2%	11.8%	23.5%	44.7%	18.8%	3.682	0.899	0.60
A6	3.5%	17.6%	14.1%	31.8%	32.9%	3.729	1.421	0.58
A7	3.5%	34.1%	38.8%	17.6%	5.9%	2.882	0.880	0.41
A8	2.4%	8.2%	31.8%	50.6%	7.1%	3.518	0.697	0.49
A9	4.7%	18.8%	49.4%	21.2%	5.9%	3.047	0.821	0.71
A10	1.2%	34.1%	22.4%	25.9%	16.5%	3.224	1.256	0.67
A11	1.2%	12.9%	36.5%	43.5%	5.9%	3.400	0.687	0.60
A12	0.0%	18.8%	28.2%	42.4%	10.6%	3.447	0.835	0.46
A13	4.7%	21.2%	36.5%	32.9%	4.7%	3.118	0.904	0.71
A14	0.0%	22.4%	23.5%	42.4%	11.8%	3.435	0.928	0.54
A15	0.0%	5.9%	25.9%	54.1%	14.1%	3.765	0.580	0.37
A16	8.2%	25.9%	30.6%	28.2%	7.1%	3.000	1.153	0.70
A17	0.0%	28.2%	23.5%	42.4%	5.9%	3.259	0.874	0.68
A18	3.5%	27.1%	29.4%	32.9%	7.1%	3.129	1.007	0.78
A19	4.7%	22.4%	30.6%	30.6%	11.8%	3.224	1.138	0.76
A20	0.0%	7.1%	9.4%	55.3%	28.2%	4.047	0.657	0.59
A21	0.0%	2.4%	27.1%	55.3%	15.3%	3.835	0.491	0.55
A22	0.0%	12.9%	22.4%	55.3%	9.4%	3.612	0.685	0.66
A23	1.2%	3.5%	23.5%	37.6%	34.1%	4.000	0.824	0.57
A24	1.2%	14.1%	17.6%	38.8%	28.2%	3.788	1.085	0.63
A25	1.2%	14.1%	28.2%	40.0%	16.5%	3.565	0.928	0.61
Section A averages	**1.93%**	**17.71%**	**26.30%**	**39.62%**	**14.44%**	**3.469**	**0.334**	**0.60**

Table 4.8: Item analysis of the South African responses for Section B (n = 85)

Section B question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
B26	0.0%	4.7%	17.6%	55.3%	22.4%	3.953	0.586	0.48
B27	1.2%	11.8%	52.9%	31.8%	2.4%	3.224	0.527	0.49
B28	0.0%	7.1%	12.9%	42.4%	37.6%	4.106	0.777	0.52
B29	4.7%	8.2%	30.6%	38.8%	17.6%	3.565	1.046	0.55

B30	1.2%	5.9%	22.4%	62.4%	8.2%	3.706	0.561	0.59
B31	2.4%	10.6%	32.9%	47.1%	7.1%	3.459	0.742	0.53
B32	0.0%	14.1%	18.8%	55.3%	11.8%	3.647	0.746	0.57
B33	2.4%	22.4%	23.5%	35.3%	16.5%	3.412	1.160	0.70
B34	0.0%	7.1%	40.0%	42.4%	10.6%	3.565	0.599	0.66
B35	0.0%	18.8%	24.7%	48.2%	8.2%	3.459	0.789	0.62
B36	0.0%	5.9%	40.0%	32.9%	21.2%	3.694	0.753	0.56
B37	1.2%	5.9%	25.9%	44.7%	22.4%	3.812	0.788	0.64
B38	0.0%	10.6%	34.1%	37.6%	17.6%	3.624	0.799	0.72
B39	1.2%	15.3%	14.1%	42.4%	27.1%	3.788	1.085	0.53
B40	4.7%	23.5%	15.3%	44.7%	11.8%	3.353	1.217	0.60
B41	4.7%	32.9%	41.2%	18.8%	2.4%	2.812	0.765	0.45
B42	2.4%	16.5%	40.0%	35.3%	5.9%	3.259	0.780	0.55
B43	1.2%	3.5%	30.6%	60.0%	4.7%	3.635	0.467	0.45
B44	0.0%	20.0%	30.6%	45.9%	3.5%	3.329	0.691	0.48
B45	0.0%	25.3%	24.1%	42.2%	8.4%	3.337	0.898	0.48
B46	3.6%	9.5%	32.1%	47.6%	7.1%	3.452	0.795	0.34
B47	0.0%	15.3%	38.8%	36.5%	9.4%	3.400	0.734	0.38
B48	4.7%	9.4%	25.9%	48.2%	11.8%	3.529	0.955	0.57
B49	5.9%	11.8%	51.8%	23.5%	7.1%	3.141	0.851	0.31
B50	1.2%	9.4%	34.1%	51.8%	3.5%	3.471	0.579	0.65
B51	2.4%	12.9%	41.2%	37.6%	5.9%	3.318	0.734	0.63
B52	3.5%	5.9%	16.5%	61.2%	12.9%	3.741	0.780	0.59
B53	3.5%	4.7%	12.9%	55.3%	23.5%	3.906	0.862	0.48
B54	0.0%	10.6%	20.0%	32.9%	36.5%	3.953	0.986	0.58
B55	0.0%	15.3%	27.1%	51.8%	5.9%	3.482	0.673	0.57
B56	0.0%	14.1%	25.9%	47.1%	12.9%	3.588	0.783	0.57
B57	1.2%	20.0%	20.0%	41.2%	17.6%	3.541	1.072	0.69
B58	4.7%	23.5%	44.7%	25.9%	1.2%	2.953	0.727	0.59
B59	1.2%	32.9%	29.4%	31.8%	4.7%	3.059	0.879	0.38
B60	2.4%	11.8%	44.7%	36.5%	4.7%	3.294	0.678	0.38
B61	4.7%	15.3%	29.4%	44.7%	5.9%	3.318	0.923	0.59
B62	8.2%	49.4%	21.2%	20.0%	1.2%	2.565	0.881	0.41
B63	5.9%	25.9%	40.0%	20.0%	8.2%	2.988	1.023	0.43
B64	3.5%	20.0%	20.0%	48.2%	8.2%	3.376	1.011	0.67
B65	2.4%	16.5%	29.4%	45.9%	5.9%	3.365	0.820	0.48
B66	3.5%	20.0%	41.2%	31.8%	3.5%	3.118	0.786	0.57
B67	2.4%	16.5%	37.6%	38.8%	4.7%	3.271	0.762	0.61
B68	0.0%	24.7%	31.8%	36.5%	7.1%	3.259	0.827	0.66
B69	0.0%	4.7%	8.2%	50.6%	36.5%	4.188	0.600	0.56
B70	0.0%	8.2%	17.6%	61.2%	12.9%	3.788	0.590	0.41
B71	0.0%	14.1%	27.1%	41.2%	17.6%	3.624	0.870	0.48
B72	1.2%	12.9%	22.4%	40.0%	23.5%	3.718	1.003	0.46
B73	0.0%	7.1%	41.2%	41.2%	10.6%	3.553	0.600	0.17
B74	0.0%	15.3%	5.9%	50.6%	28.2%	3.918	0.946	0.50
B75	0.0%	15.3%	29.4%	37.6%	17.6%	3.576	0.903	0.38
B76	1.2%	20.0%	34.1%	38.8%	5.9%	3.282	0.791	0.60
B77	0.0%	4.7%	30.6%	60.0%	4.7%	3.647	0.417	0.63
B78	0.0%	31.8%	30.6%	36.5%	1.2%	3.071	0.724	0.58
B79	1.2%	13.1%	26.2%	42.9%	16.7%	3.607	0.905	0.52
B80	2.5%	16.0%	30.9%	38.3%	12.3%	3.420	0.960	0.48
B81	0.0%	11.8%	38.8%	35.3%	14.1%	3.518	0.767	0.66
B82	1.2%	20.0%	35.3%	37.6%	5.9%	3.271	0.786	0.44
B83	0.0%	20.0%	16.5%	51.8%	11.8%	3.553	0.882	0.70

B84	2.4%	16.5%	35.3%	37.6%	8.2%	3.329	0.856	0.71
B85	2.4%	8.2%	32.9%	42.4%	14.1%	3.576	0.832	0.69
B86	0.0%	12.9%	34.1%	43.5%	9.4%	3.494	0.697	0.59
B87	4.7%	17.6%	27.1%	43.5%	7.1%	3.306	0.989	0.68
B88	3.6%	17.9%	40.5%	35.7%	2.4%	3.155	0.750	0.66
B89	0.0%	2.4%	10.6%	40.0%	47.1%	4.318	0.570	0.53
B90	0.0%	5.9%	17.6%	49.4%	27.1%	3.976	0.682	0.65
B91	1.2%	4.7%	48.2%	36.5%	9.4%	3.482	0.603	0.32
B92	0.0%	16.5%	30.6%	43.5%	9.4%	3.459	0.766	0.56
B93	0.0%	8.2%	18.8%	57.6%	15.3%	3.800	0.631	0.27
B94	1.2%	27.1%	28.2%	34.1%	9.4%	3.235	0.980	0.30
B95	2.4%	15.3%	37.6%	35.3%	9.4%	3.341	0.860	0.41
B96	3.5%	18.8%	25.9%	40.0%	11.8%	3.376	1.058	0.53
B97	5.9%	17.6%	25.9%	44.7%	5.9%	3.271	1.021	0.58
B98	0.0%	9.4%	31.8%	49.4%	9.4%	3.588	0.619	0.52
Section B averages	**1.73%**	**14.79%**	**29.15%**	**42.12%**	**12.21%**	**3.483**	**0.227**	**0.53**

Table 4.9: Item analysis of the South African responses for Section C (n = 85)

Section C question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
C99	8.2%	21.2%	25.9%	38.8%	5.9%	3.129	1.148	0.75
C100	0.0%	9.5%	28.6%	47.6%	14.3%	3.667	0.698	0.83
C101	4.7%	18.8%	48.2%	25.9%	2.4%	3.024	0.729	0.71
C102	3.5%	17.6%	25.9%	41.2%	11.8%	3.400	1.040	0.86
C103	1.2%	10.6%	48.2%	32.9%	7.1%	3.341	0.648	0.79
C104	3.5%	28.2%	16.5%	36.5%	15.3%	3.318	1.299	0.87
C105	3.7%	20.7%	43.9%	28.0%	3.7%	3.073	0.775	0.79
C106	0.0%	10.6%	25.9%	54.1%	9.4%	3.624	0.635	0.70
C107	2.4%	28.2%	36.5%	29.4%	3.5%	3.035	0.811	0.80
C108	3.5%	31.8%	34.1%	28.2%	2.4%	2.941	0.832	0.73
C109	0.0%	14.3%	42.9%	39.3%	3.6%	3.321	0.575	0.61
Section C averages	**2.79%**	**19.24%**	**34.23%**	**36.55%**	**7.20%**	**3.255**	**0.501**	**0.77**

Table 4.10: Item analysis of the South African responses for Section D (n = 85)

Section D question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
D110	0.0%	2.4%	15.3%	49.4%	32.9%	4.129	0.560	0.62
D111	4.7%	20.0%	18.8%	43.5%	12.9%	3.400	1.181	0.74
D112	2.4%	17.6%	24.7%	47.1%	8.2%	3.412	0.901	0.71
D113	5.9%	18.8%	54.1%	17.6%	3.5%	2.941	0.738	0.80
D114	4.7%	16.5%	38.8%	37.6%	2.4%	3.165	0.796	0.74
D115	4.7%	15.3%	58.8%	18.8%	2.4%	2.988	0.623	0.62
D116	1.2%	9.4%	34.1%	43.5%	11.8%	3.553	0.741	0.75

D117	1.2%	14.3%	40.5%	39.3%	4.8%	3.321	0.670	0.42
D118	0.0%	10.6%	23.5%	52.9%	12.9%	3.682	0.687	0.72
Section D averages	**2.75%**	**13.87%**	**34.30%**	**38.87%**	**10.20%**	**3.398**	**0.355**	**0.68**

Table 4.11: Overall scale statistics for the South African target population (n = 85)

	Section			
	A	**B**	**C**	**D**
Number of items	25	69	11	9
Number of examinees	85	85	85	85
Mean	3.469	3.483	3.255	3.398
Variance	0.334	0.227	0.501	0.355
Standard deviation	0.578	0.476	0.707	0.596
Skewness	0.066	0.375	-0.230	-0.381
Kurtosis	-0.604	-0.059	-0.110	0.474
Minimum	2.320	2.507	1.200	1.667
Maximum	5.000	4.959	5.000	5.000
Median	3.520	3.438	3.364	3.556
Cronbach's alpha coefficient	0.9277	0.9658	0.9304	0.8535

Table 4.12: Scale intercorrelations for the South African target population (n = 85)

		Section			
		A	**B**	**C**	**D**
Section	**A**	1.000	0.854	0.774	0.729
	B	0.854	1.000	0.724	0.675
	C	0.774	0.724	1.000	0.825
	D	0.729	0.675	0.825	1.000

4.6.2.2 Initial item and reliability analysis results (international responses)

The dimensional and non-dimensional measurement results for the international target population are presented in Tables 4.13 to 4.18 below.

Table 4.13: Item analysis of the international responses for Section A (n = 87)

Section A question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
A1	3.4%	12.6%	20.7%	47.1%	16.1%	3.598	1.022	0.55
A2	1.1%	11.5%	29.9%	41.4%	16.1%	3.598	0.861	0.67
A3	2.3%	6.9%	25.3%	42.5%	23.0%	3.770	0.913	0.58
A4	4.6%	3.4%	16.1%	52.9%	23.0%	3.862	0.924	0.70
A5	0.0%	9.2%	24.1%	47.1%	19.5%	3.770	0.752	0.70

A6	0.0%	3.4%	5.7%	59.8%	31.0%	4.184	0.472	0.60
A7	1.1%	18.4%	29.9%	37.9%	12.6%	3.425	0.934	0.67
A8	1.1%	11.5%	11.5%	46.0%	29.9%	3.920	0.971	0.58
A9	3.4%	12.6%	24.1%	48.3%	11.5%	3.517	0.939	0.73
A10	1.1%	14.9%	21.8%	40.2%	21.8%	3.667	1.027	0.66
A11	5.7%	9.2%	21.8%	43.7%	19.5%	3.621	1.155	0.75
A12	3.4%	13.8%	36.8%	42.5%	3.4%	3.287	0.757	0.62
A13	3.4%	13.8%	26.4%	35.6%	20.7%	3.563	1.143	0.73
A14	1.1%	11.5%	14.9%	56.3%	16.1%	3.747	0.810	0.64
A15	1.1%	9.2%	23.0%	51.7%	14.9%	3.701	0.761	0.67
A16	10.3%	13.8%	13.8%	47.1%	14.9%	3.425	1.440	0.76
A17	1.1%	13.8%	19.5%	51.7%	13.8%	3.632	0.853	0.57
A18	2.3%	17.2%	19.5%	48.3%	12.6%	3.517	0.985	0.78
A19	1.1%	14.9%	18.4%	46.0%	19.5%	3.678	0.977	0.68
A20	1.1%	1.1%	9.2%	49.4%	39.1%	4.241	0.574	0.41
A21	0.0%	8.0%	13.8%	63.2%	14.9%	3.851	0.587	0.51
A22	0.0%	8.0%	27.6%	39.1%	25.3%	3.816	0.817	0.57
A23	5.7%	3.4%	12.6%	26.4%	51.7%	4.149	1.277	0.76
A24	6.9%	9.2%	6.9%	48.3%	28.7%	3.828	1.315	0.76
A25	5.7%	6.9%	28.7%	42.5%	16.1%	3.563	1.051	0.81
Section A averages	**2.71%**	**10.34%**	**20.09%**	**46.21%**	**20.64%**	**3.717**	**0.407**	**0.66**

Table 4.14: Item analysis of the international responses for Section B (n = 87)

