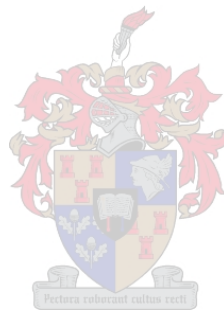# MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY

by

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Dissertation presented for the degree of Doctor of Philosophy in the Faculty of Arts and Social Sciences at Stellenbosch University.

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December 2017

DECLARATION

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SUMMARY

Traditional military activities, such as fighting wars are inherently destructive. Modern militaries undertake a diverse range of military activities; use large areas for military training and operational purposes; and they are confronted by a global focus on environmentally responsible behaviour. These conditions compel militaries to ensure that soldiers display the correct attitude toward, behaviour in and knowledge about the diverse physical, social and cultural environments they occupy and impact upon. In South Africa this is not only a moral obligation but a legal imperative too.

The aim of this research is to determine the military environmental literacy (MEL) (attitude, behaviour and knowledge regarding the environment in which the military operate) of the members of the South African Army (SA Army). To reach this aim, existing environmental questionnaires were evaluated to ascertain their suitability for use in a SA Army context. None of them was usable to effectively gauge MEL in a SA Army context. Consequently, an iterative process was initiated to develop a tailor-made, valid, reliable and organisation-specific questionnaire to assess MEL in a SA Army context.

The resulting questionnaire comprises a covering letter elucidating the study, a section with 15 attitude items and a section with 13 items related to reported behaviour, both employing a 5-point Likert-type scale. A third section has 14 multiple choice items to test the environmental knowledge of respondents. The three sections form the subscales of the questionnaire to measure the three components of MEL. Six open-ended questions constituted a fourth section in which respondents are required to answer questions and motivate their answers. The final section aims to elicit soldier biographical and service history information. A letter of consent that had to be filled in and signed by each respondent, accompanied the questionnaire.

A stratified sample was procured from the nine different formations of the SA Army. During the procurement of the stratified sample the correct percentages of possible respondents, based on the size of formations as well as the rank and gender proportions, was ensured. Twenty-five units situated throughout South Africa were selected. Of the 1203 questionnaires distributed to the units, 1090 usable questionnaires were returned.

The returned questionnaires were scanned and the data was extracted using Formware software. The database was analysed using the Lisrel 8.8 program. Analysis of variance was done for the variables and Fisher's least significant difference post hoc tests were performed for instances where the data rendered significant differences. Pearson correlation coefficients were

calculated to analyse the continuous data. The qualitative data was analysed using content analysis to investigate the military environmental narrative.

The main products of the research are an organisation-specific, valid and reliable questionnaire to assess MEL in a SA Army context and a baseline for MEL in the SA Army and its nine formations. For all three components of MEL attitude (mean of 1.8 on a five-point Likert scale), behaviour (mean of 1.8) and knowledge (mean of 65%) respondents recorded high scores. The composite MEL of 75% denotes a high level of MEL for soldiers of the SA Army. Attitude, behaviour and knowledge scores were recorded for rank, gender, age, time employed in the South African DOD, deployment experience, home language, exposure to environmental positions in the Army, environmental and geography education and level of general education. The correlation between the components revealed that the strongest correlation exists between attitude and behaviour ($r = 0.56$) with knowledge and attitude second ($r = 0.35$) and knowledge and behaviour ($r = 0.29$) third. These results are supported by those of the qualitative analysis.

The main recommendation is that the findings should be used to enhance the quality of environmental education and training in the SA Army through the Environmental Services subdivision which is responsible for environmental education and training in the SA Army.

KEYWORDS

Corporate environmental policy statement, military environmental attitude, military environmental behaviour, environmental implementation plan, military environmental knowledge, environmental management system, military environmental questionnaire, military environmental literacy, South African Army, South African DOD, qualitative research, questionnaire research, mixed-methods research

OPSOMMING

Tradisionele militêre aktiwiteite soos oorlogmaak, is inherent vernietigend. Moderne weermagte onderneem 'n diverse reeks militêre aktiwiteite; hulle gebruik groot gebiede vir beide oefenterreine en operasionele teaters; en hulle word gekonfronteer deur 'n globale fokus op omgewingsverantwoordbare optrede. Hierdie omstandighede dwing weermagte om te verseker dat hul soldate die korrekte houding teenoor optrede in en kennis van die diverse fisiese, sosiale en kulturele omgewings waarbinne hulle opereer, sal hê. In Suid-Afrika is dit nie net 'n morele verantwoordelikheid nie, maar ook 'n wetlike vereiste.

Die doel van hierdie navorsing is om die militêre omgewingsgeletterdheid (MOG) (houding, optrede en kennis van die omgewing waarbinne militêre optrede plaasvind) van lede van die Suid-Afrikaanse Leër (SAL) vas te stel. Om hierdie doel te bereik is bestaande omgewingsvraelyste geëvalueer met die oog op hul geskiktheid om in die konteks van die SAL gebruik te word. Geeneen was geskik om die MOG in die SAL te bepaal nie. Gevolglik is 'n iteratiewe proses van stapel gestuur om 'n pasgemaakte, geldige, betroubare en organisasie-spesifieke vraelys te ontwikkel wat MOG in die konteks van die SAL kan meet.

Die vraelys wat uit hierdie proses voortgevloei het, bestaan uit 'n dekbrief wat die studie verduidelik, 'n afdeling met 15 items oor houding teenoor die omgewing en 13 items wat oor self-gerapporteerde optrede handel. In beide afdelings word 'n vyfpunt Likert-skaal gebruik. 'n Derde afdeling bestaan uit 14 veelkeuse kennisitems wat die militêre omgewingskennis van respondente toets. Hierdie drie afdelings vorm die subskale van die vraelys en toets die drie komponente van MOG. Ses oop vrae maak die vierde afdeling uit. In hierdie afdeling moet respondente 'n vraag beantwoord en hul antwoorde motiveer. Die laaste afdeling bestaan uit vrae oor die biografiese en militêre diensgeskiedenis van respondente. 'n Toestemmingsbrief wat deur elke respondent ingevul en onderteken moes word, het die vraelys vergesel.

'n Gestratifiseerde steekproef is uit die nege formasies van die Leër getrek. Daar is verseker dat die korrekte persentasies van moontlike respondente, gebaseer op die grootte van formasies en die rang en geslagsverhoudings binne elke formasie in die steekproef gereflekteer is. Vyf-en-twintig eenhede, geografies versprei deur Suid-Afrika, is geselekteer. Van die 1203 vraelyste wat versprei is, is 1090 bruikbare vraelyste terugontvang.

Die bruikbare vraelyste is geskandeer en die data is met behulp van Formware sagteware onttrek. Die databasis is met die Lisrel 8.8-program ontleed. Variansie-analise van die veranderlikes is onderneem en Fisher se kleinste betekenisvolle verskil post hoc toets is uitgevoer in gevalle waar die data beduidende verskille tussen die veranderlikes aangedui het. Pearson

korrelasiekoëffisiente is vir die kontinue data bereken. Die kwalitatiewe data is ontleed met behulp van inhoudsanalise om die militêre omgewingsnarratief te ondersoek.

Die belangrikste produkte van hierdie navorsing is 'n organisasie-spesifieke, geldige en betroubare vraelys waarmee MOG in die SAL konteks gemeet kan word. Die vraelysdata het 'n basislyn vir MOG in die SAL sowel as die nege formasies van die Leër verskaf. Vir al drie komponente van MOG, naamlik houding (gemiddeld 1.8 op 'n vyfpunt Likert skaal), optrede (gemiddeld 1.8) en kennis (65%) het respondente hoë tellings behaal, 'n aanduiding dat die MOG van die SAL se soldate hoog is. Die saamgestelde MOG vir die SAL van 75% dui op 'n hoë vlak van MOG in die Leër. Tellings vir houding, optrede en kennis is bereken volgens rang, geslag, ouderdom, tyd in diens van die Departement van Verdediging, ontplooiingsondervinding, huistaal, blootstelling aan omgewingsposisies in die Leër, omgewings- en geografie opvoeding en algemene opvoedingsvlak. Met die berekening van die korrelasie tussen die komponente van MOG is bevind dat die grootste korrelasie (r = 0.56) tussen houding en optrede voorkom met die korrelasie tussen kennis en houding (r = 0.35) in die tweede plek. Die swakste korrelasie (r = 0.29) bestaan tussen kennis en optrede. Hierdie resultate is goed ondersteun deur dié van die analise van die kwalitatiewe data.

Die belangrikste aanbeveling van hierdie studie is dat hierdie bevindings gebruik moet word om die kwaliteit van omgewingsopvoeding en -opleiding in die SAL verder te verbeter deur die Subdirektoraat Omgewingsdienste, die afdeling verantwoordelik vir omgewingsopvoeding en -opleiding in die SAL.

TREFWOORDE

Korporatiewe omgewingsbeleidstandpunt, militêre omgewingshouding, militêre omgewingsoptrede, omgewingsimplementeringsplan, militêre omgewingskennis, omgewingsbestuurstelsel, militêre omgewingsvraelys, militêre omgewingsgeletterdheid, Suid-Afrikaanse Leër, Suid-Afrikaanse Departement van Verdediging, kwalitatiewe navorsing, vraelysnavorsing, gemengde-metodes navorsing

ACKNOWLEDGEMENTS

I sincerely thank:

- Professor JH van der Merwe, my supervisor, for his patient guidance over a long period of time. You have been a true mentor.

- Professor Martin Kidd, of the Centre for Statistical Consultation at Stellenbosch University for the many hours spent discussing the intricacies of exploratory and explanatory statistics.

- Sub-Committee A of Stellenbosch University for two grants to develop and print the military environmental literacy questionnaire and to execute the survey.

- The National Research Foundation for two grants to disseminate research results at international conferences.

- Focus group members and members of the questionnaire evaluation panels for their time and valuable input.

- Research assistants for assistance during the execution of the survey.

- Colleagues at the Military Academy, especially Andre, Hennie, Babalwa, Godwin, Gerhard, Jacques, Noelle and Tyrel, for allowing me space to finish the study and for their constant support.

- Copyeditors, Dr. PH de Necker, and B Russel-Smith for your thorough and methodical scrutiny of the initial versions of the thesis.

- Aan my ouers: Baie dankie dat julle ALTYD daar is vir my. Julle is die beste!

- Aan my skoonouers: Dankie dat julle my ouers is, en nie my skoonouers nie.

- Aan die familie en vriende: Dankie vir die ondersteuning tydens moeilike tye. Dit is 'n seën om julle in my lewe te hê.

- Aan Surana en Sumari: Daar is nie woorde nie. Julle is my alles. Dankie.

- Aan my Hemelse Vader: Alle eer aan U.

CONTENTS

TABLES

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ACRONYMS AND EXPLANATIONS

ABS Army Battle School. Largest training facility of the South African Department of Defence, situated at Lohatla, Northern Cape Province.

ANOVA Analysis of Variance. Overall test of whether group means differ (Field 1013).

BNC Bi-National Commission. Commission established to co-ordinate the RSA-USA military environmental cooperation.

CHEAKS Children's Environmental Attitudes and Knowledge Scale. Measuring instrument to test the environmental literacy of children (Lee 2008).

CEPS Corporate Environmental Policy Statement. Stated basis of action that sets out guidelines for decision making and action toward the environment in which the organisation operates.

CSC Centre for Statistical Consultation. Stellenbosch University centre to furnish students with statistical advice.

DEFCOM Defence Committee. Established as part of the RSA-USA Bi-National Committee to enhance military environmental education and training exchange between the RSA and USA.

DOD Department of Defence. Government department responsible for all defence related affairs in South Africa.

EIP Environmental Implementation Plan. Statutory instrument for the promotion of good environmental governance in government departments in South Africa.

EL Environmental Literacy. Attitude, knowledge levels and conduct toward the environment.

ELIKC Environmental Literacy Instrument for Korean Children. Age- and context-specific measuring instrument to test the environmental literacy of Korean children (Chu et al. 2007).

EMS   Environmental Management System. The documented procedures drawn up in terms of the South African Bureau of Standards (SABS) code of practice to ensure the sustainable operation of a specific organisation.

ERF   Environmental Review Forum. The body responsible for the development of the EMS for Defence.

ESD   Environmental Subdirectorate. The subdirectorate responsible for environmental management in the South African DOD.

ESWG   Environmental Security Working Group. The body responsible for bilateral development of military integrated environmental management projects through the exchange of information and capability.

IEM   Integrated Environmental Management. The deliberate process of managing and integrating activities into the environment in which they take place.

ITAM   Integrated Training Area Management. Management system developed for military training areas.

ITC   Item Total Correlation. Portray the correlation between each item and the total score from the questionnaire or scale in the questionnaire.

JSD   Joint Support Division. Division of the SANDF responsible for environmental management in the South African Department of Defence.

MEA   Military Environmental Attitude. A general feeling of favour or disfavour toward the military environment, i.e. the environment in which the military operates.

MEB   Military Environmental Behaviour. A demonstration of how one act toward or in the environment in which the military operates.

MEK   Military Environmental Knowledge. The ability to identify a number of concepts and behaviour patterns related to the military environment.

MEL   Military Environmental Literacy. Attitude, knowledge levels and conduct toward the military environment.

MG   Military geography. "The field of science devoted to the study of the man-environment interaction and its influence on military planning and activities" (Jacobs, Janse van Rensburg & Smit 2002: 195).

MGSA   Military Geography South Africa. Questionnaire developed to test the influence of military geography education of the environmental literacy of SAMA students.

MIEM   Military Integrated Environmental Management. The framework for managing and integrating military activities into the environment in which they take place.

MSELI   Middle School Environmental Literacy Instrument. Age-specific measuring instrument to test the environmental literacy of middle-school children (Culen & Mony 2003).

NEMA   National Environmental Management Act. Most comprehensive South African law dealing with environmental issues (Act 107 of 1998).

NEP   New Ecological Paradigm scale. The most widely-used measuring instrument to test environmental literacy in use.

NEPS   New Ecological Paradigm Scale. The updated and renamed version of the NEP scale.

PDSS   Portuguese Defence Sector Survey. Survey of environmental literacy in the Portuguese defence force.

REC   Research Ethics Committee. Stellenbosch University Committee to establish and ensure ethical research by students and staff.

RFIM   Regional Facilities Interface Management. Ensure the sustainable utilisation of military facilities at regional level in South Africa.

RFM   Rifleman. First rank in SA Army

SA Army   South African Army

SANDF   South African National Defence Force

SASO   Stability and Support Operations. Military operations aimed at establishing stability in a region, or to support the population during a time of crisis.

SAMA	South African Military Academy. Educational institute of the South African Department of Defence and Military Veterans, housing the Faculty of Military Science of Stellenbosch University at Saldanha Bay.
SEM	Structural Equation Modelling. An evaluative methodology that statistically appraises the fit of a model to the covariance matrix (Barret 2007).
SEWing	Strategic Environmental Working Group. Body responsible for the development of the EIP for Defence.
USA	United States of America
USAEAKS	United States Army Environmental Attitude and Knowledge survey. Questionnaire to test environmental attitude and knowledge in the United States Army.
US	United States

TERMINOLOGY

Closed-ended questions	Survey questions in which the respondent is asked to select an answer from a list provided by the researcher (Babbie 2004).
Content analysis	The study of recorded human communication or expression, such as text, electronic communication, paintings, etc.
Cronbach's alpha	A measure of the reliability of a scale.
Environment	Term used in its broadest sense to include the bio-physical, cultural and social environments within which humans exist.
Environmental attitude	Attitude toward the environment in which the person exist.
Environmental knowledge	Body of knowledge about the environment in which the person operates.
Environmental legislation	Any legislation prescribing the management of an aspect of the environment.
Environmental literacy	Comprehensive term encapsulating the attitude, knowledge levels and mode of conduct toward the environment of a person.
Environmental management	The prescribed procedures of managing environmental resources, and the impacts of development on these resources, to ensure sustainability.
Environmental skills	The body of skills needed to interact with the environment in a sustainable manner.
F-ratio	A test statistic with a known probability distribution. Used to test for differences in group means.
Green soldiering	Military conduct that "ensures the environmental sustainable management of facilities and activities" (Godschalk, 1998: 2).

Indicators of military environmental literacy	Measurements that can be used to assess the attitude, knowledge levels and conduct toward the military environment objectively.
Item analysis	An assessment of whether each of the items included in a composite measure make an independent contribution or merely duplicate the contribution of other items in the measure (Babbie 2004).
Likert scale	A type of composite measure developed by Rensis Likert in an attempt to improve the levels of measurement in social research through the use of standardised response categories in survey questionnaires to determine the relative intensity of different items (Babbie 2004).
Open-ended questions	Questions for which the respondent is asked to provide his or her own answers.
Organisation-specific environmental literacy	Attitude, knowledge levels and conduct pertinent toward the environment in which a specific organisation operates.
Military culture	The unique set of beliefs, attitudes, and conduct within a military organisation.
Peacekeeping operations	Action aimed at sustaining peace between two or more belligerent parties.
Peace-making operations	Action aimed at facilitating or establishing peace between two or more belligerent parties.
Pearson's correlation coefficient	Standardised measure of the strength and direction of relationship between two variables.
Reliability	The ability of a measure to produce consistent results when the same entities are measured under different conditions.
Sampling frame	The list or quasilist of units comprising a population from which a sample is selected (Babbie 2004).

Sustainability	"The ability of earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions indefinitely" (Miller & Spoolman 2012: 8).
Validity	Evidence that a study allows correct inferences about the question it set out to answer.
Variable	Anything that can be measured and can differ across entities or across time.

CHAPTER 1   ENVIRONMENTAL LITERACY IN THE MILITARY

When elephants do battle the grass gets trampled: Kikuyu saying (Claassen, Muller & Van Tonder 1998: 48).

This Kikuyu maxim recognises that large antagonists cannot tackle one another without inevitable cost to the environment. In the modern military sense, the elephants of the Kikuyu represent the armies of opposing nations in operation. The South African Department of Defence (DOD) operates on and controls large tracts of land all over South Africa. To use and maintain this land in an environmentally sustainable and responsible way is a constitutionally derived organisational imperative. The South African DOD has a long history of formal environmental management, as evidenced by the first instruction to formulate guidelines for environmental management in the then South African Defence Force since 1977 (Godschalk 1998). The National Environmental Management Act No 107 of 1998 (NEMA) eventually obligated all scheduled organs of state with functions that affect the environment, including the DOD, to develop an Environmental Implementation Plan (EIP) (South Africa 1998).

Since the promulgation of NEMA, two environmental implementation plans for defence have seen the light and a variety of internal directives testify to the apparent sincerity of the environmental commitment of the South African DOD. However, no proof of the effectiveness of these plans and policies in influencing the day-to-day activities of members of the South African National Defence Force (SANDF) exists. The policies merely reflect command concern and not actual proof of implementation nor the effect of the policies and plans on the environmental performance of members of the SANDF. This dissertation probes the reciprocal effect, or lack thereof, of DOD environmental policies and plans on the environmental performance of members of the DOD.

This first chapter of the dissertation introduces the research approach and methodology. The introduction commences with an examination of the important environmental concepts and definitions confronted in the study, followed by a review of the environmental imperative of the SANDF. The research questions, aim and objectives of the study are presented and approaches of scientific enquiry used in the research are explained. Subsequently, the qualitative and quantitative methodological approaches employed are justified. The penultimate section is dedicated to an explanation of the research design and timeline, followed by a concluding exposition of the dissertation structure.

1.1   THE ENVIRONMENT IN CONTEXT

This section clarifies the various operational definitions of the term 'environment' when applied in the military context and develops the concept 'military environmental literacy' (MEL) as sprung from general environmental literacy (EL). The operational definitions are used to undergird the arguments developed throughout this dissertation. Other relevant definitions are dealt with as needed throughout the text.

1.1.1   The environment as a holistic concept

The term 'environment' is elusive to define when applied to the human lifeworld. While the term is widely used, it means different things to different users (Nel & Kotzé 2009). Business Dictionary (2010: 55) refers to the general environment as "the factors and conditions (such as economic, legal, political and social circumstances) that generally affect everyone in an industry or market in more or less similar manner." This definition is clearly aimed at a different audience than the one addressed by Barnett & Casper (2001: 465) that defines the social environment as "the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact." According to Fuggle (2000: 4) 'environment' relates to "the totality of objects and their interrelationships which surround and routinely influence the lives of human beings." This definition is echoed by Miller & Spoolman (2012: G5) where they describe the environment as "all external conditions, factors, matter and energy, living and non-living, that affect any living organism or other specified system." A number of cognate considerations emerge from these definitions. First, the concept is multifaceted in meaning. Second, the concept must be considered holistically, or specified accordingly if not. Third, it involves a number of interrelationships. Last, the concept affects the lives of living organisms.

As far as 'the environment' is concerned, all of the above apply to military conduct. Military environment is a multifaceted concept encompassing diverse components of social, cultural and physical or natural domains in which soldiers execute their mission. When referring to the environment in a military context, it must be considered holistically or specified as the cultural, social or physical environment when used with a distinct focus. The military environment encompasses the lives of soldiers and other humans, as well as the military activities performed in it. Other living and non-living things share the military environment with humans and form interrelationships important in the understanding of the environment targeted for management.

The working definition of the concept 'military environment' used in this research holistically encompasses the bio-physical, sociocultural and socio-economic environments in which the military conduct its activities. This definition applies irrespective of which of the

standard military domain activities apply: routine daily base maintenance and management, training activities, disaster relief and support operations, peacemaking and peacekeeping oversight or any conduct of armed conflict. Whenever any specific element encompassed by the definition is isolated for investigation, it is specified as such. An example is the on-site cultural environment (embodied in places of worship, grave sites, historical buildings and archaeological or historical sites).

1.1.2   Environmental literacy and military environmental literacy

Precise definition has eluded the term 'environmental literacy' since the late 1960s (Hsu & Roth 1999). The concept is complex in nature (Miller & Spoolman 2012) and encompasses numerous and diverse meaningful components[1] like personal attitude toward, knowledge about, behaviour toward, beliefs relating to, opinions about, perceptions of and social values relating to the environment (Wright 2008). Conceptual guidance on comprehending the different components of EL is elaborated by a host of researchers, among whom Kaiser, Wölfing & Fuhrer (1999), Kibert (2000), Ehrampoush & Moghadam (2005), Meinhold & Malkus (2005), Alp et al. (2006), Amarant (2006), Lopez et al. (2007), Barr & Gilg (2007) Alp et al. (2008) and Özden (2008).

Despite the lack of a precise definition of EL as a concept, a widely accepted working definition provided by Roth (1992) has been adopted by most researchers in the field (see Walsh-Daneshmandi & MacLachlan 2006; Chu et al. 2007; Pe'er, Goldman & Yavetz 2007). Roth (1992) defined EL as an individual's knowledge about and attitude toward the environment and environmental issues, skills and motivation possessed in working toward the resolution of environmental problems, and active involvement in working toward the maintenance of dynamic equilibrium between the quality of life and the quality of the environment. This definition concurs with convictions of scholars like Walsh-Daneshmandi & MacLachlan (2006), Chu et al. 2007 and Pe'er, Goldman & Yavetz (2007). Roth (1992: 26) has suggested a helpful model that postulates three different levels on a continuum of increasing EL. The first level is 'nominal environmental literacy', which implies a basic understanding of environmental processes and a developing awareness and sensitivity toward environmental issues. At the next level, 'functional environmental literacy', a broader understanding and knowledge of the nature and interactions between humans and natural systems is registered. The third level, labelled 'operational

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[1] The term 'components' of environmental literacy is used in this dissertation when referring to three generally recognised elements of environmental literacy, namely attitude and behaviour toward and knowledge of the environment. This is in accordance with the broad terminological consensus in the literature (Kaiser, Wölfing & Fuhrer 1999; Morrone, Mancl & Carr 2001; Pèer, Goldman & Yavetz 2007; Wright 2008). The term 'scale' is used when referring to the subdivision of the questionnaire where a particular component of military environmental literacy is tested (Rattray & Jones 2007; Zecha 2010; Teksoz et al. 2014).

environmental literacy' signposts those who have moved beyond functional literacy, who routinely evaluate actions and take action to improve or sustain a healthy environment. This model therefore postulates a progression through the levels of EL in stages that include low-end awareness, through concern and understanding to eventual action at the high end. Literacy does not necessarily develop through a linear process so action might, for instance, precede understanding.

It is contended here that within the DOD a specific military culture, ethos and professional conduct has become established. This statement is corroborated by the research of Esterhuyse (2013). The military culture certainly differs significantly from civilian conduct and practice and poses unique problems, offers opportunities and requires specific skills in managing the environment in the military. Consequently, the military environment requires a unique definition to effectively encompass military environmental literacy (MEL). Godschalk (1998) has distinguished between Military Integrated Environmental Management applied in the DOD and Integrated Environmental Management adopted and applied by civilian enterprises. Appropriately, the term 'military environmental literacy' distinguishes between military-specific environmental literacy and its civilian counterpart.

These definitions are modified and combined in this study to formulate an operational definition that reflects the military context applicable to the South African Army, namely military environmental literacy is *the nature and level of the attitude toward, knowledge about, and behaviour in and toward the environment in which the military operates*.

Generally, 'attitude' is "a way of thinking or feeling about someone or something" (Hawker 2001: 50). 'Environmental attitude' thus applies to "general feelings toward ecology and the environment, feelings and concerns for specific environmental issues, and feelings toward acting to remedy environmental problems" (Pèer, Goldman & Yavetz 2007: 47). Environmental attitude can also be defined as "a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour" (Milfont & Duckitt 2010: 80). The operational definition of **military environmental attitude (MEA)** is *a general feeling of favour or disfavour toward the military environment, i.e. the environment in which the military operates*.

According to Hawker (2001: 72) behaviour is the "way in which someone or something behaves", i.e. typical conduct, action or deeds under specific circumstances. Chao (2012: 437) describes environmental behaviour as to "act toward the environment", while Kollmus & Agyeman (2002: 240) refine matters by defining pro-environmental behaviour as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world." Bamberg & Möser (2007: 15) expand and describe pro-environmental behaviour as "a mixture of self-interest (e.g. to pursue a strategy that minimises one's own health risk) and of concern for

other people, the next generation, other species, or whole ecosystems (e.g. preventing air pollution that may cause risks for others' health and/or the global climate)." **Military environmental behaviour (MEB)** is therefore defined as a *demonstration of how one acts toward or in the military environment in which the military operates*. A further distinction is drawn between self-reported and observed behaviour and the implications for interpreting results from the two types of behaviour measurement. This is elucidated in Chapter 6.

Knowledge (about something) is the "information and skills gained through experience or education" (Hawker 2001: 499). With Vincente-Molina, Fernández-Sáinz & Izagirre-Olaizola (2013) concurring, Dodd et al. (2005: 6) distinguish between "objective or actual knowledge (what a person actually knows about a product, issue or object) and subjective or perceived knowledge (what a person thinks he/she knows)." In this research objective or actual knowledge was assessed through the military environmental questionnaire. **Military environmental knowledge (MEK)** was operationalised as being *the ability to identify a number of concepts and behaviour patterns related to the military environment, i.e. the environment in which the military operates.* This trichotomy of affective, behavioural and cognitive components (military environmental attitude, military environmental behaviour and military environmental knowledge) constitutes the construct of military environmental literacy, the subject of this research.

1.2   THE ENVIRONMENTAL IMPERATIVE OF THE SANDF

In 2001 the Environmental Implementation Plan (EIP) for Defence was formulated and became part of South African subordinate law after publication in the *Government Gazette* (South Africa 2001). The second edition EIP for Defence was published in 2008 (South Africa 2008) and the DOD formulated an Environmental Management System (EMS) for Defence in 2004. In 1998 and 2014 Defence Reviews were conducted and both reports committed the DOD to sustainable environmental practices (DOD 1998; 2014). Since 2004 the DOD has been unsuccessfully trying to implement the EMS (Liebenberg 2009a, Pers com; Van Blerk 2015, Pers com).

DOD is thus externally mandated by the Constitution (more specifically NEMA) and internally committed through the EIPs to effective environmental management. However, without an implemented EMS the guiding EIP principle for environmental management, namely that "Land under military control is considered a National Asset… entrusted to the department by the nation and should therefore be used and managed wisely for as long as it is required for military purposes" (South Africa 2001: 17), remains unrealised. The motivation for this pronouncement resides in a perceived lack of management knowledge concerning the existing level of EL among members and employees of the DOD (Godschalk 2009a, Pers com; Laubscher 2009a, Pers com;

Liebenberg 2009a, Pers com; Potgieter 2009a, Pers com; Van Blerk 2009a, Pers com).[2] Following the dictates of its Corporate Environmental Policy Statement[3], and to ensure environmentally responsible action in its day-to-day activities, sound Military Environmental Literacy (MEL) of DOD members is imperative. In the absence of knowledge on the level of MEL of DOD members, (Godschalk 2009b, Pers com; Laubscher 2009b, Pers com; Liebenberg 2009b, Pers com; Potgieter 2009b, Pers com; Van Blerk 2009b, Pers com) research on the matter is vital. To effectively execute its environmental mandate, the DOD needs to accurately gauge the EL of its members as prerequisite for further training to meet management demands – the essential problem confronting the research reported in this dissertation.

1.3   RESEARCH QUESTIONS, AIM AND OBJECTIVES

A number of **research questions** emanate from the situation in the South African DOD as deliberated in the previous section:

- Have appropriate instruments, such as questionnaires, been operationalised to survey military environmental literacy in a South African military context?

- In what format, and by what agency, should such an instrument or questionnaire be developed to assess EL in the South African military?

- Should different instruments or questionnaires be developed for the different arms of military service (i.e. Army, Navy, Air Force, Military Health Services)?

- What constitutes context-specific indicators of military environmental literacy in the South African military?

- Which military entities should be serviced and surveyed by such an instrument or questionnaire?

- Which methodology and methods should be employed to conduct such research and analyse the results?

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[2] These officers currently, or in the past, held the highest-ranking posts related to DOD environmental services and as such their views represent a comprehensive and collective understanding of South African military environmental issues.

[3] The Corporate Environmental Policy Statement for Defence states that: "The Department of Defence shall, in compliance with the environmental obligations placed upon it by the Constitution, national and international regulatory provisions and within the constraints imposed from time to time by the nature of its business, protect the environment through pro-active measures of Military Integrated Environmental Management; accept responsibility for the use of the environment entrusted to it; minimise the impacts of its operations on the environment by means of a programme of continual improvement; promote open communication on environmental issues to all interested and affected parties; train and motivate its members to regard environmental considerations as an integral and vital element of its day-to-day activities" (South Africa 2001: 16).

From these research questions the following **research aim** flowed logically: The research aims to evaluate existing survey instruments, like questionnaires, for measuring EL; identify context-specific indicators of military environmental literacy in the South African Army; develop and apply a valid and reliable instrument or questionnaire to measure MEL; and to analyse and interpret the results for operational and policy relevance.

In order to achieve this aim, the following **research objectives** were pursued:

1. Analyse and evaluate existing questionnaires to determine their suitability to be used in the context of the South African Army.

2. Identify and formulate indicators of military environmental literacy in the South African Army by means of a summary of policy documents, interviews with military environmental practitioners and input received from a group of military environmental experts.

3. Develop the questionnaire through the stages of draft development, scrutiny and pilot testing.

4. Apply the questionnaire to a representative sample survey of members of South African Army units.

5. Analyse and interpret the questionnaire data.

6. Develop a model to clarify and categorise the tested variables and profiling of MEL.

7. Formulate recommendations for military environmental management based on research results.

The South African DOD consists of four main organisational and functional arms of service, the South African Army, Navy, Air Force and Military Health Services. These arms of service differ substantially in size, function, type and severity of impact on the environment (Godschalk 2009b, Pers com). This research is focused on the South African Army specifically because it controls the largest area of land in the DOD and has the greatest number of personnel (DOD 2009). Moreover, the terrestrial nature of the Army's operations make them the most likely to impact directly and extensively on the directly observable terrestrial environment.

To effectively measure MEL in the SA Army, a valid and reliable questionnaire that caters for the South African environment in the military was required. Given the diversity of environments of the South African DOD (i.e. Army, Navy, Air Force and Military Health Services) a single survey instrument would be neither effective nor feasible. However, it should be noted that results informing the creation of a questionnaire for one military arm may inform the derivation of instruments for the other arms of service.

The results of this will impact widely in the military: They will indicate the level of EL in the SA Army, differentiated according to Army subgroups (formations such as Armour, Infantry, and Artillery), personnel demographics and rank level. This knowledge should enable the SA Army to develop focused environmental curricula targeted at functional groups and enable curriculum development that is currently lacking (Van Blerk 2009a, Pers com). The study will also provide a benchmark for future studies on military environmental literacy to enable the DOD to effectively monitor its stated "programme of continual improvement" regarding environmental matters referred to in the EPS (South Africa 2001: 16). The same applies to the commitment to train and motivate members to "regard environmental considerations as an integral and vital element of its day-to-day activities" (South Africa, 2001: 16). More widely, the results will enable defence forces elsewhere, especially in the developing world, to benchmark their own EL levels and to aid efforts at environmental curriculum development. In the final instance, and especially toward bolstering academic knowledge, the research aims to broaden the theory underpinning the concept of EL by introducing military environmental literacy as a new concept.