Section B question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
B26	0.0%	3.4%	3.4%	44.8%	48.3%	4.379	0.511	0.57
B27	0.0%	13.8%	47.1%	35.6%	3.4%	3.287	0.550	0.60
B28	3.4%	9.2%	12.6%	34.5%	40.2%	3.989	1.207	0.59
B29	0.0%	6.9%	18.4%	48.3%	26.4%	3.943	0.721	0.52
B30	0.0%	12.6%	20.7%	49.4%	17.2%	3.713	0.802	0.68
B31	0.0%	13.8%	18.4%	54.0%	13.8%	3.678	0.770	0.71
B32	4.6%	9.2%	6.9%	46.0%	33.3%	3.943	1.181	0.64
B33	5.7%	10.3%	16.1%	31.0%	36.8%	3.828	1.430	0.75
B34	6.9%	12.6%	20.7%	46.0%	13.8%	3.471	1.192	0.67
B35	0.0%	10.3%	25.3%	46.0%	18.4%	3.724	0.774	0.69
B36	1.1%	9.2%	17.2%	37.9%	34.5%	3.954	0.986	0.76
B37	0.0%	8.0%	16.1%	47.1%	28.7%	3.966	0.769	0.80
B38	4.6%	6.9%	16.1%	51.7%	20.7%	3.770	1.005	0.78
B39	2.3%	2.3%	27.6%	40.2%	27.6%	3.885	0.837	0.61
B40	4.6%	6.9%	14.9%	41.4%	32.2%	3.897	1.150	0.61
B41	8.0%	16.1%	41.4%	25.3%	9.2%	3.115	1.090	0.43
B42	1.1%	10.3%	37.9%	43.7%	6.9%	3.448	0.661	0.63
B43	0.0%	9.2%	23.0%	58.6%	9.2%	3.678	0.586	0.31
B44	0.0%	4.6%	43.7%	36.8%	14.9%	3.621	0.626	0.47
B45	2.3%	16.1%	6.9%	43.7%	31.0%	3.851	1.208	0.55
B46	0.0%	2.3%	23.3%	65.1%	9.3%	3.814	0.384	0.43
B47	0.0%	5.7%	32.2%	57.5%	4.6%	3.609	0.445	0.48
B48	1.2%	5.8%	17.4%	53.5%	22.1%	3.895	0.722	0.50

B49	2.3%	23.0%	33.3%	36.8%	4.6%	3.184	0.840	0.22
B50	4.6%	11.5%	28.7%	46.0%	9.2%	3.437	0.936	0.63
B51	0.0%	3.4%	28.7%	59.8%	8.0%	3.724	0.430	0.41
B52	0.0%	2.3%	17.2%	46.0%	34.5%	4.126	0.593	0.61
B53	0.0%	10.3%	14.9%	52.9%	21.8%	3.862	0.763	0.48
B54	1.1%	4.6%	6.9%	36.8%	50.6%	4.310	0.766	0.65
B55	2.3%	12.6%	21.8%	49.4%	13.8%	3.598	0.907	0.75
B56	0.0%	2.3%	17.2%	51.7%	28.7%	4.069	0.547	0.66
B57	0.0%	5.7%	26.4%	49.4%	18.4%	3.805	0.640	0.64
B58	1.1%	17.2%	41.4%	37.9%	2.3%	3.230	0.637	0.38
B59	8.0%	19.5%	28.7%	31.0%	12.6%	3.207	1.291	0.63
B60	1.1%	21.8%	27.6%	34.5%	14.9%	3.402	1.045	0.52
B61	1.1%	8.0%	25.3%	50.6%	14.9%	3.701	0.738	0.69
B62	2.3%	16.1%	39.1%	36.8%	5.7%	3.276	0.774	0.62
B63	9.2%	21.8%	35.6%	32.2%	1.1%	2.943	0.951	0.66
B64	1.1%	9.2%	28.7%	49.4%	11.5%	3.609	0.721	0.57
B65	0.0%	16.1%	29.9%	42.5%	11.5%	3.494	0.802	0.57
B66	0.0%	13.8%	29.9%	48.3%	8.0%	3.506	0.687	0.62
B67	5.7%	20.7%	33.3%	36.8%	3.4%	3.115	0.929	0.65
B68	2.3%	25.3%	23.0%	44.8%	4.6%	3.241	0.919	0.62
B69	1.1%	5.7%	9.2%	50.6%	33.3%	4.092	0.750	0.60
B70	3.4%	11.5%	5.7%	41.4%	37.9%	3.989	1.207	0.74
B71	5.7%	8.0%	4.6%	35.6%	46.0%	4.080	1.338	0.70
B72	0.0%	12.6%	13.8%	39.1%	34.5%	3.954	0.986	0.66
B73	2.3%	13.8%	34.5%	46.0%	3.4%	3.345	0.709	0.37
B74	2.3%	8.0%	1.1%	59.8%	28.7%	4.046	0.825	0.35
B75	0.0%	6.9%	18.4%	58.6%	16.1%	3.839	0.595	0.50
B76	1.1%	3.4%	34.5%	49.4%	11.5%	3.667	0.590	0.72
B77	0.0%	2.3%	28.7%	49.4%	19.5%	3.862	0.556	0.78
B78	3.4%	16.1%	20.7%	51.7%	8.0%	3.448	0.937	0.76
B79	1.1%	14.9%	4.6%	43.7%	35.6%	3.977	1.103	0.77
B80	1.1%	10.3%	49.4%	29.9%	9.2%	3.356	0.689	0.64
B81	5.7%	8.0%	39.1%	35.6%	11.5%	3.391	0.974	0.74
B82	0.0%	11.5%	21.8%	52.9%	13.8%	3.690	0.720	0.59
B83	0.0%	6.9%	19.5%	54.0%	19.5%	3.862	0.648	0.63
B84	1.1%	12.6%	24.1%	33.3%	28.7%	3.759	1.080	0.62
B85	0.0%	10.3%	25.3%	46.0%	18.4%	3.724	0.774	0.73
B86	1.1%	18.4%	18.4%	51.7%	10.3%	3.517	0.893	0.72
B87	1.1%	24.1%	13.8%	44.8%	16.1%	3.506	1.124	0.78
B88	4.6%	17.2%	37.9%	31.0%	9.2%	3.230	0.982	0.67
B89	0.0%	3.4%	8.0%	43.7%	44.8%	4.299	0.577	0.68
B90	0.0%	5.7%	14.9%	51.7%	27.6%	4.011	0.655	0.60
B91	0.0%	5.7%	40.2%	51.7%	2.3%	3.506	0.411	0.11
B92	0.0%	9.2%	14.9%	72.4%	3.4%	3.701	0.462	0.54
B93	2.3%	10.3%	25.3%	44.8%	17.2%	3.644	0.919	0.62
B94	6.9%	12.6%	28.7%	35.6%	16.1%	3.414	1.231	0.61
B95	2.3%	21.8%	26.4%	37.9%	11.5%	3.345	1.031	0.51
B96	2.3%	12.6%	9.2%	56.3%	19.5%	3.782	0.952	0.75
B97	3.4%	13.8%	24.1%	43.7%	14.9%	3.529	1.031	0.72
B98	0.0%	5.7%	5.7%	60.9%	27.6%	4.103	0.553	0.64
Section B averages	**1.94%**	**10.90%**	**22.85%**	**45.41%**	**18.90%**	**3.684**	**0.307**	**0.63**

Table 4.15: Item analysis of the international responses for Section C (n = 87)

Section C question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
C99	6.9%	5.7%	11.5%	59.8%	16.1%	3.724	1.050	0.81
C100	3.4%	8.0%	11.5%	56.3%	20.7%	3.828	0.924	0.83
C101	0.0%	23.0%	37.9%	29.9%	9.2%	3.253	0.833	0.64
C102	3.4%	5.7%	25.3%	44.8%	20.7%	3.736	0.930	0.85
C103	5.7%	10.3%	27.6%	48.3%	8.0%	3.425	0.957	0.71
C104	4.6%	6.9%	25.3%	48.3%	14.9%	3.621	0.948	0.76
C105	5.7%	12.6%	37.9%	40.2%	3.4%	3.230	0.844	0.73
C106	6.9%	2.3%	19.5%	47.1%	24.1%	3.793	1.107	0.85
C107	4.6%	6.9%	32.2%	47.1%	9.2%	3.494	0.848	0.85
C108	11.5%	18.4%	37.9%	27.6%	4.6%	2.954	1.101	0.76
C109	1.1%	10.3%	9.2%	57.5%	21.8%	3.885	0.814	0.63
Section C averages	**4.91%**	**10.03%**	**25.08%**	**46.08%**	**13.90%**	**3.540**	**0.552**	**0.68**

Table 4.16: Item analysis of the international responses for Section D (n = 87)

Section D question number (Items)	Percentage endorsements					Mean	Variance	Item to section correlation
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree			
D110	0.0%	6.9%	6.9%	54.0%	32.2%	4.115	0.653	0.73
D111	3.4%	8.0%	17.2%	51.7%	19.5%	3.759	0.942	0.81
D112	2.3%	9.2%	26.4%	48.3%	13.8%	3.621	0.833	0.71
D113	1.1%	20.7%	42.5%	32.2%	3.4%	3.161	0.687	0.74
D114	1.1%	6.9%	31.0%	43.7%	17.2%	3.690	0.766	0.76
D115	1.1%	5.7%	52.9%	35.6%	4.6%	3.368	0.508	0.71
D116	0.0%	11.5%	12.6%	46.0%	29.9%	3.943	0.882	0.72
D117	4.6%	4.6%	34.5%	49.4%	6.9%	3.494	0.756	0.68
D118	1.1%	0.0%	8.0%	62.1%	28.7%	4.172	0.442	0.63
Section D averages	**1.66%**	**8.17%**	**25.80%**	**47.00%**	**17.37%**	**3.702**	**0.371**	**0.73**

Table 4.17: Overall scale statistics for the international target population (n = 87)

	Section			
	A	B	C	D
Number of items	25	69	11	9
Number of examinees	87	87	87	87
Mean	3.717	3.684	3.540	3.702
Variance	0.407	0.307	0.552	0.371
Standard deviation	0.638	0.554	0.743	0.609
Skewness	-0.689	-0.454	-1.227	-0.951
Kurtosis	-0.135	-0.323	1.402	0.494
Minimum	2.000	2.397	1.364	2.111
Maximum	5.000	4.877	4.727	4.889

Median	3.840	3.753	3.727	3.889
Cronbach's alpha coefficient	0.9455	0.9768	0.9290	0.8837

Table 4.18: Scale intercorrelations for the international target population (n = 87)

		Section			
		A	**B**	**C**	**D**
Section	**A**	1.000	0.936	0.789	0.707
	B	0.936	1.000	0.802	0.706
	C	0.789	0.802	1.000	0.823
	D	0.707	0.706	0.823	1.000

4.6.2.3 Summary and discussion of initial item and reliability analysis results

The item analysis of the South African and international population groups for all of the sections reveals that the item means vary between 2.565 and 4.379, with a variance of between 0.227 and 1.440, as summarised in Table 4.19 below.

Table 4.19: Summary of mean, variance and item to section correlation (minimum and maximum values) dimension for the two population groups (n = 172)

		South African responses				International responses			
		Section				Section			
		A	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Mean	Min	2.882	2.565	2.941	2.941	3.287	2.943	2.954	3.161
	Max	4.047	4.318	3.667	4.129	4.241	4.379	3.885	4.172
Variance	Min	0.334	0.227	0.501	0.355	0.407	0.307	0.552	0.371
	Max	1.421	1.217	1.299	0.901	1.440	1.430	1.107	0.882
Item to section correlation	Min	0.368	0.168	0.612	0.422	0.410	0.112	0.629	0.626
	Max	0.781	0.716	0.867	0.796	0.806	0.798	0.848	0.759

All the means of the responses to the questions are above the Likert scale level of 3, except in the following instances:

- South African responses
  - Questions A7 and A16;
  - Questions B41, B58, B62 and B63 ;
  - Question C108; and
  - Questions D113 and D115.
- International responses
  - Question B63; and
  - Question C108.

From Tables 4.7 to 4.10 (South African responses), 4.13 to 4.18 (international responses) and Table 4.19, it can be observed that the item to section correlation values are positive for all four sections, A to D, of the assessment tool. This is above Pearson's r two-tailed level of significance critical value of 0.217 (degrees of freedom (df) = n – 2 = 80 and $p < 0.05$) as stated by Hall (1998), except in the following instances:

- South African responses - Question B73 (0.168); and
- International responses - Question B91 (0.112).

The Cronbach alpha coefficients for all sections of both the South African (α's between 0.8535 and 0.9658) and international responses (α's between 0.8837 and 0.9768) are considered highly acceptable, compared to the guideline of an alpha greater than 0.70 (Nunnally & Bernstein, 1994; Smit, 1991).

From the skewness results presented in Tables 4.11 and 4.17, it can be observed that the South African population's responses to questions from Section A display the most symmetrical distribution while, international responses to the questions in Sections C and D are the least symmetrical in terms of the shape of the respective distributions. The absolute skewness statistics for the South African responses to all four sections are less than two standard errors of skewness (*ses*), indicating that there is no significant skewness problem. However, the skewness statistics for Sections A, C and D for the international population's responses are all greater than two standard errors of skewness. It can therefore be deduced that these distributions are significantly skewed. Since the sign of the aforementioned skewness statistics are all negative, one can further conclude that the data is concentrated at the high end of the scale. This is consistent with the higher median statistics reported for the international population in Table 4.17.

Similarly, the kurtosis results indicate that the results are largely flat (or platykurtical) with evenly distributed scores that are flatter than a normal distribution, except in respect of the responses of the South African population to Section D and the international responses to Sections C and D. Once again, the absolute kurtosis statistics for the South African responses to all four sections are smaller than two standard errors of kurtosis (*sek*), indicating that there was no significant kurtosis problem (kurtosis within the range of the chance fluctuations within this statistic). The same conclusion can be reached for the international data, except in the instance

of responses to Section C. The significantly positive kurtosis result (> 2 *sek*) for Section C's data indicates a leptokurtic distribution (very peaked with flat tails).

From the initial statistical item analysis, it appears that the items of the assessment tool have acceptable levels of internal consistency. The ITEMAN™ (Conventional Item and Test Analysis Program, Version 3.6) statistical software results for the combined South African and International population groups are included in Appendix C.

Following the initial item and reliability analysis described above, an exploratory factor analysis was conducted. This analysis then formed the underlying content of the measuring instrument.

4.6.3 Introduction to the exploratory factor analysis technique

Broadly speaking, factor analysis addresses the problem of analysing the structure of the interrelationships (correlations) between a large number of variables (such as test scores, test items and questionnaire responses) by defining a set of common underlying dimensions known as factors (Hair *et al*., 1998:367). This process has two primary uses and can ultimately result in summarisation (describing the data by means of a much smaller number of surrogate items) and data reduction (calculating factor scores to replace the original variables).

In exploratory factor analysis the researcher has little or no knowledge about the factor structure. In other words, there is very little theory that can be used to answer specific research questions. In such cases, researchers may collect data and explore or search for a factor structure or theory which explains the correlations between the variables. Data is used to help reveal or identify the structure of the factor model. Exploratory factor analysis can be regarded as a technique to aid in theory building. Confirmatory factor analysis on the other hand, assumes that the factor structure is known or hypothesised *a priori*. In other words, the complete factor structure, along with the respective indicators and the nature of the pattern loadings, is specified *a priori*, based on a particular underlying theory. The objective is to verify or confirm an expected factor structure empirically rather than to determine a structure that was previously unknown (Sharma, 1996:128; DeVellis, 1991:108). Exploratory factor analysis was used in this study.

According to Sharma (1996:99), the objectives of factor analysis are to use the computed correlation matrix to

- identify the smallest number of common factors that best explain or account for the correlations among the indicators;
- identify, via factor rotations, the most plausible factor solution;
- estimate the pattern or structure loadings, communalities of the variables (the square of the pattern loadings or the squared multiple correlation of a variable with the factors) and the unique variances of the indicators;
- provide an interpretation for the common factor(s); and, if necessary,
- estimate the factor scores.

Hair *et al*. (1998:368, 371) state that factor analysis techniques can meet any of three objectives:

- identifying the structure of relationships among either variables or respondents by examining correlations between the variables or respondents;
- identifying representative variables from a much larger set of variables for use in subsequent multivariate analysis; and
- creating an entirely new set of fewer variables to partially or completely replace the original set for inclusion in subsequent techniques.

Similarly, factor analysis serves several related purposes (DeVellis, 1991:92):

- assisting in determining how many latent variables underlie a set of other variables;
- condensing information so that variation can be explained by using a smaller number of variables; and
- defining the substantive meaning of the factors or latent variables.

4.6.4 Factor analysis process

Factor analysis begins with the construction of a covariance or correlation matrix from the data collected from respondents. In the case of a covariance matrix, the matrix is comprised of diagonal elements that are the variances of the individual items (representing that portion of total variance that is unique to the particular variable) and off-diagonal items that are the covariances (the portion of total variance that is shared) between all paired items. Conversely,

with common factor analysis, communalities which are estimates (square multiple correlations) of the shared or common variance among variables are inserted in the diagonal and factors are only based on the common variance. Because the objective is to identify interrelated sets of variables, Hair *et al*. (1998:374) suggest that one of the critical assumptions of factor analysis is that the data matrix has sufficient correlations (with a value greater than 0.30) to justify the application of factor analysis.

This initial step is followed by a "process of factor extraction that involves identifying hypothetical latent variables (factors) that can account mathematically for the patterns of covariance among items" (DeVellis, 1991:93). Essentially, a factor would be a latent variable that is presumed to cause the covariation among various data items and the factor loading would represent the correlation between each original item and the new latent variable. Various criteria have been developed to assist in deciding how many factors should be extracted:

- the latent root criterion, where only factors with eigenvalues greater than 1.0 are retained (mostly applicable when there are between 20 and 50 variables));
- Kaiser's eigenvalue rule (found in Nunnally (1978)) where only retaining factors that explain more variance than the average amount explained by one of the original items are retained;
- the percentage of variance approach, in which cumulative percentages of the variance extracted by successive factors is the criterion (and a common threshold when applied to study in the field of social sciences is to retain factors that account for 60% of total variance); and
- Cattell's (1966) scree test criterion, which calls for retaining the factors above the eigenvalue elbow on the scree plot and rejecting those below it, or the point at which the curve first begins to straighten is considered to indicate the maximum number of factors.

Defining the content or meaning of the factors extracted typically requires factor rotation. The goal of factor rotation is to find a set of factors that provides the clearest conceptual picture of the relationships among items. Rotation of the factors is intended to enhance the interpretation by reducing some of the ambiguities that are often associated with initial unrotated factor solutions. Orthogonal or oblique rotation techniques can be used depending on the overall objective of the factor analysis. Orthogonal rotation is applied when factors are required to be statistically independent and are rotated in a manner that ensures that they remain perpendicular to each other. Oblique rotation allows for correlation between rotated factors and

the optimal fit between each successive factor. No specific guidelines have been developed to assist in decision-making in this regard (Hair *et al*., 1998:384).

Interpreting the factor matrix involves, first, assessing the significance of the individual factor loadings; second, assessing each variable's communality with the factors; and third, assigning a meaning to the pattern of factor loadings.

First, in assessing the significance of factor loadings, the larger the absolute size of the factor loading, the more important the loading is in interpreting the factor matrix. A decision must be made about which factor loadings are worth considering when interpreting factors. The following four guidelines aid in the interpretation of factor loadings (Hair *et al*., 1998:384-386):

- practical significance and empirical evidence (when the sample size is 100 or larger) should be looked at;
- factor loadings that are greater than ±0.30 are considered to meet the minimum required level;
- loadings of ±0.40 are considered more important; and,
- loadings that are equal to or greater than ±0.50 are considered practically significant.

A more conservative approach is based on the argument that a factor loading represents the correlation between the original variable and the factor. Assuming that the stated objective is to use the 0.05 significance level in the interpretation of loadings, the following loadings should be used for the following different sample sizes:

- loadings of 0.65 for a sample size of 70;
- loadings of 0.60 for a sample size of 85;
- loadings of 0.55 for a sample size of 100;
- loadings of 0.45 for a sample size of 150; and
- loadings of 0.40 for a sample size of 200.

Sharma (1996:118) states that "high loading of a variable on a factor indicates that there is much in common between the factor and that respective variable. Although there is no definitive cut-off point to tell us how high is 'high', it has been suggested that the loadings should be at least greater than 0.60, and many researchers have used cut-off values as low as 0.40."

Secondly, as mentioned above, it is necessary to assess each variable's communality with the factor to determine if it meets acceptable levels of explanation. For example, the researcher may specify that at least one third of the variances of each variable must be accounted for. Using this guideline, the researcher would identify all variables with communalities less than 0.33 as not being sufficiently explained.

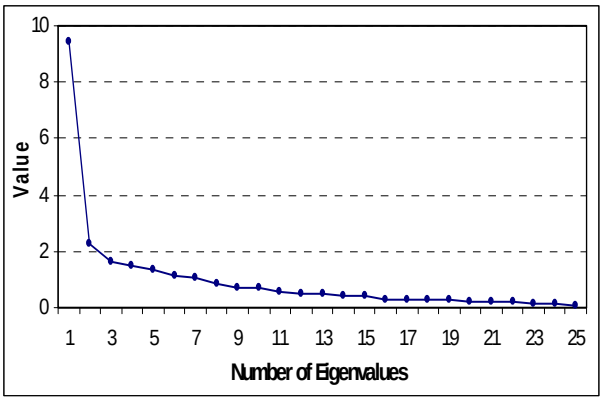
Lastly, it is necessary to assign meaning to the pattern of factor loadings. Variables with higher loadings are considered more important than other and the most emphasis should be placed on these items. These items should also have a greater influence on the name or label selected to represent the factor or underlying construct (Hair *et al*., 1998:387).

4.6.5 Exploratory factor analysis results (Section A)

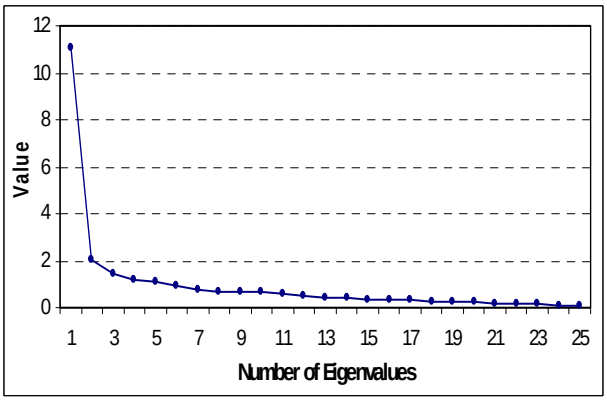
4.6.5.1 Latent roots and initial factor analysis solution (Section A)

Following the initial item and reliability analysis described above, a range of iterations of exploratory factor analysis was conducted to explore the internal structure of questionnaire items. During each of these iterations, the number of initial factors was determined based on the eigenvalues of latent roots. Scree plots were drawn up and the appropriate number of factors was identified in the various rounds. The significance of the rotated factor loadings was then evaluated and tested.

For Section A of the questionnaire, a factor analysis using BMDP statistical software was applied to the South African population's responses to determine the number of appropriate factors, which resulted in a very dominant factor with an eigenvalue of 9.4075 (explaining 37.63% of the variance) and a second potential factor with an eigenvalue of 2.2860 (accounting for 9.14% of the variance). The same process was applied to the international target population which resulted in one very dominant factor with an eigenvalue of 11.0487 (44.19% of variance) with second and third factors with eigenvalues of 2.0560 (8.24% of variance) and 1.4566 (5.83% of variance) respectively. The relevant scree plots of the eigenvalues (all 25 items originally included in Section A of the second phase questionnaire) are shown in Graphs 4.1 and 4.2 below.

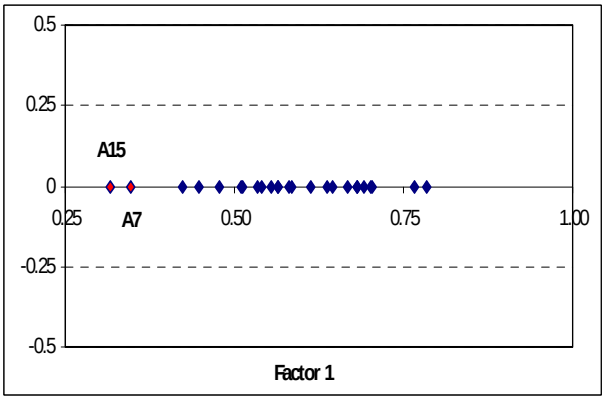


Graph 4.1: Scree plot of initial eigenvalues (South African responses to Section A)

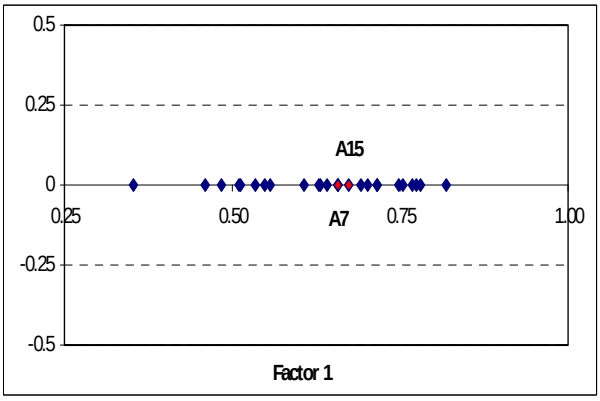


Graph 4.2: Scree plot of initial eigenvalues (international responses to Section A)

The application of the factor extraction criteria discussed above each resulted in the retention of a different numbers of factors for each of the criteria. Applying the latent root criterion required seven factors to be retained. Four factors would be retained if the percentage of variance criterion was used and a single factor would be retained if Cattell's scree test was applied. When the relevance and/or possibility of two or more factors was analysed, it was determined that the identified dominant factor was adequate, based on the Cattell criterion and that a single factor is the best descriptor of the construct. Scatter plots of the rotated (and unrotated) factor loadings (pattern) for all 25 items originally included in Section A of the second phase questionnaire are shown in Graphs 4.3 and 4.4 below.



Graph 4.3: Scatter plot of initial factor loadings (South African responses to Section A)



Graph 4.4: Scatter plot of initial factor loadings (international responses to Section A)

When Section A of the questionnaire (the conceptual / initiation phase of the project) was analysed by means of factor analysis, it became apparent that two items which measure the need to:

- communicate a sense of urgency (Item A7), and

- prioritise project objectives (Item A15);

each received different emphasis from the two target populations, namely South African and international project managers. The factor loadings for these items for the two population groups are highlighted in red to illustrate their difference locations in the respective scatter plots presented in Graphs 4.3 and 4.4 above. The factor loadings and communalities (squared multiple correlations) for the South African and international target population groups for Item A7 were 0.347, 0.657, 0.1202 and 0.4320 respectively. The identical statistical measures for Item A15 were 0.316, 0.673, 0.0995 and 0.4529. It can be observed from these results that the communality indices of these items (A7 and A15) with the primary factor identified for the South African responses to Section A of the assessment tool were extremely low.

4.6.5.2 Contingency table / chi-square test results (Section A items)

Due to the relatively small sets of data within the 1, 2, 4 and 5 dimensions of the Likert scale, it was decided to cluster these four dimensions into two categories (1 and 2 were combined into a single category and likewise, 4 and 5 were combined to form a single category). This was done to make the data more meaningful in order to be able to apply the various chi-square tests in the context of contingency table analysis. The chi-square (χ^2) test is probably the most widely used nonparametric test of significance (Cooper & Schindler, 2003:499). This technique is used to test for significant differences between the observed distribution of data among categories and the expected distribution based on the null hypothesis. "The greater the difference between them, the less is the probability that these differences can be attributed to chance. The value of χ^2 is the measure that expresses the extent of the difference. The larger the divergence, the larger is the χ^2 value" (Cooper & Schindler, 2003). With two degrees of freedom, the null hypothesis is rejected (at the 0.05 level of rejection) if the computed chi-square value is greater than or equal to

$$\chi^2_{0.05,2} = 5.991$$ (Dowdy, Wearden & Chilko, 2004:111 & 532)

Applying the chi-square test of homogeneity to the data collected on Item A7 (communicating a sense of urgency about the project), resulted in a χ^2 value of 14.401 with a probability value of 0.0007. Since this result is significantly higher than the critical chi-square value threshold of 5.991 given above, the null hypothesis (that the South African and international respondents agree on the importance of communicating a sense of urgency surrounding the project) is rejected; and it is concluded that there is evidence to indicate that the South African and

international samples are different in respect of their opinions on the importance of communicating a sense of urgency around the project. Table 4.20 below contains the relevant contingency table data in this regard.

Table 4.20: Item A7 - communicating a sense of urgency by sample (for a sample size of 172)

Likert scale dimensions	Statistical measure	South Africa	International	Total
1 to 2	Frequency	32	17	49
	Row %	65.31%	34.69%	100%
	Column %	37.65%	19.54%	28.49%
3	Frequency	33	26	59
	Row %	55.93%	44.07%	100%
	Column %	38.82%	29.89%	34.30%
4 to 5	Frequency	20	44	64
	Row %	31.25%	68.75%	100%
	Column %	23.53%	50.57%	37.21%
Total	Frequency	85	87	172
	Row %	49.42%	50.58%	100%
	Column %	100%	100%	100%

On the item of prioritisation of project objectives (item A15) both target population groups recorded similar frequencies as presented in the contingency Table 4.21 below. The chi-square test for homogeneity yielded a χ^2 value of 1.215 with a p-value of 0.5447. Similarly, since this result is lower that the same critical chi-square value of 5.991 specified above, the null hypothesis (that the South African and international groupings agree on the importance of prioritisation of project objectives) is accepted. Based on this evidence, it was concluded, that the opinions of the South African and international samples on the importance of prioritising project objectives are largely similar.

Table 4.21: Item A15 - prioritisation of project objectives by sample (for a sample size of 172)

Likert scale dimensions	Statistical measure	South Africa	International	Total
1 to 2	Frequency	5	9	14
	Row %	35.71%	64.29%	100%
	Column %	5.88%	10.34%	8.14%
3	Frequency	22	20	42
	Row %	52.38%	47.62%	100%
	Column %	25.88%	22.99%	24.42%
4 to 5	Frequency	58	58	116
	Row %	50.00%	50.00%	100%
	Column %	68.24%	66.67%	67.44%

Total	Frequency	85	87	172
	Row %	49.42%	50.58%	100%
	Column %	100%	100%	100%

It is clear from Table 4.20 above that the South African population does not regard "communicating a sense of urgency" in the project management context as important, with frequencies of 37.65% and 38.82% for the 1 to 2 and 3 categories within the Likert scale respectively. By contrast, the international target audience regarded "communicating a sense of urgency" in a project management context as important with a frequency of 50.57% (as opposed to the 23.53% for the South African sample) on the combined 4 and 5 dimensions on the Likert scale. This might be attributable to the difference in the level of maturity of project management in the international context compared to the South African context, where project and change management skills and capacity are still being developed (albeit at a rapid pace) and where "the sense of urgency" which is normally associated with successful project completion is still evolving.

The relationship between Items A7 and A15 was then determined for both samples, using the chi-square test of independence. With four degrees of freedom, the null hypothesis is usually rejected (at the 0.05 level of rejection) if the computed chi-square value is greater than or equal to

$$\chi^2_{0.05,4} = 9.488$$

Table 4.22 below contains the contingency table for the South African data for this analysis.

Table 4.22: South African respondent data (Items A7 and A15)

			Item: Prioritisation			
	Likert Scale Dimensions		**1 to 2**	**3**	**4 to 5**	**Total**
Item: Sense of urgency	**1 to 2**	Frequency	4	11	17	32
		Row %	12.50%	34.38%	53.13%	100%
		Column %	80.00%	50.00%	29.31%	37.65%
	3	Frequency	1	8	24	33
		Row %	3.03%	24.24%	72.73%	100%
		Column %	20.00%	36.36%	41.38%	38.82%
	4 to 5	Frequency	0	3	17	20
		Row %	0.00%	15.00%	85.00%	100%
		Column %	0.00%	13.64%	29.31%	23.53%
	Total	Frequency	5	22	58	85
		Row %	5.88%	25.88%	68.24%	100%
		Column %	100%	100%	100%	100%

For the South African responses, the chi-square test for independence determined a χ^2 value of 7.8484 with a p-value of 0.0973. Since this result is lower that the critical chi-square value of 9.488 specified above, the null hypothesis (that the South African opinions on the importance of communicating a sense of urgency about the project and on the importance of prioritisation of project objectives are independent) was accepted. It was concluded that the opinions of the South African sample on the importance of the two items, namely A7 and A15, are not significantly related.

The international target audience had the following view on the two items, as set out in Table 4.23 below. The international target audience resulted in a chi-square independence test value of 16.9276 with a p-value of 0.0020, indicating that the appropriate null hypothesis in this instance should be rejected and that international opinions on the two items (A7 and A15) are, in fact, dependent and related.

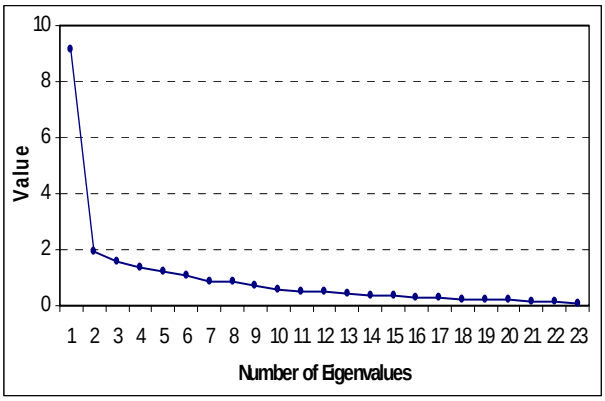
Table 4.23: International respondents data (Items A7 and A15)

			Item: Prioritisation			
	Likert Scale Dimensions		**1 to 2**	**3**	**4 to 5**	**Total**
Item: Sense of urgency	**1 to 2**	Frequency	5	6	6	17
		Row %	29.41%	35.29%	35.29%	100%
		Column %	55.56%	30.00%	10.34%	19.54%
	3	Frequency	1	9	16	26
		Row %	3.85%	34.62%	61.54%	100%
		Column %	11.11%	45.00%	27.59%	29.89%
	4 to 5	Frequency	3	5	36	44
		Row %	6.82%	11.36%	81.82%	100%
		Column %	33.33%	25.00%	62.07%	50.57%
	Total	Frequency	9	20	58	87
		Row %	10.34%	22.99%	66.67%	100%
		Column %	100%	100%	100%	100%

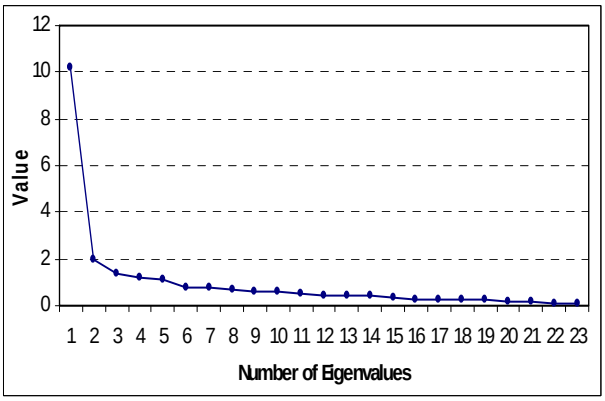
Because both chi-square tests (for homogeneity and for independence) described above, yielded opposing results in relation to the respective null hypothesis, it was subsequently decided to remove both items (A7 and A15) from the proposed assessment tool to reduce the possibility of any data contamination in any future analyses.