1.4   METHODOLOGICAL APPROACH

Kitchin & Tate (2000) identified 33 main subdisciplines with 75 subtypes of geography as a scientific discipline. Since military geography (MG) was not recognised as one of the subdisciplines, it is assumed that their list is not exhaustive. Given the scope of the discipline of geography, as illustrated here, it is to be expected that geographers employ most, if not all, recognised scientific methodologies and methods in the pursuit of creating geographic knowledge.

This section commences by defining a niche for research on MEL in the domain of MG. Next, the paradigmatic and methodological placement of the research within the broad array of scientific approaches prevalent in scientific geographical research is justified. However, an appropriate mixed methods approach was followed and hence explained in the final subsection. Appropriately detailed explanation of some methods, especially statistical in nature, and the research ethical approval process are provided in the chapters where they are directly relevant.

1.4.1   A place in military geography

According to Palka (2011a) MG originated from an overlap between geography and military science. He describes MG as a type of applied geography that employs the knowledge, methods, techniques and concepts of the discipline of geography to military affairs, places and regions. He also allows for the use of the historical perspective in MG, where the emphasis falls on the impact of physical or human geography on battles, campaigns or wars (Palka 2011a).

The military environment is the focus of a variety of studies in the field of MG and as such has its roots in environmental geography, an important subfield of geography. Barnard (2001) describes this subfield in geography as replacing physical geography, traditionally a main subdiscipline of geography. Whether this is indeed true only time will tell, but the current pre-eminence of environmental geography remains undisputed. Gregory (2000: 289) concluded that the definition of physical geography should be amended to include that it "develops research to inform environmental management and environmental design" − as military environmental research does.

A selection of military environmental issues studied by military geographers, covers such diverse interests as the ecology of military training areas (Eder 2006); the growing importance of environmental security in regional stability (Butts 2011); the legacy of federal military lands in the USA (Doe 2011); an environmental security analysis of abrupt climate change scenarios (Galgano 2011); a framework for analysing environmental influence and regional security (Krakowka 2011); nature protection and military control of land in the post-Cold War era (Martin 2011); climate change and its contribution to potential regional instability in the Arctic (Palka 2011b); and the environmental approach adopted by the South African DOD (Smit 2011). These foci of military geographers confirm that military environmental studies are important in military geographic research. This research on MEL falls within the realm of MG. The close association between military environmental management and MG is explored in Chapter 2.

1.4.2   The geographical paradigm

In general science practice, a paradigmatic or methodological approach refers to "a coherent set of rules and procedures which can be used to investigate a phenomenon or situation (within the framework dictated by epistemological and ontological ideas)" (Kitchin & Tate 2000: 6). A more focused, operational definition is suggested by Bauer (1999: 677-678) who describes methodology as "…the vehicle by which persuasive arguments are constructed." The choice of vehicle for this research is justified here.

Neuman (1994) identified three major paradigmatic approaches to conducting scientific research. They are the positivist paradigm, the interpretive paradigm and the critical paradigm. He also related subordinate feminist and postmodern research as alternative, 'newer' approaches. Kitchin & Tate (2000) subsequently expanded the classification to the Habermas structure dividing science into empirical-analytical (with empiricism and positivism as main schools of thought), historical-hermeneutical (with behaviouralism, phenomenology, existentialism, idealism and pragmatism as main schools of thought) and critical science (with Marxist approaches, realism, postmodernism, post-structuralism, and feminism as main schools of thought). Holt-Jensen (1988)

and Johnston (1991) were in broad agreement with these classifications, while Mouton (2001: 141) specifically places positivism, realism, postmodernism, critical theory, and phenomenology as paradigms in the philosophy of science in his meta-scientific "World Three.'' He defines World One as the world of everyday life and the world of science and scientific research as World Two. In his World Three, the world of meta-science, research methodology has choices among quantitative, qualitative and participatory action research (Mouton 2001). This research occupies places in World Two (empirical analysis) and World Three (method development).

According to Kitchin & Tate (2000: 7) "Positivists argue that by carefully and objectively collecting data regarding social phenomena, we can determine laws to predict and explain human behaviour in terms of cause and effect." Positivists are divided into logical positivists (who set out to verify propositions) and critical rationalists (who want to falsify hypothesises). Positivists mainly derive primary data from experimentation (physical phenomena) or closed-format questionnaires and surveys (human subjects). This research largely followed a positivist quantitative data gathering and analysis approach, but also employed qualitative narrative analysis for deeper understanding of the survey responses and the responders – a mixed-methods approach.

1.4.3   A mixed-methods approach

Research methods' "denotes a way of doing something" (Henning, Van Rensburg & Smit 2011: 36). This statement implies that the selection of a method, or even a mixture of methods, must be clarified. In essence, a decision had to be made about whether quantitative and/or qualitative methods would be applied. Kitchin & Tate (2000) refer to quantitative methods as generating structured data consisting of numbers or empirical facts that can be easily quantified and analysed by statistical techniques, while qualitative methods mostly deal with unstructured data consisting of words, pictures or sounds. Babbie (2004) distinguishes between the two types of data as the difference between numerical and non-numerical data, while Dey (1993) concludes that while quantitative data deals with numbers, qualitative data deals with meaning.

Traditionally, geographers have employed either qualitative or quantitative methods – a distinction Sui & DeLyser (2012: 111) denote as a methodological 'chasm'. Importantly, they conclude that this divide hinders geographic scholarship and propose that geographers embrace diversity in their methods and methodologies in order to better address the complexities of contemporary geographic problems. Furthermore, mixed methods ensure diversity in representation (Cheong et al. 2011) and build on the strengths and weaknesses of both qualitative and quantitative research, so introducing methodological pluralism, diversity, integration and a better understanding of the phenomena under scrutiny (Eriksen, Gill & Bradstock 2011).

Warshawsky (2014) used mixed methods to study urban food security in Johannesburg and came to the conclusion that the correct set of mixed methods offset the weaknesses of each method and led to unique insights not possible when employing only one type – experience shared by Flick (2009). Unlike single-method studies, mixed method research combines quantitative and qualitative research concepts, techniques and methods, so allowing traditionally competing methods to enrich outcome results (Williams 2007; Eriksen, Gill & Bradstock 2011). This approach was consequently adopted here. Various authors, among whom Neuman (1991), Dey (1993) and Limb & Dwyer (2001) emphasise that different approaches toward research are not opposing poles, rather they are complementary. Babbie (2004: 391) goes further by stating that: "Unless you can operate in both (qualitative and quantitative) modes, you'll limit your potential as a social researcher." Not only does the use of both types of research enrich the conclusions drawn from the survey, but triangulation[4] of results ensures improved confirmation of results.

In this study the challenge was to devise a mixed-method approach that by necessity largely relies on a questionnaire survey. In this research closed-ended and open-ended questions were incorporated in the questionnaire in an effort to ensure reaching the objectives. Initially it was envisaged that the survey would only use quantitative data generated through a classic closed-question (choice among pre-formatted question options) questionnaire to address the issue of MEL in the SA Army. During the development of the questionnaire, however, the need to include open-ended questions (subject to provide own formation of possible responses) became evident. Open-ended questions provided a qualitative response component, so constituting a mixed-method approach of kind (Steckler et al. 1992; Driscol et al. 2007). Bryman (2006) found that one research instrument generated two types of data (i.e. mixed-method results) among three quarters of the 232 published articles he analysed for his study on quantitative and qualitative research – effectively sanctioning the use of the term when referring to research using both open-ended and close-ended questions in one questionnaire. O'Cathain & Thomas (2004: 3) have recognised four categories of open-ended questions in surveys, namely extension types which ensure all options are covered and are typically of the "other, please specify" category; substitution types which substitute a closed question; general open questions typically of the "any other comments?" type; and expansion types requiring respondents to elaborate or expand on the closed answers provided. The latter category would "help to explain, illuminate, or expand upon a specific quantitative question" (O'Cathain & Thomas 2004: 3) – exactly the purpose of this questionnaire where one of the objectives was to elicit personal motivations from respondents. This fourth type of question was used extensively in

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[4] Bryman (2006: 105) defines triangulation as "convergence, corroboration, correspondence of results from different methods."

the operational questionnaire. An additional advantage of a mixed-method approach was that triangulation with quantitative analyses was possible. Triangulation involves either combining several qualitative methods or combining qualitative and quantitative methods (Flick 2009). In this MEL research, the latter applied. This research can therefore be described as a study rooted in logical positivism but using a mix of approaches, something not unusual in geographic research and indeed advocated by many geographers (Cheong et al. 2011; Sui & DeLyser 2012). In the next subsection attention turns to survey methods for environmental literacy and the survey sample selection process.

1.5   SURVEY METHODS FOR ENVIRONMENTAL LITERACY

Since a very specific survey approach had been purposely selected, overarching technical detail related to the questionnaire as data gathering instrument is required. This is done in the chapters where the questionnaire development and use are explained. This section serves mainly to sketch and justify the broad structure and content of the instrument, and also to prove the adequacy of measures taken to ensure reliability and validity of the questionnaire survey. The section concludes with detail on the survey sample selection process.

1.5.1   Questionnaire structuring

The methods used to determine MEL in the SA Army and the selection of survey items[5] for inclusion in the questionnaire is discussed in this section. To assess MEL[6] in the SA Army the selection of items for inclusion in the questionnaire was done by a process detailed in Chapter 3. Briefly, it entailed compiling item lists from the available literature and from information requirements gleaned from South African military environmental managers. These items were scrutinised by a military environmental expert group that included both South African and international military environmental professionals. A questionnaire comprising three scales (knowledge, attitude and behaviour) as well as a section with open-ended questions and a biographical and service history section was compiled from these item lists. Following a workshop session in which a panel of experts critiqued the questionnaire, it was submitted for testing by 15 students who commented on the wording of questions, readability and general issues of questionnaire design. The questionnaire was subsequently piloted at the host Military Academy at Saldanha Bay, which yielded 153 usable questionnaires.

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[5] Generically questions in a questionnaire are referred to as 'items' (Kaplowitz & Levine 2005; McBeth & Volk 2010; Rosenthal 2011). In this dissertation 'item' will be used and not 'question' because not all items in a questionnaire are questions; some are statements, while others are indicators of biographical categories.

[6] At the outset of the research, the term 'military environmental literacy' did not exist, so this new term is one outcome of the study.

The three scales of the pilot questionnaire were statistically analysed to determine the suitability, reliability and validity of the questions. The LISREL 8.80 package (Jöreskog & Sörbom 2006) was used for the statistical analysis. Evaluation of items for inclusion in the final questionnaire was based on reliability, item total correlation and partial least squares (PLS) path modelling results for the attitude and behaviour scales. Analysis of item difficulty and discrimination was conducted on the knowledge scale to decide on the removal or inclusion of knowledge items.

Missing data was managed by pairwise deletion of data, i.e. the temporary deletion of the data of an individual respondent from the analysis, but only for those items for which the respondent recorded no entries. This is an accepted procedure for managing missing data when data is not missing in a particular pattern (Oppenheim 1992; Czaja & Blair 2005; Field 2013). It was also applied during the data analysis phase of the final MEL survey.

1.5.2   Questionnaire reliability

Establishing the reliability and validity (see next section) of a questionnaire are pivotal to questionnaire development (Neuman 1994), and indeed to the research results based on it. Related issues associated with questionnaire design like clarity of question wording, length of the questionnaire and order of questions are dealt with in detail in Chapters 3 and 4 on questionnaire construction and only generic issues are discussed in this section.

Reliability, as a controlling concept, refers to the "ability of a questionnaire to consistently produce the same results when the same people are surveyed under different conditions" (Field 2013: 13). A reliable questionnaire should therefore render comparable results should the same subjects be surveyed at a later stage or in a different location. One of the methods to safeguard reliability is by assessing the same subjects once more at a later stage − the test-retest method advocated by some methodologists (Chapman & Monroe 1993; Field 2013). This method was deemed unsuitable given the prohibitive costs of printing questionnaires and the logistics of distribution to Army units across South Africa.

The established statistical measure used in assessing the reliability of a questionnaire is Cronbach's alpha (Cortina 1993; Santos 1999; Gliem & Gliem 2003; Tavakol & Dennick 2011). This statistical measure was developed by Lee Cronbach in 1951 and measures the internal consistency of a test or scale (Cronbach 1951). Internal consistency indicates the extent to which all items in a test, or scale of a test, measure the same concept or construct and therefore reflects the interrelatedness of the items within the test or scale of the test or questionnaire. Cronbach's alpha is expressed as a decimal ranging between 0 and 1 (Tavakol & Dennick 2011), where 1

indicates perfect internal consistency and reliability of the items in the scale, while 0 indicates absolute internal inconsistency and unreliability of the items in the scale. Nunally (1978) recommends 0.7 as an acceptable reliability coefficient, but Field (2013) found that values between 0.7 and 0.8 are more often accepted by users to indicate acceptable values for Cronbach's alpha. Gliem & Gliem (2003) refer to George & Mallery's (2003) 'rules of thumb' rather to judge values above 0.9 as excellent, between 0.8 and 0.9 as good, and between 0.7 and 0.8 as acceptable. They conclude that an alpha of 0.8 is the most reasonable comparative goal. Streiner (2003) cautions that an alpha of above 0.9 probably indicates redundancy in the items and implies that some of them should be removed. After careful consideration of these rules of thumb and expert consultation (Kidd 2011a Pers com), it was decided to adopt a coefficient above 0.7 as acceptable proof of questionnaire reliability, but to strive for a coefficient of above 0.8.

In the questionnaire developed for this MEL survey, three scales, one each for attitude, behaviour and knowledge, were developed. The first two scales used Likert-type questions and therefore Cronbach's alpha was calculated for their responses. Cronbach's alpha is usually not calculated for knowledge questions with a correct/incorrect type of answer (Kidd 2011b, Pers com). Difficulty and discriminatory tests conducted for the knowledge scale led to the removal of some so enhancing the reliability and validity of this scale. Nunnally (1972) defined an item difficulty index as an index indicating the percentage of respondents who answered a question correctly. Questions that were deemed either too difficult or too easy were removed from the scale. Item discrimination refers to how well a question 'discriminates' or separates bottom performers from top performers on a knowledge scale (Venter 2006; Ferrando 2009; McElhiney et al. 2014). The Mann-Whitney U test was used to test the hypothesis that an item does not discriminate between high achievers and low achievers. The p-values of this test for the knowledge items were used to help selection of items for inclusion in the final questionnaire. More comprehensive explanations of these tests are given in Chapter 4.

The fact that the questions for all three scales were generated and verified by military environmental experts in the SA Army, as well as by other means, testifies to the reliability of the attitude, behaviour and knowledge scales.

1.5.3 Questionnaire validity

According to Nunnally (1978), the term 'validity' refers to the scientific usefulness of the questionnaire. A questionnaire is deemed valid if it measures what it is intended to measure. Issues related to a lack of validity revolve around the integrity of the theoretical constructs and ideas that support and provide the foundation for a research project. Lack of validity can also relate to the soundness of the research strategies employed during the research process (Kitchin & Tate 2000).

It is thus imperative to address these issues in order to ensure validity – a multifaceted concept and essential element of questionnaire development (Neuman 1994; Babbie 2004; Field 2013). Questionnaires must be valid for a specific purpose, such as measuring knowledge, attitude, or behaviour, in the applicable scales in this research. These scales form the subcomponents of the overarching construct MEL while discounting related constructs such as leadership or intelligence.

Different forms of validity are distinguished. While Nunnally (1978) distinguishes between predictive, construct and content validity, Babbie (2004: 144-145) differentiates between face validity ("the quality of an indicator that makes it seem a reasonable measure of some variable"), content validity ("the degree to which a measure covers the range of meanings included within a concept"), criterion-related or predictive validity ("the degree to which a measure relates to some external criterion") and construct validity ("the degree to which a measure relates to other variables as expected within a system of theoretical relationships"). In the case of this MEL survey, the concept is military environmental literacy.

Various methods to ensure validity can be employed. For the MEL, face validity, content validity, criterion-related validity and construct validity were established through a range of processes described in Chapter 3 but only overviewed here. A thorough search of the literature was conducted to gain insight into the concepts associated with the construction of EL. A number of questionnaires dealing with EL were evaluated and a selection of items from these questionnaires was used to compile the first draft of the pilot questionnaire. These items were discussed with military environmental experts who established their relevance in an iterative process, while adding items when necessary. Content analyses of various South African military documents dealing with the military environment were conducted and this added to the pool of items. These items were discussed either personally or via e-mail with a group of military environmental experts. Delegates at an international conference of military geoscientists were used as sounding boards regarding an early draft. The questionnaire was also evaluated by a panel of geography peers, military practitioners, a military language practitioner, and military environmental experts during a panel discussion. The draft questionnaire was again evaluated by the military environmental expert group and by 15 first-year MG students at the South African Military Academy. This exhaustive process rendered a valid pilot questionnaire.

The use of structural equation modelling (SEM) has become a technique of choice for the statistical validation of questionnaires (Hu & Bentler 1999; Hooper, Coughlan & Mullen 2008). Two families of SEM techniques exist: covariance-based techniques, as represented by LISREL, and variance-based techniques of which PLS path modelling is the most prominent (Henseler, Ringle & Sinkovics 2009).

During the pilot phase of questionnaire construction, covariance-based SEM testing was conducted on the data gathered during the pilot survey to assess the fit of the model to the data. Covariance-based SEM was used because it is the SEM technique used in LISREL, the statistical package employed to analyse the results of the pilot phase. Covariance-based SEM as an evaluative method statistically appraises the fit of a model to the covariance matrix. According to Barret (2007: 816), model fit is a "matter of testing whether the discrepancies (or residuals) are greater than would be expected by chance alone." In SEM methodology, the chi-square value is the traditional measure to assess overall model fit (Hu & Bentler 1999; Hooper, Coughlan & Mullen 2008). SEM testing indicated less than ideal results for model fit for the pilot questionnaire. These results posed a challenge regarding the validity of the questionnaire, especially because of the exhaustive process followed in constructing the pilot questionnaire.

The less-than-ideal results obtained for model fit forced revisitation of the literature to ascertain why, despite meticulously following best-practice procedures in questionnaire construction, the SEM result indicated model fit that was less than adequate. Scrutiny of the literature revealed that covariance-based SEM fit has become a contentious area of evaluative methodology. A thorough analysis of SEM literature and correspondence with an international statistics expert indicated, on the one hand, that adequate goodness of fit provides insufficient basis for model evaluation (Marsh, Hau & Wen 2004; Newsom 2014, Pers com) and, on the other hand, that there are a variety of reasons for models failing the chi-square test. The reasons include model misspecification, small sample bias, estimation method effect, effects of violation of normality and independence, and model complexity (Hu & Bentler 1999). Many researchers indicate that large sample sizes (as in this case) nearly always lead to rejection of the model (Hooper, Coughlan & Mullen 2008; Barret 2007; McIntosh 2007; Newsom 2014, Pers com). The latter advisor pointed out that even sample sizes greater than 200 negatively influence model fit. These authors emphasise the importance of judging models according to substantive theory, something done throughout the construction of the questionnaire.

Following the reappraisal of the literature it was decided to use components-based SEM to select questions for removal and to increase the validity of the questionnaire. Components-based SEM, or PLS path modelling, also known as the PLS (partial least squares) method, has been advocated by some researchers as a component-based estimation procedure that is different from the covariance-based approach (Henseler, Ringle & Sinkovics 2009; Wetzels, Odekerken-Scröder & Van Oppen 2009; Vinzi et al. 2010). One of the differences between PLS path modelling and the covariance-based SEM is that in PLS path modelling a global fit index is not computed for the whole scale. Instead, each item is assessed individually to assess suitability of the item for

inclusion in a questionnaire or one of the scales of a questionnaire (Wetzels, Odekerken-Scröder & Van Oppen 2009). On the advice of a statistical expert (Kidd 2011b, Pers com), PLS path modelling was selected to assess the items instead of relying on the results of covariance-based SEM. On the grounds of this process of ensuring validity and the advice of the statistical expert the validity and reliability issues were adequately resolved to ensure a valid and reliable questionnaire (Kidd 2011c, Pers com).

1.5.4   Selection of the survey sample

The population surveyed is members of the South African Army (SA Army) – a disparate entity divided into different formations, each with a uniquely dedicated role. Populations that are not homogeneous entities necessitate a proportional structured sample to adequately cover the population during a survey (Toyne & Newby 1977; McGrew & Monroe 1993; Williams, Sweeney & Anderson 2006). Stratification was used in the selection of units and members within each unit. This was done to ensure adequate representation by significant subgroups in the Army (Infantry, Artillery, Armour) and various personnel groupings (rank, gender). Further detail on stratification is provided in Chapter 5.

With sample type decided, sample size had to be determined. This important issue affects the validity of the survey (Griffith & Amrhein 1991; McGrew & Monroe 1993; Kopman, Lien & Naguib 2010; Newing et al. 2011). Neuman (1994) warns that a large sample does not alone ensure representativeness, as sampling type plays a vital role in guaranteeing representativeness too. According to Kitchin & Tate (2000) larger samples ensure greater confidence in the statistics derived from them regarding the matching of population parameters more closely. Although somewhat vague on what they consider to be 'large samples' Kitchin & Tate (2000) contend that large samples are not always feasible (or even necessary). Conducting surveys poses practical challenges because a balance between the scientific rigour of the survey and practicalities like available budget are encountered. Bartlett, Kotrlik & Higgins (2001: 43) describe the determination of sample size as a "function of the primary variables of measurement, error estimation, and variance estimation" and argue that a researcher needs a sample that is large enough to infer research findings back to a population. Chapman & Monroe (1993) list four technical factors that must be considered in selecting sample size: type of sample, population parameters being estimated, degree of precision needed and level of confidence required.

Newing et al. (2011) introduce the argument regarding population size in determining the sample size that a population exceeding 5000 obviates sample size as the sample requires progressively smaller percentages of the population to ensure representativeness. Newman (1994) and Terre Blanche, Durrheim & Painter (2007) maintain that conventional or commonly accepted

minimum sampling sizes do exist. Increasing population size requires progressively smaller sample proportions, for instance below 1000 (30%), 10 000 (10%), 150 000 (1%) and more than 10 million (0.025%). Bartlett, Kotrlik & Higgins (2001) recommend a sample size between 83 (0.8%) and 623 (6.2%) for a population of 10 000, depending on the type of data to be gathered and margin of error allowed. According to Kitchin & Tate (2000) if a confidence level of 95% and a confidence limit (±% of the mean) of 3% is needed from a large population, a sample size of 1067 can be used as a rule of thumb. Unfortunately they do not specify the size of a 'large' population.

According to the annual report for the financial year 2008/2009 of the DOD, the SA Army had 34 462 members (DOD 2009). Using the above rule of thumb, sample sizes of 1000 (2.9%) is justified. Advice from the Centre for Statistical Consultation at Stellenbosch University (Kidd, 2011d, Pers com), and accounting for practical realities of cost and time to perform the survey, a sample of 1000 was deemed adequate to support valid assumptions about the SA Army population. Subpopulation differentiation among the SA Army formations had also to be considered. Valid assumptions about subpopulations require between 20 and 30 respondents per group (Kitchin & Tate 2000), although Newman (1994) suggests a more conservative 50 respondents. This more conservative estimate of 50 was used as a benchmark to ensure validity even when the target number of 50 respondents fell slightly short. The total number of soldiers attached to each formation served as basis for calculating sample size of formations, while smaller formations that yielded a calculated sample size fewer than 50 received a minimum count of 50. This procedure satisfied the conservative minimum requirement set by Newman (1994). To ensure that the required number of completed questionnaires was received, a surplus of questionnaires was despatched to each unit. The practical steps to procure a structured, representative sample from the SA Army as a population are detailed in Chapter 5.

1.6   DATA ANALYSIS

The mixed-method approach used in the MEL survey resulted in the collection of both quantitative and qualitative survey data. Since both quantitative and qualitative analyses were employed in the research, a brief overview of the analytical techniques employed is provided here. Methods used to analyse the quantitative data are explained first, followed by an exposition of how the qualitative military environmental narrative was constructed. A theoretical model developed to categorise the MEL variables and profile MEL is described briefly to conclude the section on data analysis.

1.6.1 Quantitative data analysis

The quantitative data for the study was derived from the first three sections of the questionnaire. In the first two sections Likert-type questions with five possible responses ranging from 1 (strongly agree) to 5 (strongly disagree) were used, while the third section tested the knowledge of respondents by means of multiple choice questions. The discrete data was probed for relationships through analysis of variance testing, while Pearson product-moment correlation coefficients were calculated for the continuous variables.

The first questionnaire scale assessed the *attitude* of respondents toward the environment in which the military operates. Fifteen items gauged the attitude of respondents from preformulated statements regarding the environment in which the military operates. Respondents were required to rate statements on a five-point Likert scale by indicating the level of agreement or disagreement with each statement. In the *behaviour* scale, 13 items rated the self-reported behaviour of respondents toward the environment in which the military operates. The same five-point Likert scale applied. In the *knowledge* scale, 14 multiple choice items assessed the knowledge of respondents toward the environment in which the military operates. Twelve items offered five scale choices, while two had only three choices. All items allowed "I do not know" as an option to capture uncertainty or lack of knowledge.

Several statistical methods were employed to analyse questionnaire responses. Commencing with simple descriptive statistics (mean, mode, median) and graphic display (histograms, boxplots, barplots, pie graphs) analyses were elevated to more advanced inferential statistics and statistical modelling for which methodological guidance were gleaned from prominent sources such as Falissard (2012), McKillup (2012), Bless, Higson-Smith & Sithole (2013) and Field (2013). Methods to analyse the MEL survey data are outlined in this section to demonstrate their appropriateness.

Analysis of variance (ANOVA) was calculated for discrete variables (e.g. gender, formation) to assess their relationships with attitude, behaviour and knowledge. In experimental research ANOVA is used as an overall test of whether group means differ significantly. This technique gives an F-statistic[7] where low values (F close to 1) indicate similarity which implies limited ability to make predictions from the observed data. Higher values (F larger than 1) indicate dissimilarity, implying ability to make predictions from the observed data (Field 2013). *P*-values smaller than 0.05 indicate that the hypothesis that the observed variables are all the same, can be

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[7] The *F*-statistic was named in honour of Sir Ronald A. Fisher who developed the analysis of variance as a statistical technique from 1918 onwards (McKillup 2012).

rejected. For example, a *p*-value smaller than 0.05 indicates that in at least one case the attitude of that formation will differ from the rest. However, it remains to be determined which formations differ significantly from one another. This is done thorough post hoc testing (Remenyi, Onofrei & English 2011; McKillup 2012; Field 2013).

Statistically significant differences between variables can be determined by conducting *post hoc* or *a posteriori* testing. Both terms refer to the fact that the testing was done 'after the event' where the 'event' refers to a significant result for ANOVA (McKillup 2012). Different types of post hoc tests, such as Sheffé's method (Steyn et al. 1994), the Tukey test (McKillup 2012) and the Bonferroni's test, are but a few types. Statistical Package for the Social Science (SPSS) performs 18 (Field 2013). In the MEL study Fisher's least significant difference (LSD) tests were performed on the data to determine statistically significant differences between variables.

Because the variables service duration, age, highest level of education completed and highest level of geography education completed are continuous they cannot be analysed in the same way as the discrete variables. *Pearson product-moment correlation coefficients* were calculated for the discrete variables. Correlation analysis assesses the association between two variables as well as the strength and direction (positive or negative) of the association. Correlation coefficients range between -1 (strongly negative) and +1 (strongly positive), while 0 denotes no association (Remenyi, Onofrei & English 2011). A *p*-value below 0.05 indicates that the association is statistically significant. Although there is no scientific reason for the choice of 0.05 as indicator value, it is the "standard significance level" for probability that most researchers use (McKillup 2012: 60). To assess the relationship between the scales attitude, behaviour and knowledge the correlation between the different scales was computed following international practice (Chu et al. (2007), Lee (2008), Negev et al. (2008), Esa (2010)). The results were presented by means of scatterplots for the correlations between attitude and behaviour, knowledge and attitude, and knowledge and behaviour to probe for relationships between the components of MEL.

Following Falissard (2012) *composite scores* were calculated for each of the three questionnaire scales. The arithmetic means for these scales were calculated to summarise the attitude, behaviour and knowledge levels of respondents or the subcategories of respondents. However, combining the components of environmental literacy (EL) into a *single, composite EL score* was uncommon (Mc Beth 2016 pers com) and lacked a strict scientific basis (Marcinkowski 2016 pers com). It does have practical value, such as enabling comparison between similar studies or repeat surveys of the same population, something for which this research hope to form the basis. As such, a composite MEL score was calculated using the three components of MEL. McBeth et

al. (2008) calculated a composite EL score for the National Environmental Literacy Project (NELP), a baseline study of middle grade students in the USA. Their method entailed the construction of composite scores for EL components transformed into scores out of 60 to ensure equal representation of all the components (McBeth et al 2008; McBeth &Volk 2010; McBeth et al 2011). This method was also used by Karatekin (2013) in a study of the EL levels of student teachers in Turkey and it was consequently adapted for use in the MEL research.

1.6.2   Qualitative narrative analysis

The qualitative data generated for the study was examined by content analysis of the responses to the six open-ended items in Section 4 of the MEL questionnaire. The first two items dealt with the attitude of respondents, the next two items elicited information about behaviour patterns and the last two items focused on knowledge attainment. Krippendorff (2004), McMillan (2009) and Kuckartz (2014) all contend that content analysis is an efficient method for the analysis and extraction of meaning from text. Consequently, this method was applied to analyse responses recorded for each of the six open-ended items and to extract the MEL narrative[8] from these responses.

Qualitative data derived from open-ended items in a questionnaire is usually more structured and shorter than that produced by interviews or focus groups. One mode of analysing structured data is to code responses into categories and present them as a list so enabling a summary of response counts. Invariably, direct quotations are reported to authenticate findings and ensure that the voices of respondents are heard (Wendt et al. 2011; Bless, Higson-Smith & Sithole 2013). Once the data is classified and presented an investigation of the themes and identification of patterns commences to build a comprehensive picture of the responses (Henning, Van Rensburg & Smit 2011).

Content analysis is a collection of methods that may be applied to most forms of expressed (written or verbal) communication (Babbie & Mouton 2002; Berg 2009). It entails "the application of *scientific* methods to documentary evidence" Holsti (1969: 5). Although content analysis is a flexible research method it does apply scientific rigour. Content analysis has evolved from "the objective, systematic and quantitative description of the manifest content of communication" (Berelson (1952: 18) to also dissect latent content (hidden meaning of text) (Graneheim &

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[8] In the context of the MEL survey the word 'narrative' is used in the sense of an account or chronicle of the themes derived from the open-ended items. Through their responses the respondents narrate, or tell the story, of how they perceive integrated military environmental management in the SA Army.

Lundman 2004). Muehlenhaus (2011) even demonstrated the inherent flexibility of content analysis methods by adapting them for the study of variation in thematic map design.

Krippendorf (2004), Graneheim & Lundman (2004) and Berg (2009) have distinguished two general types of content analysis: quantitative and qualitative. Whereas the quantitative approach focuses more on enumerating occurrences in text, the qualitative approach discerns the meaning of text. Hsieh & Shannon (2005) present various content analysis methods, among which grounded theory, ethnography, historical research and phenomenology, and they distinguish three approaches, namely conventional, directed and summative. Conventional content analysis aims to describe phenomena, such as the reaction of respondents to open-ended items. In this investigation of MEL quantitative and qualitative versions were applied, especially conventional content analysis. Closer attention to these is provided in the discussion of the results.

Qualitative content analysis entails five distinct, but sometimes simultaneous and overlapping actions, namely identification of data segments; data matrix construction and coding; memo-ing; diagramming and reflection (Finfgeld-Connett 2014). During segment identification, text is read carefully and reflectively and initial codes or response categories are formulated. Data matrices and coding involve table development and extraction of response categories or coding. As data analysis progresses, memos and diagrams are constructed to record and interpret observations. Final reflection on the integration, interpretation and synthetising of ideas culminates in a process of revisiting and repeating of steps as new insights emerge. Zardo & Collie (2014) used an initial coding process and later expanded and changed the codes to make sure that they suited the purpose of the research. Response categories or codes can be identified before, after or during the data collection process (Ryan & Bernard 2000; Saldaña 2013), while Henning, Van Rensburg & Smit (2011) maintain that in open coding, codes are made up as the researcher engages with the data.