4.6.5.3 Final factor solution and loadings (Section A)

A final round of factor analysis was then applied to both target audiences for Section A, excluding Items A7 and A15 in an attempt to confirm the structure. The scree plots of the eigenvalues (with the reduced number of 23 items in Section A of the Phase 2 questionnaire) are shown in Graph 4.5 and Graph 4.6 below. Two dominant factors with eigenvalues of 9.158 for the South African and 10.191 for the international group were extracted. Each factor accounted for 39.8% and 44.3% of the total variance.



Graph 4.5: Scree plot of final eigenvalues (South African responses to Section A)

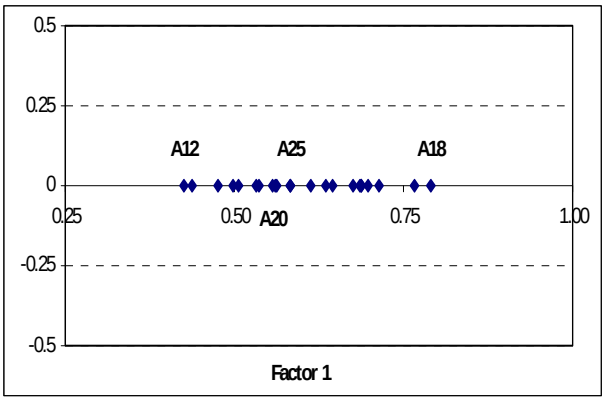


Graph 4.6: Scree plot of final eigenvalues (international responses to Section A)

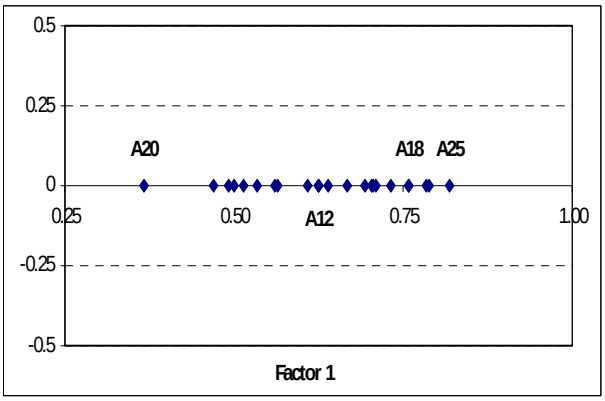
Once again, applying the factor extraction criteria discussed before resulted in the retention of different numbers of factors as follows:

- six factors when the latent root criterion was applied;
- four factors when applying the percentage of variance criterion; and
- one factor according to Cattell's scree test.

Furthermore, when the relevance of two or more factors was analysed, it was determined that the identified dominant factor was adequate, based on the Cattell criterion; and that a single factor was the best descriptor of the final Section A construct. Scatter plots of the rotated (and unrotated) factor loadings (pattern) for the reduced number of 23 items included in Section A of the Phase 2 questionnaire are shown in Graph 4.7 and Graph 4.8 below.



Graph 4.7: Scatter plot of factor final loadings (South African responses to Section A)



Graph 4.8: Scatter plot of factor final loadings (international responses to Section A)

Table 4.24 below gives a summary of the sorted rotated factor loadings for the two target audiences and the combined group in relation to the construct underpinning Section A. Factor rotation was done using the direct quartimin (oblique rotation) method.

Table 4.24: Section A - sorted rotated factor loadings (South African, international and combined group (n = 172) respondents)

SECTION A					
South African responses		**International responses**		**Combined group**	
Question	**Factor loadings**	**Question**	**Factor loadings**	**Question**	**Factor loadings**
A18	0.791	A25	0.819	A18	0.791
A19	0.766	A23	0.788	A16	0.735
A16	0.713	A24	0.785	A19	0.725
A13	0.698	A11	0.759	A13	0.720
A17	0.687	A18	0.759	A9	0.712
A9	0.687	A16	0.732	A25	0.685
A1	0.686	A13	0.709	A24	0.682
A22	0.675	A5	0.706	A11	0.679
A2	0.646	A9	0.704	A23	0.660
A10	0.635	A4	0.694	A10	0.656
A24	0.612	A19	0.668	A2	0.636
A25	0.582	A10	0.639	A5	0.621
A11	0.582	A14	0.626	A22	0.617
A5	0.563	A12	0.624	A17	0.615
A6	0.560	A2	0.609	A1	0.614
A20	0.556	A6	0.565	A4	0.599
A21	0.536	A3	0.560	A14	0.569
A23	0.532	A22	0.535	A6	0.562
A4	0.507	A8	0.515	A3	0.520
A14	0.498	A17	0.499	A8	0.519
A3	0.475	A1	0.492	A21	0.493
A8	0.438	A21	0.469	A20	0.484

		A12	0.426	A20	0.367	A12	0.481
Cronbach's alpha coefficient (all variables)		**0.929**		**0.941**		**0.937**	
Variance explained		**8.5628**		**9.6108**		**9.1522**	
Cumulative proportion of variance	In data Space	**37.23%**		**41.79%**		**39.79%**	
	In factor Space	**100%**		**100%**		**100%**	
Factor score covariance		**93.80%**		**95.10%**		**94.30%**	

It can be seen from the above results that all the factor loadings exceed the required minimum threshold level of 0.45 for a sample size of 150, at the 0.05 significance level. The communalities of the variables with the primary factor range from 0.2316 (Item A12) to 0.6254 (Item A18).

4.6.5.4 Scale naming / description (Section A)

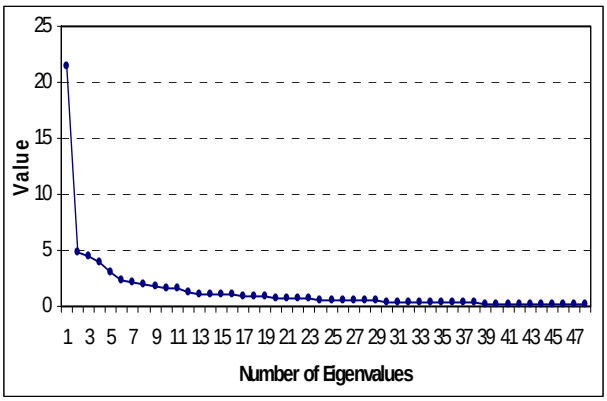
More detailed information on the various aspects of the construct for Section A of the measuring instrument can be found in Appendix B. Section A of the measuring instrument can essentially be described as "**ensuring alignment and organisational readiness after assessing and/or creating the need for change**" in the conceptual/initiation phase of the project. To summarise, the underlying construct for Section A covers the following most important aspects and critical elements:

- diagnosing the organisational operating environment and assessing readiness for and implications of change;
- identifying and acting to eliminate anxiety surrounding potential job losses and potential barriers and resistance to change;
- developing capacity and resilience for change within an organisation;
- creating an awareness of the importance of change management and motivating stakeholders constantly to ensure support;
- ensuring leadership understands the complexities of change management and is able to manage change dynamics and demonstrates visible commitment; and
- aligning the change intervention with overall business strategy.

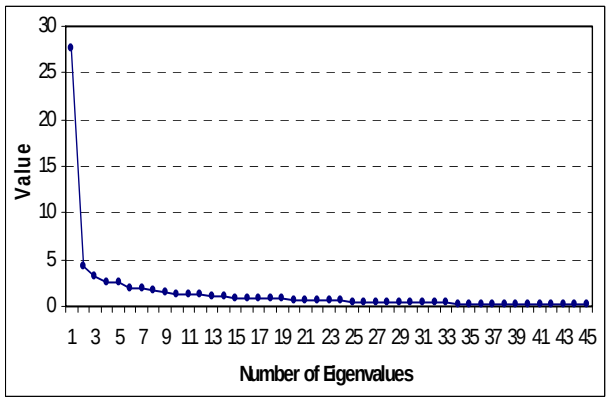
4.6.6 Exploratory factor analysis results (Section B)

4.6.6.1 Latent roots and initial factor analysis solution (Section B)

Numerous rounds of exploratory factor analysis of the responses to Section B of the assessment tool were then conducted. Each round of analysis resulted in a different number of dominant factors being extracted and several of the items in Section B of the original questionnaire were excluded during the next round of analysis. The results of one of the rounds of factor analysis (after three items had already been discarded) are included here for illustrative purposes. The relevant scree plots of the eigenvalues (69 of the items that were originally included in Section B of the Phase 2 questionnaire) for the particular round of Section B factor analysis are used as an example, as shown in Graphs 4.9 and 4.10 below.

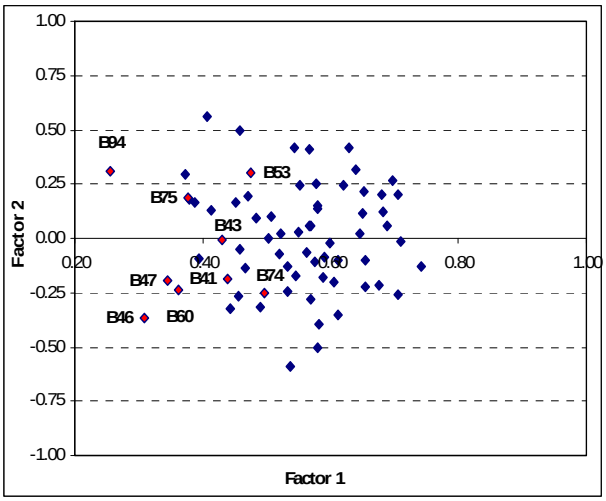


Graph 4.9: Scree plot of initial eigenvalues (South African responses to Section B)

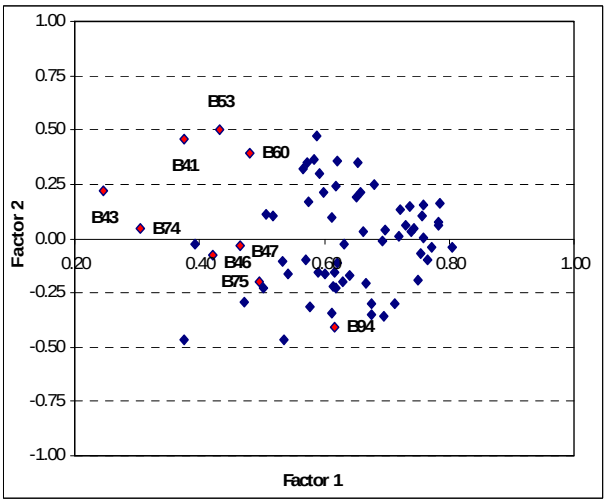


Graph 4.10: Scree plot of initial eigenvalues (international responses to Section B)

Scatter plots of the unrotated factor loadings (pattern) for a two-factor solution of the remaining 69 items included in Section B of the Phase 2 questionnaire are shown in Graphs 4.11 and 4.12 overleaf.

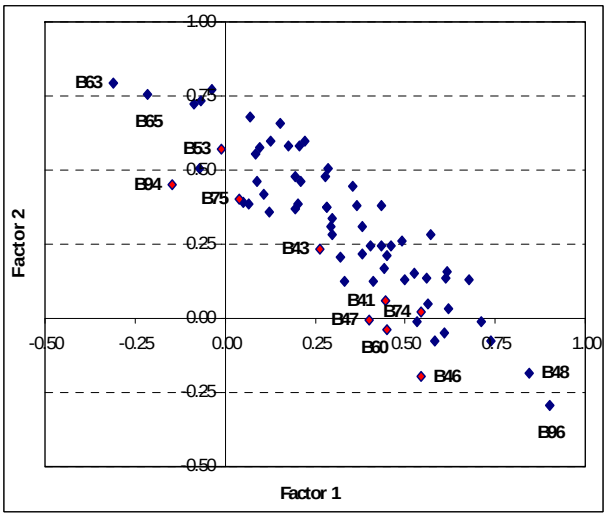


Graph 4.11: Scatter plot of unrotated factor loadings (South African responses to Section B)

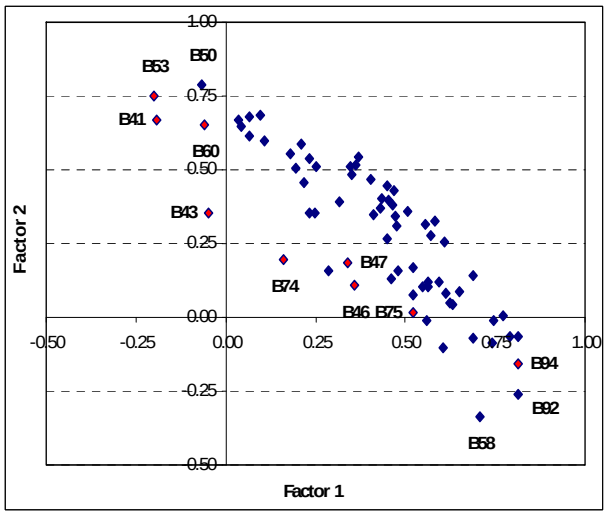


Graph 4.12: Scatter plot of unrotated factor loadings (international responses to Section B)

Graphs 4.13 and 4.14 below show scatter plots of the rotated factor loadings (pattern) for the same two factor solution of the remaining 69 items included in Section B of the Phase 2 questionnaire.



Graph 4.13: Scatter plot of rotated factor loadings (South African responses to Section B)



Graph 4.14: Scatter plot of rotated factor loadings (international responses to Section B)

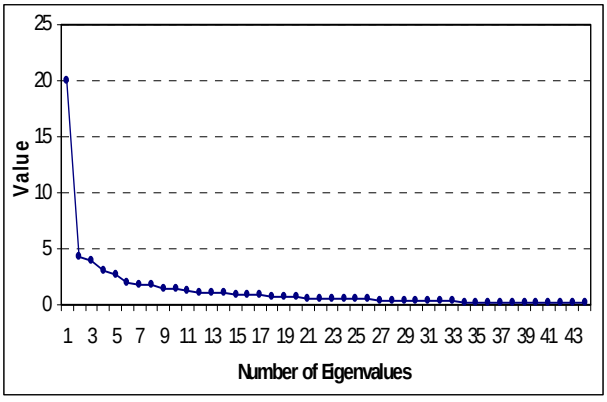
The variance explained by the first factor for the South African and international responses were 20.8594 and 27.1236 respectively. Factor 2 merely accounted for 4.1226 and 3.8497 of the total variance for the same population groupings respectively. Communalities of the variables

with the factors ranged from 0.6343 (Item B96) to 0.1586 (Item B47) for the South African responses and from 0.6479 (Item B37) to 0.0951 (Item B74) for the international group.

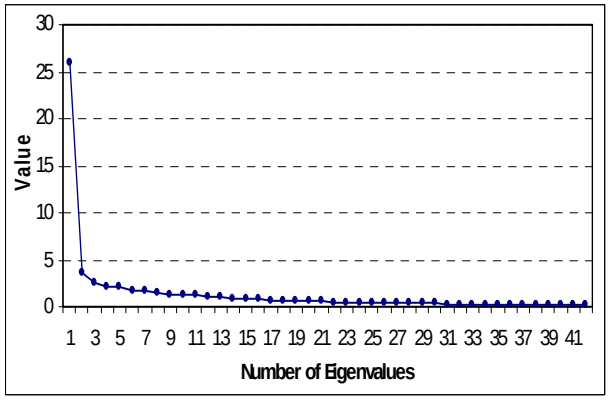
In addition to the above, chi-square tests (for homogeneity and for independence) of the various items highlighted in red in Graphs 4.12 to 4.14 above were done in order to confirm the significant differences between the responses from the two population groups. In the interest of brevity, the complete set of Section B results in this regard is not reported here, since the detail of a similar process has been fully described in the discussion above on the statistical results for Section A of the assessment tool. This iterative process resulted in the exclusion of 13 items originally included in Section B of the questionnaire for the purposes of further analysis. These excluded items are summarised in Table 4.33 below.