In the MEL survey, the process of content analysis was operationalised sequentially (see Figure 1.1). Response categories were primarily identified during initial data scrutiny, although response categories that had been identified during the literature study, compilation of the questionnaire and data collection process were also employed. The items in the open-ended section require respondents to agree or disagree with a statement or to answer positively or negatively to an item. After posting a positive or negative response, respondents had to give reasons for their answer. As a first step in the coding process, responses to each item were collated in a separate data set for each item. The responses to the first part of each of the items in each data set were counted and described.
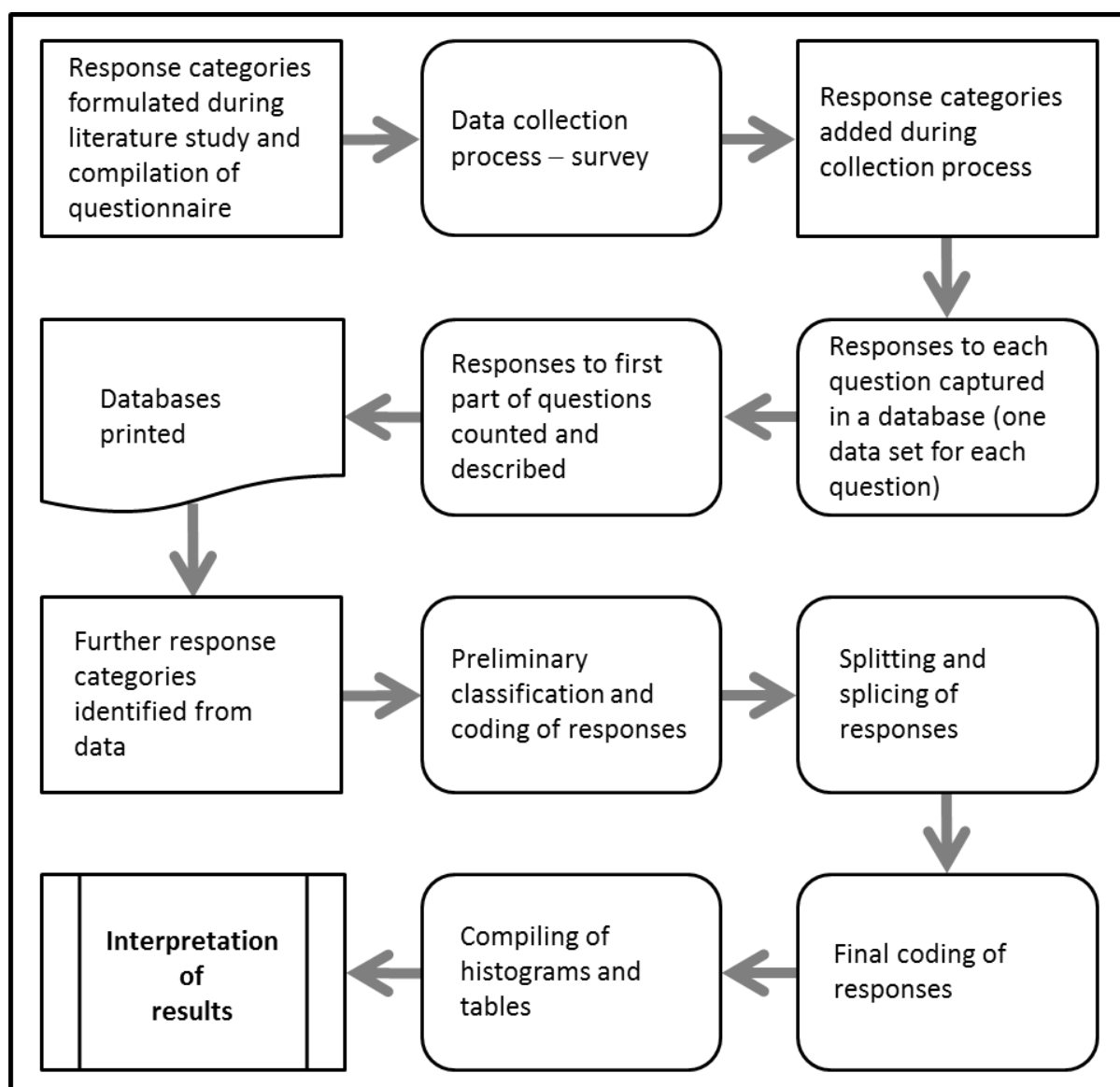
Figure 1.1 The compilation and analysis of qualitative survey data

The data sets were printed to facilitate the reading and coding of responses. The printed data sets were used to expand the response categories identified during the literature study, the compilation of the questionnaire and the data collection process. Responses were then preliminarily coded according to the identified response categories.

According to Dey (1993) researchers should, after creating and assigning categories or response categories, find ways to refine or focus the process of analysis. Following a thorough scrutiny of the identified response categories, some were divided into two or more response categories, a process called splitting (Dey 1993). Consequent to the splitting process, response categories were revisited and some merged, a process called splicing (Dey 1993). The responses were then recoded to final response categories. During each step in the content analysis the responses were read either partially or in total, so leading to the 'thicker' (Henning, Van Rensburg

& Smit 2011) or fully descriptive meaning of the responses – the primary goal of qualitative research (Elo & Kyngas 2007; Bless, Higson-Smith & Sithole 2013). Tables were compiled that enumerate the total number of responses, non-responses and typical responses to items. Typical response recognition ensures authenticity of the results and avoids the imposition of researcher interpretations on the responses (Negev et al. 2010; Bless, Higson-Smith & Sithole 2013).

A significant group of researchers has concentrated their efforts on establishing factors predicting, mediating or moderating pro-environmental conduct or acting as barriers to environmentally friendly behaviour (Peterson & Liu 2008; Dolnicar & Grün 2009; Noblet, Lindenfeld & Anderson 2013; Xue & Zhao 2015). In the discussion of the responses to the open-ended items in Chapter 7, these models and factors were employed to undergird the analysis. Because of the context-specific nature of the MEL research, some of the responses are not supported by the literature so that they support and are discussed as extensions to the environmental literacy debate. At the conclusion of the analysis the results were described and interpreted to identify salient response trends – the normal research conclusion (Stemler 2001; Vaismoradi, Turunen & Bondas 2013). Chapter 7 elaborates on the operationalising of content analysis.

1.6.3   Theoretical models of MEL

Research on environmental behaviour has given much attention to the identification of factors influencing environmental behaviour as well as the development of theoretical models to predict or explain environmental behaviour (Ajzen 1991; Stern 2000; De Groot & Steg 2009; Chao 2012; Grønhøj & Thøgersen 2012). Among these models, the theory of planned behaviour Ajzen (1991) and the model of responsible environmental behaviour Hines, Hungerford & Tomera (1986/1987) are the most cited and used, although other models abound (Stern 2000; Kollmuss & Agyeman 2002; Barr & Gilg 2007). The earlier models of pro-environmental behaviour, dating from the early 1970s, established a causal, linear link between environmental knowledge, environmental attitude and environmental behaviour. These models assumed that improved knowledge about environmental issues lead to better attitude toward the environment and this would foster pro-environmental behaviour (Kollmuss & Agyeman 2002).

Ajzen & Fishbein's (1980) 'theory of reasoned action' premises that because people act rationally earlier linear models could not adequately explain pro-environmental behaviour. They added beliefs (both evaluative and normative) to their model and later expanded it as the theory of planned behaviour (Ajzen 1991) which holds that people act "in accordance with their intentions and perceptions of control over the behaviour, while intentions in turn are influenced by attitudes

toward the behaviour, subjective norms, and perceptions of behavioural control" (Ajzen 2002: 43). Hines, Hungerford & Tomera's (1986/1987) model of responsible environmental behaviour is based on the Ajzen & Fishbein (1980) theory of reasoned action of which it is an expansion. This model includes attitudes, locus of control and personal responsibility, personality factors, knowledge of issues and strategies, and action skills which are influenced by the intention to act and situational factors.

Kollmuss & Agyeman (2002: 239) made the telling remark about models of environmental behaviour that: "the question of what shapes pro-environmental behaviour is such a complex one that it cannot be visualised through one single framework or diagram." This viewpoint was supported a decade later when Robelia & Murphy (2012: 300) declared that "factors influencing environmental behaviour are too complex to describe in any one model." Although these cautionary sentiments of Kollmuss & Agyeman (2002) and Robelia & Murphy (2012) are valid, they do recognise the usefulness of environmental models to categorise and clarify environmental behaviour, the ultimate aim of this research.

Each component of MEL can be impacted by a host of factors that will augment or restrict the influence of the component in MEL. In this research the influences of demographic, military service, and education and training variables on MEL were investigated and the results of such a survey, together with insights gained from the military environmental narrative, can be encapsulated in a model. Consequently, a MEL model was developed to structure the research results and do MEL profiling of the respondents. This model is presented and explained in the final section of Chapter 7.

1.7   RESEARCH DESIGN AND TIMELINE

The research design set out in Figure 1.2 graphically portrays the design and execution of the study, as well as the time frame within which the actions were completed. The study commenced with an analysis and evaluation of existing questionnaires found during the literature study to determine their suitability for use in the context of the SA Army. Five extant questionnaires were analysed and evaluated in depth but none was suitable for measuring MEL in the SA Army.

Once the unsuitability of these questionnaires to measure MEL in the SA Army was established, the existing literature was mined to identify and formulate indicators of MEL in the SA Army. Content analysis was conducted on selected documents to establish the elements identified by the SANDF and other sources to be characteristic of environmentally literate soldiers. Policy documents of the DOD and SANDF were especially valuable. This information was

October 2009	**Analyse and evaluate existing questionnaires to determine suitability for application to the South African Army** • Five most suitable questionnaires analysed • *None qualified*		**Obtain ethical approval** • Stellenbosch University Research Ethics Committee • South African National Defence Force
	Identify and formulate indicators of military environmental literacy (MEL) in the South African context • Review literature • Consult military environmental experts • Content analysis of policy documents	
May 2010	**Develop South African Army MEL questionnaire** • Draft development • Military environmental expert group • Panel evaluation • Pre-test • Pilot test • *153 usable questionnaires*		**Consult: Stellenbosch University Centre for Statistical Consultation**
May 2012	**Conduct MEL survey** • Nine SA Army Formations • Sample 25 units (1112 soldiers) surveyed • *1090 usable questionnaires*		**Final South African MEL questionnaire** • Introductory Letter • Quantitative section Attitude; Behaviour; Knowledge • Qualitative section Six open-ended questions • Biographical section • Informed consent letter
October 2012	**Process questionnaires** • Capture raw data • Reclass and recode data • Complete database	
August 2013	**Analyse and interpret data** • Quantitative data analysis • Qualitative data analysis		**Consult: Stellenbosch University Centre for Statistical Consultation**
	Develop MEL model	
June 2016	**Policy recommendations**	

Figure 1.2 Key steps and activities in investigating military environmental literacy in the South African Army

supplemented with insights gained from interviews with role players in the DOD, especially the Army, involved in military environmental management. An environmental expert group was constituted, with South African and international military environmental experts to help generate items for inclusion in the draft questionnaire and to comment on the MEL questionnaire.

Concurrent with performing these tasks, an application procedure was initiated for ethical approval of the study. Studies of this nature, i.e. where people are surveyed, demand a high level of integrity, sensitivity and ethical behaviour from the researcher. This must be reflected in the behaviour of research staff, as well as in the structure of the survey methods. Ethical approval was obtained from Stellenbosch University, the custodian of this research, through the Research Ethics Committee. A prerequisite of this process was to obtain permission from the SA Army to do the research. The Chief of the SA Army gave his imprimatur following security clearance by Defence Intelligence. The process of obtaining ethical approval for the study and the steps taken to ensure adherence to the parameters of ethical research conduct are described fully in Chapter 3.

The items generated by the literature review, military environmental experts and survey of policy documents were used to develop a draft questionnaire. The draft questionnaire was subsequently scrutinised by identified experts in the military environmental services and after making changes based on their inputs, a panel of geography peers, military environmental experts, military practitioners and a military language practitioner workshopped with the researcher to assess its integrity. The adapted questionnaire was submitted to the military environmental expert group for their final inputs following which the questionnaire was critiqued by 15 undergraduate students at the South African Military Academy and adapted accordingly.

A pilot survey among students and staff members at the South African Military Academy in Saldanha rendered 153 usable questionnaires for gauging the validity and reliability of the survey instrument. The insights gained helped to refine the questionnaire regarding length and item selection. Results from the pilot survey were considered with statisticians in the Centre for Statistical Consultation at Stellenbosch University and necessary changes were made to produce the final version used in the main survey. The processes of questionnaire development and pilot testing are treated further in Chapters 3 and 4.

The final questionnaire consisted of a letter of introduction, a quantitative section with three subsections, one each for attitude, behaviour and knowledge, a qualitative section with six open-ended items, and a biographical and service history section. An informed consent letter accompanied each questionnaire. The questionnaire was administered to a representative sample of 25 Army units, representing all nine formations. A total of 1090 usable questionnaires were returned from which quantitative and qualitative databases were compiled for later analysis. The process of data gathering is discussed further in Chapter 5.

The quantitative data was analysed in collaboration with the Centre for Statistical Consultation (CSC) at Stellenbosch University, using LISREL 8.8 software (Jöreskog & Sörbom 2006). Collaboration with CSC staff regarding the statistical analyses contributed to ensuring the

validity and reliability of the results through descriptive and correlational statistical procedures. Kaiser, Wölfing & Fuhrer (1999), Kibert (2000), Walsh-Daneshmandi & MacLachlan (2006), Chu et al. (2007) and McBeth & Volk (2010) have used various statistical packages and determined means and standard deviations, and ANOVA to check the effects of the different variables on the components of environmental literacy assessed in their studies. These studies constitute the framework for the development of the MEL questionnaire and the analyses of the results of the MEL survey. Multiple regression analyses were carried out to detect whether participants' self-reported environmentally friendly behaviours were significantly related to their environmental knowledge and attitudes.

The qualitative examination of the open-ended items was done by using content analysis methodology described by Dey (1993), Limb & Dwyer (2001), and Henning, Van Rensburg & Smit (2011), among others. The environmental narrative extracted from the results is dealt with in Chapter 7. The results of the quantitative and qualitative investigations were used to develop a MEL model to structure the research results and do MEL profiling of the respondents.

Execution of the research design was accomplished by conducting a set of procedures, sometimes concurrently, sometimes in a set order. It is apparent in Figure 1.2 that the researcher encountered time delays in obtaining institutional and ethical research permission, especially in securing institutional permission. This should be a warning to researchers intending to do research in large, bureaucratic institutions to allow ample time to secure permission to do the research. The ethical approval procedures at Stellenbosch University have recently been streamlined and computerised to expedite approval. The institutional permission conundrum is considered further in Chapter 3.

1.8   DISSERTATION STRUCTURE

The dissertation is structured logically from introduction to summary and conclusions in eight chapters. Chapter 1 reviews the background to environmental literacy research in the military; points out problems faced in this regard by the South African DOD; clarifies environmental concepts and definitions; introduces the research questions, aim and objectives; and overviews the research approach and methods.

Chapter 2 dissects the environmental imperative for the SANDF. Impacts of military activity on the environment; the relationship between military geography and environmental research; the nature of military environmental management and policy; and the history of environmental management in the SANDF are explored to justify the need to assess the MEL of SA Army personnel.

Chapter 3 evaluates a selection of existing questionnaires to determine their suitability to a SA Army context and subsequent sections sketch the development and construction process of a valid and reliable, organisation-specific questionnaire to measure MEL. Chapter 4 deals with the pilot survey at the South African Military Academy in Saldanha and the development of the final questionnaire to survey MEL. The validity and reliability of the questionnaire are assessed and item selection for the final questionnaire is justified. In Chapter 5 the processes of respondent selection, survey conduct and quality control to ensure data integrity are reported.

Chapter 6 discusses the quantitative analysis and results of the study for the attitude, behaviour and knowledge scales according to the socio-demographic, education and training, and service profiles of the respondents. In Chapter 7 composite scores are used to establish relationships between respondents' socio-demographic, education and training, and service profiles. The MEL scores are also presented and discussed. Reporting of the qualitative analysis of the military environmental narrative based on the responses to the six open-ended items in the questionnaire constitutes the second part of the chapter. Dominant themes in the narrative are identified and the response codes justified. Quantitative and qualitative content analyses probe and interpret the perceptions of respondents' attitudes, behaviour and knowledge in the military environment. These results are triangulated with the results from the quantitative results. The chapter is concluded with a military environmental model that visually portrays the research results. In Chapter 8 the findings are summarised, conclusions are drawn, theoretical and practical implications are noted and recommendations are made for improving MEL in the SA Army.

The rationale for a study to assess MEL in the SANDF, the methods to accomplish this, the academic and practical contributions such a study can make, as well as the structure of the dissertation have been introduced in this chapter. Attention now shifts to the status of environmental management in the SANDF.

CHAPTER 2   ENVIRONMENTAL MANAGEMENT IN THE SANDF

It is important to remember that proper environmental care is not only the responsibility of some specialist environmental managers, but of every member of the Department [of Defence]. It must become a way of doing our day-to-day tasks in a manner that complements the environment (Matanzima 2001: 19).

Historically, the environment has suffered severely in times of war. Examples of extreme damage include urban firebombing during WWII, napalm bombing of mangrove forests during the Vietnam War and the firing of oil wells during the Iraq wars (Ansari 1996; Carr 2007). Kemp (1990) vividly described the catastrophic environmental effects of even a small-scale nuclear conflict, while Carr (2007: 335) talks about the "shock and awe" of the opening manoeuvres of the American invasion of Iraq, and when bombs rained down incessantly on Baghdad. These views are shared by authors such as Liebenberg (2007), Butts (2011) and Hupy (2011). Usually the image of environmental destruction by the military is the one exploited by the media and implanted into the memories of the civilian population, but does not provide a comprehensive or accurate account of the relationship between the military and the environment – neither internationally, nor in South Africa.

The first four sections of this chapter provides proper context. First, the paradoxical relationship between military activities and the environment is explained; second, military geography's role in environmental research is described; third, the nature of military environmental management and policy in South Africa is highlighted; and fourth, the historical development of environmental management in the SANDF is sketched. The attention then turns to the need for accurate management information regarding MEL among SA Army personnel. This chapter serves to elucidate the complex relationship between the environment and the military, both generally and more specifically the South African context.

2.1   MILITARY ACTIVITIES AND THE ENVIRONMENT: A PARADOX

Although there is no denying the devastating effects of war, a simplistic view of the way militaries operate would be fundamentally flawed on at least two counts. In the first instance, militaries globally spend only a small portion of their time actively involved in conflict-related activities. The rest of the time they train, take part in peacekeeping missions and perform humanitarian assistance duties. In their military roles environmental concerns are pertinent (Singer & Keating 1999). These authors catalogue operational domains such as land use, testing and development of new weapons (especially chemical and biological), manufacturing and production of armaments, training and practice exercises, maintenance of hardware and infrastructural

facilities and disposal of old or used weaponry all as important environmentally impacting military actions. Fortunately, the operational domain is also most readily susceptible to programs aimed at reducing the military environmental footprint. In the second incidence, the world has changed. No longer are militaries allowed to wage indiscriminate war and most nations today subscribe to safeguarding the physical and cultural environments during wartime. Ansari (1996) and Carr (2007) contend that this was previously not always the case and during the Vietnam and Iraq conflicts the environment was actually targeted to deprive contenders of cover or valuable resources.

The impacts of military activity on the environment tend to be multifaceted. Mosher et al. (2008) explain that the long duration of occupations and post-conflict involvements of the US military placed greater emphasis on the importance of environmental considerations in military conduct. They advance additional reasons: In conflict zones where the environment poses a threat to soldiers, longer stays exacerbate the threat. The actions of US soldiers with respect to the local environment have also become more important because of their more lasting effect on the local population, while improvement of the local environment can generate goodwill among the local population toward the US occupying forces. It is important to note that poorly handled environmental impacts are not bound by borders and can easily cloud good relations with countries bordering the conflict zone. In 2012 when American soldiers inadvertently burnt copies of the Koran in Muslim Afghanistan the US military suffered severe reprisals, protests and deaths among soldiers. They learnt the hard way that the total local environment, including the cultural environment, must be respected at all times (Rubin 2012). More importantly, the event tarnished the image of Americans among both the Afghan population, and the neighbouring Muslim nations, so negatively influencing the reaching of American military objectives in that conflict.

Mosher et al. (2008: xvii) registered seven major findings on how the US Army should approach environmental considerations during overseas contingency operations, especially during the post-conflict and reconstruction phases:

- "Environmental concerns impact operations significantly;

- Environmental considerations are particularly important for success in the post-conflict phase of operations;

- Environmental considerations in contingency operations differ significantly from those in normal operations taking place in the United States;

- Environmental issues have far-reaching impacts across Army operations, and everywhere in the world;

- Deficient environmental practices in contingency operations increase current and future operational costs, liabilities, strain diplomatic relations, and pose risks to soldiers' health;

- The US Army could improve its understanding of environmental considerations and could incorporate them more effectively into plans and operations; and

- The US Army lacked a comprehensive approach to environmental considerations in contingencies, especially in the post-conflict phase."

The foregoing pronouncements hold true for most militaries worldwide and have far-reaching implications for the way in which environmental issues are addressed by militaries. It also provides a powerful incentive and rationale for militaries to conduct their affairs in environmentally responsible ways. Poor environmental conduct not only reflects poorly on the nation conducting the military operation, but it may also jeopardise mission success and even the lives of soldiers involved in the mission (Bonds 2015).

Modern-day defence forces are increasingly subjected to elevated environmental concern, manifesting in mounting corpuses of national and international environmental legislation that regulate both peacetime and wartime operations. There is growing recognition of the environmental dimension of global security, and militaries worldwide are coming under increasing pressure to perform their activities in an environmentally responsible manner and in abeyance of national and international environmental legislation, both in times of war and during peacetime (Potgieter 2000; Shrivastava 2001). Wilson (1996), referring to the Australian Army, shares this sentiment and stresses that poor management practices may lead to environmental degradation, diminishing the value of training or even limiting the access to training areas.

While globally the core function of defence forces remains the same – to fight and win nations' wars – modern defence forces are called upon to assist in peacekeeping and/or peacemaking operations, provide hazard and disaster management planning and mitigation services in vulnerable areas, and generally lend a helping hand during times of crisis. The effective execution of such tasks depends on the maintenance of a wide scope of diverse training facilities, so that training can be done in real-world environmental conditions. Shaw et al (2000: 68) warn that "… when no environmentally comparable site exists in the United States, the Army lacks a training resource as fundamental as time, equipment, soldiers or money." In a later expansion on this article Shaw et al. (2005: 379) reiterated their viewpoint by stating that "from a readiness perspective, these lands and their associated physical attributes (such as terrain, vegetation and climate), can be viewed as operational analogs for areas where the Army may deploy to fight a major theatre war or participate in a stability and support operation."
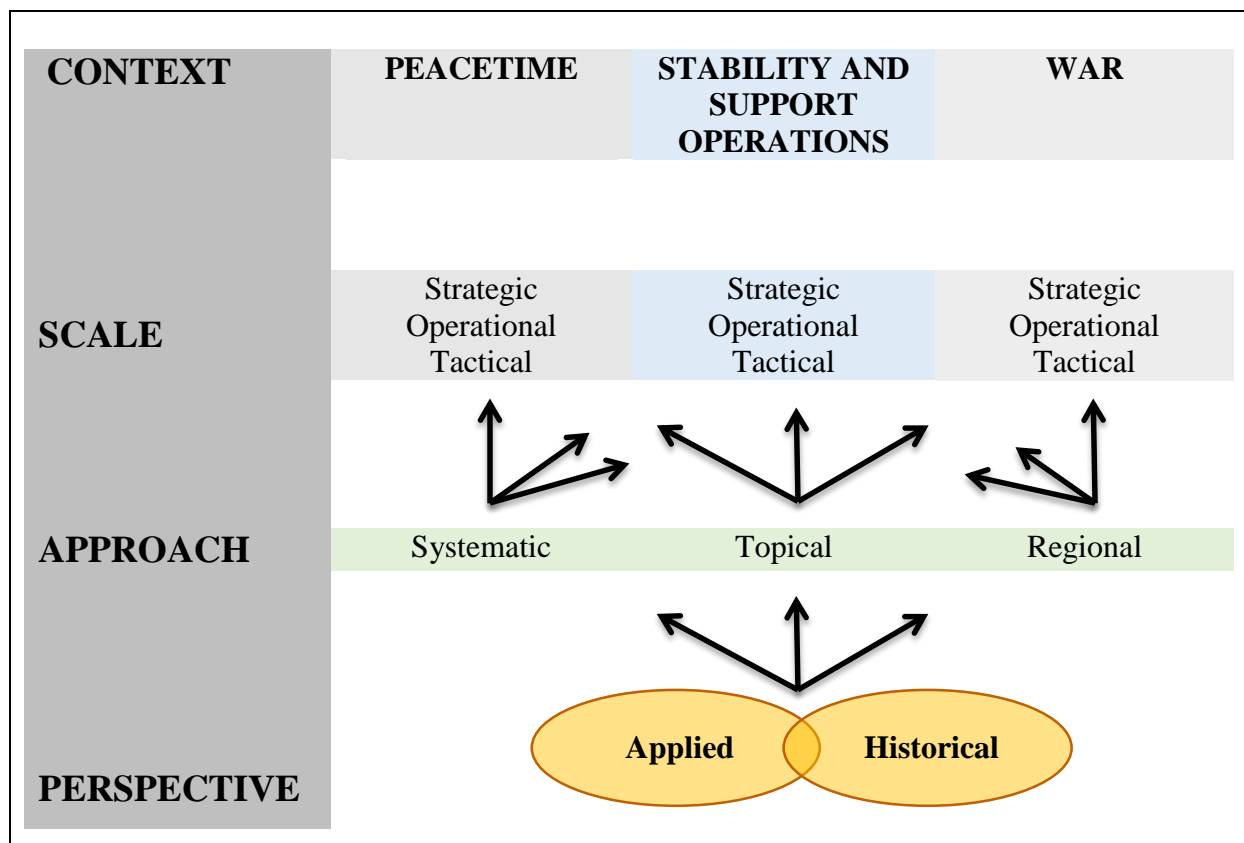
In their book on United States Army environmental considerations for operations, Mosher et al. (2008: 3), poignantly asks: "Why should commanders care about environmental issues?" Concerns such as soldier health and safety, mission success, the amplification of environmental issues during long deployments and the importance of 'doing the right thing' are offered as reasons for taking environmental matters into consideration during all phases of military activity (Mosher et al. 2008: 11). In summary: To modern militaries, also in the South African context, environmental concerns matter at all levels of military planning and execution.

2.2   MILITARY GEOGRAPHY AND ENVIRONMENTAL RESEARCH

The most dramatic change in the organisation of geography since the 1880s has been the replacement of a specialised physical geography by environmental geography due to "increased environmental pressures at both local and global levels" (Hagget 2002: 967) as one of seven trends in world geography (Barnard 2001). These developments placed environmental issues firmly within the sphere of geography and in the subdiscipline of military geography – the home discipline for the MEL research. Janse van Rensburg & Smit (2012) support this viewpoint by drawing attention to the need for a broadening of military geography to incorporate the importance of both physical and cultural environmental phenomena as critical factors to ensure mission success.

As early as the 1960s Jackman (1962: 8) defined military geography as a "… sub discipline of geography which applies geographical principles and knowledge to the solution of military problems", while Peltier & Pearcy (1966: 7) described it as "…the application of the geographic discipline within the business of military affairs." At first it seemed as if the "high profile which environmental issues currently enjoy in geographical research contrasts strongly with geographers' apparent interest in defence matters" (Coulson 1995: 371), but environmental awareness then became one of the study themes of what he termed "…the geography of defense." Collins (1998: 3) regarded military geography as "…a subfield of geography that concentrates on the influence of physical and cultural environments over politico-military policy, plans, programs and war/support operations within global, regional and local contexts." Palka & Galgano (2005: v) simplified the definition of military geography to the "…application of geographic information, tools and techniques to military problems." According to the latter authors (and as portrayed in Figure 2.1), the context of military geography included the study of peacetime operations, stability and support operations (SASO), as well as wartime operations.

The scale of scrutiny can fluctuate from strategic through operational to tactical level. A systematic, topical or regional approach can be relevant, while the perspective can be either applied or historical.

CONTEXT	PEACETIME	STABILITY AND SUPPORT OPERATIONS	WAR
SCALE	Strategic Operational Tactical	Strategic Operational Tactical	Strategic Operational Tactical
APPROACH	Systematic	Topical	Regional
PERSPECTIVE		Applied Historical	

Source: Adapted from Palka & Galgano (2005: vii)

Figure 2.1 The scope of military geography

In 2002 South African military geographers defined their subject field as the "study of the man-environment interaction and its influence on military planning and activities" (Jacobs, Janse van Rensburg & Smit 2002: 195). This definition implies that military geography follows a holistic approach that encompass elements of physical, human, regional and environmental geography, as well as geographers' tools such as cartography, satellite remote sensing, and geographic information systems (GIS) to help solve military-related problems and to develop more advanced military systems.

The South African MEL study was approached from an applied perspective, followed a topical approach variously conducted at all three scales and within all three contexts. From this brief discussion it is evident that military geographers can and should study issues such as environmental literacy within a military context in the broad embrace of international and national environmental management policies. In the next section attention is focused on concerns related to military environmental management and policy particularly in South Africa.

2.3   DAWNING OF MILITARY ENVIRONMENTAL MANAGEMENT AND POLICY IN SOUTH AFRICA

Lonie & Moloney (1996) have alleged that environmental responsibility has attained the global status of a 'new morality' that manifests in community emphasis on environmental concerns such as recycling, 'green' product usage and the promulgation of laws regulating activities with possible harmful effects on the environment. This expectancy of high standards of responsible environmental conduct was extended to modern defence forces as well.

The very nature of modern militaries and the large tracts of land used and managed by them, necessitate the re-evaluation of the impact military activities have on the environment. In the South African military this process started officially in 1977 when South Africa followed the lead of the US military and became the second country to officially institute a policy to protect the military environment.

Globally, 1970 is recognised as a watershed year regarding environmental issues when Rachel Carson's *Silent Spring* (1962) elicited responses at both international and national levels, and started a global move toward greater environmental awareness (Rabie & Fuggle 2000). The National Environmental Policy Act was signed on 1 January 1970 in the USA, while in South Africa 1970 was declared Water Year. In 1973 this was followed by the celebration of Our Green Heritage. Various environmental bodies were formed during the following decade, including several flagship government committees that played an important role in environmental governance. The White Paper on a national policy regarding environmental conservation was published in 1980 (Rabie & Fuggle 2000). This action reflected an initial concern with and, as would often be alluded later, a confusion of conservation as the only management concern.

The blossoming global and national concern for the environment did not pass unnoticed by the South African military and in 1977 resulted in the first instruction by the then Minister of Defence, General MA de M Malan, to the Defence Force to care for the environment on its properties – a brief similar to that required by the national framework (Kleyn 1988). In 1978 this measure was followed by the formulation of the first South African policy on military environmental matters (South Africa 2008). In a four-page document titled "Nature conservation in the South African Defence Force" (DOD 1978: 1)[9], the management principles for nature conservation in the Defence Force are set out. These management principles focused on the preservation of fauna and flora on military property and the need for serving members to acquire

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[9] Note the difference in name between the pre-1994 South African Defence Force, and the present South African National Defence Force.

knowledge about nature conservation. The document also established that Officers Commanding would be held responsible for nature conservation in their base areas, the culling and management of game and that finances for these activities would be made available in the "normal way" (DOD 1978: 3). While rather rudimentary, this document nevertheless formed the foundation of South African military environmental management. The exclusive focus on conservation and the absence of any mention of the link between this conservation and military activities are distinguishing elements of the document.

This first environmental policy was followed by various Logistics pamphlets operationalising the policy. The aim of Log 17 Pamphlet 20 (DOD n.d.: 1), Nature and environmental conservation in South Africa, was to "formulate procedures for the application of the nature conservation policy of the South African Defence Force, and to ensure the successful implementation thereof." The pamphlet comprises 15 pages and three appendices and describes nature conservation as a secondary objective of the military and, while referring to the integration of military activities and nature conservation in passing, no indication on how this should be accomplished is provided. The definition of nature conservation in this document refers to the "judicious use, the intelligent development and the efficient control of the renewable resources of nature" with the important utilitarian caveat "for the benefit of mankind" (DOD n.d.: 2). This document formed the blueprint for dealing with the military environment during the next decade and displayed a strong focus on the usefulness of the environment for the military and on the conservation of fauna and flora, without too much emphasis on how this was to be integrated with the military mission or the execution thereof.

In 1994, South Africa went to the polls in its first democratic election. This election ushered in the era of democracy, but also an increased realisation of the importance of the environment. The new democratic government inherited a fragmented set of governance structures and relationships, together with laws, policies, guidelines and procedures that formed the basis of managing the environment under the previous dispensation (Strydom & King 2009). The new democratic dispensation also led to a new era of environmental consciousness and four years later, in 1998, the National Environmental Management Act (NEMA), Act number 107 of 1998, was signed into law (South Africa 1998). NEMA is a framework for environmental legislation and conforms to the new form of public administration and governance that complies with the constitutional imperative of cooperative governance (Strydom & King 2009). As such, this Act forms the backbone of South African environmental law. NEMA required every national department that may affect the environment to compile an environmental implementation plan within one year of the promulgation of the Act and to update it at least every four years thereafter

(South Africa 1998). The environment was placed firmly amid the day-to-day activities of the South African Department of Defence (DOD) by this legislation.

2.4   IMPERATIVES FOR ENVIRONMENTAL MANAGEMENT IN THE SANDF

The South African DOD occupies some 490 000 hectares (roughly a quarter of the size of the Kruger National Park) of land area with more than 30 000 buildings on it (Godschalk 1996b; Jordaan n.d.). Of these, 25 areas are larger than 2500 ha, with Army Battle School at Lohatla in the Northern Cape the largest at 135 000 ha. These territories are used for personnel training, testing of weapons and other equipment, maintaining depots, providing accommodation, as shooting ranges, as operational bases and as air bases (Godschalk 1996a). Although some of these bases have been decommissioned since 1996, the 2014 Defence Review (DOD 2014) records the area of DOD controlled property at 420 000 hectares. Notwithstanding this decommissioning, the DOD still controls large areas of land and remains an important national role player in environmental management.

In the following subsections, the initial focus on military environmental conservation; the significant shift to military integrated management; the essence of environmental implementation plans for defence; military environmental cooperation with the USA; and the environmental management system for defence are explored as environmental management imperatives.

2.4.1   The conservation focus of military environmental management

In the decade preceding 1998, the preeminent South African environmental statute was the Environmental Conservation Act (Act 73 of 1989) (Hamman, Booth & O'Riordan 2000; Rabie & Fuggle 2000). As its title implies, environmental conservation formed the nucleus of the activities stipulated and regulated by this legislation. Within the South African DOD the same approach was pursued, so that, until the 1990s, the emphasis remained on the conservation of the environment under DOD jurisdiction, with scant regard for management integration into day-to-day activities (Godschalk 1998).

The advent of the new political dispensation in the nineties coincided with an era of environmental consciousness, culminating in the 1998 National Environmental Management Act (NEMA) (South Africa 1998). As an overarching framework law, NEMA provided for integrated environmental management and coordinated and sustainable protection of the environment (Van der Linde 2009). In the same year that NEMA was promulgated, the South African Defence Review was approved by Parliament. In Chapter 12: Land and Environment, the areas under DOD control are discussed and the approach of military integrated environmental management elucidated. According to the Review, military environmental management entails taking the

impact of military activities into account in all aspects of the planning and execution of such activities (DOD 1998) – a major deviation from the earlier exclusive focus on environmental conservation-in-isolation.

2.4.2 From conservation to military integrated environmental management

The emphasis on nature conservation continued to evolve, eventually encompassing a broad range of subfunctions that included the ecological management of training areas, base environmental management, cultural resource management, environmental research and environmental education. Despite these advances, the environmental function was still perceived as an over-and-above function with little relevance to the core business of the military and one left to the environmental experts, while the military professionals concentrated on the execution of military missions.

During the early 1990s this emphasis on conservation-in-isolation began to shift toward the integration of environmental management into each and every sphere of military activities (Godschalk 1998). In 1992 the military top management officially adopted this new strategy for the Environmental Services subdirectorate responsible for the overarching functioning of environmental management in the DOD (Godschalk 1996b). The structure of Environmental Services in the DOD is graphically portrayed in Figure 2.2.

The environmental function of the DOD resides at levels 2 to 4 of the Department's organisational structure. At level 2 (at Directorate Facilities of Joint Support Division) the Environmental Services subdirectorate has four environmental posts. Staff in these posts are responsible for the overall management of the military environmental function, as well as developing, formulating and promulgating military environmental guidelines, procedures and policies (South Africa 2001). At level 3 a section Specialist Environmental Services comprises nine environmental specialists, each focusing on a particular domain of the environment. This capacity is extended through a further 10 dedicated environmental posts – two at each of the five Regional Facilities Interface Management (RFIM) offices. The environmental officers at the RFIM offices are responsible for regional implementation and monitoring of military integrated environmental management. Twenty-four General Support Bases (GSBs) each have at least one dedicated environmental officer to support units, force structure elements and satellite offices regarding military environmental management. In summary, 47 dedicated environmental posts exist to affect environmental management in the DOD (South Africa 2001), a matter revisited toward the end of the subsection.
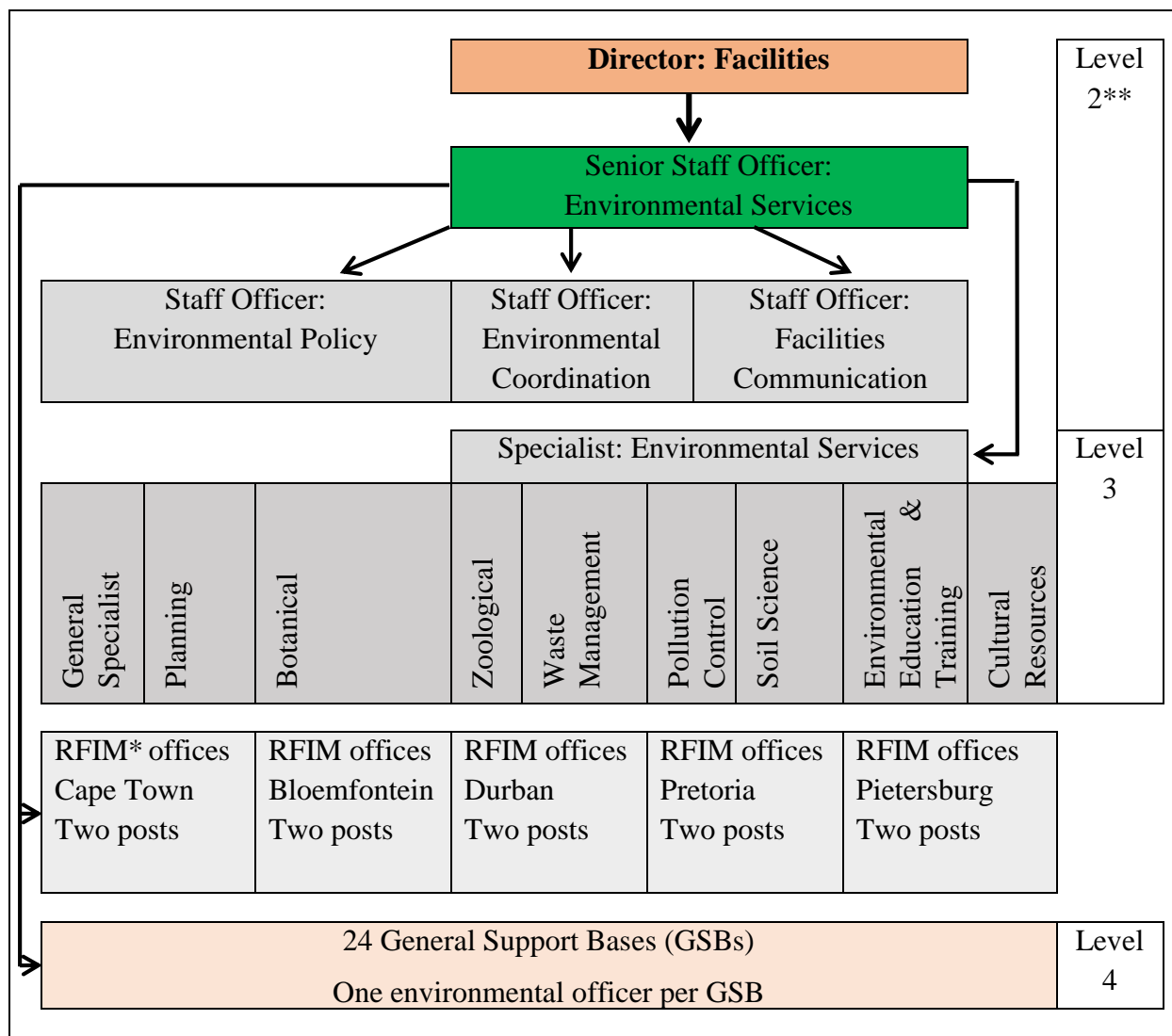
Source: Adapted from South Africa (2001:17-18)

Notes: * RFIM is Regional Facilities Interface Management; ** The levels in the diagram indicate increasing levels of authority from level 4 as the lowest level, to level 2 as the highest level of environmental services authority.

Figure 2.2 The structure of Environmental Services in the SANDF

The Comprehensive DOD policy statement on Defence facilities and environmental management (Department of Defence instruction: Policy and plan number 00033/2000) endorsed this new strategy and contains an important definition elucidating this shift toward integration of environmental management and military activities. In the policy statement military integrated environmental management (MIEM) is defined as: "the integration of military activities with the environmental setup where the military activities are carried out. This is done by taking into account the environmental opportunities and constraints presented by the environment in the planning and execution of military activities" (DOD 2000: 6). This definition implies that environmental considerations must be integrated into all aspects of military activities, not only during the execution of activities but, more importantly, during the planning of such activities. The

main differences between the earlier conservation approach and the MIEM approach are summarised in Figure 2.3.

KEY ELEMENTS	OLD APPROACH	NEW APPROACH
Mission	Conservation	Environmental management
Function	Secondary; over-and-above	Integrated
Emphasis	Environmental resource management	Military integrated environmental management
Military involvement	Low	Concentrated
Environmental services responsibility	Specialist	Commander
Monitoring	General	Auditing
Education	Awareness; ad hoc	Training; integrated
Research	General environmental	Environmental impact and management
National effort	Stand-alone	Integrated
External co-operation	Loose	Structured
Environmental services personnel	National Servicemen	Permanent Force

Adapted from Godschalk (1996b:2)

Figure 2.3 Comparison between the old and new approaches toward the environment in the Department of Defence

The new approach formalised in the DOD instruction: Policy and plan number 00033/2000 constituted some far-reaching changes (DOD 2000). The mission and function of military environmental services transformed from a secondary, over-and-above conservation function to a fully integrated military environmental management function within the DOD. The emphasis of military environmental management shifted from the management of environmental resources, characterised by low military involvement, to an emphasis on integrated environmental management supported by active military involvement (DOD 2000). Responsibility for the environmental function was transferred from an environmental specialist (usually a National Service member and not a permanent member of the DOD) to the commander of each unit, while general environmental monitoring was replaced by the auditing of environmental performance by auditors from Defence Inspectorate (South Africa 2001).

The focus of environmental education as part of the environmental management drive shifted from ad hoc awareness campaigns that did little to influence the integration of environmental concerns into military activities to integration of military environmental management into all aspects of training (Godschalk 1996b). This shift of focus implies that all training in the SANDF had henceforth to be planned and executed with the military environment and the impacts on it, foremost in mind. Magagula (2014) claims that this integration does not necessarily occur throughout the DOD through a lack of adequate funding and adequately trained military environmental staff, making the attainment of integration of environmental concerns into all aspects of military training an unattainable goal while these constraints exist.

Complementary to the integration of environmental concerns into military activities, research focused on environmental impacts rather than general environmental issues (Godschalk 1996b). At national level, an integrated environmental conservation effort replaced the stand-alone, fragmented situation, with structured external cooperation replacing the loose, unstructured cooperation between different public and governmental role players. The capacity gaps identified by the two Environmental Implementation Plans (EIP's) for Defence indicate that this effort at integrated environmental management had not totally substituted the fragmented old approach (South Africa 2001; 2008).

With the phasing out of the National Service System in 1994 (Conway 2012), environmental services, previously staffed mainly by qualified National Servicemen, became fully staffed by Permanent Force members. This development ensured much-needed continuity in dealing with environmental issues in the DOD − one of the fundamental flaws at the time. In principle, the new system would rely on well-trained military environmental staff, but this did not happen. The DOD failed to substitute skilled National Servicemen with skilled Permanent Force members able to execute the full spectrum of its environmental functions (Magagula 2014).

The new DOD approach therefore constituted a more scientifically based, integrated approach to military environmental management. Environmental management was no longer viewed as a separate function executed by environmental specialists, but as an activity integral to the daily routine of military personnel. Continuity of management staffing was to guarantee that environmental management expertise could be built and retained more effectively than during the previous era (Godschalk 1996b). Unfortunately the practical realities of underfunding, policy fragmentation and lack of skilled human resources hindered the effective implementation of this new approach (South Africa 2001; 2008). Although MIEM is widely accepted and promoted throughout the DOD, research indicates an inability to implement it at grassroots level (Magagula 2014).

As a means to foster an ethos of environmental awareness, a military environmental competition was established. During the seventh annual award ceremony in June 2000, awards were presented in such diverse categories as energy efficiency, water efficiency, ecological management, base environmental management, environmental education and training, and military integrated environmental management (Liebenberg 2000). External sponsors donate most of the trophies for these competitions and a team of external experts is used to adjudicate the entries (Harmse 1999; DOD 2015). The 2015 awards included two extra categories, namely integrated waste management and individual/team recognition for environmental effort. This testifies to the continued effort to recognise and reward environmentally sustainable practices in the DOD (DOD 2015).

The foregoing developments put the South African DOD on a firm footing toward greater integration of environmental concerns into the full spectrum of military activities. This process gained momentum with the development of the Environmental Implementation Plans for Defence.

2.4.3   Environmental implementation plans for the DOD

The advent of democratic government in South Africa in 1994 and the new Constitution created profound changes in environmental and land-use policies in South Africa. Article 24 of the South African Bill of Rights entrenches the right to an environment that is not harmful to the health or well-being of people and to have the environment protected (South Africa 1996). One of the results of the Constitution was the promulgation of the NEMA by the Minister of Environmental Affairs and Tourism in January 1998 (South Africa 1998). The adoption of Military Integrated Environmental Management (MIEM) by the DOD encapsulated the phrase "Green Soldiering"[10] (Godschalk 1998: 1; Godschalk 2000: 2). The aim of MIEM is to "ensure the environmental sustainable management of facilities and activities" (Godschalk 1998: 2), implying that all activities are to be conducted with sustainable environmental management principles integrated into their planning, practice and execution.

NEMA posed a challenge to the SANDF and its environmental strategy, by issuing instructions to all scheduled organs of the state that perform environmentally affected functions, including the DOD, to develop an EIP. The deadline for plan submission was 28 January 2000 but was later deferred until June 2000 (Ismail 1999; Van Blerk 2000). Despite the challenges of integrating different defence forces[11] into the SANDF after 1994, the environmental function of

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[10] 'Green Soldiering' refers to "a way of life in the military where all military activities are carried out in an environmentally sustainable way" (Godschalk 1998: 1).

[11] Subsequent to the 1994 elections, the South African Defence Force was transformed into the South African National Defence Force. This process entailed the integration of the South African Defence Force, Umkhonto we Sizwe, the

the DOD had quickly developed into a fully-fledged support function integrated into the core business and mission of the DOD. The DOD was therefore able to immediately start developing an EIP.

A Strategic Environmental Working (SEWing) Group was established on 4 November 1999 to design this plan and on 31 March 2000 they tabled the First Draft Environmental Implementation Plan for internal consultation (Dladla 2000; Van Blerk 2000). In June 2000 the SEWing Group reported to the plenary Defence Staff Council that the first edition of the EIP had been completed (Motumu 2000). This EIP for Defence became part of South African subordinate law with its publication in the *Government Gazette* in February 2001 (South Africa 2001).

The constant re-evaluation of the impact of the South African military on the environment gained new impetus with the publication of this First Edition Environmental Implementation Plan for Defence. The EIP for Defence was the first EIP published by a state department, an indication of the importance the DOD placed on abiding by the stipulations of the NEMA (Van Blerk 2015 pers com.).

The EIP identified capacity gaps and efficient areas in the environmental performance of the DOD and illustrated the DOD's commitment toward MIEM as evident in the quote by Lieutenant General Matanzima at the start of this chapter. This four-year plan structured the implementation of measures of cooperative governance for the environment and for harmonising DOD policies, plans and programmes with national environmental legislation. It also secured protection of the environment within the context of the national objectives for sustainable development. The EIP is a strategic document and does not specify operational or tactical objectives, but aims to address the implementation of measures and mechanisms to enable sustainable environmental performance in line with the prescriptions of the NEMA (South Africa 2001).

The most important deficiencies impeding environmental management in the DOD identified by the first edition EIP were lack of adequate funding, the point that environmental education and training were not formalised practice in the DOD, limited capacity for environmental litigation, and fragmented military environmental policy. Furthermore, enforcement and monitoring of environmental compliance were inadequate and environmental regulatory obligations were not included in the performance agreements of Officers Commanding. The latter deficiency is important because, while environmental responsibility had already been

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Azanian People's Liberation Army, Kwazulu Self-Protection Forces and the defence forces of Transkei, Bophuthatswana, Venda and Ciskei (Le Roux 2005).

transferred to the Officers Commanding by the 1987 policy, in 2001 they were still not formally held accountable for it (South Africa, 2001). This is clearly an untenable situation.

The first edition EIP has since been supplemented by a Second Edition EIP for Defence, which indicated progress and identified areas of concern still in need of being addressed (South Africa 2008). Unfortunately, capacity gaps identified by the second edition EIP carbon copies those put forth by the first edition EIP: Lack of funding of environmental management functions; environmental education and training not formalised in DOD training policy; absence of environmental regulatory obligations in the performance agreements of Officers Commanding; and fragmentation of environmental policy. To this list the second edition EIP adds the lack of adequately qualified staff to effectively implement integrated environmental management; the lack of formal integration of environmental considerations in the management of training areas; and the execution of deployments as inhibiting factors (South Africa 2008). The lack of integration of environmental considerations in the management of training areas and the execution of deployments are particularly disconcerting. Training areas form the backbone of defence preparation and neglect in ensuring sustainable training areas can influence both the continued usefulness of training facilities and the operational readiness of the armed forces. To deprive internationally deployed soldiers of the benefit of sound environmental education and training spells disaster waiting to happen. Environmentally illiterate soldiers' environmentally unfriendly actions are exported to the countries to which they deploy – something none of the countries involved can afford.

While the capacity gaps identified by the first edition EIP can be viewed as the result of sincere introspection, the fact that the same deficiencies reappeared in the 2008 EIP, places the DOD's stated concern about the military environment and the success of military integrated environmental management in question. Recent research at the Grahamstown military installation confirmed the continuation of these inadequacies in the DOD's environmental management planning and execution through the absence of a dedicated budget, qualified environmental personnel, satisfactory environmental management structures, current policies and external linkages (Magagula 2014). A third edition EIP for Defence is presently in progress, but unavailable for scrutiny (Van Blerk pers com. 2015).

The situation that two consecutive strategic DOD documents, spaced seven years apart, list the same issues as capacity gaps in environmental management is a serious indictment of the stated commitment of the DOD toward integrated military environmental management. However, the DOD would claim serious underfunding of the military in South Africa as the cause of this state of affairs. The Defence Review of 2014, while recommitting the military to military environmental

management, also indicated that the South African military is 24% underfunded regarding its current size and shape and is in a "critical state of decline" (DOD 2014: ix). The difference between commitment to military integrated environmental management and implementation thereof might be a symptom of this 'critical decline'. Regardless of the reason for this discrepancy, visionary leadership and commitment are needed to secure a sustainable future for military environmental management in the South African DOD.

2.4.4 International cooperation in military environmental management

In the first edition EIP for Defence, provision was made for the possible adoption of the ISO 14 000 series International Standard for Environmental Management Systems by the DOD, based on the guidelines of the NATO-CCMS Pilot study on Environmental Management Systems in the Military Sector (NATO 2000; South Africa 2001). This eventually set the scene for the DOD to deal with a much broader range of environmental issues, such as contaminated sites, ozone-depleting substances, greenhouse gasses, energy management, hazardous and toxic materials and wastes, the treatment and disposal of storm water and sewage, the protection of heritage sites and conflicting community expectations.

Together with the USA, Canada and Australia, South Africa became part of a quadrilateral initiative to develop guidelines for the incorporation of environmental considerations into the planning and execution of military operations (Godschalk 2000). In 1997, the Defence Committee (DEFCOM) was established as part of the RSA-USA Bi-National Commission (BNC). One of the working groups of the DEFCOM was constituted in late 1997 as the Environmental Security Working Group (ESWG). The objective of this body is to observe bilateral development of MIEM projects through the exchange of information and capability. The ESWG is co-chaired by South African and US military environmental functionaries and it has already completed various bilateral projects.

One such project was the Mobile Military Integrated Range Management Course presented by a visiting Mobile Training Team consisting of six trainers from the US. The course was presented from 10 to 14 September 2001 at SA Defence Intelligence College, Pretoria and repeated on 17 to 21 September at SA Army School of Armour in Bloemfontein. In total, 115 members of the DOD in the rank group Corporal to Colonel attended this course (South Africa 2001).

An International Conference on Military Integrated Environmental Management was held in Pretoria from 4 to 8 August 2003. This event was co-sponsored by the USA and South Africa and attended by delegates from 20 countries. The conference highlighted the global reputation and linkages of the South African military environmental effort, helped to establish and expand

international contacts, exchanged information, research and techniques, and served as a barometer of the progress made in the South African military environmental field (Environmental Security Working Group 2007b).

Another project facilitated by the bilateral agreement was the compilation of a series of guidebooks on military environmental management by joint teams of experts from South Africa and the US. The guidebooks cover topics such as military integrated training range management (Environmental Security Working Group 2000a); military environmental education and training (Environmental Security Working Group 2000b); military environmental assessment (Environmental Security Working Group 2004); environmental considerations during military operations (Environmental Security Working Group 2006); and integrated waste management in the military (Environmental Security Working Group 2007). These guidebooks are being widely used by environmental practitioners in the DOD (Laubscher 2015 Pers com). The bilateral agreement was dormant for a period, but resumed in 2015 and a range of activities are planned (Van Blerk 2015 Pers com). All of these activities have been stimuli for the DOD to take its environmental management to the next logical level, namely the development of a formal environmental management system for the South African DOD.

2.4.5   An environmental management system for the DOD

Following the publication of the EIP, the Strategic Environmental Working (SEWing) Group that developed the EIP, was disbanded and replaced by the Environmental Review Forum (ERF). This forum was responsible for designing and developing an environmental management system (EMS) for Defence. The EMS for Defence aims to structure, focus and ultimately incorporate environmental management principles into the day-to-day activities of the DOD.

According to the International Organisation for Standardisation (2004: 2) a management system is "a set of interrelated elements used to establish policy and objectives and to achieve those objectives. An EMS forms part of an organisation's management system and is used to develop and implement its environmental policy and manage its impacts." Ortiz (2005: 2) describes an EMS as "a structure that enables an organization to systematically reduce its environmental 'footprint' in its day-to-day activities." An important aspect highlighted in this regard is the provision of opportunities for continual environmental improvement, something explicitly stated in the Corporate Environmental Policy Statement (CEPS) of the South African DOD (South Africa 2001). Liu, Lau & Fellows (2012: 164) expanded on this definition and stated that an EMS "comprises management principles, tools and procedures which, when followed properly, enable the organization to recognize, measure and monitor (with a view of reducing) the impacts that its activities have on the environment" and added that an independent, qualified expert

is essential to periodically certify this process. According to Freimann & Walther (2001) organisations implement environmental management systems to improve corporate environmental practices by detecting and removing ecological weak spots. This can either be self-imposed or can be facilitated by stakeholders. Ortiz (2005) described the functioning of an EMS as helping to prevent potential environmental problems such as lack of training, lack of targets and goals, not enough staff, and communication and feedback problems. It also ensures the effective integration of environmental management into day-to-day activities and can support the organisational mission.

It is clear from these definitions, functions and benefits of an EMS that a powerful rationale for the development and implementation of an environmental management system for the South African DOD has existed in the DOD since the promulgation of the first edition EIP for Defence in 2001. The draft EMS for Defence was completed in 2004 and assessed in a pilot project at seven units of the DOD, but it was terminated in 2007 due to a lack of progress with implementation. The ERF investigated the reasons for failure and a new EMS was established to review the department's environmental performance (Godschalk 2005, Pers com; Liebenberg 2008, Pers com). The revised EMS was implemented successfully in some military units, notably at Air Force Base Overberg, an ISO 14001 accredited facility, but at most units implementation failed (Magagula, 2014; Van Blerk 2015 Pers com). In light of the benefits of an EMS, the failure to implement the EMS for defence throughout the Defence Force seriously threatens the commitment to improve the DOD's environmental performance. Despite these structural problems, military environmental management in the DOD functions and is driven by committed personnel from the Environmental subdirectorate at Joint Support Division.

An important question originating from the above discussion, and underpinning this research, is whether management information regarding the MEL of SA Army personnel exists within the South African DOD – the issue explored further in the next section.

2.5   COMPREHENDING ENVIRONMENTAL LITERACY LEVELS IN THE SOUTH AFRICAN ARMY

The natural and cultural environments pose threats, constraints and possibilities to the soldier in battle and on any other mission, as well as to those who are responsible for the planning of military missions at higher levels. It is therefore necessary for military practitioners to be well underlain in a variety of environmental-related subjects to enable them to solve problems that are of military-environmental nature. Ultimately, the South African DOD seeks to produce military

practitioners aware of their environmental responsibilities and equipped with the necessary skills, tools and attitudes to deal with environmental challenges – a *green soldier*.

Despite the comprehensive policies and plans related to military environmental management, the DOD faces the inability to comprehensively implement the EMS it developed (Liebenberg 2008 Pers com; Van Blerk 2015 Pers com), but remains bound to an external directive (NEMA), as well as internal commitments (evidenced by Defence Reviews, EIPs and the CEPS they contain, as well as various DOD policy documents) to manage its duties in an environmentally responsible manner (Smit 2011). The recurrence of the same capacity gaps inhibiting effective integrated military environmental management in the South African military identified in the first edition EIP and in the second edition EIP must be a cause of serious concern and introspection to the DOD. This directly contravenes commitments regarding integrated environmental management made in virtually every policy document regarding the South African military environment. Important to this study, the CEPS require adherence to the "programme of continual improvement" referred to in the Environmental Policy Statement and the training and motivating of its members to "regard environmental considerations as an integral and vital element of its day-to-day activities" (South Africa 2001: 16).

Executing the environmental imperatives of the DOD requires insightful knowledge of members' present attitudes, knowledge levels and conduct toward the environment – their environmental literacy – as part of their day-to-day activities to inform the development of a comprehensive training and motivation programme (Environmental Security Working Group of the United States-South Africa Defence Committee n.d.). A thorough and comprehensive target group analysis of Army members is necessary to provide the required knowledge base to drive proper environmental management in the South African military. Such survey-based analysis has never been done (Godschalk 2009a, Pers com; Laubscher 2009a, Pers com; Liebenberg 2009a, Pers com; Potgieter 2009a, Pers com; Van Blerk 2009a, Pers com; Laubscher 2015 Pers com). An analysis of this nature would serve to account for the lack of overall progress of the DOD's environmental management programme, identify areas for intervention, develop effective training and motivation programmes, and ensure that personnel acting as drivers of MIEM are environmentally literate.

Such a target group analysis is addressed by the research into the environmental literacy of SA Army members. Chapter 3 relates the search for and evaluation of existing questionnaires to assess MEL in the SA Army context and argues for the development of an organisation-specific questionnaire, tailor-made for SA Army needs.

CHAPTER 3   ORGANISATION-SPECIFIC QUESTIONNAIRE DESIGN

If the author of the preliminary questionnaire does not leave the meeting with at least a slightly bruised ego, the group has not functioned properly (Sheskin 1985: 52).[12]

To accomplish the stated aim of employing a military-specific, valid and reliable questionnaire to measure MEL in the SA Army, it was necessary to investigate the suitability of existing questionnaires for surveying MEL in a South African context. Using existing questionnaires saves time and money, allows comparison between own results and findings of other researchers, and requires mere description of instrument outline details when reporting results (Babbie 2004; Boynton & Greenhalgh 2004). Leeming, Dwyer & Bracken (1995) recommend the adaptation of existing questionnaires to assess environmental literacy among target populations and only if no suitable questionnaire can be found should a new questionnaire be developed. It was therefore essential to ascertain whether suitable questionnaires exist for conducting surveys before embarking on a lengthy questionnaire construction process. In this chapter the evaluation of existing civilian questionnaires for use in the MEL survey is first contemplated. This is followed by an exploration of the functional design, content and structural requirements of a unique, South African questionnaire to assess MEL in the SA Army. Finally, the structuring, content determination, review and testing procedures of the pilot questionnaire, as well as a summary of the ethical clearance process, conclude the chapter.

3.1   INSTRUMENTS TO MEASURE ENVIRONMENTAL LITERACY

Notwithstanding the obvious importance of environmental literacy among employees working in a military context, scant empirical research regarding its nature and measurement exists. Corson & Morris (2001) developed a questionnaire to survey members of the US Army on environmental attitude and knowledge. They surveyed a large group of soldiers, but neglected to analyse and publish the results (Corson 2008, Pers com) – an unfortunate waste of effort. Ramos et al. (2008) surveyed and reported on the environmental performance of the Portuguese defence sector, while Smit (2009) investigated the influence of military geography education on the environmental attitude of students at the SAMA. However, none of these studies provided a readily adoptable survey instrument uniquely suited to measure MEL in the SA Army. Questionnaire development for this study consequently required an overview of existing questionnaires for

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[12] Sheskin (1985) in his book *Survey research for geographers* about the functioning of the panel of experts tasked to 'pick apart' a questionnaire under development.

testing environmental literacy among civilian populations and an assessment of a selection of these for suitability to the South African context.

3.1.1 Instruments for civilian environmental literacy surveys

Notable examples exist of measuring instruments to assess environmental literacy and their application in civilian contexts. A literature survey indicated that the majority of studies investigating environmental literacy developed purpose-specific instruments. More than 50 studies using questionnaires to gather data were identified and evaluated for use in the South African military. The evaluated surveys typically employed three components of environmental literacy, namely attitude, knowledge and behaviour, to structure the survey questionnaires (Grodzinska-Jurczak et al. 2003; Frick, Kaiser & Wilson 2004; Esa 2010; Zecha 2010). The surveys targeted children (Leeming, Dwyer & Bracken 1995; Chu et al. 2007; McBeth & Volk 2010; Erdogan 2011); university students (Ehrampoush & Moghadam 2005; Pe'er, Goldman & Yavetz 2007; Özden 2008; Wright 2008; Karatekin 2013); and general adult audiences (Hsu & Roth 1999;

Dunlap et al. 2000; Morrone, Mancl & Carr 2001; Frick, Kaiser & Wilson 2004; De Chano 2006; Ramos et al. 2009). While almost half of the surveys originated in the USA, a global variety of countries (Brazil, Chile, China, Germany, Hungary, Iran, Ireland, Korea, Malaysia, Mexico, Portugal, Singapore, Spain, South Africa, Switzerland, Taiwan, and Turkey) contributed the rest.

The most widely used instrument to measure environmental concern among adults is the New Ecological Paradigm (NEP) scale, employed worldwide in hundreds of studies (Dunlap 2008). The NEP scale was developed by Dunlap & Van Liere (1978) and subsequently updated and renamed the New Ecological Paradigm Scale (NEPS) (Dunlap et al. 2000).

The most notable scale to survey the environmental literacy of children was the Children's Environmental Attitudes and Knowledge Scale (CHEAKS) developed by Leeming, Dwyer & Bracken (1995) and used or critiqued by Amarant (2006), Walsh-Daneshmandi & MacLachlan (2006), Dunlap (2008) and Lee (2008). Less prominent instruments like the Middle School Environmental Literacy Instrument (MSELI) (Culen & Mony 2003) and the Environmental Literacy Instrument for Korean Children (ELIKC) (Chu et al. 2007) cater for the diversity of survey populations by focusing on specific population groups. Cultural and population diversity remain the determining variables in applications among countries, requiring new instrument development or adaptation of existing ones to ensure fit to purpose (Hsu & Roth 1999; La Trobe & Acott 2000; Alp et al. 2006; Pe'er, Goldman & Yavetz 2007). While the aforementioned instruments have been used globally to assess environmental literacy among diverse subject groups and they most often assess the components attitude, behaviour and knowledge in the

questionnaires, their suitability for military application was unclear and begged further investigation.

3.1.2 Suitability for use for the South African Army

Determining the suitability of a survey instrument for a particular application demands the formulation of criteria to measure suitability. This section first establishes relevant questionnaire attributes for a military context and the SA Army as unique application domain. Selection of an initial group of suitable candidate questionnaires is justified, followed by a structural overview of the selected instruments. In conclusion a comparative overview of these instruments is presented to justify the need for a unique SA Army instrument.

3.1.2.1 Criteria to determine the suitability of military questionnaires

Within the civilian context, environmental literacy alludes to the three components, attitude toward, knowledge about and behaviour toward the environment (Grodzinska-Jurczak et al. 2003; Frick, Kaiser & Wilson 2004; Esa 2010; Zecha 2010). All three components must be measured before a questionnaire can be deemed suitable to conduct a valid and reliable assessment of environmental literacy in a civilian or a military context.

Militaries operate in three contexts: wartime, peacetime and support and stability operations (SASO). In each context, military activities take place on tactical, operational and strategic levels, each of which involves planning, maintenance and exercise or execution phases (Palka & Galgano 2005). The three components of environmental literacy, the military operational contexts, levels and phases must be reflected in an instrument suitable to measure MEL.