4.6.6.2 Final factor solution and loadings (Section B)

After the exclusion of 13 of the original items included in Section B of the Phase 2 questionnaire, a final round of factor analysis was performed. Eigenvalues of 20.0539 (explaining 33.42% of the total variance) and 25.8892 (accounting for 43.15% of the total variance) were obtained for the primary factor associated with the South African and international responses respectively. The resulting eigenvalues for a potential second factor for each of the population groups were 4.3229 and 3.5950 (each accounting for 7.20% and 5.99% of total variance respectively). Scree plots of the relevant eigenvalues are shown in Graphs 4.15 and 4.16 below.



Graph 4.15: Scree plot of final eigenvalues (South African responses to Section B)



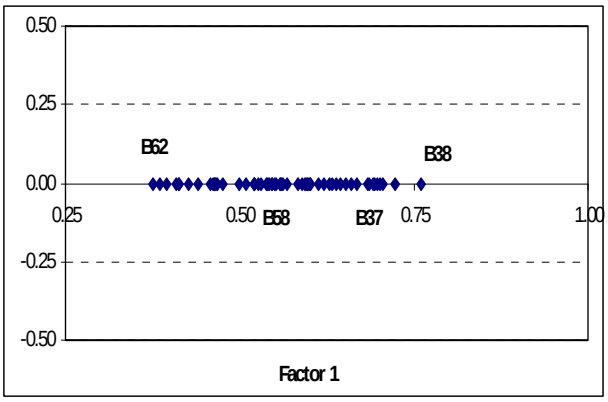
Graph 4.16: Scree plot of final eigenvalues (international responses to Section B)

Three different numbers of factors would be retained if the factor extraction criteria discussed before was applied. The number of factors to be retained for each of the three factor extraction criteria applied was:

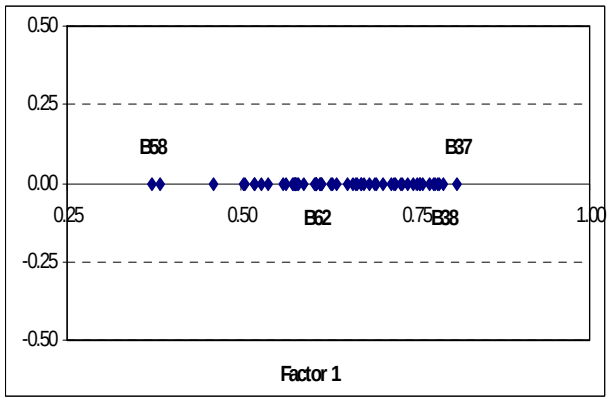
- twelve (latent root criterion):
- six (percentage of variance criterion); and
- one (Cattell's scree test).

However, when the relevance of two or more factors was analysed, it was determined that the identified primary factor was sufficiently dominant (and compliant with the Cattell criterion) and that a single factor was the best descriptor of the construct.

Scatter plots of the rotated factor loadings (pattern) for the further reduced number of 60 items included in Section B of the Phase 2 questionnaire are shown in Graphs 4.17 and 4.18 below.



Graph 4.17: Scatter plot of final rotated factor loadings (South African responses to Section B)



Graph 4.18: Scatter plot of final rotated factor loadings (international responses to Section B)

Table 4.25 below gives a summary of the sorted rotated factor loadings for the two target audiences and the combined group in relation to the construct underpinning Section B. Factor rotation was done using the direct quartimin (oblique rotation) method.

Table 4.25: Section B - sorted rotated factor loadings (South African, international and combined group respondents)

SECTION B					
South African responses		International responses		Combined group	
Question	Factor loadings	Question	Factor loadings	Question	Factor loadings
B38	0.761	B37	0.809	B38	0.773
B83	0.724	B38	0.790	B33	0.755
B84	0.706	B87	0.784	B37	0.749
B33	0.701	B77	0.783	B87	0.743
B87	0.698	B96	0.778	B77	0.723
B64	0.693	B36	0.776	B85	0.716
B57	0.692	B33	0.770	B36	0.695
B85	0.685	B79	0.760	B84	0.675
B37	0.684	B55	0.756	B96	0.673
B68	0.668	B85	0.756	B76	0.671
B88	0.661	B76	0.753	B78	0.671
B34	0.653	B70	0.747	B83	0.670
B81	0.644	B81	0.738	B61	0.669
B50	0.638	B78	0.731	B55	0.668
B90	0.633	B97	0.730	B81	0.665
B67	0.628	B86	0.722	B97	0.665
B61	0.622	B31	0.720	B35	0.662
B51	0.613	B61	0.715	B79	0.659
B40	0.602	B71	0.704	B88	0.654
B35	0.602	B35	0.694	B86	0.653
B30	0.600	B89	0.691	B57	0.650
B77	0.598	B30	0.684	B30	0.643
B69	0.596	B54	0.676	B32	0.639
B32	0.593	B72	0.673	B31	0.636
B86	0.590	B56	0.673	B34	0.635
B97	0.584	B88	0.667	B54	0.631
B36	0.568	B32	0.665	B64	0.625
B54	0.562	B63	0.660	B71	0.622
B92	0.561	B34	0.653	B70	0.617
B76	0.559	B98	0.636	B56	0.614
B52	0.558	B57	0.631	B90	0.608
B48	0.552	B84	0.629	B40	0.607
B58	0.551	B39	0.616	B68	0.605
B55	0.547	B52	0.616	B89	0.597
B78	0.547	B80	0.614	B52	0.593
B42	0.543	B83	0.614	B50	0.585
B29	0.540	B67	0.608	B67	0.584
B56	0.539	B62	0.608	B98	0.584
B66	0.530	B69	0.608	B42	0.579

		B39	0.526	B90	0.607	B72	0.576
		B96	0.521	B42	0.606	B69	0.575
		B31	0.520	B59	0.590	B66	0.566
		B28	0.520	B40	0.582	B39	0.561
		B89	0.510	B68	0.580	B26	0.547
		B80	0.499	B50	0.577	B48	0.547
		B98	0.476	B28	0.577	B29	0.545
		B79	0.468	B26	0.576	B80	0.544
		B44	0.466	B66	0.575	B92	0.539
		B27	0.464	B64	0.574	B28	0.529
		B65	0.464	B82	0.565	B45	0.521
		B26	0.463	B27	0.561	B62	0.521
		B71	0.458	B45	0.539	B59	0.519
		B45	0.440	B92	0.528	B63	0.519
		B72	0.427	B29	0.519	B82	0.517
		B82	0.413	B65	0.518	B27	0.514
		B63	0.412	B95	0.506	B51	0.506
		B59	0.410	B48	0.503	B65	0.493
		B95	0.396	B44	0.461	B44	0.48
		B70	0.386	B51	0.383	B58	0.463
		B62	0.375	B58	0.371	B95	0.457
Cronbach's alpha coefficient (all variables)		**0.965**		**0.977**		**0.974**	
Variance explained		**19.3934**		**25.3313**		**22.5574**	
Cumulative proportion of variance	In data space	**32.32%**		**42.22%**		**37.58%**	
	In factor space	**100%**		**100%**		**100%**	
Factor score covariance		**96.90%**		**98.00%**		**97.35%**	

It can be observed from the results presented in Table 4.25 above that all of the factor loadings exceed the required minimum threshold level of 0.45 for a sample size of 150, at the 0.05 significance level. The communalities of the variables with the primary factor range from 0.1373 (Item B58) to 0.6540 (Item B37).

4.6.6.3 Scale naming / description (Section B)

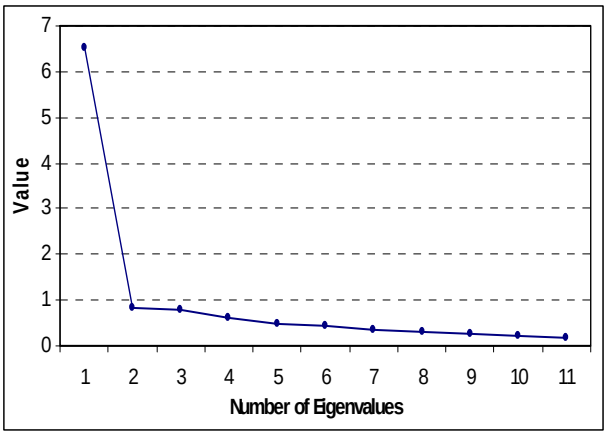
Appendix B contains more descriptive information concerning the construct for Section B which is intended to measure change dynamics during the planning phase of the project. The underlying factor for Section B can best be described as the "**creation of an enabling environment for change through communication and engagement**". Furthermore, some of the most important sub-elements of this construct are summarised below

- reliable, consistent, open, quality and adequate communication from leadership and the project management team on the vision, scope and impact of all potential organisational changes to maintain enthusiasm and comprehension for the project throughout;
- conducting comprehensive risk analysis, together with managing risk in accordance with mitigation strategies;
- prioritising and dealing with competing issues by acting quickly to resolving emerging problems;
- ensuring role clarity, orientation and continuous cooperation between line, function and project management;
- using and maintaining an appropriate change management methodology, including the provision of infrastructure, tools, expertise and adequate resources to empower and support change agents;
- assessing training needs in relation to new tools required for project success and (customised) training of affected employees on new requirements to ensure adequate capacity;
- fostering desired organisational values;
- clear migration and stakeholder engagement planning;
- aligning top management behaviour with the goals and outcomes of the project; and
- exploiting synergies between top management and the project team.

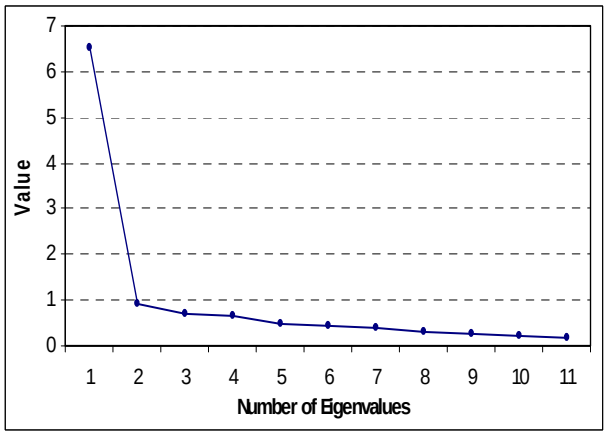
4.6.7 Exploratory factor analysis results (Section C)

4.6.7.1 Latent roots and factor loadings (Section C)

The first round factor analysis of responses to Section C of the questionnaire resulted in primary factors with eigenvalues of 6.5355 and 6.5013 (South African and international respondents) each accounting for more than 59% of the total variance. Potential second factors with an eigenvalues of 0.8463 and 0.9305 were both eliminated based on the latent root criterion. The relevant scree plots of the eigenvalues are shown in Graphs 4.19 and 4.20 overleaf.

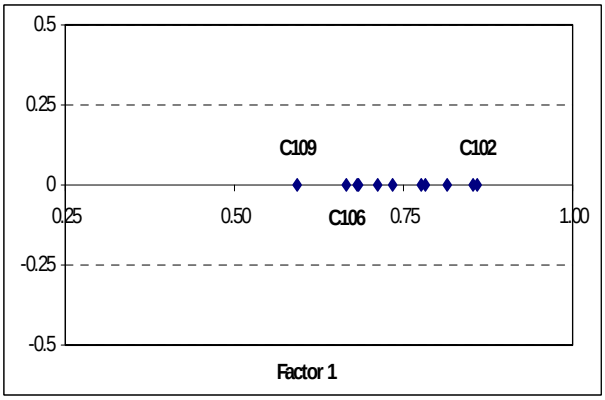


Graph 4.19: Scree plot of eigenvalues (South African responses to Section C)

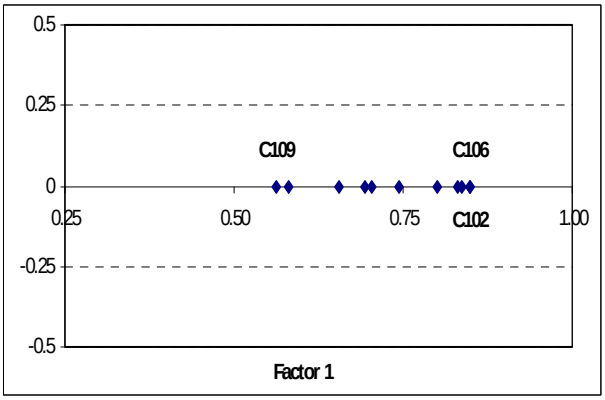


Graph 4.20: Scree plot of eigenvalues (international responses to Section C)

Scatter plots of the rotated factor loadings (pattern) for the original 11 items included in Section C of the Phase 2 questionnaire are shown in Graphs 4.21 and 4.22 below.



Graph 4.21: Scatter plot of rotated factor loadings (South African responses to Section C)



Graph 4.22: Scatter plot of rotated factor loadings (international responses to Section C)

Table 4.26 overleaf gives a summary of the sorted rotated (using the direct quartimin, oblique rotation method) factor loadings for the two target audiences and the combined group in relation to the construct underpinning Section C.

Table 4.26: Section C - sorted rotated factor loadings (combined group n = 172)

		SECTION C					
		South African responses		International responses		Combined group	
		Question	Factor loadings	Question	Factor loadings	Question	Factor loadings
		C102	0.858	C106	0.849	C102	0.856
		C104	0.852	C102	0.848	C100	0.826
		C100	0.815	C100	0.836	C107	0.814
		C107	0.783	C107	0.831	C104	0.794
		C103	0.776	C99	0.800	C106	0.765
		C105	0.734	C104	0.744	C99	0.764
		C99	0.711	C108	0.703	C105	0.717
		C101	0.683	C105	0.693	C103	0.700
		C108	0.682	C103	0.655	C108	0.686
		C106	0.665	C101	0.580	C101	0.643
		C109	0.593	C109	0.562	C109	0.586
Cronbach's alpha coefficient (all variables)		**0.930**		**0.929**		**0.931**	
Variance explained		**6.1133**		**6.0776**		**6.1073**	
Cumulative proportion of variance	In data Space	**55.58%**		**55.25%**		**55.52%**	
	In factor Space	**100%**		**100%**		**100%**	
Factor score covariance		**94.00%**		**94.20%**		**93.90%**	

As can be seen from the above results, with a minimum value of 0.586 for the combined group, all the factor loadings exceed the required minimum threshold level of 0.45 for a sample size of 150, at the 0.05 significance level as previously recommended. The communalities of the variables with the primary factor range from 0.3153 (Item C109) to 0.7205 (Item C106) with an average of 0.5552.

4.6.7.2 Scale naming / description (Section C)

Section C of the assessment tool measures change dynamics during the implementation phase of the project. The construct for Section C can most accurately be labelled as "**executing to achieving the stated objectives and outcomes of the project**". The most important aspect of the underlying factor is the need for properly managed change throughout the process. Additional sub-elements are

- fostering organisational integration without fragmented, departmental interests and with inclusive and transparent decision-making;

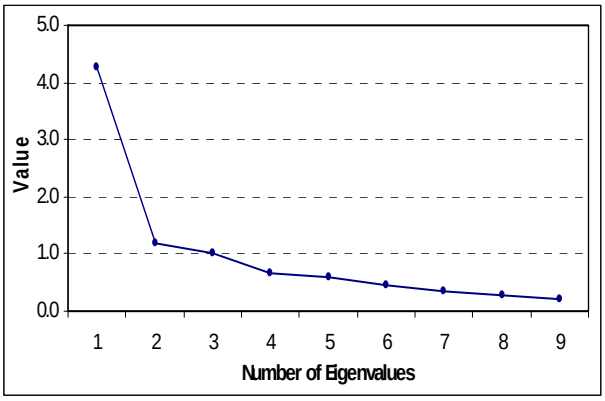
- focusing on perception management and management of anxiety associated with change (loss of positional power and job losses);
- continuously promoting and communicating of new values to all stakeholders; and
- motivating staff according to their needs.

Section C of Appendix B contains more descriptive information surrounding the construct for the implementation phase of the project.

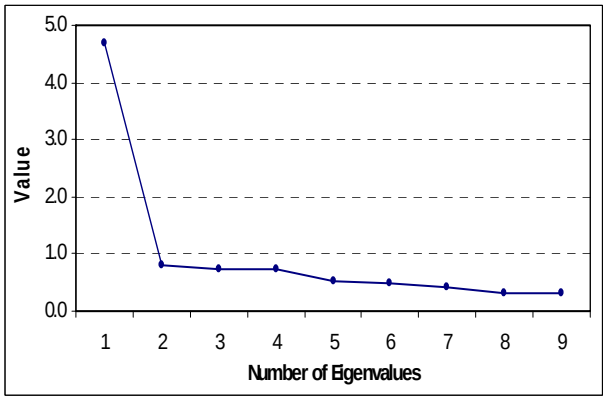
4.6.8 Exploratory factor analysis results (Section D)

4.6.8.1 Latent roots and factor loadings (Section D)

Factor analysis on the South African population responses to Section D of the instrument resulted in three potential factors with eigenvalues of 4.2554, 1.1926 and 1.0237. These factors would account for 47.28%, 13.25% and 11.37% of the total variance. Similarly, the most important latent root eigenvalues for the international population were 4.6775 and 0.8056 (each explaining 51.97% and 8.95% of the total variance respectively). The relevant scree plots of the eigenvalues (all the items originally included in Section D of the Phase 2 questionnaire) are shown in Graphs 4.23 and 4.24 below.