The basic premise in MEL research is that the military generally constitute a target population unique in age composition (younger), organisational framework (the DOD) and military culture (Dandeker 2013). Specific militaries embody an own ethos (compared to civil society and other militaries) and, in the case of the SA Army, with uniquely South African military environmental characteristics. A questionnaire targeting children or university students will be unsuitable for use in the SA Army as the age of soldiers typically ranges much wider (18 to 65) (DOD 2009). These factors combine to demand a special instrument to effectively measure MEL within a SA Army context.

The criteria against which an existing questionnaire must be judged for use in a SA Army MEL survey are military specificity and exclusive SA Army contextualisation. It must reflect the military operational contexts, levels and phases, target adults and include the components of environmental attitude, behaviour and knowledge. These criteria will be used to evaluate a

selection of questionnaires for their suitability to be used in the SA Army military environmental survey.

3.1.2.2   Initial questionnaire selection

While performing the extensive literature search, most survey instruments failed initial scrutiny because of overt inadequacies in what they measured and the target audiences they were aimed at. Five questionnaire models met early requirements and were selected for closer scrutiny. They are the US Army Environmental Attitude and Knowledge Survey (USAEAKS) (Corson & Morris 2001); the Portuguese defence sector survey (PDSS) (Ramos, et al. 2008); the survey on the influence of military geography education on the environmental attitude of students at the SAMA, the MGSA (Smit 2009); the Children's Environmental Attitudes and Knowledge Scale (CHEAKS) (Leeming, Dwyer & Bracken 1995; Amarant 2006; MacLachlan 2006; Dunlap 2008; Lee 2008); and the New Ecological Paradigm Scale (NEPS) (Dunlap et al. 2000).[13]

The rationale for this selection are, succinctly:

- The USAEAKS (Corson & Morris 2001), PDSS (Ramos et al. 2008) and MGSA (Smit 2009) questionnaires are the only instruments that survey the environmental attitude of military personnel, and as such invited closer scrutiny;

- CHEAKS was developed to assess the environmental attitude and knowledge of children. Although the present research aimed to focus on adults, this questionnaire qualified because some elements might be applicable to adults; and

- NEPS and its predecessor, the NEP is widely used and cited in the mainstream literature. Its versatility is attested to by Dunlap (2008: 3): "several more recent studies conducted in a variety of nations have found the NEPS to be a useful predictor of both reported and observed behaviour." It was essential to analyse the NEPS, the most used and cited instrument to assess environmental literacy in the adult population further because of its dual focus on behaviour measurement.

3.1.2.3   Questionnaire structure

Besides generic sections on biographical information, the selected questionnaires differ on important structural, extent and content aspects, so that a brief summary of each is required for comparative purposes.

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[13] This scale is a revision of the New Environmental Paradigm (NEP) scale, developed by Dunlap & Van Liere (1978) and used extensively by researchers.

The USAEAKS (Corson & Morris 2001) (full version in Appendix A) consists of six sections covering 65 items, all in closed-ended format. The first section (13 items) probes respondent perceptions before joining the Army and during entry-level training as a soldier, while the second section (four items) probes perceptions on the impact of Army activities. These two sections measure responses on a three-tier scale: agree/disagree/unsure. The third section (21 items) probed perceptions on impacting Unit practices, on a five-point scale (A=always, B=usually, C=sometimes, D=never, E=not applicable/do not know). The fourth section (16 items) surveys opinion on the environmental responsibility on a military installation. The penultimate section (six items) probes knowledge concerning Army policy on a simple yes, no, unsure scale, while the final section (five items) gathers respondent biographics. This questionnaire is a well-structured and balanced instrument catering for the US Army. Unfortunately, it does not contain any of the components comprising environmental literacy (EL) as reflected in EL literature.

The PDSS (Ramos et al. 2008) (full, translated version in Appendix B) covers 172 items in open- and closed-ended format to survey environmental practices and performance in the Portuguese defence sector. The questionnaire commences with a biographics section (11 items), followed by one on unit activities and their impacts (38 items). Unit activities are identified through tick-box options and environmental impact intensity is expressed on a three-point scale: 1=low, 2=medium, 3=high. The third section (104 items) follows up on the responses given in the second section to rate impact significance on a simple yes/no scale. The next section (11 items) probes respondents' opinions on environmental performance indicators. In this section yes/no answers, as well as open-ended questions are employed. Finally the contact details of respondents are recorded (8 items). This is a rather lengthy questionnaire dealing with a wide range of issues. The main drawbacks of the questionnaire are the long completion time and its failure to reflect the general components of EL.

The MGSA (Smit 2009) (full version in Appendix C) assessed the environmental attitudes of both geography and non-geography undergraduate students at the SAMA. The first part of the questionnaire records respondent biographics (four items), while the second part contains 21 statements regarding the military environment. These statements deal with issues such as environmental destruction, environmental education, waste generation, water conservation, noise- and air pollution, and the environmental laws applicable to the military. Dichotomous response categories to statements gauge respondents' agreement or disagreement. Nineteen of the 21 statements are worded so that an agreement response reflects an environmentally-positive attitude. For the remaining two statements agreement meaning on attitude is reversed. The MGSA is a

concise questionnaire intended for use in situations where a short completion time is needed. Unfortunately, this means that the full range of EL components is not captured in the questionnaire.

CHEAKS (Leeming, Dwyer & Bracken 1995) (full version in Appendix D) opens with six biographics items and then sets 68 items using a five-point Likert-type scale. It is divided into sections on Verbal Commitment (the first 12 items), Actual Commitment (the next 12 items), Affect (the next 12 items) and Knowledge (the last 32 items). The items are put in simple, straightforward language but do address fairly difficult concepts like precycling, perpetual resources and the effect of phosphates on sea life. In this questionnaire the full range of EL components is reflected, making it a balanced and highly useful instrument.

NEPS (Dunlap et al. 2000) (full version in Appendix E) provides 15 statements to which respondents may react on a five-point scale: strongly agree, mildly agree, unsure, mildly disagree, and strongly disagree. The scale is treated as a measure of environmental concern, values, attitude or beliefs, but mainly assesses the ecological worldview of the respondent (Dunlap 2008).

3.1.2.4   Verdict on suitability

The foregoing comparative analyses, summarised in Table 3.1, provide the basis for the verdict on the questionnaires' usefulness for the purposes of this research.

Table 3.1 Suitability of the existing questionnaires analysed

QUESTIONNAIRE	SUITABILITY CRITERIA				
	Adult subjects	All EL* components	Military specificity	Full military context**	SA Army context
USAEAKS	**Yes**	No	**Yes**	No	No
PDSS	**Yes**	No	**Yes**	No	No
MGSA	No	No	**Yes**	No	No
CHEACKS	No	**Yes**	No	No	No
NEPS	**Yes**	No	No	No	No

Notes: * Attitude, behaviour and knowledge. ** Operational contexts, levels and phases

As a point of departure, against which suitability may be rated, this research needed to consider whether survey instruments had targeted appropriate survey subjects (adults vs children), had gauged opinion on all three EL components, was sufficiently specific to military environmental impacts, targeted the full context within which the military operates and was sufficiently sensitive to the unique SA Army context. Concerning the latter, it is recognised that the SA Army is a unique, South African organisation with its own code of practice, organisational terminology, culture and ethos.

While the USAEAKS questionnaire was developed for an adult, military target group, it specifically targeted the US Army. Consequently, the American terminology would be confusing in the local context; the questionnaire does not reflect the special circumstances under which the SA Army operates; it does not accommodate the SA Army's character and ethos; it does not cater for the three components of EL, neither does it reflect the military operational contexts, levels and phases.

The PDSS questionnaire similarly focused on an appropriate adult military target group. However, it failed on three criteria by covering too wide an array of environmental indicators and structural issues, not addressing all EL components and using terminology foreign to the purpose of the SA Army survey.

MGSA, although appearing at first glance to be appropriate for assessing EL of members of the SA Army because it was developed within the Army's ambit, failed on a number of counts. While specifically targeting the South African military, its content was far too generic in nature to meet the objectives of this study. It focused on military students but failed to capture representative demographics (such as age cohorts) within the SA Army and targeted all branches of the SANDF and not only the Army. Furthermore, it did not incorporate the three components of EL nor reflect the full military operational contexts, levels and phases.

CHEAKS is the only questionnaire to address all three components of EL as operationalised for this study. However, it fails to meet requirements on the remaining four counts. It was developed specifically for children as the target group and not for a mature and age-diverse South African organisation. It does not cater for a military-specific organisation, the full military operational context or the peculiar specifics of the SA Army.

NEPS, although popularly used and highly respected, likewise succeeds on the single count of addressing a mature audience only. It fails to reflect the three components of EL and does not accommodate any of the three military criteria: military specificity or operational contexts, nor the special South African ethos and terminology. Both CHEAKS and NEPS evaluate general EL and not military-specific EL.

In summary, while initial scrutiny of the five questionnaires indicated suitability for the South African MEL survey, deeper analysis revealed the opposite. The three military questionnaires show promise by virtue of their military specificity, but terminology and the lack of a focus on the distinctiveness of the SA Army and the environment in which it operates, render them unsuitable for this study. The two civilian questionnaires are too generic in nature, lacked both military and South African context and were developed to survey children. Based on the evidence of the analyses, the verdict was that not one of the five instruments under consideration

sufficiently satisfied the set of suitability criteria to justify adoption for direct deployment in this research. An own, novel South African instrument had to be developed that incorporates structural elements of the existing questionnaires.

3.2   A SOUTH AFRICAN MILITARY QUESTIONNAIRE

Questionnaire construction follows a generic research sequence, commencing with design decisions and progressing to draft questionnaire review and testing. The operational process of developing a SA Army EL questionnaire is set out in this section. According to De Vaus (1996) and Bless, Higson-Smith & Sithole (2013) three sets of considerations shape any survey, namely technical, practical and ethical. In this section the design, review and pretesting of the initial questionnaire are examined. These processes followed the design process advocated by Frazer & Lawley (2000) and adherence to this design process led to the construction of a final pilot questionnaire that was pilot-tested at the SAMA in Saldanha.

3.2.1   Questionnaire design

The most frequently used method to collect data in educational and evaluation research is through a questionnaire survey (Radhakrishna 2007). According to Sheskin (1985) it is also a long-established method in geographic fieldwork, especially when the researcher explores the behavioural characteristics of human subjects.

3.2.1.1   The design process

To develop a valid and reliable questionnaire necessitates a set procedure with several steps that typically take a considerable time to successfully conclude (Boynton & Greenhalgh 2004; Radhakrishna 2007). Frazer & Lawley (2000) describe the seven steps to be followed to develop a new questionnaire, a process adopted and operationalised in this research as depicted graphically in Figure 3.1.

According to this model the researcher should, in sequence, commence by determining the suitability of available existing questionnaires for the study. If there are none, a new questionnaire has to be developed. The survey method (self-administered or drop-off-and-collect) must be chosen and the required information content and target audience must be determined. Preparing a draft questionnaire and pretesting must follow and the validity and reliability of the questionnaire should be ensured before the questionnaire can be finalised. The detail of the operationalisation of these steps in the military environmental literacy research is documented in the following subsections.

1		Suitable?

1

Determine suitability of existing questionnaires

- Five most prominent questionnaires analysed

Suitable?
- Use existing

Unsuitable?
- Develop new

3

Determine survey mode and questionnaire extent

- Self-administered, drop-off-and-collect

2

Determine required information content and subject population

- Military environmental literacy [Attitude, behaviour and knowledge regarding the military environment]
- SA Army personnel

4

Prepare draft questionnaire

- Adapt items from existing questionnaires
- Analyse South African military environmental policy documents, guidebooks and awareness booklets
- Co-opt military environmental expert group to generate relevant questions
- Develop first draft questionnaire

5

Pretest and revise questionnaire for question validity

- Submit first draft questionnaire to military environmental expert group for commentary
- Submit to supervisor for scrutiny
- Revise questionnaire
- Consult CSC
- 'Trashing' by group of academic peers and military environmental experts
- Revise questionnaire
- Pretesting by selected group at Military Academy
- Clear with supervisor and statistician
- Revise questionnaire

6

Assess questionnaire reliability

- Pilot testing: 153 students and staff at Military Academy
- Statistical analysis of results
- Revise questionnaire

7   FINAL QUESTIONNAIRE

Source: Adapted from Frazer & Lawley (2000)

Figure 3.1 The questionnaire design process followed in this research

3.2.1.2   Questionnaire content and mode of conduct

Broadly, the information to be gathered is all the items relevant to determining MEL. The details of the information items are covered comprehensively later, that is the measurement of the three components constituting environmental literacy, namely attitude, behaviour and knowledge. These three components must target the environment in which the military operates as well as

military environmental issues. The fundamental distinction between MEL and civilian environmental literacy is crucial.

The appropriate mode of data gathering is a self-conducted questionnaire submitted to members of the SA Army – the only mode that lends itself to the impartial and representative registering of human behavioural characteristics in a large organisation like the South African military. The information was collected from sample-selected members of the SA Army.

3.2.1.3   Survey mode and length of questionnaire

Due to the wide geographical distribution of SA Army units it was essential to use a self-administered questionnaire distributed via the drop-off-and-collect method. This method is widely used and its technical attributes have been extensively reviewed (Chu et al. 2007; Negev et al. 2008; Dijkstra & Goedhart 2012; Ali, Rose & Ahmed 2015).

Various commentators (Neuman 1994; Kitchin & Tate 2000) have emphasised the importance of questionnaire length in the design and piloting phases. Excessive length causes boredom among respondents and lower response rates. Kitchin & Tate (2000) advised that questionnaires should not take longer than 10 minutes to complete, while Neuman (1994) regarded questionnaire length of between three and four pages as the most appropriate for surveying the general population before boredom and a drop in response rate set in. Importantly, Oppenheim (1992) prescribed a balance between length and content as the ideal.

Neuman (1994) recorded significant drops in response rates for questionnaires longer than 10 pages, while results from other studies are inconclusive. Surprisingly, Herzog & Bachman (1981) have reported insignificant effects on data quality even in two-hour long questionnaires. Dilman, Sinclair & Clark (1993) found no effect of questionnaire length on response rates in some studies they reviewed, while others suggested only a slight negative effect from longer questionnaires. Their research concluded that respondent-friendly (easy to complete, clear and emotionally neutral), shorter questionnaires generated increased response rates. In summary, questionnaire length affects response rates in some populations, but not in others.

Rolstad, Adler & Rydén (2011) conducted a meta-analysis of response burden (effort required to answer a questionnaire) of 20 studies. Their findings were that response rates were lower for longer questionnaires, but that it is impossible to separate the impacts of questionnaire content from those of questionnaire length. Clearly, questionnaires have to be vetted to exclude unnecessary items, but practical considerations eventually determine the final length of a questionnaire as the literature is inconclusive on the topic.

In this study, the ideal length of the questionnaire was determined by applying guidelines from the literature and inputs received during the development, pretesting, and piloting phases of questionnaire construction. This process and the relevant decisions made are discussed in subsequent reporting on questionnaire development.

3.2.1.4   Item appropriateness

In essence, the questionnaire construction process encompassed the identification of essential information items, followed by a screening stage when a wide range of knowledgeable experts was identified and consulted on the appropriateness of items for inclusion. During the preparation of the first draft of the questionnaire many items from existing questionnaires concerning the military were scrutinised and some adapted for inclusion in the draft questionnaire (recall Figure 3.1 which depicts the process). An examination of policy documents (listed in Appendix F) regarding environmental issues in the South African military was done to identify items for inclusion in the first draft of the questionnaire. Relevant policy documents were the two *Environmental implementation plans for Defence*, the full range of guidebooks developed by the Environmental Security Working Group between 2000 and 2007, as well as the *Guide to environmental compliance for Officers Commanding*. These documents contain the strategic guiding principles for environmental management in the DOD and the principles are embodied in typical environmental attitude, behaviour and knowledge to be established among personnel.

At a more practical level, scrutiny of internal policy on nature and environmental management; environmental guidelines on field sanitation during military training and operations in the DOD; procedural guidelines on prevention and control of erosion; procedural guidelines on incorporating environmental considerations in the planning of peace support operations; and integrated waste management in the military yielded a wealth of essential elements to transform into relevant items. A pocket guide to environmental responsibility developed for soldiers taking part in military exercises completed the corpus of documents that was perused. Collectively, these documents contain the policy guidelines developed for use by environmental practitioners in the DOD. A rough draft questionnaire was compiled from the identified items and made ready for initial scrutiny by experts.

A research visit in 2010 to the United States Military Academy at West Point made it possible to submit the first draft of the MEL questionnaire for evaluation to their Program Director: Environmental Science, Department of Geography and Environmental Engineering. Valuable input (Johnson 2010, Pers com) regarding the structure of the questionnaire and the wording of the items led to a marked improvement in the first draft. At the same time a military environmental expert group, as listed in Table 3.2, was constituted to assist in the drafting of the questionnaire,

Table 3.2 Members and credentials of the military environmental expert group

MEMBER	CREDENTIALS
Col (Retired) SKB Godschalk	Involved in military environmental management in SANDF from 1979 to 2006. Retired as Senior Staff Officer (SSO) Environmental Services. At present director of *Environmental & Sustainability Solutions,* Pretoria. More than 27 years of experience in military environmental management and the person with the most experience of military environmental management in SANDF.
Capt (SAN) A Liebenberg	Senior Staff Officer (SSO) Environmental Services, Pretoria, with more than 15 years' of experience of military environmental management.
Lt Col EF van Blerk	Senior Staff Officer (SSO) Environmental Services (SAAF), Pretoria. Previously Staff Officer (SO) 1 Environmental coordination in SANDF. Responsible for the development of the First Edition EIP for Defence, environmental coordination in the SANDF and linkages with role players outside the SANDF, both national and international. More than 20 years of involvement in military environmental management.
Lt Col JHJ Potgieter	Member of Environmental Services (Pretoria) until 2006 with more than 22 years of experience in environmental management.
Ms T Reynecke	Assistant Director, SO Environmental Education and Training, Environmental Services in SANDF, Pretoria, with more than 12 years of experience of military environmental management.
Lt Col L Laubscher	SO 2 Regional Environmental Manager, Regional Facilities Interface Management (RFIM) Cape Town, with more than 15 years of experience of military environmental management.
Maj R Jefferys	SO 3 Environmental Manager, RFIM Cape Town, with more than 10 years of experience of military environmental management.
Maj L van Rensburg	SA Army Environmental Officer: Lohatla, with more than 10 years of experience of military environmental management.
Maj H van Niekerk	SO 2 Regional Environmental Manager, RFIM Bloemfontein, with more than 15 years of experience of military environmental management.
WO 2 C Mauer	Battery Sergeant Major (BSM), 10 Anti-Aircraft Regiment, Kimberley, with five years of experience of military environmental management.
Brigadier-General MW Corson	Commanding General, 103d ESC, Joint Base Balad, Iraq. Helped to develop the environmental questionnaire for use in the US Army while a lecturer at the United States Military Academy at West Point.
Professor M Johnson	Program director: Environmental science, Department of Geography and Environmental Engineering, United States Military Academy, West Point.

to act as sounding board for ideas and intentions, and to supply regular feedback during the process of questionnaire development.

Sourcing a group of experts to confirm validity is a well-established practice in questionnaire construction and is reported on extensively in the literature (Kruse & Card 2004; Venter 2006; Rattray 2007; Alp et al. 2008; Dijkstra & Goedhart 2012; Nilson et al. 2013). It is insightful to reflect on the composition and expertise of this expert group. The 11 South African members of the group are indisputably the preeminent roleplayers in the military environmental field in South Africa. Their combined applied experience amount to more than 150 years and they fill, or previously filled, the paramount positions in military environmental management in South Africa. Colonel Godschalk, Captain (SAN) Liebenberg, and Lt Col Van Blerk were the leaders in this field since the inception of environmental management in the South African Defence Force. Regarding the two Americans, Professor Johnson leads the Environmental Science programme at the prestigious United States Military Academy, while Brigadier General Corson commanded a

United States Support base in Iraq at the time of his involvement as panel member. In Iraq he dealt with the dismantling of the base and the environmental issues associated with such an operation. The two Americans are experts in their own right, while Brigadier General Corson also helped to develop the American questionnaire to assess environmental attitude while he was a lecturer at the United States Military Academy, West Point. He is one of only a small number of people with experience in questionnaire development to assess military environmental performance.

The members of the military environmental expert group served the research endeavour at various stages by identifying relevant literature about military environmental management, suggesting potential items to be included in the questionnaire, commenting on selected items and the format of various versions of the questionnaire, and acting as general sounding boards to assess the questionnaire at various levels of the development process. They played invaluable roles in ensuring the validity of the questionnaire.

3.2.2 Review procedures of the draft questionnaire

The draft questionnaire was subjected to a formal review process as the actions in Fig 3.1 indicate, embracing expert involvement in question selection and formatting – for both technical and statistical validity. Sheskin (1985) prescribes the evaluation of draft questionnaires by a panel of experts. The group dynamics in which each expert strives to demonstrate his/her ability to criticise the questionnaire lead to an instrument that collects the information it is designed to collect. In line with this prescription the constantly improved draft questionnaire was iteratively presented to the military environmental expert group for their comments on question content and wording, and general structure and layout. After incorporation of all relevant input, the questionnaire was submitted to the Centre for Statistical Consultation (CSC) for comment on statistical aspects of the instrument, namely, the type and number of items and the number of response categories provided. These aspects were approved as statistically sound (Kidd 2010, Pers com).

To enhance the credibility of a questionnaire it is recommended that other disciplinary experts be consulted for technical and conceptual critique of an instrument's structure and content (Hsu & Roth 1999; Boynton & Greenhalgh 2004; Du Preez, Visser & Van Noordwyk 2008; Negev et al. 2008). Consequently, a panel of academic peers in geography and military environmental management were assembled to fine-tune the questionnaire. A panel discussion forum was convened at Stellenbosch University on 5 May 2011 (panel members are listed in Appendix G). The carefully selected panel consisted of members representing the spectrum of environmental themes addressed in the questionnaire. Two professors in geography guarded the academic integrity of the process, while two senior members of the RFIM office, Cape Town, provided a

military environmental perspective. A military practitioner ensured that item wording conformed to language usage in the SA Army and a military language practitioner[14] provided expertise in military conceptual exactness, language clarity and applicability of terminology. Collectively, expertise in general practical academic survey research, as well as military and practical and theoretical environmental management was garnered. These safeguards ensured that the questionnaire was effectively evaluated and critiqued. It guaranteed a sound instrument with academic and military environmental integrity, using user-friendly, uncomplicated, comprehensible and militarily correct language.

Following lengthy discussions, the panel members formulated three key recommendations:

- the two separate questionnaires developed for the fighting corps and the logistics corps should be integrated into one questionnaire, because the tasks of the two corps were undifferentiated;

- the language used in the questionnaire should be further simplified; and

- the cover page should make the aim of the study clear.

Detailed suggestions regarding item phrasing and format were made and the improved versions of the questionnaire were further reviewed by individual scientific and military panel members, without reconvening the panel. Their feedback was screened by the supervisor and used where necessary to improve the questionnaire.

3.2.3 Pretesting the draft questionnaire

Best practice in questionnaire construction prescribes the evaluation of a questionnaire through pretesting to tap group expertise to complete and evaluate the draft questionnaire (Sheskin 1985; Frazer & Lawley 2000; Babbie & Mouton 2008). This evaluation mode was applied in two ways. First, the draft questionnaire resulting from the panel evaluation process was submitted to a select group of military geoscientists at the 9th International Conference on Military Geosciences held in Las Vegas, USA, 19-24 June 2011. This procedure enabled some final inputs from international military experts to be incorporated into the questionnaire. Comments on the structure of the questionnaire and a few wording issues were highlighted and their comments ensured a more valid and reliable instrument.

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[14] A military language practitioner is an expert in the use of language in a military context. Commander (Dr) GM van Zyl has more than 25 years of experience in language education of students at the SAMA.

As a second control, on 16 August 2011, a convenience sample of 15 first-year military geography students at the SAMA was tasked to complete and evaluate the draft questionnaire. This draft appears as Appendix H. The respondents completed the evaluation of the questionnaire and their feedback was incorporated in the final pilot questionnaire. The panel mandate, composition, evaluation results and consequent remedial actions derived from the process are presented in the next four subsections.

3.2.3.1   Mandate to pretesting panel

Scholars of research procedure (Sheskin 1985; Babbie & Mouton 2008; Krosnick & Presser 2010) often advise the conduct of an 'in-house' pre-test during questionnaire development. A pretesting panel is expected to complete the questionnaire and indicate any issues arising from the preliminary questionnaire. Consequently the mandate to pretesting respondents was to:

- complete the questionnaire;

- underline any words or phrases not understood;

- indicate any items not understood with a question mark;

- complete the consent form; and

- submit the completed consent form and the completed questionnaire separately.

In conformance with Sheskin's (1985) prescription the evaluation was followed by a discussion with respondents to ensure that all the relevant comments and issues were captured. The issues are listed and discussed in the following subsections.

3.2.3.2   Composition of the pretesting panel

The composition of the pretest evaluation panel set out in Table 3.3 demonstrates the representativeness and diversity of membership. Six of the nine Army formations were fairly evenly represented.

All the respondents were current members of the SAMA; were Candidate Officers; had been in the employment of the DOD for three years; were young (between 20 and 24 years old); full-time students with matric; and were single. None of the respondents had any environmental management experience. Genderwise there was a slight preponderance of males (60%) and the ethnic representation was somewhat uneven (seven of the country's 11 official languages groups). The largest national language groups, namely isiZulu and isiXhosa were underrepresented. Although English is the official language of instruction and communication in the Army, none of the panellists reported it as a first or home language. This emphasised the importance of taking

Table 3.3 Composition and characteristics of the pre-testing panel members

RESPONDENT CHARACTERISTICS	NUMBER OF RESPONDENTS
Army formation	
Infantry	4 (26.7%)
Artillery	3 (20.0%)
Logistics	2 (13.3%)
Signal	3 (20.0%)
Engineer	2 (13.3%)
Armour	1 (6.7%)
Military unit	
Military Academy	15 (100.0%)
Rank level	
Candidate officer	15 (100.0%)
Time in employ of DOD	All 3 years
Current post level	All students
Environmental management experience	None
Age range (years)	20-24
Gender	
Female	6 (40.0%)
Male	9 (60.0%)
Marital status	All single
Home language	
Setswana	4 (26.7%)
Tshivenda	3 (20.0%)
Afrikaans	2 (13.3%)
Sesotho	2 (13.3%)
Sesotho sa Leboa	2 (13.3%)
isiZulu	1 (6.7%)
isiXhosa	1 (6.7%)
Highest level of education completed	All secondary school/matriculated
Highest level of geography education completed	
None	5 (33.3%)
Grade 10	3 (20.0%)
Grade 12	6 (40.0%)
Deployment experience	1 (6.7%)

extra care with language usage in the questionnaire. Respondents had a measure of geography education (60% up to grade 10 or higher), but 40% had none at all.

These respondents displayed similar characteristics to those expected in the population in some respects, but not in terms of formation membership, rank, age, marital status, or military experience. Babbie & Mouton (2008) do not set a prerequisite for respondents in a pretest to mirror the population exactly. The panellists did share a military background, hence an understanding of the draft questionnaire. Understanding the concepts inherent to the items in the questionnaire, and meaningfully evaluating and responding to them posed no challenge to the group – contrary to what civilian counterparts without a military background would have experienced.

3.2.3.3   Outcomes of the pretesting

The outcomes of the pretesting of the draft questionnaire broached two salient issues: completion duration and language clarity. Duration issues were pinned down to the time spent on

the survey preliminaries and the actual completion process. Prior to answering the questionnaire explanations were given of the survey's purpose and process; the function of the consent form; assurance of confidentiality; differentiation of military contexts (training, stability and support, war operations); and invitation was given to pose questions throughout. This took six minutes. Recorded questionnaire completion times varied between 32 (1 respondent), 35-40 (7 respondents), 41-46 (5 respondents) and 49 minutes (2 respondents). Despite the lower average time of 41 minutes, this implied a longest completion duration (the only crucial statistic), briefing included, closing in on one hour. Since the obtaining of permission from OCs for occupying respondents for more than one hour was unlikely, and since this was a relatively better informed group, the questionnaire's length and the time spent on preliminaries both had to be reduced.

Language issues boiled down to items and keywords that panellists deemed difficult to understand. The incomprehensible items included:

- Item 20 indicates that the South African military must become known as a 'green force' (4 respondents). The concept of a 'green' military proved problematic.

- Items 13, 17, 24, 52, 69 and 71 (one respondent each) referred to key terms in environmental management, namely waste production, recycling, wastewater, hazardous materials, impact minimisation, and military environmental education. Ignorance of these by respondents is a serious concern.

The words panellists could not understand were: holistically (2 respondents), archaeological (2 respondents), reuse, inhibit, dissertation, custodian, envisaged, rehabilitated and rebunkering sites (1 respondent each). Because miscomprehensions can lead to confusion and invalid responses (Sheskin 1985), clear alternatives for these words had to be found for inclusion in the final pilot questionnaire. Item 20 was removed (a similar theme was addressed by other items) and the wording of misinterpreted questions was altered to improve clarity. Words flagged as incomprehensible were replaced with intelligible synonyms.

A practical problem that arose was that respondents altered their responses after reflection or due to uncertainty or confusion. This practice had to be countered by an instruction prohibiting overwritten responses because these compromise the optical capture of answers by the computer using Formware software to scan and digitally record responses. The recording procedures render an Excel spreadsheet ready for processing by various statistical packages (Promark Technology 2005). The technical advantage of Formware is that it enables quick and accurate data capture from large numbers of questionnaires, so improving project turnaround time and contributed to cost savings.

The panellists asked no questions during the pretesting exercise, so indicating that the instructions and items were generally clear and unambiguous. The final pilot questionnaire was printed and submitted for proofreading by a military language practitioner at the SAMA, followed by physical preparation for Formware application.

3.2.4   The final pilot questionnaire

The final pilot questionnaire comprised an instrument consisting of a one-page covering letter, a nine-page body of items, and a one-page letter of consent (these materials appear in Appendix I). Table 3.4 summarises the instrument's structure and content. The attitude and behaviour sections of the questionnaire consisted of 22 items each dealing with the environment in the military and required responses in Likert format. The 21 questions in the knowledge section called for answers about military environmental knowledge in multiple-choice format.

Table 3.4 Structure and content of the final pilot questionnaire

STRUCTURAL ELEMENT	CONTENT
Letter of introduction	Explanatory information to elicit informed participation and responses from respondents.
Attitude scale items	22 items capture attitude responses in Likert format.
Behaviour scale items	22 items capture self-reported behaviour responses in Likert format.
Knowledge scale items	21 items capture environmental knowledge responses in multiple-choice format
Open-ended items	Six open-ended items allow respondents to give reasons for their responses and establish an environmental narrative.
Biographics and service history section	17 items on respondent background characteristics
Informed consent form	Detail about the implications of participation, requiring a consensual signature from respondents

The first two sections are scored on a Likert-type ordinal, variable scale registering five possible responses: agree strongly, agree, neutral, disagree and disagree strongly. McLafferty (2010) recommends an uneven number of response categories as this offers a neutral response option in the absence of definitive feelings in any direction. She advocates using 5- or 7-class response categories to cater for a middle option and an equal number of options either side of it while preventing too many categories to sacrifice the discriminatory power between categories.

To enable digital capture and numeric analysis, the scale values were scored numerically from 1 (agree strongly) to 5 (disagree strongly). All of the statements or questions that were worded negatively had their polarity reversed prior to analysis. Negatively worded items are used in questionnaires to curb acquiescence, disrupt non-substantive responding and secure improved

coverage of the content of a construct (Swain, Weathers & Niedrich 2008; Weijters & Baumgartner 2013). Because an answer indicating strong disagreement with a statement such as "I am not positive toward military environmental management" actually indicates a strong positive feeling toward military environmental management, the response must be recoded to reflect this opinion accurately by recoding (1) to (5) and (2) to (4). The reverse applies to responses recorded as 'disagree strongly'. Of course, responses captured as a medial (3) remain unaltered (Herche & Engelland 1996; Swain, Weathers & Niedrich 2008; Weijters & Baumgartner 2013; Ali, Rose & Ahmed 2015).

The multiple-choice type responses to the 21 multiple choice items on environmental knowledge generally offered five choices, including the neutral 'I do not know' option. Six of the items had only three choices, (true, false, I do not know). The open-ended section comprised six items requiring initial affirmative (yes) or negative (no) responses to each, but required explanatory reasons to be provided.

Because Thomas (2004) and Brace (2008) caution that respondents may perceive biographical questions to be intrusive and that placing this section early in a questionnaire may interrupt the flow of the 'conversation' in the questionnaire, the section requiring personal and service history information was placed last to obviate non-response. Respondents were asked to indicate service details (unit, formation, rank level, time in DOD employment, current post level, experience in military environmental management, deployment experience) and biographical (age, gender, marital status, mother tongue and education level) particulars. A final pilot questionnaire resulted from the processes discussed in Section 3.2. In the next section, the ethical issues of questionnaire survey are elucidated.

3.3   OBTAINING ETHICAL CLEARANCE

Although, obtaining ethical clearance for the research is not included in Figure 3.1, it is an essential element of survey research which involves an invasion of the privacy of respondents so that ethical considerations are crucially important (Sheskin 1985; Hofstee 2006; Dillman, Smyth & Christian 2009). This section commences by overviewing the concept and principles of research ethics and then sketches the series of steps in obtaining clearance from the University of Stellenbosch and the SA Army.

3.3.1   Principles of ethical research

The parties potentially affected by survey research, or the results thereof, include the research participants, colleagues, the profession, sponsors and funders. Privacy, participation and the conduct of ethical research all imply ethical considerations (Sheskin 1985; Neuman 1994).

Regarding participants, the voluntary nature of participation, informed consent, anonymity, confidentiality and the principle of no harm to participants during or after the exercise have to be addressed. Professionally, the scientific soundness of analysis and reporting, and the acknowledgement of collaborators and assistants must be carefully considered to prevent potential censure by professional bodies, prosecution by research participants or dismissal by employers (Bless, Higson-Smith & Sithole 2013). All obligations to funders and sponsors are to be met without compromising other ethical considerations (Mouton 2001).

Bless, Higson-Smith & Sithole (2013: 29) expand the ethics list to the "principles of ethical research": non-maleficence, beneficence, autonomy, justice, fidelity and respect for participants' rights and dignity. Non-maleficence implies that participants must not suffer any harm during their participation in the research project, while beneficence indicates the potential benefit a research project should have to society. The principle of autonomy recognises the freedom of individuals to participate in the research or not. Justice and fidelity refer to the equal treatment of all people and the keeping of all promises, undertakings and agreements made during the project. As an indication of respect for the rights and dignity of participants, their legal and human rights should not be violated in any way during the research. These principles were adhered to by obtaining official permission from the university and from the Army.

3.3.2   The university as knowledge custodian

Stellenbosch University is the main guardian of all research conducted under its auspices. Ethical approval for the survey had to be officially obtained from the Research Ethics Committee (REC) of Stellenbosch University, whereby it is certified that the researcher adhered to formally agreed and recognised principles of scientific research conduct.

A formal approval process was followed, entailing the mandatory submission of prescribed study details to the REC on a proforma application document. The required details included the project title, place of research and a declaration of the subject universe as well as the purpose of the research, the respondent selection mode and the time frame. The process, its potential benefits and risks to respondents, confidentiality matters, data security measures and the means of disseminating the results were communicated in the application attached as Appendix J. The participant information sheet and informed consent form were attached to the application form.

It is noteworthy that this application involves a long and time-consuming (2.75 years) compulsory process. The first application submitted on 26 May 2009 secured preliminary consent on 30 September 2009. The preliminary consent form (Appendix K) states provisos that the research remains within the boundaries of the proposal submitted in the application, that all

applicable national legislation and organisational guidelines be respected and that the questionnaire, once developed and before being administered, must be submitted for final approval.

Once the final questionnaire had been constructed, a final application was made to the REC (with the final questionnaire attached) on 17 August 2011 and an 'approved with stipulations' document was received from the REC on 17 October 2011. The stipulations were trivial and easily complied with, enabling a resubmission of documentation on 20 October. Final authority to commence with the survey was received on 17 November 2011 (the final authorisation is Appendix L) and final ethical clearance took another three months, so the operational survey could only commence in the first quarter of 2012. This final authorisation again emphasised the obligation to comply with national legislation, organisational guidelines and the principles of scientific conduct. It stipulated that, in the event of significant deviation from the proposed plan, a new application for ethical clearance from the committee was obligatory.

3.3.3 SA Army custodianship

The SA Army functions as the gatekeeper that permits or denies internal access to its research participants. Various permissions had to be obtained through different lines of authority. Permission to survey the selected Army units had to be obtained from the Chief of the Army in accordance with normal military practice. To add authority and legitimacy, letters were drafted and dispatched via the Dean of the Faculty of Military Science and the Commandant of the SAMA to Defence Intelligence for consideration and clearance of security issues. Authority from a security perspective was granted, on condition that "the final product of the study must be submitted for scrutiny and authority for release before distribution to any organisation or individual outside of the Department of Defence" (Matlakeng 2009: 1 – attached as Appendix M). Because the questionnaire was still under construction at that juncture, a stipulation was added that the final questionnaire had to be submitted for security screening before commencement of the final survey. Official, written security clearance of the final questionnaire was secured on 29 August 2012, although informal clearance dated from May 2012 (Appendix N holds the final Defence Intelligence authority document).

Obtaining operational clearance for the final survey proved a more daunting task. Following the first security clearance letter in 2009, a letter was sent via the Dean and Commandant to the Chief of Joint Training to obtain the obligatory signature. This permission was given on 8 September 2010 (see Appendix O). A subsequent letter addressed to the Chief of the Army for his condonation was followed by several unsuccessful attempts to solicit approval. Eventually, the process was facilitated by a Future SA Army Strategy Project Officer, resulting in

the Chief of the Army signing the letter and providing final permission on 13 October 2011 (Masondo 2011; Appendix P). On 12 April 2012, SA Army Headquarters Instruction 017/12 (Appendix Q) was issued, tasking the Chiefs of the different Formations to assist with the study, authorising the researcher to make direct contact with the selected units and sanctioning the start of the final survey.

The ethical and organisational approval processes both took much longer than expected and seriously hampered the management of the research process. The university process, albeit now drastically streamlined, took almost two years to conclude. The organisational permission took almost three years to obtain, even though the researcher is an officer employed by the DOD. This implies that a researcher from outside the organisation is very likely to encounter even greater difficulties in securing permission. Research in large, bureaucratic organisations can be seriously obstructed by such red tape. Determining the lines of authority was extremely difficult, while identifying and linking with the right people and getting timely responses proved daunting. Researchers need to take cognisance of these challenges and plan their research accordingly.

In a command-and-obey environment like the military, adherence to principles and stipulations of ethical research conduct was crucial and were meticulously adhered to, that is research subjects could not be forced to take part in the research; the anonymity and confidentiality of respondents' responses had to be protected; and all research-related documents had to be stored safely and made available to the authorities. Army stipulations restricted the research to the prior-identified units, and also required the final report to be evaluated for security purposes by Defence Intelligence before publication of the report or parts thereof.

The research chronicle now shifts to an account of the process of compiling the final questionnaire.

CHAPTER 4   THE OPERATIONAL QUESTIONNAIRE

Questionnaires do not emerge fully-fledged; they have to be created or adapted, fashioned and developed to maturity after many abortive test flights (Oppenheim (1992: 47).

Conventional survey practice requires a final pilot questionnaire to be thoroughly tested in a pilot survey. This exercise helps strengthen reliability and validity, and facilitates the selection of items for inclusion in the final questionnaire. Removing items from the draft questionnaire according to scientific criteria further increases reliability and validity (Du Preez, Visser & Van Noordwyk 2008; De Pinho et al. 2013) while compressing the questionnaire because the excessive length of the draft questionnaire was raised as a concern. Various statistical analysis techniques were applied to the pilot study database to help rectify this predicament.

The prescribed procedures followed (Sheskin 1985; Frazer & Lawley 2000; Venter 2006; Babbie 2008; Du Preez, Visser & Van Noordwyk 2008; De Pinho et al. 2013) are described in this chapter. The process of pilot testing the questionnaire is overviewed and the selection of pilot respondents is justified by means of a profile analysis. The selection of questionnaire items is explained and the construction of an adapted pilot questionnaire is described. The essence of each of the three modified scales is sketched and examined. The results of statistical tests to establish the validity of the item-reduced questionnaire are presented. Finally, the structure and content of the final questionnaire are introduced.

4.1   THE PILOT-TESTING PROCEDURE

The statistical testing of the reliability and validity of a questionnaire accords with international best practice in questionnaire construction (Ivy et al. 1998; Carretero-Dios; De los Santos-Roig & Buela-Casal 2008; Ali, Rose & Ahmed 2015) and is a final stage of the questionnaire design process. The pilot survey entailed distribution of the pilot questionnaire to a convenience sample (Babbie 2008 and Du Preez, Visser & Van Noordwyk 2008) of 160 members of the SA Army at the SAMA. This institution was selected for its accessibility to the researcher[15]. The questionnaires were distributed and collected personally by the researcher, a practice supported by Sheskin (1985). By conducting the pilot survey personally the researcher experienced the survey process and observed possible complications first-hand. The researcher briefed staff members verbally and the questionnaires were left with the respondents to be completed and collected the following day. If not completed by the following day, a new collection date was arranged and one day before a reminder was e-mailed. Non-completion by the second collection

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[15] The researcher is a lecturer at the South African Military Academy.

date disqualified the questionnaire from the pilot survey. Sheskin (1985) recommends a maximum of three attempts. Student participants in the survey were engaged in groups under personal supervision of the researcher. A total of 157 completed questionnaires were received on time, three having been disqualified for non-completion.

The questionnaires were subjected to strict quality control to confirm data integrity and completeness. A questionnaire was deemed unusable if more than five items had not been responded to, or if three or more of the vital biographical items (such as rank level) had not been completed. Four questionnaires did not meet these criteria. Captiva Formware software (Promark Technology 2005) was used to scan and prepare the 153 questionnaires for statistical analysis. Qualitative and written responses were captured manually. A final measure of quality control was to compare the Excel spreadsheet database with the original questionnaires to confirm the dependability of the automatic and manual processes. A few small adjustments were required to declare the database ready for statistical analysis.

4.2   RESPONDENT PROFILES

Profiles of respondents in a pilot survey are compiled for comparison with the population to test validity (Sheskin 1985). Although an exact fit is not required, respondents should display the essential characteristics of the population, in this case a range of military service, and education and training particulars. The MEL questionnaire was designed specifically to survey a military population so that the respondent profiles will differ from those encountered in the literature targeting civilian populations. These profiles are sketched and considered in the next subsections.

4.2.1   Demographic profile of the respondents

Only four demographic variables of the respondents were deemed significant, the particulars of which are marshalled in Table 4.1. These demographic variables are established in the literature on questionnaire construction, although results are sometimes conflicting.

A negative relationship between level of support for environmental action and **age** has been reported by Elliot, Seldon & Regens (1997), Levine & Strube (2012) reported the opposite, and Al-Dajeh (2012) and Xiao, Dunlap & Hong (2013) found no significant association. These disparate findings about age as an explanatory variable imply that age should be included in the MEL survey to further test the associations. More than half of the pilot respondents were younger than 25 years of age, signifying a fairly young and, on average, a younger population than in the Army as a whole. This is fortuitous because this young cohort may represent observant respondents contributing to the aims of pilot testing.

Table 4.1 Demographic profile of the respondents

DEMOGRAPHIC PROFILE VARIABLES	VALUES	PROPORTION OF RESPONDENTS (%) n = 153
Age	< 25 years	83 (54.2)
	≥25 years	70 (45.8)
Gender	Male	98 (64.1)
	Female	55 (35.9)
Home language	Afrikaans	48 (31.4)
	English	12 (7.8)
	isiNdebele	2 (1.3)
	isiXhosa	12 (7.8)
	isiZulu	9 (5.9)
	Sesotho	9 (5.9)
	Sesotho se Leboa	15 (9.8)
	Setswana	35 (22.9)
	siSwati	3(2.0)
	Tsivenda	2 (1.3)
	Xitsonga	4 (2.6)
	Other	2 (1.3)
Marital status	Married	34 (22.2)
	Unmarried	115 (75.2)
	Divorced	4 (2.6)

Source: Pilot survey (2011)

Research on EL in Korea by Chu et al. (2007) established that **gender** influenced environmental literacy, with girls scoring better than boys on the knowledge, attitude and behaviour scales. Contrarily, Ehrampoush & Moghadam (2005) found the level of environmental knowledge of males to be significantly higher than that of females, while Lee (2008) reported no statistically significant differences between males and females concerning environmental attitude. Higher attitude scores were recorded for women by Lopez et al. (2007) and Özden (2008). Xiao, Dunlap & Hong (2013) report higher scores for environmental concern by males than females, while Al-Dajeh (2012), Levine & Strube (2012) and Schumacher (2014) found no significant difference in environmental concern between men and women. Dijkstra & Goedhart (2012) reported significantly more positive attitudes and behaviour scores for females than for men, but a reversal in scores for environmental knowledge with males outperforming females. These disparate results regarding gender as an explanatory demographic variable support its inclusion in the MEL survey. Although the pilot group was biased toward male members, the gender split was almost identical to that of the population.

Home language as demographic variable was included in the questionnaire because it is a proxy for ethnicity and cultural affiliation but more importantly, because of the language policy of the South African DOD. The policy stipulates English as sole language of communication and instruction. Because English is the second or third language of a large cohort (the majority) of soldiers, this may be seen as an impediment to effective communication (Van Zyl 2007). Language

diversity in the population has two practical implications: the survey instrument must anticipate this reality in user-friendly language, and environmental education in the DOD must earnestly counter any miscommunication of its environmental message caused by unintelligible language (Van Zyl 2014, Pers com). The fact that even in this relatively small sample the country's 11 official languages are represented testifies to the language diversity in the DOD. That English mother-tongue speakers constituted only 8% of the sample, again emphasises the critical importance of using clear and easily understandable language in the questionnaire to elicit accurate responses. Language is a useful indicator of ethnic and cultural backgrounds by which particular groups in the SA Army can be identified for differentiated environmental training.

The findings of studies on the effect of **marital status** on the indicators of EL were inconsistent with Conroy & Emerson (2014) concluding that married respondents have a lesser concern for environmental issues and Schumacher (2014) finding no relationship between marital status and environmental concern. Consequently, this variable was included in the pilot study.

4.2.2   Education and training profile

Three variables measuring the status of education and training were deemed significant for inclusion (see Table 4.2) as they are well established in the literature on questionnaire construction. The positive correlation between **education level** and EL has been widely documented (Fransson & Gärling 1999; Kaplowitz & Levine 2005; Smit 2009; Zsóka et al. 2013; Conroy & Emerson 2014). Since all the respondents had matriculated, almost half had tertiary qualifications and most were enrolled in a degree course, the group is considered to be well educated. This places them in the upper echelons of the military at large, so qualifying them above-average scrutineers of the pilot questionnaire.

Table 4.2 Education and training profile of the respondents

EDUCATION AND TRAINING PROFILE VARIABLES	VALUES	PROPORTION OF RESPONDENTS (%) $n = 153$
Highest level of education completed	Secondary school	78 (51.0)
	Post school diploma	22 (14.4)
	First university degree	27 (17.6)
	Postgraduate qualification	26 (17.0)
Highest level of geography education completed	None	35 (22.9)
	Grade 10	32 (20.9)
	Grade 12	60(39.2)
	Postschool diploma	2 (1.3)
	First university degree	20 (13.1)
	Postgraduate qualification	4 (2.6)
Completed or enrolled in environmental courses	Yes	9 (5.9)
	No	144 (94.1)

Source: Pilot survey (2011)

Schooling in specific disciplines is likely to be a meaningful determinant of EL. Pe'er, Goldman & Yavetz (2007) found a significantly higher level of environmental knowledge in students enrolled for **geography** and life sciences (so-called 'environment-affiliated fields'). Smit (2009) recorded similar results for knowledge, attitude and behaviour in students enrolled in geography courses. Fransson & Gärling (1999) and Karatekin (2013) concur and suggest that environmental content in subjects such as geography and biology can positively influence EL. More than half of the pilot sample reported a geography qualification at or beyond Grade 12 and when lowered to Grade 10 the fraction climbs beyond three quarters, while a further 10% reported having biology as a subject in their highest completed qualification. These figures point to a relatively high level of environmental awareness not expected in the general military population. Concerning **environmental education** only a negligible proportion reported having completed or having been enrolled in a related subject field. It is however noteworthy that a positive relationship between exposure to environmental education and EL does exist according to Smit (2009) and Karatekin (2013).

Respondents reported exposure to a variety of **functional courses** which are prerequisites for promotion. Since this indicator relates to the rank level (see 4.2.3) of individuals, it was omitted from the final questionnaire.

Collectively, the education and training profile of the respondents reflects a subgroup with a high level of education and exposure to subjects that positively influenced the EL of the respondents. The population in the main survey may not be as highly educated as this sample.

4.2.3   Service profile

A fairly standard set of variables (used by Corson & Morris 2001; Ramos et al. 2008; and Smit 2009) build the service profile of the respondents namely the operational unit in which they serve in the Army; service formation; rank level; current post occupied and authorised responsibility; environmental experience; and deployment status. Information about formation and unit signify how well formations and units are represented, while rank level and service duration indicate seniority in the Army and the respondent's level of influence. The current post occupied and authorised responsibility, as well as environmental experience attest to exposure to environmental information which is proven to enhance EL (Culen & Mony 2003; Smit 2009). The deployment status of respondents is supremely important since soldiers on deployment export good or poor EL to deployment areas. Table 4.3 records the structure and content of the service profile.

Table 4.3 Service profile of the respondents in the pilot survey

SERVICE PROFILE VARIABLES	OPTIONS	PROPORTION OF RESPONDENTS (%) $n = 153$
Unit	SA Military Academy	153 (100.0)
Service formation	Air Defence Artillery	5 (3.4)
	Armour	8 (5.2)
	Artillery	12 (8.5)
	Engineer	12 (8.5)
	Infantry	41 (25.5)
	Intelligence	21 (13.7)
	Signal	12 (7.8)
	Support	37 (22.2)
	Other	5 (3.4)*
Rank level	Candidate officer	60 (39.7)
	Second Lieutenant	20 (13.9)
	Lieutenant	34 (22.5)
	Captain	8 (5.3)
	Major	6 (4.0)
	Lieutenant Colonel	12 (7.9)
	Colonel	2 (0.7)
	Sergeant	4 (2.0)
	Staff Sergeant	4 (2.0)
	Warrant Officer	4 (2.0)
Service duration (in years)	≤5	85 (55.6)
	6-10	31 (20.2)
	11-15	8 (5.2)
	16-20	13 (8.5)
	21-25	9 (5.9)
	>25	7 (4.6)
Current post and responsibility	Undergraduate student	101 (65.7)
	Postgraduate student	20 (13.3)
	Lecturer	17 (10.7)
	Support staff	15 (10.3)
Environmental experience	Yes	0 (0.0)
	No	153 (100.0)
Operational deployment experience	Yes	44 (28.8)
	No	109 (71.2)

Source: Pilot survey (2011)

Note: * Totals not adding up to 100.0 are due to non-responses to that particular item.

Although all respondents belong to one **unit**, they represent all but one (Training) **formation** of the Army[16]. One quarter of the respondents resort under Infantry, the largest formation in the SA Army. The number of respondents per formation does not necessarily reflect the proportional size representation of formations. All the members surveyed have the SAMA as home unit, and regarding **rank level**, basically only the officer's corps is represented.

This absence of ordinary servicemen means that their ability to understand and complete the questionnaire was not tested. Nevertheless, since a large contingent (35%) of respondents was

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[16] The South African Military Academy is the home unit of students representing all the formations in the Army, as well as the Navy, Air Force and South African Military Health Services.

officers-in-training, the obstacle was partially circumvented and the implications must be borne in mind when fine-tuning the final questionnaire.

Service duration in the DOD varied between one and 33 years, with an average of 15.5 years indicating long military experience, although most (more than half) are relative newcomers to the DOD with five or less years as members of the DOD. Almost 90% of the respondents are either **students or lecturers** who conceivably exhibit an alertness to environmental matters. The academic background of this group was markedly different to that of the sampled population for the main survey.

None of the respondents had any formal **experience in environmental management** except some who reported ad hoc experience such as tree planting and base cleaning. Almost one in three respondents had seen domestic and/or international **deployment** to countries like Angola, Burundi, Comoros, Democratic Republic of Congo, Lesotho, Namibia, Mozambique, Sudan and Swaziland. Of course, in the population a wider deployment range can be expected, but this is not a serious concern.

4.2.4   Group summary profile

The pilot sample was not a fully representative subgroup of the population. With the exception of gender, all the other indicators differ from what can be expected from the population (all SA Army personnel). The pilot group is younger, better educated and has a strong officer bias. Relatively high levels of geography and biology education further contributed to a strong sense of responsibility for and a positive attitude toward the military environment. The biographical profile of the pilot sample suggests a degree of MEL greater than expected in the Army in general. Sheskin (1985) maintained that exact correspondence between pilot respondents and the population is not a prerequisite for a successful pilot survey. The fact that the respondents are military personnel in the SA Army suffices.

4.3   REFINEMENT OF QUESTIONNAIRE ITEMS

Shortening a questionnaire by removing items that do not meet the criteria for inclusion is an established way to increase the instrument's reliability and validity (De Pinho et al. 2013). In this section item selection for the three scales of the MEL questionnaire (attitude, behaviour, and knowledge) are examined. Standard procedures for questionnaire development were applied to the pilot study database. For the behaviour and knowledge scales item total correlation was performed for each item (Du Preez, Visser & Van Noordwyk 2008; Nilson et al. 2013) together with Cronbach's alpha (Nunally 1978; Field 2014) and PLS path analysis (Vinzi et al. 2010). These techniques are used for scales consisting of Likert-type responses. The knowledge scale, consisting

of multiple-choice items, necessitated different approaches (Nunally 1972; Ferrando 2009), namely item difficulty analysis (Carretero-Dios, De los Santos-Roig & Buela-Casal 2008; McElhiney et al. 2014) and item discrimination analysis (Venter 2006; Ferrando 2009) to indicate item suitability for inclusion in the final MEL questionnaire. The item selection process resulted in a more condensed questionnaire.

4.3.1 Attitude scale items

The pilot-test results are interpreted and the item selection flowing from the evaluation are discussed in this section. The way item total correlation (ITC) enhances the item selection process is considered, the reliability of the attitude scale derived from the pilot survey is elucidated and the results of the PLS path analysis are listed and discussed.

4.3.1.1   Item total correlation

The results of ITC were used in the final item selection process. They represent the correlation between each item and the total score from the questionnaire or scale in the questionnaire. A reliable scale consists of individual items each correlating well with the overall score of the scale, i.e. it measures the same concept. Although correlation values normally range between +1 (perfect positive correlation) and -1 (perfect negative correlation) with 0 indicating no correlation, in this case item total correlations are always positive. Negative correlations indicate the use of negatively-framed items (Kidd, Pers Com 2015). Such items were carefully guarded against in drafting items for inclusion. The stipulation of absolute values for item removal is hotly debated in literature, with low correlation values (below 0.3) generally slated as candidates for removal (Field 2014). However, cut-off values as low as 0.25 have been advanced by some scholars (Rattray & Jones 2007; Olatunji et al. 2007; Du Preez, Visser & Van Noordwyk 2008; Carretero-Dios, De los Santos-Roig & Buela-Casal 2008; Nilson et al. 2013). For this research Field's (2013) rule-of-thumb value of 0.3 was adapted for MEL to a more stringent cut-off value of 0.4 to identify items to be considered for removal.

4.3.1.2   Reliability for the attitude scale

Table 4.4 summarises the reliability statistics for the set of 153 valid pilot test cases on 22 questionnaire items. the goal of achieving a Cronbach's alpha value of ≥0.8 remains the target, implying full acceptance of the set. Cortina (1993) and Field (2013) caution that a large number of items in a scale artificially inflates Cronbach's alpha values. Cortina (1993: 101) regards 40

Table 4.4 Reliability statistics for the attitude scale

Summary for this scale: Valid sample size (n): 153; Cronbach alpha: 0.86. Standardised alpha: 0.87		
VARIABLE	ITEM TOTAL CORRELATION	ALPHA IF DELETED
Item 1	0.38	0.86
Item 2	0.34	0.86
Item 3	0.45	0.86
Item 4	0.37	0.86
Item 5	0.41	0.86
Item 6	0.38	0.86
Item 7 (reversed)	0.34	0.86
Item 8	0.29	0.86
Item 9	0.63	0.85
Item 10	0.34	0.86
Item 11	0.45	0.86
Item 12	0.45	0.86
Item 13	0.32	0.86
Item 14	0.56	0.85
Item 15	0.52	0.86
Item 16	0.63	0.85
Item 17(reversed)	0.45	0.86
Item 18	0.39	0.86
Item 19	0.41	0.86
Item 20	0.50	0.86
Item 21	0.59	0.85
Item 22	0.57	0.85

Source: Pilot survey (2011)

items as "a large number of items", so the Cronbach's alpha values will decline insignificantly for the final scale with reduced items.

The values in the 'Alpha-if-deleted-column' in Table 4.4 indicates no item deletion will significantly affect the total alpha of the scale. Any item with an alpha value greater than 0.86 would call for its removal to improve the total alpha. According to the two statistical analyses all the attitude items in the pilot questionnaire can be retained in the final questionnaire.

4.3.1.3   PLS path analysis of the attitude scale

PLS path analysis investigates the significance of individual items (Henseler, Ringle & Sinkovics 2009; Wetzels, Odekerken-Scröder & Van Oppen 2009; Vinzi et al. 2010). Non-significant items must be re-evaluated and considered for exclusion from the questionnaire. The results of the PLS path analysis for the attitude scale are listed in Table 4.5.

Significant results, i.e. outer loading and bootstrap mean values between the 95% lower and upper limits for each item, were posted for all the items so that, based on this criterion alone, no justification was found for the removal of any items.

Table 4.5 PLS path analysis of attitude items

ITEM	OUTER LOADING	BOOTSTRAP MEAN	95% LOWER	95% UPPER	SIGNIFICANCE
Item 1	0.46	0.45	0.28	0.60	Significant
Item 2	0.39	0.38	0.17	0.57	Significant
Item 3	0.50	0.48	0.29	0.63	Significant
Item 4	0.55	0.55	0.38	0.70	Significant
Item 5	0.61	0.61	0.43	0.74	Significant
Item 6	0.57	0.57	0.39	0.72	Significant
Item 7	-0.41	-0.41	-0.61	-0.19	Significant
Item 8	0.29	0.28	0.10	0.47	Significant
Item 9	0.69	0.68	0.50	0.81	Significant
Item 10	0.34	0.34	0.08	0.61	Significant
Item 11	0.46	0.45	0.22	0.64	Significant
Item 12	0.50	0.49	0.31	0.65	Significant
Item 13	0.29	0.27	0.06	0.47	Significant
Item 14	0.59	0.58	0.36	0.75	Significant
Item 15	0.59	0.59	0.42	0.72	Significant
Item 16	0.69	0.69	0.58	0.78	Significant
Item 17	-0.52	-0.52	-0.66	-0.33	Significant
Item 18	0.46	0.45	0.23	0.65	Significant
Item 19	0.44	0.44	0.23	0.61	Significant
Item 20	0.50	0.49	0.28	0.65	Significant
Item 21	0.62	0.61	0.45	0.74	Significant
Item 22	0.66	0.65	0.53	0.75	Significant

Source: Pilot survey (2011)

4.3.2 Behaviour scale items

Based on the reliability of the behaviour scale, supported by PLS path analysis, refined item selection is reported in this section. The various procedures, results and decisions are sanctioned here.

4.3.2.1 Reliability results for the behaviour scale

As done for the attitude scale, Table 4.6 summarises the reliability statistics for the set of 153 valid pilot-test cases on 22 questionnaire items on MEB. The goal of achieving a Cronbach's alpha value of ≥0.8 remains the target for full acceptance of the set.

Cautions expressed by Cortina (1993) and Field (2013) that inclusion of a large number of items in a scale will artificially inflate Cronbach's alpha values are relevant, but since the former author only regards 40 items as a large number, a decrease in Cronbach's alpha for the final scale with reduced items is deemed insignificant.

Table 4.6 Reliability statistics for the behaviour scale

VARIABLE	ITEM TOTAL CORRELATION	ALPHA IF DELETED
Summary for the scale: Valid sample size (n): 153; Cronbach alpha: 0.87; Standardised alpha: 0.89		
Item 23	0.39	/0.86
Item 24	0.31	0.87
Item 25 (reversed)	0.29	0.87
Item 26 (reversed)	0.32	0.87
Item 27 (reversed)	0.32	0.87
Item 28	0.52	0.86
Item 29	0.55	0.86
Item 30	0.49	0.86
Item 31 (reversed)	0.60	0.86
Item 32 (reversed)	0.60	0.86
Item 33 (reversed)	0.57	0.86
Item 34	0.51	0.86
Item 35	0.58	0.86
Item 36	0.64	0.86
Item 37	0.55	0.86
Item 38	0.52	0.86
Item 39	0.54	0.86
Item 40	0.46	0.86
Item 41	0.31	0.86
Item 42	0.37	0.87
Item 43 (reversed)	0.38	0.86
Item 44	0.51	0.86

Source: Pilot survey (2011)

4.3.2.2   PLS path analysis of the behaviour scale

The results of PLS path analysis for the behaviour scale shown in Table 4.7 record

Table 4.7 PLS path analysis of behaviour items

ITEM	OUTER LOADING	BOOTSTRAP MEAN	95% LOWER	95% UPPER	SIGNIFICANCE
Item 23	0.49	0.50	0.37	0.63	Significant
Item 24	0.40	0.39	0.22	0.56	Significant
Item 25	-0.02	-0.02	-0.27	0.24	Not significant
Item 26	-0.05	-0.04	-0.29	0.21	Not significant
Item 27	-0.05	-0.05	-0.29	0.20	Not significant
Item 28	0.75	0.75	0.60	0.84	Significant
Item 29	0.78	0.77	0.63	0.86	Significant
Item 30	0.73	0.73	0.58	0.84	Significant
Item 31	-0.45	-0.45	-0.65	-0.19	Significant
Item 32	-0.46	-0.45	-0.66	-0.20	Significant
Item 33	-0.49	-0.48	-0.67	-0.25	Significant
Item 34	0.61	0.61	0.42	0.76	Significant
Item 35	0.72	0.72	0.48	0.86	Significant
Item 36	0.82	0.82	0.74	0.88	Significant
Item 37	0.78	0.78	0.69	0.84	Significant
Item 38	0.49	0.49	0.24	0.70	Significant
Item 39	0.53	0.53	0.34	0.69	Significant
Item 40	0.53	0.53	0.35	0.67	Significant
Item 41	0.39	0.38	0.18	0.55	Significant
Item 42	-0.35	-0.35	-0.51	-0.15	Significant
Item 43	0.55	0.55	0.40	0.67	Significant
Item 44	0.74	0.74	0.63	0.82	Significant

Source: Pilot survey (2011)

significant results for all items except 25, 26 and 27. The loading and mean values outside the 95% lower and upper value range denote that these items qualify to be reassessed. While the selection criteria discussed in 4.3.1 and 4.3.2 was used to select items for the attitude and behaviour scales, different criteria was used to select the knowledge items. These criteria are discussed in 4.3.3.

4.3.3   Knowledge scale items

Items in the knowledge scale had to be re-evaluated to meet two criteria for inclusion in the final questionnaire; namely item difficulty and item discriminatory power. These routinely-used criteria for determining suitability of knowledge scales in questionnaire construction are explored in the next two subsections with reference to the pilot questionnaire.

4.3.3.1   Item difficulty on the knowledge scale

An item difficulty index reveals the percentage of respondents answering an item correctly (Nunnally 1972). Although the index is often referred to as the item difficulty index, it actually indicates the obviousness of an item. If 80% of the respondents answer an item correctly, that item registers a rating of 0.80. Various researchers (Carretero-Dios, De los Santos-Roig & Buela-Casal 2008; De Pinho et al. 2013; McElhiney et al. 2014) have used cut-off values ranging between 0.10 and 0.92. Venter (2006) used the Nunnally (1972) guideline of a critical test range between 0.35 and 0.85 for battery inclusion, while conceding that some really challenging items (average score below 0.35) or straightforward items (average score above 0.85) may have to be retained because they assess useful or critically important information aspects that will detract from the questionnaire if absent. Based on these divergent criterion values the 0.45-0.85 range was taken as inclusion limits. Such conservative cut-off values ensure that all items requiring knowledge that is either too demanding or too obvious are re-evaluated before final decisions on inclusion or removal are reached.