Graph 4.23: Scree plot of eigenvalues (South African responses to Section D)



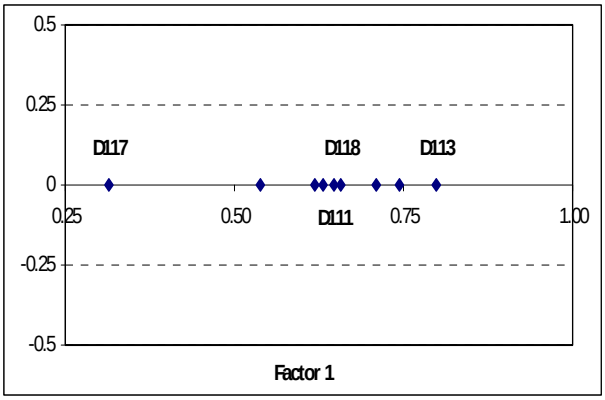
Graph 4.24: Scree plot of eigenvalues (international responses to Section D)

The factor extraction criteria already discussed indicated that the following number of factors should be retained

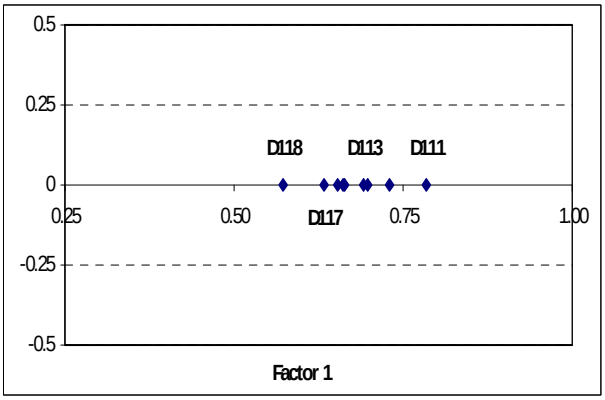
- latent root criterion:

- o South African population - three factors to be retained;
- o international population - one factor to be retained;
- percentage of variance criterion - two factors to be retained; and
- Cattell's scree test - one factor to be retained.

When the relevance of two or more factors was analysed, it was determined that the identified dominant factor was adequate based on the latent root and Cattell criterion. It was decided to use a single factor since it was best suited for the purposes of this study and was consistent with the theoretical construct. Scatter plots of the rotated factor loadings (pattern) for the original nine items included in Section D of the Phase 2 questionnaire are shown in Graphs 4.25 and 4.26 below.



Graph 4.25: Scatter plot of rotated factor loadings (South African responses to Section D)



Graph 4.26: Scatter plot of rotated factor loadings (international responses to Section D)

Table 4.27 below gives a summary of the sorted rotated (direct quartimin, oblique rotation method) factor loadings for the two target audiences and the combined group in relation to the construct underpinning Section D.

Table 4.27: Section D - sorted rotated factor loadings (combined group n = 172)

SECTION D					
South African responses		**International responses**		**Combined group**	
Question	**Factor loadings**	**Question**	**Factor loadings**	**Question**	**Factor loadings**
D113	0.798	D111	0.784	D113	0.751
D114	0.744	D114	0.730	D114	0.749
D116	0.709	D110	0.698	D116	0.717

	D118	0.658	D113	0.692	D118	0.716
	D111	0.647	D115	0.664	D111	0.656
	D112	0.631	D116	0.662	D112	0.654
	D115	0.618	D112	0.654	D115	0.645
	D110	0.538	D117	0.633	D110	0.588
	D117	0.315	D118	0.573	D117	0.475
Cronbach's alpha coefficient (all variables)	**0.854**		**0.884**		**0.875**	
Variance explained	**3.713**		**4.1482**		**3.9975**	
Cumulative proportion of variance – In data Space	**41.26%**		**46.09%**		**44.42%**	
Cumulative proportion of variance – In factor Space	**100%**		**100%**		**100%**	
Factor score covariance	**87.90%**		**89.00%**		**88.50%**	

It is evident from the results presented in Table 4.27 above that all factor loadings exceed the required minimum threshold level of 0.45 for a sample size of 150, at the 0.05 significance level, as required. The communalities of the variables with the primary factor range from 0.2316 (Item D117) to 0.5646 (Item D114), with an average of 0.4442.

4.6.8.2 Scale naming / description (Section D)

Appendix B contains more detailed information on the various elements addressed by the construct for Section D which is best described as "**embedding and institutionalising the changes effected through the project**". Section D measures the change dynamics during the post-implementation phase of the project. Briefly, some of the most important aspects of the construct are the need for the following:

- measuring and monitoring the impact of change on a continual basis;
- continuously providing (desired) behavioural training;
- encouraging, accepting, formalising and reinforcing of the new organisational state, culture and desired organisational behaviour through performance management and incentive systems; and
- continuously communicating and sensitising people about the change.

4.6.9 Final item and reliability analysis on remaining items

After the abovementioned processes of factor analysis, the initial item analysis was repeated on the remaining scale items for both samples. Tables 4.28 to 4.31 contain the information for the two target populations.

Table 4.28: Overall scale statistics (South African responses)

	Section			
	A	B	C	D
Number of items	23	60	11	9
Number of examinees	85	85	85	85
Mean	3.481	3.484	3.255	3.398
Variance	0.361	0.263	0.501	0.355
Standard deviation	0.601	0.513	0.707	0.596
Skewness	0.015	0.302	-0.230	-0.381
Kurtosis	-0.705	-0.359	-0.110	0.474
Minimum	2.217	2.450	1.200	1.667
Maximum	5.000	4.950	5.000	5.000
Median	3.522	3.433	3.364	3.556
Cronbach's alpha coefficient	0.929	0.965	0.930	0.854

Table 4.29: Scale intercorrelation statistics (South African responses)

		Section			
		A	B	C	D
Section	A	1.000	0.844	0.765	0.729
	B	0.844	1.000	0.726	0.680
	C	0.765	0.726	1.000	0.825
	D	0.729	0.680	0.825	1.000

Table 4.30: Overall scale statistics (international responses)

	Section			
	A	B	C	D
Number of items	23	60	11	9
Number of examinees	87	87	87	87
Mean	3.731	3.708	3.540	3.702
Variance	0.412	0.357	0.552	0.371
Standard deviation	0.642	0.598	0.743	0.609
Skewness	-0.745	-0.560	-1.227	-0.951
Kurtosis	-0.015	-0.273	1.402	0.494
Minimum	1.913	2.217	1.364	2.111
Maximum	5.000	4.917	4.727	4.889
Median	3.826	3.783	3.727	3.889
Cronbach's alpha coefficient	0.941	0.977	0.929	0.884

Table 4.31: Scale intercorrelation Statistics (international Responses)

		Section			
		A	B	C	D
Section	A	1.000	0.946	0.777	0.704
	B	0.946	1.000	0.808	0.705
	C	0.777	0.808	1.000	0.823
	D	0.704	0.705	0.823	1.000

From Tables 4.28 and 4.30, above, it can be seen that the following scale statistics for the responses to Sections A and B of the assessment tool have all increased (compared to the original results reported above) as a result of the excluding the items reported in Table 4.33. The median statistics have also changed between -0.36% and 0.80%:

- Mean - by between 0.03% and 0.65%
- Variance - by between 1.12% and 16.21%
- Standard deviation - by between 0.56% and 7.80%

The shape of the various distributions also did not change significantly as a result of the item omissions, based on the skewness and kurtosis results presented above, even though the skewness results for the South African responses to section A and B of the questionnaire changed by -77.84% and -19.48% respectively (the distribution became more symmetrical). The international responses to Section B became less symmetrical by 23.49%. No significant skewness problem arose from the final item analysis results shown above. Similarly, the kurtosis results indicated that the results of the South African Section A and B responses were even more flat (or platykurtical) than in the original scenario, especially in the instance of the South African Section B responses. The distributions for the international population group became more peaked than before, but still within the previously discussed *sek* limits.

The Cronbach alpha coefficients for the reduced number of scale items in Sections A and B of the assessment instrument varied between -0.49% and 0.13%, compared to the results obtained and reported above in relation to the original Phase 2 questionnaire. The final Cronbach alpha coefficients for all sections of both the South African (α's between 0.8535 and 0.9651) and international responses (α's between 0.8837 and 0.9769) that resulted from the reduced number of items in Sections A and B of the assessment tool are still considered highly acceptable, compared to the guideline of alpha > 0.70 (Nunnally & Bernstein, 1994; Smit, 1991).

From Tables 4.29 and 4.31, it is also clear that the scale inter-correlations were relatively high (and that these statistics for the international grouping were higher than those for the South African responses). This was not unexpected, since strong links exists between the respective project management life cycle phases. This result was congruent with the theoretical construct.

The final round of item analysis confirmed that the items of the assessment tool had acceptable levels of internal consistency.

4.6.10 Structural equivalence (Tucker's phi results)

In exploratory factor analysis, construct (structural) equivalence is defined operationally as factorial invariance (Meredith 1993; Rensvoeld & Cheung 1998; Ten Berge 1986). This definition implies that a construct is equivalent across groups if the factor loadings of the items on the latent factor are invariant across groups. The agreement between factor loadings of items from two different groups (in this case the South African and international response data) can be expressed via Tucker's coefficient of agreement or, phi (Tucker, 1951). The index measures the identity of two factors by a positive, multiplying constant. The following formula is used to compute Tucker's phi (Van de Vijver & Leung, 1997):

$$p_x = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2 \sum y_i^2}}$$

where

x_i = rotated factor loadings for South African data; and

y_i = rotated factor loadings for international data

Unfortunately, the index has an unknown sampling distribution, which makes it impossible to construct statistical confidence intervals. Some empirical rules have been proposed. Values higher than 0.95 are taken to indicate factorial invariance, whereas values lower than 0.90 (Van de Vijver & Poortinga, 1994) or 0.85 (Ten Berge, 1986) are indicative of non-negligible incongruities. This index is, however, accurate enough to examine factorial similarity at a global level (Van de Vijver & Leung, 1997).

The difference in factor loadings per item between the two population groups and Tucker's phi results for each section of the assessment tool are included in Table 4.32 below.

Table 4.32: Construct equivalence of the different sections of the assessment tool

Section A		Section B		Section C		Section D	
Concept / initiation Phase		Planning phase		Implementation phase		Post implementation phase	
Quest-ion	Difference in factor loadings	Quest-ion	Difference in factor loadings	Quest-ion	Difference in factor loadings	Quest-ion	Difference in factor loadings
A1	-0.194	B26	0.113	C99	0.089	D110	0.160
A2	-0.037	B27	0.097	C100	0.021	D111	0.137
A3	0.085	B28	0.057	C101	-0.103	D112	0.023

A4	0.187	B29	-0.021	C102	-0.010	D113	-0.106
A5	0.143	B30	0.084	C103	-0.121	D114	-0.014
A6	0.005	B31	0.200	C104	-0.108	D115	0.046
A8	0.077	B32	0.072	C105	-0.041	D116	-0.047
A9	0.017	B33	0.069	C106	0.184	D117	0.318
A10	0.004	B34	0.000	C107	0.048	D118	-0.085
A11	0.177	B35	0.092	C108	0.021		
A12	0.198	B36	0.208	C109	-0.031		
A13	0.011	B37	0.125				
A14	0.128	B38	0.029				
A16	0.019	B39	0.090				
A17	-0.188	B40	-0.020				
A18	-0.032	B42	0.063				
A19	-0.098	B44	-0.005				
A20	-0.189	B45	0.099				
A21	-0.067	B48	-0.049				
A22	-0.140	B50	-0.061				
A23	0.256	B51	-0.230				
A24	0.173	B52	0.058				
A25	0.237	B54	0.114				
		B55	0.209				
		B56	0.134				
		B57	-0.061				
		B58	-0.180				
		B59	0.180				
		B61	0.093				
		B62	0.233				
		B63	0.248				
		B64	-0.119				
		B65	0.054				
		B66	0.045				
		B67	-0.020				
		B68	-0.088				
		B69	0.012				
		B70	0.361				
		B71	0.246				
		B72	0.246				
		B76	0.194				
		B77	0.185				
		B78	0.184				
		B79	0.292				
		B80	0.115				
		B81	0.094				
		B82	0.152				
		B83	-0.110				
		B84	-0.077				
		B85	0.071				
		B86	0.132				
		B87	0.086				
		B88	0.006				
		B89	0.181				
		B90	-0.026				
		B92	-0.033				
		B95	0.110				

			B96	0.257				
			B97	0.146				
			B98	0.160				
Proportionality coefficient per factor (Tucker's phi)		**0.9767**		**0.9813**		**0.9921**		**0.9800**
Identity coefficient per factor		**0.98**		**0.97**		**0.99**		**0.98**

Inspecting Table 4.32 shows that the Tucker's phi-coefficients for the South African and the international groups were all acceptable (> 0.95). Therefore, it can be deduced that the factor structures for all four sections of the assessment tool were equivalent for the two groups. This may be the result of the fact that respondents from both groups have been exposed to the field of project management due to its prominence over the last few years. Another contributing factor could be the fact the South Africa has become part of the global arena over the past decade. Therefore, South African project managers have interacted with their international counterparts and gained experience in the best practice application of the project management methodology and its various components.

Table 4.33: Summary of measurement items omitted during the next phase of the assessment tool development

Section	Item	Measurement item description
A	A7	A sense of urgency is communicated and understood by each stakeholder
	A15	Priorities are identified and discussed by all stakeholders and the project team
B	B41	Stakeholders, together with the project team, are involved in bringing about change management
	B43	The project manager manages the participation of all project team members and stakeholders as an integral part of the project plan
	B46	Project team members understand the company culture
	B47	Project team members conduct themselves in such a way as not to alienate the organisation
	B49	Project teams communicate and celebrate early gains (“quick wins”)
	B53	The project manager selects competent people to become part of the project team
	B60	Stakeholders are continuously involved to ensure that the project is aligned to both organisational and political agendas
	B73	A multi-disciplinary team comprising all stakeholders is put together for the project
	B74	The project success is measured quantitatively
	B75	The project success is measured qualitatively

	B91	Responsible project team members take ownership of data collection and data feedback
	B93	Top management has a medium-to-long term focus
	B94	Top management does not place emphasis on a “quick-fix” mentality
C	None	
D	None	

4.6.11 Responses to the open question included in the questionnaire

An open question was included in Section E of the questionnaire in an attempt to collect any additional change management aspects that respondents viewed as pertinent to the study. The open question read as follows:

- “Please mention any other aspects that you consider to be relevant to the measurement of change dynamics within the project management domain THAT RUNS CONTINUOUSLY THROUGHOUT ALL THE PROJECT PHASES, e.g. communication, risk management, etc.“

The responses from the target population groups to the open question mentioned above amounted to the following input which is summarized in Table 4.34 below.

Table 4.34: Summary of open question responses (Section E of the questionnaire)

Change management element	Number of responses
Effective communication to ensure continuous improvement rather that corrective action	1
Team involvement throughout	1
Continuous focus on strategy (including mission, vision, values, etc)	2
Transparency in decision-making	1
Stakeholders and their buy-in to be regarded as equally important and treated as such	3
Continuity of project leadership	1
Pre-planning and sharing the project scope with all stakeholders	1
Proper risk management throughout the course of the project	2
Formalisation of roles of the project management team	1
Recognition for the need to change	1
Organizational maturity	1
Knowledge sharing	1
Corporate culture to include values of trust and empowerment	1
Maintenance of business continuity during the project duration	1

Because of the rather limited response from the target population in this regard, it was not considered as statistically significant and was therefore not included in the final assessment tool. However, it is presented here as part of the final research report in order to provide comprehensive findings on the response to the questionnaire.

4.6.12 Analysis of variance (ANOVA) technique

Subsequent to the item, reliability, factor and structural equivalence analyses, an ANOVA, utilising SAS/STAT® statistical analysis software (version 9.2), was administered to determine whether any tendencies were apparent for different demographic elements as set out in the assessment instrument for the identified factor across the four phases of a project life cycle.