Figure 4.1 shows that seven items in the scale registered high percentages (>85%) of correct answers, while in four cases less than 45% of the answers were correct. Items covering knowledge about environmental plans, training, disaster and conflict damage elicited more than 90% correct responses, while the items about environmental law, the placing of field toilets and DOD responsibility to respect the environmental rights of vulnerable groups during war, drew 85% correct answers. These items appear to be too obvious and prompted scrutiny for exclusion from the questionnaire.
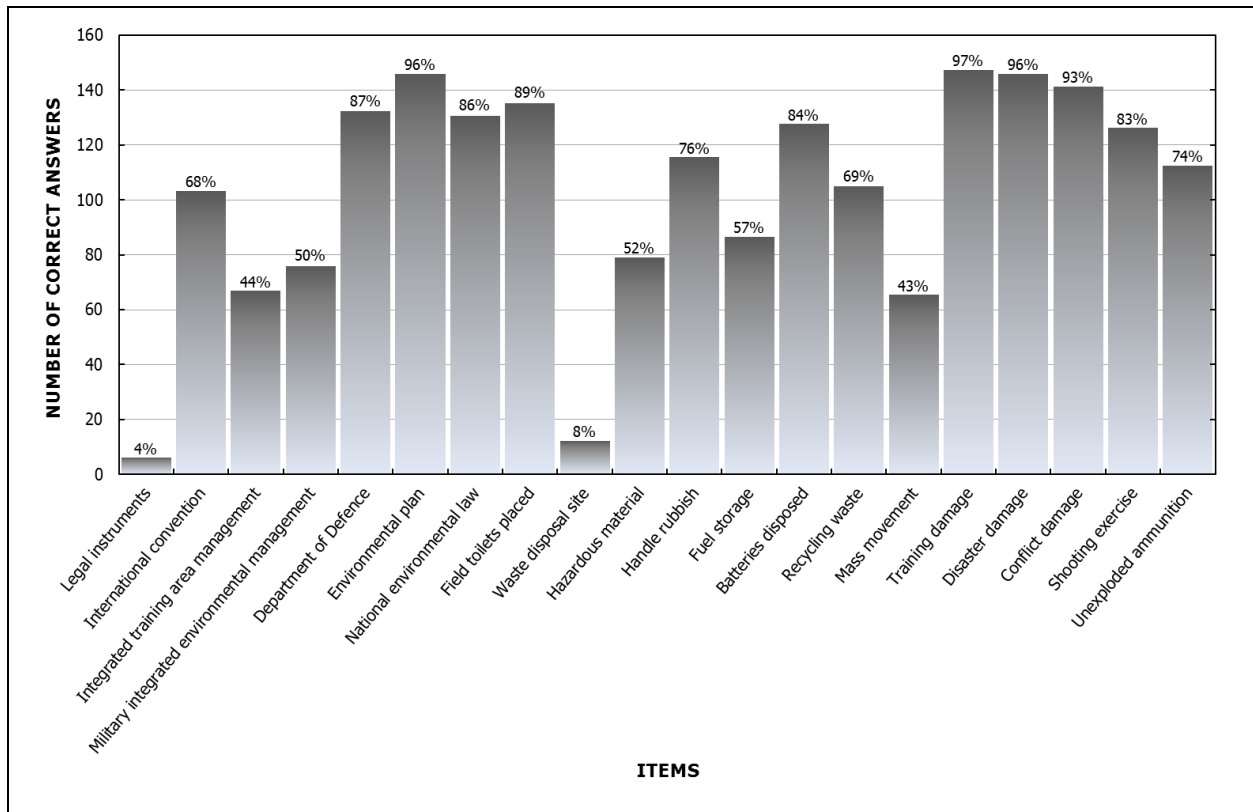
Figure 4.1 Assessment of item difficulty for the knowledge scale

The items about integrated training area management and the mass movement of troops attracted correct response rates in the exclusion zone below 45%, while the correct answers for the items about legal instruments and waste-disposal sites dropped below 10%. These four items seemed to be too difficult so that they qualified for further evaluation and possible exclusion.

4.3.3.2   Item discrimination in the knowledge scale

Item discrimination refers to how well an item 'discriminates' or separates bottom performers from top performers on a knowledge scale (Venter 2006; Ferrando 2009; McElhiney et al. 2014). When applying the test for discrimination, the ideal result would be large differences in respondents' answers to items, with top performers scoring well and bottom performers scoring badly. In MEL research item discrimination entails that subjects scoring high overall marks (top performers) also score high marks on individual items and bottom performers would score low marks.

To assess the discriminatory power of such analyses on each item, a Mann-Whitney U test was performed per item. For explanatory purposes, Figure 4.2 graphically shows an example of a Mann-Whitney U test result for Item 45 to explain the functioning of the test.
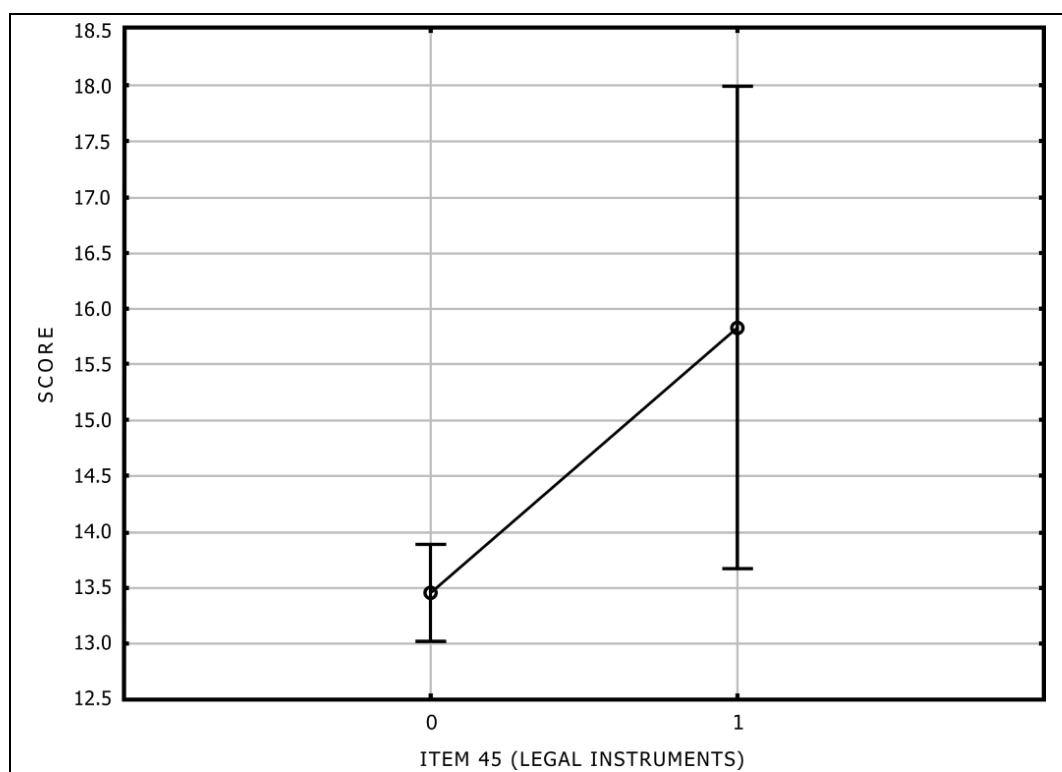
Figure 4.2 Example of the result of a Mann-Whitney U test on a knowledge item

The Mann-Whitney U test is used here to test the hypothesis that Item 45 does not discriminate between high achievers and low achievers on the knowledge scale. The aim is to reject the hypothesis, and to do that the *p*-value of the test must be <0.05 (Williams, Sweeney & Anderson 2006; Remenyi, Onofrei & English 2011; McKillup 2012; Field 2013). In this example the score difference between low (0) and high (1) achievers seems fairly large with a *p*-value of 0.02, well below the threshold of 0.05. Therefore, the hypothesis that the item does not discriminate between high and low achievers can be rejected at the 0.95% confidence interval, and this item will indeed discriminate between respondents who know the answer to the item and those who do not. In the next section the *p*-values of this test for the knowledge items were used to help evaluate the items for inclusion in the final questionnaire.

With the criteria for item selection for the different scales of the questionnaire set, the evaluation of items commenced. This process is discussed in Section 4.4.

4.4   THE MODIFIED SCALES

Taking cognisance of the criteria for item selection set out above the attitude, behaviour and knowledge scales were subsequently adapted. The selection process is debated and evidence is given to justify decisions in each subsection. The section concludes with a discussion of the content and morphology of the final questionnaire.

4.4.1 An adapted attitude scale

Table 4.8 summarises the statistical results for each item considered for selection in the attitude scale as well as the decisions taken about inclusion or removal of items. The indicators used are ITC, PLS path analysis reports and Alpha-if-deleted.

Table 4.8 Statistical results used to evaluate items for the attitude scale

ITEM NO	ITEM THEME	ITEM TOTAL CORRELATION *	PLS PATH ANALYSIS **	ALPHA IF DELETED *** Alpha = 0.86	DECISION
1	Protection of military environment during training, daily activities and base management	0.38	Significant	0.86	Remove
2	Protection of military environment during disaster relief, peace operations or support operations	0.34	Significant	0.86	Remove
3	Protection of military environment during armed conflict	0.45	Significant	0.85	Retain
4	Protection of cultural environment during training, routine daily activities or base management	0.37	Significant	0.86	Retain
5	Protection of cultural environment during any form of disaster relief, peace operation or support operation	0.41	Significant	0.85	Retain
6	Protection of cultural environment during any form of armed conflict	0.38	Significant	0.86	Retain
7	Environmental protection not necessary	0.34	Significant	0.86	Remove
8	Environmental education and training	0.29	Significant	0.86	Remove
9	Consult military environmental officer	0.63	Significant	0.85	Retain
10	Protection of animals during training, routine daily activities or base management	0.34	Significant	0.86	Remove
11	Protection of animals during any form of disaster relief, peace operations or support operations	0.45	Significant	0.85	Remove
12	Protection of animals during any form of armed conflict	0.45	Significant	0.86	Retain
13	Waste production	0.32	Significant	0.85	Retain
14	Environmental management plans	0.56	Significant	0.85	Retain
15	Environmental laws	0.52	Significant	0.85	Retain
16	Pollution	0.63	Significant	0.85	Retain
17	Recycling	0.45	Significant	0.85	Retain
18	Rehabilitation after military activities	0.39	Significant	0.85	Retain
19	Water conservation	0.41	Significant	0.85	Remove
20	Soil erosion	0.50	Significant	0.85	Retain
21	Environmentally responsible force	0.59	Significant	0.85	Retain
22	Respect religions, customs and languages	0.57	Significant	0.85	Retain

Source: Pilot survey (2011)

Notes: * Target value > 0.4; ** Must be significant; *** Must not improve Alpha of the scale if deleted.

Items 1, 2 and 7 were removed due to their weak ITC and in view of the fact that the same theme is adequately addressed by item 3. Item 3 was retained and the wording was altered to read: *During any form of military operation the environment in which the military operates must be protected.*

After careful consideration items 4 to 6 were retained, although items 4 and 6 registered fairly weak ITC results. Their retention was nevertheless justified on grounds of the theme addressed being too important for removal. The ITC for item 8 was weak and it was removed as the issue of environmental education was sufficiently addressed in open-ended items.

Because all three measures for item 9 yielded satisfactory results, it was retained as it is the only item dealing with the position of the environmental officer. Items 10 and 11 were removed by reason of item 12 dealing with the same protection theme. The retained item 12 was reworded to: *During any form of military operation animals must not be harmed.*

Although items 13 and 18 yielded weak ITC scores, they were retained as they introduce important themes not attended to elsewhere in the questionnaire.

Contrary to this decision, item 19 was removed for being too generic and already proxied in other items. Items 20 to 22 were retained because of their strong ITC results and the vital themes they address.

This process of item selection removed redundant items from the attitude scale, improved the clarity of items and shortened the questionnaire by seven items. The result is a more focused and user-friendly scale consisting of 15 vital items. The process followed to select items for the attitude scale was repeated for the behaviour scale as reported next.

4.4.2   An adapted behaviour scale

Table 4.9 summarises the statistical results for each item considered for selection in the behaviour scale as well as the decisions taken on the inclusion or removal of items. The same indicators used for the attitude scale (ITC; PLS path analysis reports; Alpha-if-deleted) are applied to each behaviour item.

The ITC values for items 23, 24, 41 and 42 were too low; the PLS path analysis yielded significant results; and Alpha-if-deleted indicated no improvement in Alpha for the whole scale. After careful consideration these were the only items found to probe the crucial themes of oil-spill pollution, energy saving, waste recycling and route selection. All four were retained.

Respondents cited items 25, 26 and 27 in the pilot questionnaire as entries that might elicit preconceived (positive) responses because they invited an anticipated (expected) response.

Table 4.9 Statistical results employed to evaluate items for inclusion in the behaviour scale

ITEM NO	ITEM DESCRIPTION	ITEM TOTAL CORRELATION *	PLS PATH ANALYSIS **	ALPHA IF DELETED ***	DECISION
23	Oil-spill procedure	0.39	Significant	0.86	Retain
24	Energy saving	0.31	Significant	0.87	Retain
25	Waste-water management during training, routine daily activities or base management	0.29	Not significant	0.87	Remove
26	Waste-water management during disaster relief, support operations or peace operations	0.32	Not significant	0.87	Remove
27	Waste-water management during armed conflict	0.32	Not significant	0.87	Remove
28	Consider cultural environment during training, routine daily activities or base management	0.52	Significant	0.87	Remove
29	Consider cultural environment during disaster relief, support operations or peace operations	0.55	Significant	0.86	Remove
30	Consider cultural environment during armed conflict	0.49	Significant	0.86	Remove
31	Littering during training, routine daily activities or base management	0.60	Significant	0.86	Remove
32	Littering during disaster relief, support operations or peace operations	0.60	Significant	0.86	Remove
33	Littering during armed conflict	0.57	Significant	0.86	Retain
34	Temporary base construction	0.51	Significant	0.86	Retain
35	Respect cultural environment during training, routine daily activities or base management	0.58	Significant	0.86	Retain
36	Respect cultural environment during disaster relief, support operations or peace operations	0.64	Significant	0.86	Retain
37	Respect cultural environment during armed conflict	0.55	Significant	0.86	Retain
38	Do not destroy natural vegetation during training, routine daily activities or base management	0.52	Significant	0.86	Retain
39	Do not destroy natural vegetation during disaster relief, support operations or peace operations	0.54	Significant	0.86	Retain
40	Do not destroy natural vegetation during armed conflict	0.46	Significant	0.86	Retain
41	Recycle at work	0.31	Significant	0.87	Retain
42	Take shortest route irrespective of damage caused	0.37	Significant	0.87	Retain
43	Repair damage to environment after digging defensive positions	0.38	Significant	0.86	Remove
44	Respect religion, customs and language of local inhabitants	0.51	Significant	0.86	Retain

Source: Pilot survey (2011)

Notes: * Target value > 0.4; ** Must be significant; *** Must not improve Alpha of the scale if deleted.

Sheskin (1985) cautions against this type of biased item so that all three items were removed because the ITC was also below the norm. A further reason for their removal was that their common theme, waste water management, is a specialised activity falling outside the normal military activities performed by most of the respondents.

Items 28 to 32 were removed despite their ITCs being adequate, their PLS path analysis results being significant and there being no movement in Alpha if removed. However, they were seen as redundant due to being proxied by other themes in the scale. Similarly, item 43 was removed since its ITC was too low and it was also proxied by other themes. The other items yielded adequate results for all three measures and were retained.

This evaluation of each item for retention or removal eliminated redundant items from the behaviour scale, improved the clarity of items and shortened the questionnaire by nine items. The result is a prioritised and user-friendly behaviour scale consisting of 13 items.

4.4.3   An adapted knowledge scale

Here a similar assessment process as the foregoing was followed but with different statistical indicators to accommodate the special type of item in this scale. That is, the previous two scales measured Likert-type responses whereas the knowledge scale consisted of multiple-choice items calling for an appropriate approach.

When assessing item difficulty it must be kept in mind that the convenience sample drawn at the SAMA differed in one vital aspect from the SA Army population, namely the former's higher level of education. Consequently, it was foreseen that higher proportions of respondents would respond correctly to knowledge items. Based on the gauging of item difficulty and item discrimination (Mann-Whitney U test) as indicated in Table 4.10, a number (6) of the knowledge items were removed and most (14) retained.

Although the item discrimination of item 45 was appropriate, the very low percentage of respondents who answered this item correctly marked it for removal from the questionnaire without impairing the validity of the set of items. Its wording was confusing and it is perhaps better suited to military-legal professionals only. Items 50 and 52 elicited high correct response rates, indicating that they were too obvious and although their item discrimination results were adequate, they were removed.

Although items 60, 61 and 62 (all three have the cultural environment as theme) elicited very high proportions of correct responses, the cultural theme is too fundamental for total removal from the scale as removal would seriously jeopardise the defined environmental integrity of the

Table 4.10 Rationales for removing or retaining items from the knowledge scale

ITEM NO	ITEM DESCRIPTION	ITEM DIFFICULTY (%)*	ITEM DISCRIMINATION **	DECISION
45	Most important law dealing with military environment	4	< 0.01	Remove
46	Geneva Convention	68	< 0.01	Retain
47	Integrated training area management	44	< 0.01	Retain
48	Military integrated environmental management	50	< 0.01	Retain
49	Respect environmental rights	87	0.03	Retain
50	Environmental plan	96	< 0.01	Remove
51	National environmental law	86	< 0.01	Retain
52	Placement of field toilets	89	< 0.01	Remove
53	Placement of waste-disposal site	8	0.23	Remove
54	Storage of hazardous material	52	< 0.01	Retain
55	Handling of rubbish and refuse	76	< 0.01	Retain
56	Fuel storage and rebunkering sites	57	< 0.01	Retain
57	Disposal of batteries	84	< 0.01	Retain
58	Recycling of waste products	69	< 0.01	Retain
59	Mass movement of troops during an exercise	43	< 0.01	Retain
60	Damage to cultural environment during training, routine daily activities or base management	97	< 0.01	Remove
61	Damage to cultural environment during disaster relief, support operations or peace operations	96	< 0.01	Remove
62	Damage to cultural environment during armed conflict	93	< 0.01	Retain
63	Trees and shrubs as targets	83	< 0.01	Retain
64	Handling of unexploded ammunition	74	< 0.01	Retain

Source: Pilot survey (2011)

Notes: * All items scoring below 45 % or above 85 % are motivated; ** All items where $p = <$ 0.05, indicate adequate item discrimination and may be retained

set of items. Despite the acceptable item discrimination for all three items, items 60 and 61 were removed and item 62 retained with its wording changed to an encompassing format: *During any military operation, the cultural environment must be protected.*

The item difficulty of item 47 did not meet the criterion of 45%, nonetheless inclusion or removal was decided by virtue of ITAM being conceptually too important to omit from the questionnaire. The item discrimination value fell within the acceptable parameters and the item was retained. Item 59 displayed almost the same statistics and was also retained.

While item 49 was answered correctly by a high percentage of respondents, it was deemed vital that members recognise the importance of respecting the environmental rights of all people under any circumstances. Item discrimination also pointed to its removal but it was retained given

its importance as a central theme in the questionnaire. Item 53 did not meet the requirements of item difficulty and item discrimination, and given that technical information of this nature can be sourced from instruction manuals, it was removed without fear of impairing the scale's validity.

Item 51 was answered correctly by a relatively high proportion of respondents, but on account of the vital importance of military members understanding their inevitable subordination to all national environmental laws and because item discrimination was acceptable, the item was retained. Item difficulty and item discrimination values for items 46, 48, 54 to 58, 63 and 64 fell within the acceptance parameters and they were all retained. The item selection process for the knowledge scale culminated in a scale of 14 items after the removal of six items. Consequent to removal or retaining of items from the scales, the final questionnaire for the MEL survey could be constructed. In the Section 4.4.4 the compilation of the final questionnaire to test MEL in the SA Army is considered.

4.4.4   Compilation of the final questionnaire

The full set of items for inclusion in the final questionnaire is set out in Table 4.11. The item selection process removed duplicated items, potentially confusing items, items too difficult or too easy and items statistically unfit for inclusion to yield a set of items fit to produce a reliable, valid and shortened final questionnaire. The number of attitude items was reduced from 22 to 15, the behaviour items from 22 to 13 and the knowledge items were condensed from 20 to 14. Although the total number of items was reduced from 64 to 42, a one-third reduction, the balance between the scales was retained. The length of the questionnaire, including the letter of introduction and informed consent form, now spanned a total of 10 pages, a reduction of one page, or nearly ten per cent.

It was estimated that the final questionnaire could be completed in less than one hour, avoiding possible complications during the main survey. This also improved time management and ensured that Officers Commanding units could easily fit in a period to accommodate the survey without undue interruption of unit programmes.

The item selection procedure ensured that a questionnaire was drafted that is interesting, understandable, quicker to complete, containing no unnecessary items and is respondent friendly. More importantly, this final version of the questionnaire is a valid and reliable instrument suitable for surveying the MEL of SA Army soldiers.

Table 4.11 The set of reconstituted items in the final questionnaire

ITEM NUMBER IN THE PILOT QUESTIONNAIRE	NEW ITEM NUMBER IN FINAL QUESTIONNAIRE	THEME ADDRESSED
Attitude scale		
3	1	Protect military environment during any form of military operation
4	2	Protect cultural environment during training or base management
5	3	Protect cultural environment during peace- or support operation
6	4	Protect cultural environment during any form of armed conflict
9	5	Involvement of military environmental officer in planning
12	6	Harming of animals
13	7	Waste production
14	8	Necessity of environmental management plans
15	9	Applicability of national and international environmental laws
16	10	Antipollution measures
17	11	Recycling
18	12	Rehabilitation of damage done to environment
20	13	Soil erosion caused by military activities
21	14	SA Army as a 'green' force
22	15	Respect for religions, customs and languages
Behaviour scale		
23	16	Oil-spill procedure
24	17	Energy saving
33	18	Littering
34	19	Regulations regarding temporary base construction
35	20	Respect for cultural environment during training or base management
36	21	Respect for cultural environment during disaster relief or support operation
37	22	Respect for cultural environment during armed conflict
38	23	Damage to vegetation during training or base management
39	24	Damage to vegetation during disaster relief or support operation
40	25	Damage to natural vegetation during armed conflict
41	26	Recycling
42	27	Shortest route irrespective of environmental damage
44	28	Respect religion, customs and language
Knowledge scale		
46	29	Geneva convention
47	30	Integrated training area management
48	31	Military integrated environmental management
49	32	Respect environmental rights
51	33	National environmental law
54	34	Storage of hazardous material
55	35	Handling of rubbish and refuse
56	36	Fuel storage and rebunkering sites
57	37	Disposal of batteries
58	38	Recycling of waste products
59	39	Mass movement of troops during and exercise
62	40	Damage to cultural environment during armed conflict
63	41	Trees and shrubs as targets
64	42	Handling of unexploded ammunition

4.5   STATISTICS FOR THE QUESTIONNAIRE WITH REDUCED ITEMS

On completion of item selection for the final questionnaire, another round of statistical evaluation of the questionnaire, now containing the reduced set of items, was completed to determine the statistical consistency of its items and scales. The results of this statistical evaluation process are overviewed in this section.

The reliability statistics for the attitude scale in Table 4.12 indicate a Cronbach's alpha of 0.84 and a standardised alpha of 0.85 (previously 0.86 and 0.87 as indicated in Table 4.4). Although slightly lower than before item removal, alpha still indicates appropriate reliability when

Table 4.12 Reliability statistics for the attitude scale with reduced items

Summary for the scale: Valid sample size (n): 153; Cronbach alpha: 0.84; Standardised alpha: 0.85		
VARIABLE	ITEM TOTAL CORRELATION	ALPHA IF DELETED
Item 1	0.43	0.84
Item 2	0.39	0.84
Item 3	0.44	0.84
Item 4	0.42	0.84
Item 5	0.58	0.83
Item 6	0.38	0.84
Item 7	0.31	0.84
Item 8	0.56	0.83
Item 9	0.51	0.83
Item 10	0.64	0.83
Item 11 (reversed)	0.44	0.84
Item 12	0.40	0.84
Item 13	0.49	0.83
Item 14	0.60	0.83
Item 15	0.59	0.83

measured against the stipulated goal of a Cronbach's alpha of 0.80 for the MEL questionnaire. The slight lowering of the alpha may be due to the smaller number of items in the scale, a tendency recognized by Cortina (1993) and Field (2013) who indicated that a high number of items may artificially inflate Cronbach's alpha. In effect this means that the smaller number of items in the attitude scale reflects a more accurate alpha than the original scale with more items.

Except for items 4 (0.39), 12 (0.38), and 13 (0.30), the ITC of all the individual items in this scale were above the 0.40 statistic, indicating adequate interitem correlation. The PLS path analysis report indicated significant results for all the items.

Reliability results for the behaviour scale indicated in Table 4.13 show a Cronbach's alpha of 0.84, and a standardised Alpha of 0.86 (before the items were removed Chronbach's Alpha was 0.87 and the standardised Alpha 0.89 as shown in Table 4.6).

Table 4.13 Reliability statistics for the behaviour scale with reduced items

Summary for the scale: Valid sample size (n): 153; Cronbach alpha: 0.84; Standardised alpha: 0.86		
VARIABLE	**ITEM TOTAL CORRELATION**	**ALPHA IF DELETED**
Item 16	0.44	0.84
Item 17	0.36	0.84
Item 18 (reversed)	0.40	0.84
Item 19	0.55	0.83
Item 20	0.56	0.83
Item 21	0.67	0.82
Item 22	0.59	0.83
Item 23	0.59	0.83
Item 24	0.67	0.82
Item 25	0.58	0.82
Item 26	0.39	0.84
Item 27 (reversed)	0.38	0.85
Item 28	0.54	0.84

Although Chronbach's Alpha is slightly less than before removal of items, it still indicates appropriate reliability when measured against the stipulated goal of a Cronbach's alpha of 0.80 for the MEL questionnaire. The slight lowering of the alpha may also be due to the smaller number of items in the scale. Except for items 24 (0.36), 41 (0.39) and 42 (0.38), the ITC of all the items in this scale exceeded the 0.40 statistic, indicating adequate interitem correlation. PLS path analysis produced significant results for all the items.

The knowledge scale was not evaluated again for item difficulty and item discrimination because if an item was included and scored 50% for item difficulty and < 0.01 for item discrimination, the results would be the same irrespective of whether some items were removed or not.

Results were submitted to the CSC for their confirmation, leading to the conclusion that reliability and validity concerns were adequately addressed and that the questionnaire could be used to accurately measure MEL in the main survey (Kidd 2011d, Pers com). The structure and content of the questionnaire approved by the CSC is discussed in Section 4.6.

4.6   THE STRUCTURE AND CONTENT OF THE FINAL QUESTIONNAIRE

The final questionnaire developed through the process described in this chapter was accompanied by a letter of introduction, while the main body of the questionnaire consisted of five sections and an expanded consent form. Appendix R is a copy of the final questionnaire showing its overall structure and content. A summary of the structural elements and content is given in Table 4.14.

The letter of introduction sketches the nature and purpose of the research, deals with confidentiality issues, explains the purpose of the consent form and requests the participants to

Table 4.14 The structure and content of the final military environmental literacy questionnaire

STRUCTURAL ELEMENT		CONTENT
Letter of introduction		Explanatory information for the respondents to enable them to make an informed decision about participation in the survey.
Quantitative	Attitude scale	Eliciting responses regarding attitude 15 Likert-type items
	Behaviour scale	Eliciting responses regarding self-reported behaviour 13 Likert-type items
	Knowledge scale	Eliciting responses to military environmental knowledge items 14 multiple-choice items
Qualitative	Open-ended items	Allow respondents to motivate their responses and establish an environmental narrative. Six open-ended items *(First two items correspond to the attitude section in the quantitative part of the questionnaire, two to the behaviour section and two to the knowledge section)*
Biographical and service history section		Eliciting biographical and service history information 16 items
Informed consent form		Explanation of the implications of participation in the research. Signature required from a respondent to participate.

take part in the research by completing the items in the questionnaire.

The attitude section of the main questionnaire investigates the attitude of respondents toward the environment in which the military operates. The main aim of this scale is to elicit responses from respondents regarding their attitude toward the military environment and military environmental issues. The attitude scale consists of 15 items, examines attitude toward environmental concerns such as protection of the environment, the cultural environment, planning of operations, protection of wildlife, waste production, environmental management plans, environmental laws, pollution, recycling, soil erosion, damage to the environment, the rights of local inhabitants and the environmental image of the SA Army.

The behaviour section investigates the self-reported behaviour of the respondents. The main aim of this scale is to elicit responses regarding their behaviour in the military environment while executing their task. The scale consists of 13 items dealing with themes such as the procedure followed after an oil spill, energy conservation, littering, regulations regarding the environment, respect for the cultural environment, destruction of the natural environment, recycling, conduct when selecting alternative transportation routes and respect for the traditions and customs of local populations.

In the knowledge section respondents address a series of multiple-choice items. The aim of this scale is to test the knowledge and awareness of respondents regarding environmental

concerns they are confronted with at their workplace. This scale consists of 14 items and engages with themes such as international conventions, important military environmental acronyms, environmental rights, environmental laws, procedures for storing hazardous materials, handling refuse, storing fuel, disposing of batteries, recycling of wastes, troop movements, cultural issues among local populations, conduct during shooting exercises and the handling of unexploded ammunition.

A section with open-ended items was included in the questionnaire to afford respondents the opportunity to motivate their answers and to establish a military environmental narrative that supplies qualitative data to complement the quantitative data of the rest of the questionnaire, so enabling triangulation. The items in this fourth section investigate themes such as the importance of environmental protection, the level of environmental awareness of respondents, whether good environmental practices can improve mission success, conduct at work, the environmental education and training the respondent received from the SA Army and the need for further information about the environment in which the military operates. The biographical and service history section elicits responses to 16 personal items.

The form used to secure consent to participate in the survey from respondents accompanied the final questionnaire as a separate sheet. The rationale for including a separate sheet of paper was to enable respondents to submit the consent form separately from the questionnaire, thus ensuring anonymity. The consent form spells out the purpose of the survey, procedures and potential risks and discomforts, potential benefits and rewards (if any) for participants, the rules of confidentiality, participation and withdrawal, identification of the researcher and the research assistant(s), and the rights of research subjects. All respondents were required to sign the form, with the supervisor (researcher or research assistant) co-signing.

The production of the final questionnaire was a procedure that commenced with a literature search and review and continuing with initial questionnaire development, focus group input, panel evaluation, pretesting, piloting and statistical analysis to final item selection. During each of these the utmost care was taken to ensure the integrity of the process. Eventually, the exercise rendered a ten-page, organisation-specific, valid and reliable questionnaire for testing MEL in a SA Army context. The conduct of the main MEL survey is reported on in Chapter 5.

CHAPTER 5   SURVEY CONDUCT IN THE SOUTH AFRICAN ARMY

Without data, you are just another guy with an opinion (Author unknown).

The process of questionnaire development and validation described in Chapter 4 set the stage for the selection of respondents from the SA Army to assess the MEL of SA Army soldiers through survey. Sheskin (1985) refers generically to these activities as 'sampling issues' and 'survey logistics'. Czaja & Blair (2005) prefers 'selecting a sample' and lists defining the population, development of a sampling frame, determination of the sample size, sample selection and the selection of respondents as typical sample selection activities, while Ornstein (2013) uses 'survey data collection' as the overarching term and then discusses what Sheskin termed 'survey logistics'.

This research essentially blazes a trail regarding the conducting of survey research in large corporate or government bureaucracies − ostensibly in South Africa, but quite likely with international applicability. Consequently this chapter fully details particulars regarding the conduct and outcomes of the final survey. The narrative commences with the organisational structure of the SA Army to be sampled before moving to descriptions of the process of respondent selection, explaining the survey logistics and an exposition of the outcomes of the survey. The methods by which data quality, representativeness and reliability were assured are dealt with extensively, before an overview of survey costs and a recapping of the survey conclude the chapter.

5.1   ORGANISATIONAL STRUCTURE OF THE SOUTH AFRICAN MILITARY

The South African military establishment is organisationally divided in several levels of authority (DOD 2009). Figure 5.1 graphically illustrates the structure of the South African military with the Ministry of Defence and Military Veterans forming Level 0, the highest level. The SANDF, together with the Defence Secretariat, form the Department of Defence and Military Veterans at Level 1.

The SA Army is a Level 2 subdivision of the SANDF. Within this structure the Army forms the major component and the division responsible for most of the environmental impacts, mainly because the Army is the largest subdivision and is geographically distributed throughout South Africa. Nine subcomponents of the Army, called formations, reside at Level 3.[17] These nine formations cater for the different functions a modern army must be able to execute (DOD 2009).

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[17] Since the research commenced, changes were effected to this structure with a Works Formation being added. Due to the advanced status of the research at that stage, this formation was not included in the survey.

The formations are divided into 87 units at Level 4. The units form the operational legs of the Army and it is in these units that soldiers are trained, from where they execute their missions and

							Level
Ministry	Ministry of Defence and Military Veterans						**0**
Department	Department of Defence and Military Veterans (South African National Defence Force and Defence Secretariat)						**1**
Arms of Service	Joint Operations Division	Military Health Service	Air Force	Army	Navy	Defence Intelligence Division	Corporate Staff Division	**2**

Formation	Air Defence Artillery	Armour	Artillery	Engineer	Infantry	Intelligence	Signal	Support	Training	**3**
Units	3	4	4	8	19	3	22	20	4	**4**
Personnel	1044	1546	1661	2894	13088	791	4043	7780	1616	

Subdivision	School of Engineering and Field Regiments Special Units	Force Preparation and HQ Parachute Mechanised Infantry Motorised Infantry • Conventional • Unconventional • Air Landed • Sea Landed	HQ and School of Signals Signal Units	HQ and Support Bases Technical Support Capability OSC Capability National Ceremonial Guard

Source: Adapted from DOD (2009)

Figure 5.1 Organisational structure of the South African military

from where environmental impacts derive. The SA Army is the statistical universe from which the respondent sample for the MEL survey was drawn.