The data was clustered in the following way to combine sets of data for each of the South African and international groups, to make it meaningful in terms of statistical analysis for the ANOVA. Table 4.35 contains this categorisation:

Table 4.35: Demographic data categorisation

Main category	Sub-category
Age (E1)	Equal to or less than 30 years of age
	31 to 40 years
	41 to 50 years
	51 years and older
Gender (E2)	Male
	Female
Length of service in sector (E3)	1 to 10 years
	11 to 20 years
	21 years or more
Economic sector (E4)	Manufacturing
	Electricity, gas and water
	Transport, storage and communication
	Financial intermediation, insurance, real estate and business services
	Other
Qualifications (E5)	Grade 12 (Standard 10) or equivalent to National diploma/National higher diploma
	Bachelor's degree or equivalent qualification
	Honours degree or equivalent qualification
	Master's or Doctoral degree or equivalent qualification

Organisational level (E6)	Senior management
	Middle management
	Supervisory
	Other
Years of project management Experience as a project team member (E8)	1 to 10 years
	11 to 15 years
	16 and more years
Years of project manager experience (E9)	0 to 5 years
	6 to 10 years
	11 and more years

The purpose of the analysis of variance is to test differences in means (of groups or variables) for statistical significance (StatSoft, 2006). "Analysis of variance (ANOVA) is used to uncover the main and interaction effects of categorical independent variables (called "factors") on an interval dependent variable. The new general linear model GLM implementation of ANOVA also supports categorical dependents" (Garson, 2006). The variables that are measured (in this case the scale items) are called **dependent** variables. Variables that are manipulated, controlled or divided into groups that can be compared through some other criterion are called **factors** or **independent** variables (StatSoft, 2006).

ANOVA relies on the fact that variances (computed as the sum of squared (SS) deviations from the overall mean, divided by one less than the sample size or n-1), can be divided up into components. This is accomplished by partitioning the total variance into the components that are due to true random errors (within-group *SS*) and components that are due to differences between means. These difference between means variance components are then tested for statistical significance, and if significant, the null hypothesis of no differences between means is rejected, and the alternative hypothesis that the means (in the population) are different from each other is accepted (StatSoft, 2006).

The results of the ANOVA are presented in an ANOVA table that is likely to resemble the one in Table 4.36.

Table 4.36: Example of an ANOVA results table

Source	df	SS	MS	F-ratio	Prob
Between groups	3	1234.56	345.67	12.567	0.0034
Within groups	25	2345.67	56.78		
Total	28	3580.23			

An ANOVA table contains columns labelled “Source” or “Source of variation”, “df” or “degrees of freedom”, “SS” or “Sum of squares”, “MS” or “Mean square”, “F-value” or “F-ratio” (a ratio of explained variance versus error) and “p”, “P-value”, “prob”, “probability”, “sig.”, “sig. of F” or “Pr > F” (the probability of an F-ratio of the magnitude observed). The “Between groups”, “Model” or “Effect” row represents what is often called the “explained variance” or “systematic variance” that is due to the differences in means between the groups of the independent variable. The “Within groups” or “Error” variance represents what is often called “error variance”. This is the variance within the groups, in other words, variance that is not due to the independent variable (Hall, 1998). In interpreting ANOVA table results, the row labelled "Between groups", which has a probability value associated with it, is the most important in the initial ANOVA analysis, particularly the values appearing in the last two columns (Stockburger, 1998).

In an ANOVA, the F-ratio is the statistic used to test the null hypothesis that the group means of the dependent variable are not significantly different from one another (in other words, that the effects are not real) (Garson, 2006). The F-ratio can be interpreted as a measure of how different the means are relative to the variability within each sample. The larger this value, the greater the likelihood that the differences between the means are due to something other than chance (Stockburger, 1998). If the computed F-value is approximately 1.0, differences in group means are merely random variations. If the computed F-score is significantly greater than 1.0, then there is more variation between groups than within groups, from which one can infer that the grouping variable is significant. If the F-score is sufficiently above 1.0, it will be found to be significant in a table of F-values. A "Sig." or "p" probability value of 0.05 (or any other critical value (α) specified for the study) or less on the F test, conventionally leads to the conclusion that the effect is real (significant) and not due to chance sampling, while any value greater than this value will result in negligible effects. If F is significant, we can conclude that there are differences in group means, indicating that the independent variable has an effect on the dependent variable (Garson, 2006).

To summarise, the purpose of the ANOVA test is to ascertain whether there are significant differences between various groups. The GLM procedure in the SAS/STAT® software package was used for this purpose. Univariate GLM is the version of the GLM now often used to implement two long-established statistical procedures - ANOVA and analysis of covariance (ANCOVA). Univariate GLM, ANOVA, and ANCOVA all deal with a situation where there is one dependent variable and one or more independent variables (Garson, 2006). The overall significance level was specified as “alpha = 0.05”.

4.6.12.1 ANOVA table results for all four project phases (Sections A to D)

The ANOVA table results for all four sections of the assessment tool are given in Tables 4.37 to 4.44 below.

Table 4.37: Overall ANOVA results for Section A (dependent variable) of the measuring instrument

		SECTION A			
Source of variation	**Degrees of freedom (df)**	**Sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
Model	19	24.3332	1.2807	4.53	< 0.0001
Error	144	40.6855	0.2825		
Corrected total	163	60.0187			

Table 4.38: ANOVA results for Section A of the measuring instrument by independent variables

Source of variation	**Degrees of freedom (df)**	**Type III sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
E1 (Age)	3	0.4409	0.1470	0.52	0.6691
E2 (Gender)	1	5.1927	5.1927	18.38	< 0.0001
E3 (Work history in sector)	2	0.0016	0.0008	0.00	0.9971
E4 (Economic sector)	4	5.7822	1.4456	5.12	0.0007
E5 (Qualifications)	2	6.8480	3.4240	12.12	< 0.0001
E6 (Organisational level)	2	0.9522	0.4761	1.69	0.1891
E8 (PM Experience as team member)	2	1.5457	0.7729	2.74	0.0682
E9 (Experience as project manager)	2	0.4207	0.2104	0.74	0.4768
Combined group	1	0.3869	0.3869	1.37	0.2438

Note [1]: Demographic E7 (the "home language" section in the questionnaire, which contains all eleven official South African languages) has been omitted from this analysis for all sections (A to D) because it is not possible to compare the South African and international response data in this regard.

From Table 4.38 it can be seen that the following demographic categories for Section A, all have Pr values greater than F-values (or ratios) which are well above the 0.05 cut-off level:

- E1 (age) - 0.6691;
- E3 (work history in the sector) - 0.9971;
- E6 (organisational level) - 0.1891;
- E8 (project management experience as a team member) - 0.0682 (marginal);
- E9 (experience as project manager) - 0.4768; and

- the combined group; - 0.2438.

From these values, it can be concluded that the means of the demographic subgroup are not significantly different from one another and that the above independent variables do not have a significant effect on the dependent variable (Section A – concept/initiation phase of the project).

The Pr > F-values for E2 (gender), E4 (economic sector) and E5 (qualifications), set out in Table 4.38, are all well below the 0.05 cut-off threshold and indicate that gender, economic sector and qualifications all have a statistically significant effect on the concept/initiation phase of the project. The statistical differences between the subgroup are explained in more detail in Table 4.45 in section 4.6.12.2 below.

Table 4.39: Overall ANOVA results for Section B (dependent variable) of the measuring instrument

		SECTION B			
Source of variation	**Degrees of freedom (df)**	**Sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
Model	19	19.3155	1.0166	4.45	< 0.0001
Error	144	32.8907	0.2284		
Corrected total	163	52.2062			

Table 4.40: ANOVA results for Section B of the measuring instrument by independent variables

Source of variation	**Degrees of freedom (df)**	**Type III sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
E1 (Age)	3	1.1197	0.3732	1.63	0.1841
E2 (Gender)	1	4.6345	4.6345	20.29	< 0.0001
E3 (Work history in sector)	2	0.0466	0.0233	0.10	0.9030
E4 (Economic sector)	4	4.1504	1.0376	4.54	0.0017
E5 (Qualifications)	2	4.0493	2.0247	8.86	0.0002
E6 (Organisational level)	2	1.0278	0.5139	2.25	0.1091
E8 (PM Experience as team member)	2	0.3216	0.1608	0.70	0.4963
E9 (Experience as project manager)	2	0.3943	0.1971	0.86	0.4240
Combined group	1	0.4011	0.4011	1.76	0.1872

The ANOVA results reported for Section B in Table 4.40 are similar to the corresponding results reported for Section A in Table 4.38. With Pr > F-values greater than the 0.05 significant level,

the following independent variable demographics do not have a significant effect on the dependent variable, Section B – planning phase of the project:

- E1 (age);
- E3 (work history in the sector);
- E6 (organisational level);
- E8 (project management experience as a team member);
- E9 (experience as project manager); and
- the combined group.

From the Pr > F-values for E2 (gender), E4 (economic sector) and E5 (qualifications), set out in Table 4.40, it can be concluded that gender, economic sector and qualifications all have a statistically significant effect on the planning phase of the project. The significant differences between the means of the subgroups for the gender, economic sector and qualifications, are investigated in more detail in Table 4.46 in section 4.6.12.2 below.

Table 4.41: Overall ANOVA results for Section C (dependent variable) of the measuring instrument

		SECTION C			
Source of variation	**Degrees of freedom (df)**	**Sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
Model	19	31.0497	1.6342	4.03	< 0.0001
Error	144	58.4333	0.4058		
Corrected total	163	89.483			

Table 4.42: ANOVA results for Section C of the measuring instrument by independent variables

Source of variation	**Degrees of freedom (df)**	**Type III sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
E1 (Age)	3	2.8198	0.9399	2.32	0.0782
E2 (Gender)	1	6.7248	6.7248	16.57	< 0.0001
E3 (Work history in sector)	2	1.7155	0.8577	2.11	0.1245
E4 (Economic sector)	4	5.7804	1.4451	3.56	0.0084
E5 (Qualifications)	2	5.8647	2.9324	7.23	0.0010
E6 (Organisational level)	2	1.2280	0.6140	1.51	0.2237
E8 (PM Experience as team member)	2	3.0603	1.5301	3.77	0.0253
E9 (Experience as project manager)	2	0.1629	0.0815	0.20	0.8183
Combined group	1	0.6573	0.6573	1.62	0.2052

The ANOVA results for Section C are similar to those of sections A and B except in the instance of the E8 (project management experience as a team member) demographic group. The Pr > F-value of 0.0253 for E8 is less than the 0.05 cut-off level, indicating that project management experience as a team member (in addition to the gender, economic sector and qualifications grouping reported for sections A and B) has a statistically significant effect on the implementation phase of the project (Section C).

The statistically significant effects and differences between the means of the subgroups for the E2 (gender), E4 (economic sector), E5 (qualifications) and E8 (related team membership project management experience) demographic groupings, as indicated by the results set out in Table 4.42, are discussed in more detail in Table 4.47 in section 4.6.12.2 below.

Age, work history in the sector, organisational level, experience as project manager and the combined group do not have any statistically significant effects on the implementation phase of the project.

Table 4.43: Overall ANOVA results for Section D (dependent variable) of the measuring instrument

		SECTION D			
Source of variation	**Degrees of freedom (df)**	**Sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
Model	19	24.0182	1.2641	4.66	< 0.0001
Error	144	39.0854	0.2714		
Corrected total	163	63.1036			

Table 4.44: ANOVA results for Section D of the measuring instrument by independent variables

Source of variation	**Degrees of freedom (df)**	**Type III sum of squares**	**Mean squares**	**F-value**	**P-value (Pr > F)**
E1 (Age)	3	3.1805	1.0602	3.91	0.0102
E2 (Gender)	1	4.4651	4.4651	16.45	< 0.0001
E3 (Work history in sector)	2	0.1342	0.0671	0.25	0.7812
E4 (Economic sector)	4	4.3010	1.0753	3.96	0.0044
E5 (Qualifications)	2	2.7959	1.3980	5.15	0.0069
E6 (Organisational level)	2	0.0500	0.0250	0.09	0.9120
E8 (PM Experience as team member)	2	4.0980	2.0490	7.55	0.0008

E9 (Experience as project manager)	2	1.0951	0.5475	2.02	0.1368
Combined group	1	0.7952	0.7952	2.93	0.0891

The ANOVA results for Section D in Table 4.44 indicate that age (with a Pr > F-value of 0.0102 (< 0.05)), gender, economic sector, qualifications and project management experience as a team member all have a statistically significant effect on the post implementation phase of the project. Work history in the sector, organisational level, experience as project manager and the combined group do not have any statistically significant effects on the post implementation phase of the project.

As can be seen from the F-values for all four sections (A to D) of the measurement instrument in Table 4.37, Table 4.39, Table 4.41 and Table 4.43 above, all are well below the critical P-value cut-off level of 0.05. As stated before, it can be concluded that the groups are statistically significantly different from one another. However, two very important questions remain. First, which means are significantly different from which other means and, second, what were the actual scores of the group (Hall, 1998)?

When the effects are significant, the means must then be examined in order to determine the nature of the effects. "*Post hoc* tests" are procedures used to assist a researcher in this task, but the analysis is often fairly evidently determined simply by looking at the size of the various means (Stockburger, 1998). Tukey's *post hoc* tests, which are similar to a series of t-tests, can be used to address pair-wise comparison questions.

The Tukey honestly significant difference (HSD) test method is preferred when the number of groups is large, as it is a very conservative pair-wise comparison test. Researchers prefer to be conservative when a large number of groups threaten to inflate Type I errors (Garson, 2006). Tukey's HSD is the most conservative of the *post hoc* tests, since it is the most likely test to accept the null hypothesis of no group differences. Tukey's HSD test is based on the q-statistic (the studentised range distribution) and is limited to pair-wise comparisons. When one studies Tukey's *post hoc* test results tables, one notices that *post hoc* tests are consistent with what is observed in the means (Hall, 1998).

As part of the ANOVA analysis in this study, a Tukey test evaluation was done to compare the various sets of data. The GLM procedure in the SAS/STAT® software package was again used for this purpose. The results are set out in Tables 4.45 to 4.48 below:

4.6.12.2 ANOVA on Section A with Tukey's post hoc studentised range (HSD) test

Table 4.45: Section A ANOVA with Tukey's *post hoc* studentised range (HSD) test results

		SECTION A						
Source	**Level**	**N**	**Mean**	**Standard deviation**	**Difference between means**	**Statistically significant difference**	**F-value**	**P-value (Pr > F)**
E1 (Age)	< or = to 30 years	8	3.821	0.738		None	0.52	0.6691
	51 years or more	42	3.793	0.575				
	41 to 50 years	58	3.635	0.641				
	31 to 40 years	56	3.474	0.625				
E2 (Gender)	Female	30	3.857	0.655	0.278	1 (Male)	18.38	**< 0.0001**
	Male	134	3.579	0.617	-0.278	2 (Female)		
E3 (Work history in the sector)	11 to 20 years	72	3.714	0.628		None	0	0.9971
	21 years or more	32	3.633	0.575				
	1 to 10 years	60	3.562	0.658				
E4 (Economic sector)	8 (Financial and business services)	21	3.872	0.562	0.598	4 (Elec., gas and water)	5.12	**0.0007**
					0.421	7 (Log. and comms.)		
	Other	57	3.787	0.567	0.336	7 (Log. and comms.)		
					0.514	4 (Elec., gas and water)		
	3 (Manufacturing)	25	3.722	0.494	0.448	4 (Elec., gas and water)		
	7 (Logistics and communications)	30	3.451	0.765	-0.421	8 (Fin. and business services)		
					-0.336	Other		
	4 (Electricity, gas and water)	31	3.273	0.582	-0.598	8 (Fin. and business services)		
					-0.514	Other		
					-0.448	3 (Manufacturing)		
E5 (Qualifications)	2 to 4 (Grd 12/Std 10, certificate or diploma)	23	3.828	0.726	0.467	7 to 8 (Master's or PhD)	12.12	**< 0.0001**
	6 (Honours degree)	83	3.762	0.535	0.402	7 to 8 (Master's or PhD)		
	7 to 8 (Master's degree or PhD)	58	3.361	0.640	-0.467	2 to 4 (Grd12/Std 10, cert. or diploma)		
					-0.402	6 (Honours degree)		
E6 (Organisational level)	1 (Senior management)	64	3.702	0.597		None	1.69	0.1891
	2 (Middle management)	75	3.617	0.644				
	3 to 4 (Supervisory or other)	25	3.480	0.674				

E8 [1] (PM experience as team member)	11 to 15 years	57	3.799	0.499	0.305	1 to 10 years	2.74	***0.0682***
	16 years or more	28	3.665	0.656				
	1 to 10 years	79	3.494	0.682	-0.305	11 to 15 years		
E9 (Experience as project manager)	11 years or more	21	3.725	0.672		None	0.74	0.4768
	6 to 10 years	65	3.686	0.606				
	1 to 5 years	78	3.556	0.642				
Group	International	84	3.760	0.636		None	1.37	0.2438
	South African	80	3.492	0.600				

Note [1]: Demographic E7 (the "home language" section in the questionnaire, which contains all eleven official South African languages) has been omitted from this analysis for all sections (A to D) because it is not possible to compare the South African and international response data in this regard.

From Table 4.45, it can be seen that the Pr > F-values for E2 (gender), E4 (economic sector) and E5 (qualifications) are all well below the 0.05 cut-off threshold and therefore the means of the various subgroups within these aforementioned demographic categories are statistically different from one another. The F-value for E8 (project management experience as a team member) of 0.0682 is marginal and has been analysed further. The significant differences are set out in Table 4.45 above. To elaborate further on the particular demographic categories in question, the significant differences for the conceptual/initiation phase of the project are the following:

- E2 (gender)
  - between the means of the male and female respondents;
- E4 (economic sector)
  - between the means of the respondents from the financial and business services sector from those of electricity, water and gas; and logistics and communications;
  - between the means of the respondents from the "other" sector from those from logistics and communications and electricity, water and gas;
  - between the means of the manufacturing sector respondents and those from electricity, water and gas;
- E5 (qualifications)
  - between the means of Grade 12 (Standard 10), Certificate or Diploma level and the Master's degree or PhD grouping;

- between the means of the respondents with Honours degrees and those with Master's or PhD degrees; and

- E8 (project management) - between the respondents with 11 to 15 years experience as members of a project management teams and those with one to ten years' experience.

It can also be noted that *post hoc* tests are consistent with what is observed in the difference between means.

4.6.12.3 ANOVA on Section B with Tukey's post hoc studentised range (HSD) test

The Section B results for Tukey's *post hoc* studentised range test are given in Table 4.46.

Table 4.46: Section B ANOVA with Tukey's *post hoc* studentised range (HSD) test results

		SECTION B						
Source	**Level**	**N**	**Mean**	**Standard deviation**	**Difference between means**	**Statistically significant difference**	**F-value**	**P-value (Pr > F)**
E1 (Age)	< or = to 30 years	8	3.825	0.783		None	1.63	0.1841
	51 years or more	42	3.798	0.483				
	41 to 50 years	58	3.667	0.564				
	31 to 40 years	56	3.411	0.539				
E2 (Gender)	Female	30	3.886	0.587	0.325	1 (Male)	20.29	**< 0.0001**
	Male	134	3.561	0.546	-0.325	2 (Female)		
E3 (Work history in the sector)	11 to 20 years	72	3.717	0.537		None	0.1	0.903
	21 years or more	32	3.627	0.484				
	1 to 10 years	60	3.502	0.623				
E4 (Economic sector)	8 (Financial and business services)	21	3.810	0.558	0.485	4 (Elec., gas and water)	4.54	**0.0017**
	Other	57	3.755	0.496	0.300	7 (Log. and comms.)		
					0.430	4 (Elec., gas and water)		
	3 (Manufacturing)	25	3.723	0.461	0.398	4 (Elec., gas and water)		
	7 (Logistics and communications)	30	3.455	0.725	-0.300	Other		
	4 (Electricity, gas and water)	31	3.325	0.458	-0.485	8 (Fin. and business services)		
					-0.430	Other		
					-0.398	3 (Manufactur-ing)		

E5 (Qualificat-ions)	2 to 4 (Grd 12/Std 10, certificate or diploma)	23	3.804	0.489	0.376	7 to 8 (Master's or PhD)	8.86	**0.0002**
	6 (Honours degree)	83	3.705	0.537	0.277	7 to 8 (Master's or PhD)		
	7 to 8 (Master's degree or PhD)	58	3.428	0.589	-0.376	2 to 4 (Grd12/Std 10, cert. or diploma)		
					-0.277	6 (Honours degree)		
E6 (Organisat-ional level)	1 (Senior management)	64	3.715	0.539		None	2.25	0.1091
	2 (Middle management)	75	3.586	0.571				
	3 to 4 (Supervisory or other)	25	3.485	0.602				
E8 (PM experience as team member)	11 to 15 years	57	3.734	0.449		None	0.7	0.4963
	16 years or more	28	3.639	0.625				
	1 to 10 years	79	3.532	0.610				
E9 (Experience as project manager)	11 years or more	21	3.706	0.640		None	0.86	0.424
	6 to 10 years	65	3.669	0.547				
	1 to 5 years	78	3.558	0.561				
Group	International	84	3.739	0.589		None	1.76	0.1872
	South African	80	3.497	0.516				

The same significant differences were found between the demographics of gender and qualifications. Marginal differences in the results of Tukey's *post hoc* HSD for the economic sector demographic were found for Section B – planning phase of the project, when compared to the results for Section A.

4.6.12.4 ANOVA on Section C with Tukey's post hoc studentised range (HSD) test

The Section C results for Tukey's *post hoc* studentised range test are given in Table 4.47 below.

Table 4.47: Section C ANOVA with Tukey's *post hoc* studentised range (HSD) test results

		SECTION C						
Source	**Level**	**N**	**Mean**	**Standard deviation**	**Difference between means**	**Statistically significant difference**	**F-value**	**P-value (Pr > F)**
E1 (Age)	< or = to 30 years	42	3.671	0.568		None	2.32	0.0782
	51 years or more	8	3.523	0.904				
	41 to 50 years	58	3.390	0.791				
	31 to 40 years	56	3.242	0.743				

E2 (Gender)	Female	30	3.712	0.689	0.360	1 (Male)	16.57	< **0.0001**
	Male	134	3.352	0.739	-0.360	2 (Female)		
E3 (Work history in the sector)	11 to 20 years	72	3.511	0.670		None	2.11	0.1245
	21 years or more	60	3.379	0.786				
	1 to 10 years	32	3.281	0.800				
E4 (Economic sector)	8 (Financial and business services)	21	3.680	0.601	0.592	4 (Elec., gas and water)	3.56	**0.0084**
	Other	57	3.566	0.666	0.478	4 (Elec., gas and water)		
	3 (Manufacturing)	25	3.549	0.625				
	7 (Logistics and communications)	30	3.185	1.030				
	4 (Electricity, gas and water)	31	3.088	0.553	-0.592	8 (Fin. & business services)		
					-0.478	Other		
E5 (Qualificat-ions)	2 to 4 (Grd12/Std 10, certificate or diploma)	23	3.581	0.614	0.426	7 to 8 (Master's or PhD)	7.23	**0.001**
	6 (Honours degree)	83	3.556	0.662	0.401	7 to 8 (Master's or PhD)		
	7 to 8 (Master's degree or PhD)	58	3.155	0.828	-0.426	2 to 4 (Grd12/Std 10, cert. or diploma)		
					-0.401	6 (Honours degree)		
E6 (Organisat-ional level)	1 (Senior management)	64	3.500	0.773		None	1.51	0.2237
	2 (Middle management)	75	3.398	0.715				
	3 to 4 (Supervisory or other)	25	3.269	0.734				
E8 (PM experience as team member)	11 to 15 years	57	3.635	0.498	0.377	1 to 10 years	3.77	**0.0253**
	16 years or more	28	3.429	0.771				
	1 to 10 years	79	3.258	0.838	-0.377	11 to 15 years		
E9 (Experience as project manager)	11 years or more	21	3.481	0.869		None	0.2	0.8183
	6 to 10 years	65	3.429	0.787				
	1 to 5 years	78	3.392	0.671				
Group	International	84	3.568	0.732		None	1.62	0.2052
	South African	80	3.260	0.721				

The results for Section C (implementation phase of the project) were identical to those for Section A, except in the case of the economic sector demographic, where the means of the respondents in the manufacturing and logistics and communications sector were not significantly different from those of the other group sub-levels.

4.6.12.5 ANOVA on Section D with Tukey's post hoc studentised range (HSD) test

The results of Tukey's *post hoc* studentised range test for Section D are summarised in Table 4.48 below.

Table 4.48: Section D ANOVA with Tukey's *post hoc* studentised range (HSD) test results

		SECTION D						
Source	**Level**	**N**	**Mean**	**Standard deviation**	**Difference between means**	**Statistically significant difference**	**F-value**	**P-value (Pr > F)**
E1 (Age)	< or = to 30 years	8	3.958	0.608	0.523	41 to 50 years	3.91	**0.0102**
	51 years or more	42	3.772	0.476	0.338	41 to 50 years		
					0.292	31 to 40 years		
	31 to 40 years	56	3.480	0.599	-0.292	51 years or more		
	41 to 50 years	58	3.435	0.689	-0.523	< or = to 30 years		
					-0.338	51 years or more		
E2 (Gender)	Female	30	3.796	0.671	0.286	1 (Male)	16.45	**< 0.0001**
	Male	134	3.510	0.601	-0.286	2 (Female)		
E3 (Work history in the sector)	11 to 20 years	72	3.617	0.592		None	0.25	0.7812
	1 to 10 years	60	3.550	0.638				
	21 years or more	32	3.462	0.663				
E4 (Economic sector)	8 (Financial and business services)	21	3.836	0.567	0.628	4 (Elec., gas and water)	3.96	**0.0044**
					0.429	7 (Log. and comms.)		
	Other	57	3.700	0.546	0.492	4 (Elec., gas and water)		
	3 (Manufacturing)	25	3.644	0.495	0.436	4 (Elec., gas and water)		
	7 (Logistics and communications)	30	3.407	0.748	-0.429	8 (Fin. and business services)		
	4 (Electricity, gas and water)	31	3.208	0.590	-0.628	8 (Fin. And business services)		
					-0.492	Other		
					-0.436	3 (Manufactur-ing)		
E5 (Qualificat-ions)	6 (Honours degree)	83	3.673	0.519	0.313	7 to 8 (Master's or PhD)	5.15	**0.0069**
	2 to 4 (Grd12/Std 10, certificate or diploma)	23	3.671	0.623	0.311	7 to 8 (Master's or PhD)		
	7 to 8 (Master's degree or PhD)	58	3.360	0.711	-0.313	2 to 4 (Grs12/Std 10, cert. or		

						diploma)		
					-0.311	6 (Honours degree)		
E6 (Organisat-ional level)	2 (Middle management)	75	3.600	0.635		None	0.09	0.912
	1 (Senior management)	64	3.535	0.617				
	3 to 4 (Supervisory or other)	25	3.520	0.618				
E8 (PM experience as team member) Group	11 to 15 years	57	3.735	0.439	0.290	1 to 10 years	7.55	**0.0008**
	16 years or more	28	3.544	0.643				
	1 to 10 years	79	3.444	0.701	-0.290	11 to 15 years		
E9 (Experience as project manager)	11 years or more	21	3.688	0.659		None	2.02	0.1368
	1 to 5 years	78	3.580	0.628				
	6 to 10 years	65	3.501	0.605				
Group	International	84	3.725	0.598		None	2.93	0.0891
	South African	80	3.392	0.605				

The most important difference between the Section D (post implementation phase) results and those of the previous three sections is that with regards to the demographic category of age. Here significant differences were observed between the following:

- the less than or equal to 30 years of age and the 41 to 51 years of age levels; and
- the 31 to 40 years, 41 to 50 and, 51 years or more groupings.

4.6.12.6 Summary of Tukey's post hoc studentised range (HSD) test results (all four sections)

A summary of the results for all four sections is given in Table 4.49 below for ease of reference.

Table 4.49: Summary of ANOVA and Tukey's *post hoc* studentised range (HSD) test results

		Statistically significant difference			
Source	**Level**	**Section A**	**Section B**	**Section C**	**Section D**
E1 (Age)	< or = to 30 years	None	None	None	41 to 50 years
	31 to 40 years				51 years or more
	41 to 50 years				< or = to 30 years
					51 years or more
	51 years or more				41 to 50 years
					31 to 40 years
E2 (Gender)	Male	2 (Female)	2 (Female)	2 (Female)	2 (Female)
	Female	1 (Male)	1 (Male)	1 (Male)	1 (Male)

ee3 (Work history in the sector)	1 to 10 years	None	None	None	None
	11 to 20 years				
	21 years or more				
E4 (Economic sector)	Other	4 (Elec., gas and water)	4 (Elec., gas and water)	4 (Elec., gas and water)	4 (Elec., gas and water)
		7 (Log. and comms.)	7 (Log. and comms.)		
	3 (Manufacturing)	4 (Elec., gas and water)	4 (Elec., gas and water)		4 (Elec., gas and water)
	4 (Electricity, gas and water)	Other	Other	Other	Other
		3 (Manufacturing)	3 (Manufacturing)		3 (Manufacturing)
		8 (Fin./bus. serv.)	8 (Fin./bus. serv.)	8 (Fin./bus. serv.)	8 (Fin./bus. serv.)
	7 (Logistics and communications)	Other	Other		8 (Fin./bus. serv.)
		8 (Fin./bus. serv.)			
	8 (Financial and business services)	4 (Elec., gas and water)	4 (Elec., gas and water)	4 (Elec., gas and water)	4 (Elec., gas and water)
		7 (Log. and comms)			7 (Log. and comms.)
E5 (Qualificat-ions)	6 (Honours degree)	7 to 8 (M or PhD)	7 to 8 (M or PhD)	7 to 8 (M or PhD)	7 to 8 (M or PhD)
	2 to 4 (Grd12/Std 10, certificate or diploma)	7 to 8 (M or PhD)	7 to 8 (M or PhD)	7 to 8 (M or PhD)	7 to 8 (M or PhD)
	7 to 8 (Master's degree or PhD)	2 to 4 (Grd12/Std 10, cert. or diploma)	2 to 4 (Grd12/Std 10, cert. or diploma)	2 to 4 (Grd12/Std 10, cert. or diploma)	2 to 4 (Grd12/Std 10, cert. or diploma)
		6 (Hon. degree)	6 (Hon. degree)	6 (Hon. degree)	6 (Hon. degree)
E6 (Organisat-ional level)	1 (Senior management)	None	None	None	None
	2 (Middle Management)				
	3 to 4 (Supervisory or other)				
E8 (PM experience as team member)	1 to 10 years	11 to 15 years	None	11 to 15 years	11 to 15 years
	11 to 15 years	1 to 10 years		1 to 10 years	1 to 10 years
	16 years or more				
E9 (Experience as project manager)	1 to 5 years	None	None	None	None
	6 to 10 years				
	11 years or more				
Group	International	None	None	None	None
	South African				

It is evident from the results in Table 4.49 above that there were no significant differences between the means of the various categories, namely “work history in the sector”, “organizational level”, “experience in project management in a leadership role” and the combined South African and international group. As mentioned before, this can possibly be attributed to the fact that South Africans have been exposed to international business over the last few decades. Due to the exposure to project management methodology and related thinking, the South African community is likely to have a similar mindset to the international community in this regard.

The means of the responses from the two gender groupings are significantly different throughout. Moreover, the impact of different qualifications on the responses to the Phase 2 questionnaire is consistent across all four sections of the assessment tool. Differences between responses from the various age levels only appear in Section D. The "Economic sector" and "Experience as a member in a project management team" demographic categories only show slight differences between sections, most notably in Sections C and B.

Due to the relatively technical and mechanistic nature of traditional project management, it has largely been the domain of males worldwide, until recently, when more females began to embark on technical careers. This could be a possible explanation for the significantly different responses from the two gender groupings.

The differences between the responses from various sectors could potentially be ascribed to the different nature of the projects undertaken. Projects in the services sector which would be more process driven (such as end-to-end services provisioning and IT projects), are likely to require significant change management intervention whereas projects in the manufacturing and construction environment may involve change dynamics to a lesser extent.

The impact of age and years of relative project management experience on the data collected may be attributed to the level of involvement of the various groups in the operational and strategic aspects of any particular project.

4.7 SUMMARY AND CONCLUSION

Information on what constitutes change management in the project management domain was gathered using the Delphi technique. This data shaped the initial design of the questionnaire used during the first phase of the research design. The draft framework for the measurement instrument was then pre-tested through the application of Lawshe's content validity methodology. The results largely validated the measurement items included in each of the four project life cycle phases at the $\alpha = 0.05$ significance level. Based on the Lawshe results, 25 items were also excluded from the proposed assessment tool for the next phase of the research project.

The next phase of testing exposed the change management measurement instrument to the views and opinions of two target population groups, namely South African and international project managers of various experience levels and from different economic sectors. The data collected was analysed to determine the scale statistics for the groupings and to measure the internal consistency and reliability of the instrument, using Cronbach's alpha coefficient. The results indicated highly intercorrelated items in each of the four sections of the questionnaire.

Various iterations of exploratory factor analysis indicated the primary factors for each of the four phases of a project life cycle. The essence of each phase has been named or described as follows:

- Section A: Conceptual / initiation phase of the project - "ensuring alignment and organisational readiness after assessing and/or creating the need for change";
- Section B: Planning phase - "creation of an enabling environment for change through communication and engagement";
- Section C: Implementation phase - "executing to achieving the stated objectives and outcomes of the project"; and
- Section D: Post-implementation period - "embedding and institutionalising the changes effected through the project".

The most important change management elements of each have also been identified and highlighted in this chapter for retention in the final assessment tool.

A second round of item-scale and reliability analysis, together with Tucker's phi results confirmed the reliability, consistency and structure of the assessment tool when the number of measurement items was reduced from 118 to 103. The choice of measurement items that were eliminated was influenced by the outcome of the factor analysis.

Finally, the ANOVA and Tukey's *post hoc* HSD test results highlighted significant differences between the responses from various demographic groupings, particularly, between groupings defined in terms of gender, economic sector and various project management qualification levels.