5.2   SELECTION OF A REPRESENTATIVE SAMPLE

The multistage process of survey research commences with sample selection (Bourque 2003). To ensure that the selected members constitute a representative sample of the SA Army, the principle of stratification is considered next, followed by a detailed account of how the sample stratification by unit and personnel was performed and operationalised.

5.2.1   Sample stratification

The MEL survey commenced by ensuring that the questionnaire respondents would represent the target population, the SA Army. Babbie (2008) assents that only a properly drawn sample provides information useful for describing the population. In a heterogeneous population it is necessary to make certain that all subsets of the population are represented in the sample (Neuman 1994). To organise a diverse population into homogeneous subsets and to select an appropriate number of possible respondents from these subsets is the ultimate function of stratification (Neuman 1994; Babbie 2008). Following stratification, a random sample[18] is drawn from each subpopulation. Effective stratification presupposes a population with a known composition and the availability of valid stratification criteria (Bless, Higson-Smith & Sithole 2013).

Neuman (1994) and Kitchin & Tate (2000) contend that a population can be divided into subpopulations (or strata) based on supplementary information available about a population. According to Babbie (2008) it is customary to select stratification variables depending on what is available in the sampling frame. Stratification variables should be those the researcher wants accurately represented in the study. This means that the sampling frame for this study had to be carefully investigated to determine a set of functional stratification variables. Three stratification variables were chosen to stratify the SA Army, i.e. formation size, rank and gender.

Stratification variables vary from study to study: Frick, Kaiser & Wilson (2004) stratified according to municipalities; Iarossi (2006) according to sectors of a population; and Babbie (2008) included departmental affiliation as a stratification variable. The nine formations of the Army vary in size, function and organisation and they constitute departments or sectors (DOD 2009), thus formations qualify as a relevant stratification variable. After all, recommendations made on the basis of the research will be implemented in formation context according to each one's distinctive organisation and function. In accordance with practice advocated and used by Hsu & Roth (1999), Frick, Kaiser & Wilson (2004) and Iarossi (2006), sample size was determined to be proportional to each Army formation's personnel strength.

Many scholars (Babbie 2008; Özden 2008; McBeth & Volk 2010; Ali, Rose & Ahmed 2015) consider staff seniority a credible stratification variable. Like most militaries worldwide the

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[18] The RAND function in Microsoft Excel generated random numbers by which to select any units from the sample frame (formations, units, personnel clusters). Appendix Y lists the numbers generated by the RAND function and the units selected by this procedure. When selected units could not accommodate the survey (for example a unit was deployed after being selected for a survey), the next unit on the alphabetical list within the same group was selected. The same procedure was followed for personnel selection, with respondents being selected randomly and proportionally from each rank group and according to the gender split in the unit. Appendix Z contains an example of how this procedure was operationalised.

SA Army, based on the British system, runs on a command-and-control system in which strict rank structures serve as the measure of seniority. The rank groups are also proxies for service duration and age. The rank system is part of the inherent hierarchical culture shared by military organisations regardless of time or space (Esterhuyse 2013). Two parallel rank paths exist, namely Officers and Warrant Officers, and Non-commissioned officers (Radburn 1990; Jans 2013). According to the 2014 Defence Review (DOD 2014: 1-6 to 1-8) the officer corps constitutes the "collective commissioned leadership of the Defence Force", while the Warrant Officers and Non-Commissioned Officers "train soldiers and provide combat-ready soldiers with which to execute missions. Warrant Officers also ensure that forces remain functioning during combat." Warrant Officers and Non-Commissioned Officers are "military craftsmen, skilled in combat tactics and leadership" (DOD 2014: 11-9). These two rank structures each has its own function, organisation and culture, and as such stratification in sample selection is imperative. Within these two rank structures further stratification is necessary to ensure that ranks at each seniority level are included proportionally.

Gender is normally included as a stratification variable because it relates to many other variables (Babbie 2008). Gender is nonetheless a much debated and researched variable in EL studies because significant, inconsistent and inexplicable correlations between gender and EL or components thereof have been observed (see Section 4.2.1). The differences in results concerning gender and EL have been explained by Shields & Zeng (2012) and Teksoz et al. (2014) as a consequence of socio-economic differences between men and women. Hence, gender is a proxy for an amalgam of gender-based differences between respondents.

To investigate this gender conundrum in this research, it was important to include a proportionally representative sample of both sexes in the MEL survey. This is especially important in the light of the gender representativeness in the pilot study that pointed to the SA Army's gender split not reflecting the South African population. In the pilot project, females constituted only 35.3% of the population while in the South African population they constitute 51.2% of the total (Statistics South Africa 2012).

Other stratification variables reported in the literature include geographical location, electoral districts and level of education (Babbie 2008). Ivy, Lee & Chuan (1998) used school quality (below average, average and above average) to stratify the population in their studies of EL in Singapore, whereas Negev, et al. (2008) added town size, socio-economic situation and administrative sector to the list. Although some of these stratification variables are included in the questionnaire, others were deemed irrelevant to this military population spread over 87 geographically diverse bases. Consequently, stratification by only three variables, formation, rank

and gender, was considered to guarantee sufficient and functional representativeness in the survey. Attention now shifts to the operationalisation of sample selection.

5.2.2   Sample structure

Putting the stratification principle to work for the purpose of the actual survey was a daunting task, given the locational, organisational and staffing complexities of the SA Army. This section describes how the stratification was effected.

5.2.2.1   Unit selection

A random sample of units was drawn from each subpopulation of the Army formations according to directions from literature (Neuman 1994; Babbie 2008; Bless, Higson-Smith & Sithole 2013). Army formations range in size between about 800 and more than 13 000 members (see Figure 5.1 and Table 5.1).

Table 5.1 The number and percentage of units selected from each formation for inclusion in the MEL survey sample

ARMY FORMATION	NUMBER OF UNITS IN FORMATION (%)	MEMBERSHIP (%)	NUMBER OF UNITS SELECTED (%)
Air Defence Artillery	3 (3.4%)	1044 (3.0%)	2 (8.0%)
Armour	4 (4.6%)	1546 (4.5%)	2 (8.0%)
Artillery	4(4.6%)	1661 (4.8%)	2 (8.0%)
Engineer	8 (9.2%)	2894 (8.4%)	2 (8.0%)
Infantry	19 (21.8%)	13088 (38.0%)	6 (24.0%)
Intelligence	3 (3.4%)	791(2.3%)	2 (8.0%)
Signal	22 (25.3%)	4043 (11.7%)	3 (12.0%)
Support	20 (23.1%)	7780 (22.6%)	4 (16.0%)
Training	4 (4.6%)	1616 (4.7%)	2 (8.0%)
TOTAL	**87 (100.0%)**	**34463 (100.0%)**	**25 (100.0%)**

The size of each formation was obtained from Army records (Hepburn 2011, Pers com) and formations were categorised according to their personnel number and the apparent heterogeneity of a formation's functions. In the smaller formations (Air Defence Artillery, Armour, Artillery, Intelligence and Training) formation function is unidimensional with all units in the formation expected to execute the same task and mission. This leads to homogeneity within a formation. Although the selection of only one unit from each of these formations would satisfy the heterogeneity criterion, geographical proximity of the units in these formations led to the selection of two units from each to make allowance for possible heterogeneity not apparent during the selection process.

In the larger formations, homogeneity is not a given because in them different groups of units execute a large array of diverse tasks and missions. The Infantry formation is a good example

of this diversity. The units belonging to the Force Preparation, Parachute, Mechanised and Motorised subdivisions are all expected to execute different tasks and missions. Motorised Infantry is further subdivided to cater for these functional differences. For these formations the subdivisions were taken to represent functional differences, and consequently, stratification aimed to include units from each of these different subdivisions. Signal formation is a notable exception with no subdivisions, so indicating homogeneity in function. The stratification process yielded 25 Army units selected from a total of 87 eligible units in the SA Army. The outcome of the formation stratification has been set out in Table 5.1. Further justification for the formation stratification follows.

It should be noted that prior knowledge about the greater or lesser diversity in the activity scope among the units in a formation prompted decisions to increase (to account for diversity) or decrease (to account for homogeneity) the number of units selected above or below the average proportions.

In the formations with five or fewer units, two units (50%) were randomly selected using the procedure set out in Section 5.2.1. This procedure was used throughout the selection process. The Air Defence Artillery, Armour, Intelligence and Training Formations belong to this group of small formations.

The Engineer formation houses eight units and occupies an intermediate position in terms of size. Two units (25%) were selected from this formation, one from the School of Engineering and Field Regiments, and one from the Special Units. This selection catered for the noted diversity within the formation. In the case of the larger formations with between 19 and 22 units per formation, the sample was drawn with the size of the formation, number and size of subdivisions and diversity within the subdivisions taken into account. These selections involved the following:

a) The Infantry formation with 19 units is the largest in the SA Army and is subdivided into:

- Force Preparation and HQ (three units);
- Parachute (three units);
- Mechanised Infantry (two units); and
- Motorised Infantry (subdivided into Conventional Infantry consisting of a Northern and Southern component of four units each), Unconventional Infantry (one unit), Air Landed Infantry (one unit) and Sea Landed Infantry (one unit).

Six units (32%) were selected from the Infantry formation, one each from the Force Preparation, Parachute and Mechanised Infantry divisions. An additional three units were selected: one from Motorised Infantry; one from Unconventional, Air Landed, or Sea

Landed; and one each from the Northern and Southern components of Conventional Infantry.

b) The Support formation is the second largest in the SA Army and is subdivided into:

- HQ and Support Bases (9 units);

- Technical Support Capability (8 units);

- OSC Capability (2 units); and

- National Ceremonial Guard (one unit).

Four units (20%) were selected, two from Support Bases and one each from Technical Support Capability units and the combined units of OSC Capability and the National Ceremonial Guard.

c) The Signal formation with 22 units is the third largest and least diverse, large formation in the SA Army. It consists of the HQ, School of Signals and a number of signal units. Because the internal homogeneity of the units in the formation is so high, only three units were selected randomly while keeping representativeness intact. Stratification according to number, rank and gender was performed among personnel in these selected units.

5.2.2.2   Personnel selection by number

The personnel size of the formations in the SA Army was used as the first stratification variable. The number of soldiers attached to each formation, as reported in Table 5.2, was ascertained from the Project Officer Future SA Army Strategy (Hepburn 2011, Pers com).

Table 5.2 Personnel numbers and proportions in the South African Army formations

FORMATION	STRENGTH (%)	SAMPLE NUMBER OF RESPONDENTS	ADAPTED SAMPLE NUMBER OF RESPONDENTS (%)
Air Defence Artillery	1044 (3.0%)	30	50 (+20) (4.7%)
Armour	1546 (4.5%)	45	50 (+5) (4.7%)
Artillery	1661 (4.8%)	48	50 (+2) (4.7%)
Engineer	2894 (8.4%)	84	84 (7.9%)
Infantry	13 088 (38.0%)	380	380 (36.0%)
Intelligence	791 (2.3%)	23	50 (+27) (4.7%)
Signal	4043 (11.7%)	117	117 (11.1%)
Support	7780 (22.7%)	226	226 (21.5%)
Training	1616 (4.6%)	47	50 (+3) (4.7%)
SOUTH AFRICAN ARMY	**34 463 (100.0%)**	**1000**	**1057 (100.0%)**

For various reasons, including sufficient representation and logistical constraints, a total sample size of 1000 (2.9%) was mooted at the onset. The desired number of respondents was drawn from each formation proportional to the formation's share of the total personnel strength.

This strategy yielded the sample division as presented in Table 5.2. But, to allow for meaningful statistical comparisons to be made between formations (formations being the rational comparative level decided upon), a minimum of 50 respondents (Newman 1994) per formation was required, bringing the sample total to 1057 (3.1% of the total population). The necessary adjustment made to five formations is shown in Table 5.2.

5.2.2.3   Selection of personnel by rank and gender

Only soldiers with the rank of Lieutenant Colonel and lower were included in the survey. The rationale for this is that most unit structures contain only one member with a rank above Lieutenant Colonel. Selection of a member who is the only member in a unit with a particular rank might lead to response bias and would compromise the ethical integrity of the research as the principle of anonymity committed to would be violated. Within the above rank groups representativeness was assured by drawing a random, proportionally representative sample from each rank group. Following the selection of units, a name list[19] for each unit was used to randomly select (see footnote 18 in Section 5.2.1 on the random selection method) the required number of respondents. The rank and gender splits in the unit were taken into consideration to ensure rank and gender representativeness. If a selected member was absent on the day of the survey, the next member on the alphabetical list in the same rank and gender groups was selected.

Table 5.3 contains the names of the formations, their selected units, unit location and number of questionnaires distributed at each. The total number of questionnaires (more than 1200) distributed in each formation compensated for non-response by exceeding the minimum required total and ensuring return of at least 50 completed, usable questionnaires per formation.

In the larger formations between 55 and 70 questionnaires were distributed for these reasons and in the smaller formations, units received between 30 and 50 questionnaires each. One exception was made. At 4 Signal Regiment in Wonderboom the unit size was too small to accommodate a sampling process yielding 30 respondents, consequently the sample sizes of the other units were increased, while that of 4 Signal Regiment was reduced to 25. The net effect of this process was a surplus of 10 questionnaires per formation dispatched to the Air Defence Artillery, Armour, Artillery, Intelligence and Training formations. Engineer formation received 16 more than the required total, Signal formation 18 more, Support formation 22 more and Infantry 40 more. This sufficiently catered for possible non-response.

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[19] Unit name lists have a generic format. Names are provided in decreasing rank, alphabetically ordered in each rank group and with gender indicated for each member. Some unit name lists were in Excel format, while others were only available in Word format. These name lists were sourced directly from the units to ensure that the most recent version available was used.

Attention now turns to the other two stratification variables, rank and gender. As the name list of each identified unit was sourced, the proportions of each rank, as well as the gender split of

Table 5.3 Survey sample structure for the South African Army

FORMATION	SELECTED UNITS	UNIT LOCATION	QUESTIONNAIRES SUBMITTED PER UNIT FOR COMPLETION
Air Defence Artillery	Air Defence Artillery School	Kimberley	30
	10 Anti-Aircraft Regiment	Kimberley	30
Armour	School of Armour	Bloemfontein (Tempe)	30
	1 Special Service Battalion	Bloemfontein (Tempe)	30
Artillery	School of Artillery	Potchefstroom	30
	4 Artillery Regiment	Potchefstroom	30
Engineer	2 Field Regiment	Bethlehem	50
	35 Engineer Support Regiment	Dunottar	50
Infantry	Infantry School	Oudtshoorn	70
	1 Parachute Battalion	Bloemfontein (Tempe)	70
	8 South African Infantry Battalion	Upington	70
	9 South African Infantry Battalion	Cape Town (Eersterivier)	70
	7 South African Infantry Battalion	Phalaborwa	70
	5 South African Infantry Battalion	Ladysmith	70
Intelligence	School of Tactical Intelligence	Potchefstroom	30
	1 Tactical Intelligence Regiment	Potchefstroom	30
Signal	1 Signal Regiment	Wonderboom	55
	3 Electronic Workshop	Wonderboom	55
	4 Signal Regiment	Wonderboom	25
Support	Army Support Base Lohatla	Postmasburg*	-
	Army Support Base Kimberley	Diskobolos	62
	Army Support Base Western Cape	Cape Town (Kenwyn)	62
	17 Maintenance Unit	Potchefstroom	62
	Army Support Base Bloemfontein	Bloemfontein	62
Training	Combat Training Centre	Postmasburg	30
	3 South African Infantry Battalion	Kimberley	30
TOTAL			**1203**

Note: * During the process of surveying the formations, it was found that the Support Base at Lohatla had closed down. A new unit, Army Support Base Bloemfontein was then selected randomly from the remaining Support bases to replace Army Support base Lohatla.

each unit were calculated and the respondents randomly selected from these groups to reflect the respective populations. Table 5.4 shows the representativeness of these two variables. The units selected housed 13 240 members from which the respondents were to be selected.

Total SA Army membership numbered 34463 in 2009 (DOD 2009). Table 5.4 shows that the sample of Senior Officers very closely represents the SA Army. The Junior Officer group is

Table 5.4 Representative samples by rank and gender

RANK GROUP AND GENDER	GROUP NUMBER AND SAMPLE PROPORTION (%)	USABLE COMPLETED QUESTIONNAIRES FROM THE SURVEY (%)	PERCENTAGE PER RANK GROUP IN THE SOUTH AFRICAN ARMY (UNIVERSE)*
Senior Officers	328 (2.5)	48 (4.4)	4.5
Junior Officers	944 (7.1)	89 (8.0)	5.7
Senior Warrant Officers	1543 (11.7)	163 (15.0)	13.8
Junior Warrant Officers	4507 (34.0)	378 (34.7)	35.7
Riflemen	5918 (44.7)	412 (37.9)	40.3
TOTAL	**13240 (100.0)**	**1090 (100.0)**	**100.0**
Male	10768 (81.3)	851 (78.0)	79.8
Female	2472 (18.7)	239 (22.0)	20.2

Note: * Compiled from internal DOD Human resources documents (DOD 2012).

overrepresented by 2.3%, due to more junior officers being employed at unit level than at formation headquarters. Senior Warrant Officers are slightly overrepresented (by 1.2%) and Junior Warrant Officers are underrepresented by 1%. Riflemen, the largest group, is underrepresented by 2.4%. Generally, the representativeness among all the rank groups was within acceptable limits and the differences are negligible.

The SA Army, being a male-dominated organisation (DOD 2009), had only 22% females in the selected units - suitably matching the 20.2% in the SA Army. This female representation is far smaller than the 51.2% in the general South African population (Statistics South Africa 2012). This gender imbalance in the sample was foreseen and matches women's representation in the SA Army universe, affording them an essential voice in the MEL debate.

5.2.3   Geographical location of selected units

The 87 units of the SA Army that constitute the sampling frame are spread throughout South African territorial space. This distance and accessibility challenge made it logistically unfeasible to visit all units directly, hence the necessity for sampling. The location of each selected unit is indicated in Figure 5.2. With the exception of the Eastern Cape and Mpumalanga, at least one unit was selected from each province. Although this provincial distribution was not a stratification criterion, the geographical representation of the sample is satisfactory.

Most (6) of the selected units are situated in Northern Cape, followed by Free State and North West, with five units each and Gauteng with four. Three units were selected in Western Cape and one each in KwaZulu-Natal and Limpopo. The unequal concentration of selected units in Northern Cape, Free State and North West is a reflection of the percentages of the total number of units in these provinces and therefore reflects reality.
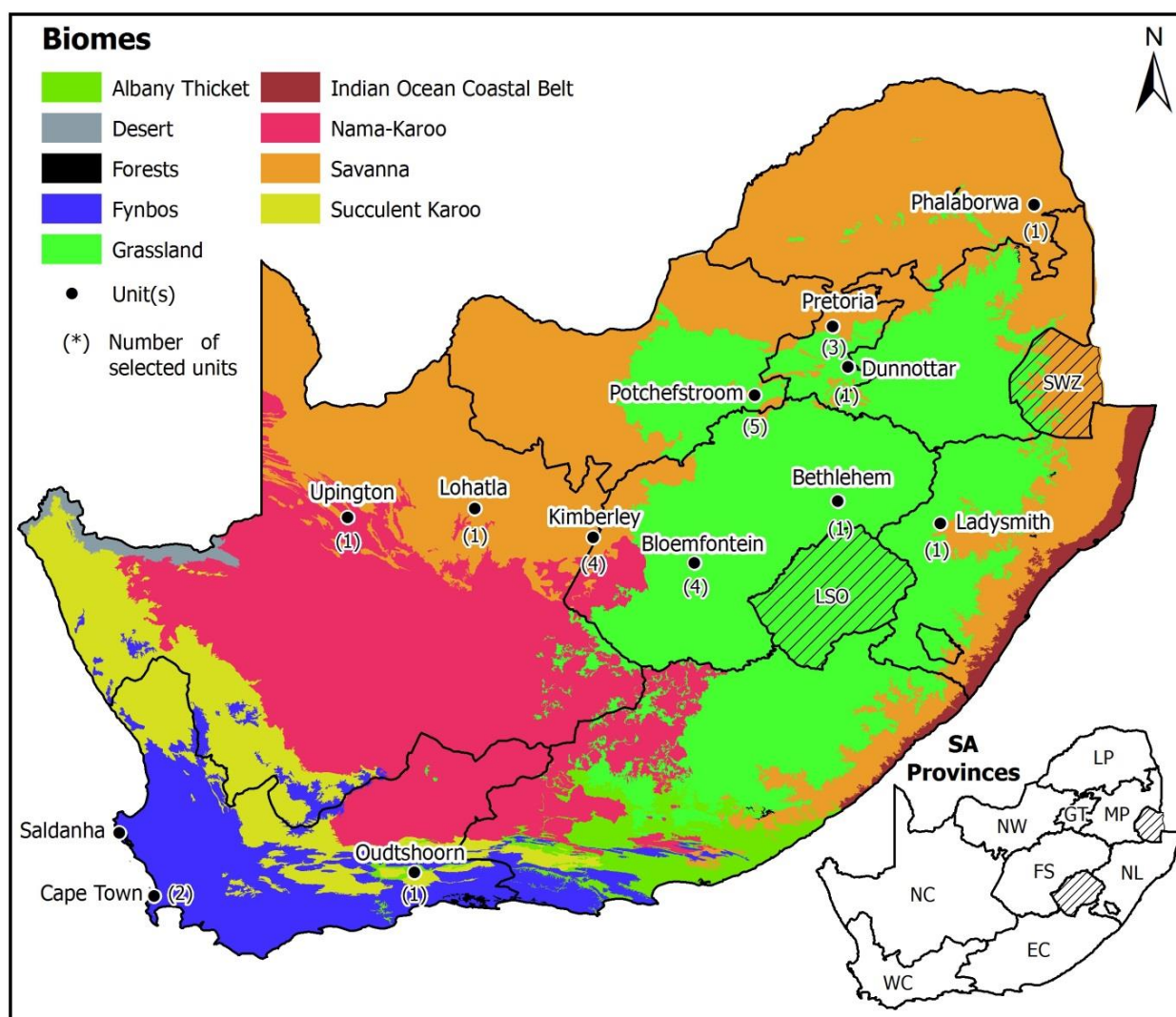
Source: Adapted from Mucina, Rutherford & Powrie (2006)

Figure 5.2 Location of the selected military units in South Africa

The notable concentrations of units in or around Potchefstroom, Bloemfontein, Kimberley and Pretoria reflects the spatial concentration of Army units in or around these urban areas. The potential exposure of large numbers of the South African population to environmentally unfriendly activities of the SA Army due to this locational proximity to the units underscores the importance of environmentally literate soldiers and their responsible conduct. An unintended benefit of this concentration was economic – decreased time and cost to survey these units compared to outlying units.

The three units selected in the Western Cape are situated in the sensitive Fynbos biome (Stock 2004). The Fynbos biome has an exceptional concentration of endemic species, comprising the highest number of rare and endangered taxa of any biome in southern Africa (Olivier, Myakayaka & Richards 2009). Due to the high level of endemism and the resultant vulnerability of flora and fauna in this biome, military activities in this area, if not conducted according to strict

environmental regulations, can cause irreparable damage. The units selected in the Northern Cape are located in a similarly sensitive Nama-Karoo biome (Upington) and the somewhat less sensitive Savanna biome (Lohatla and Kimberley). The unit selected in Limpopo (Phalaborwa) is also in the Savanna biome. The units selected in Bloemfontein, Bethlehem, Dunnottar, Ladysmith, Potchefstroom and Pretoria are all situated in the Grasslands biome (Mucina, Rutherford & Powrie 2006) which is subject to its own environmental constraints. Together these four biomes cover more than 80% of the land surface of South Africa (Olivier, Myakayaka & Richards 2009; Wessels et al. 2011). Although neither biomal nor provincial representativeness was specifically aimed for in the selection of units, a high level of representation still resulted from the random selection.

With the sampling frame constituted and the units selected, the MEL survey could commence.

5.3   FINAL SURVEY LOGISTICS

The execution of a survey requires substantial attention to detail and coordination and implies the development of a detailed plan for the distribution, completion and collection of the completed questionnaires (Bourque 2003; Punch 2003). Iarossi (2006) names the social environment, survey design and respondent psychology as factors influencing a survey. The social environment engenders socio-demographics like social responsibility and social cohesion. Participants' responses are determined by their sense of social responsibility, the perceived legitimacy of the institution sponsoring the survey, as well as the nature of the survey itself. These factors are to be accommodated in survey design – choices regarding survey methods, unit of investigation and the characteristics of the surveyor. Respondent psychology refers to the state of mind of the respondent when agreeing to take part in a survey (Iarossi 2006). Ornstein (2013) avers that survey response rates are affected by the identity of the survey sponsor, the survey mode and topic, and the target population. Other determinants of survey success are the hiring and training of personnel, survey timing, appearance of the questionnaire and incentives to respondents (Sheskin 1985; Bourque 2003; Thomas 2004).

The ways the abovementioned factors were promoted through well-planned survey conduct in this research are the subject of this section. The survey progressed through successive experience-driven stages, each reported separately in the next two subsections: an initial survey strategy developed in accordance with established theory and practice prescriptions; and a revised strategy dictated by real-world survey experience and informed by an extensive reconnaissance field survey.

5.3.1   Initial planned survey strategies

Initially the foreseen strategy for survey conduct entailed contacting each selected unit, obtaining the personnel name lists of the unit, randomly selecting the required number of respondents from the name lists, returning the list with envisaged respondents to the unit, arranging a date for the researcher to visit the unit to perform the survey and finally executing the actual survey. Appendix S is a typical unit personnel list of name, rank and gender as example of a sampling frame from which representative, structured sample cases could be randomly selected. The following four subsections in turn sketch the planned survey procedures; outline an exploratory survey at a single Cape Town military base to test the envisaged methods; report on an extended field survey campaign and make remarks on the initial survey. The conduct of the initial survey led to an adjusted approach involving assistance commandeering as reported in Section 5.3.2.

5.3.1.1   Planned survey procedures

Survey method was planned to strictly adhere to all the relevant guidance and prescriptions gleaned from a thorough literature survey on the subject. The questionnaires were to be filled in under examination conditions, with the researcher personally invigilating. All respondents were to be in the same venue at the time of the survey as prescribed by Huysamen (1993) and Babbie (2008). Respondents were not to be allowed to communicate with each other during the survey, discuss the questions or assist one another. Each respondent was to be given sufficient time to read through the questionnaire and the separate consent form, ask questions about the form and then write out their name and surname in the allocated spaces. If they agreed to participate in the study, the consent form had to be signed.

The supervisor was to explain to respondents that the consent form would only be used to verify their consent to participate, and would in no way be used to identify them personally or their responses. To assure the respondents of anonymity, the consent forms were to be collected and stored separately in sealed envelopes before the respondents started to complete the questionnaires. The completed consent forms would also be stored in separate envelopes from the completed questionnaires.

Respondents were to be directed to complete all questions with either a black or blue pen or a pencil (the research team provided black pens). Using black or blue pens to complete the questionnaires was a Formware prerequisite to allow efficient data capturing. Respondents lacking experience of fighting a war were to be encouraged to still answer items such as "During any form of armed conflict …" by using their imagination on how they were likely to behave under such

conditions. As an ice-breaker each participant was to be given a compensative lollipop when accepting the questionnaire – a novel idea favoured by several authors (Bourque 2003; Iarossi 2006, Harrison 2010).

The planned data gathering method was intended to have several benefits, namely to limit survey costs, afford full researcher (or research assistant) control over the filling-in process, allow questions to be answered, render a high response rate and ensure anonymity (Huysamen 1993). When applied in the current survey, these benefits were indeed realised and the survey could commence.

5.3.1.2   Single unit test survey

The survey commenced at Army Support Base Western Cape in Kenwyn, Cape Town on 30 May 2012. The practical realities experienced during this first survey exercise at this unit led to a number of changes in the survey strategy. The first involved survey time planning. Acquiring the units' name list and fixing a convenient survey date were unexpectedly challenging. The unit routine only allowed specific days and times when the survey could be conducted – a complication that arose at all the bases. Despite the date and time for the survey being agreed upon two weeks in advance and telephonically confirmed two days prior to the survey date, the survey team arrived at the unit for a 08:00 appointment, but waited until 11:00 before the survey could commence. The prescribed survey requirements (Thomas 2004; Iarossi 2006; Ornstein 2013) were met; the sponsoring entities (Stellenbosch University and the office of the Chief of the Army) were legitimate and prominent academic and command and control institutions; the appropriate contact person (the Commanding Officer of the unit) had formally authorised the survey; the topic of the survey was of interest to the respondents; and the timing of the survey was suggested by the host unit itself. None of the survey manuals or prescriptions mentioned this type of delay. Prospective surveyors of large organisations, particularly the military, need to take cognisance of unanticipated predicaments like this.

When the target respondents were finally released at 10:00 they had been subjected to two hours of speeches from various visitors at their previous engagement and some immediately left for tea. The full complement of selected respondents arrived at 11:00 at the designated venue, where few of them expressed willingness, let alone enthusiasm, to participate in the survey. The researcher was nevertheless allowed to address and persuade them to participate.

The survey's purpose was explained, and the consent forms, questionnaires and complimentary lollipops were distributed. This turned the mood of the respondents, they signed the consent forms and started to complete the questionnaires. The lollipops, initially intended to

be an ice breaker to relieve inhibitions, did more as the respondents saw it as recognition and some compensation for their time sacrificed to take part in the survey. When later queried on the effect of the lollipops, the respondents bemoaned their regular subjection to questionnaire sessions (survey fatigue according to Iarossi (2006)) and expressed their appreciation of the small token. This response was encountered at the units throughout the survey campaign (note the scene from a later survey in Figure 5.3 with the lollipop in evidence). The minor cost outlay paid large
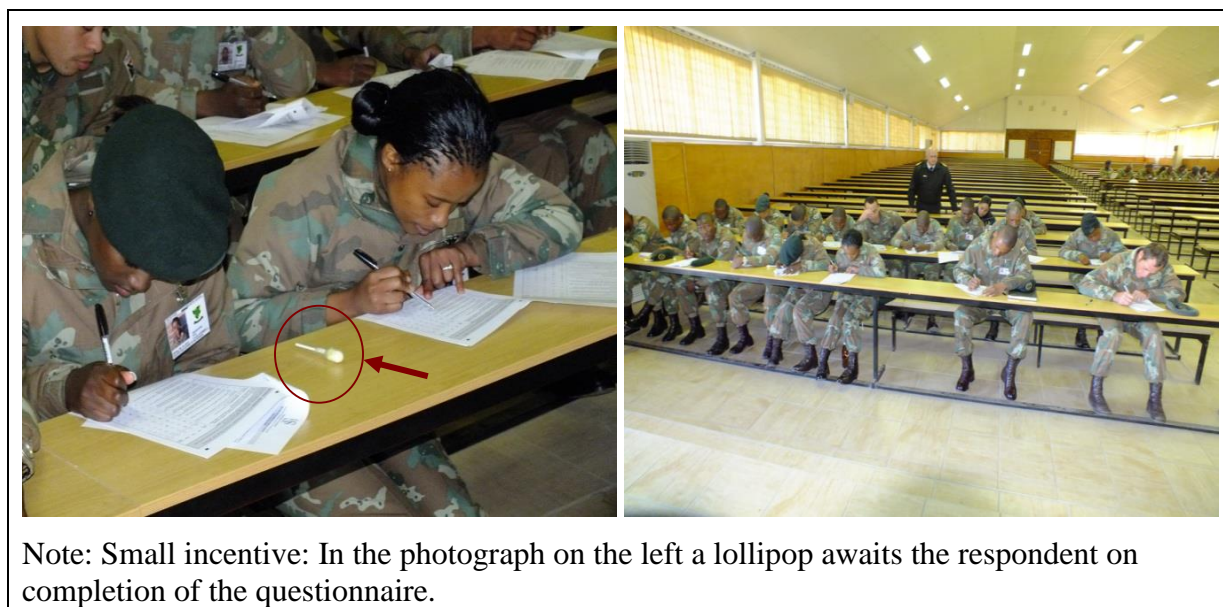
Note: Small incentive: In the photograph on the left a lollipop awaits the respondent on completion of the questionnaire.

Figure 5.3 Respondents completing questionnaires at Infantry School, Oudtshoorn

dividends in terms of higher and more dedicated response rates, so confirming experience elsewhere (Sheskin, 1985; Oppenheim, 1992; Ornstein 2013).

By 12:00 all of the 62 questionnaires had finally been completed to achieve a 100% response record. In a number of ways the lessons learnt from this exercise were to alter the survey process significantly. However, a second trial run on a larger scale added to the survey learning curve.

5.3.1.3   The extended field survey

With the aim to assess the ability to survey a larger number of units in a short space of time; to limit expenditure; enable the researcher to personally conduct the survey; and acquire first-hand experience of the survey process (recommended by Sheskin (1985) and Babbie (2008)), a more extensive field-survey expedition was executed. This exercise further aimed to improve survey facilitation and confirm the efficacy of altered survey strategies emanating from the previous one-unit survey.

On 24 June 2012 a survey team consisting of the researcher and a research assistant, departed from the SAMA in Saldanha for Bloemfontein to survey the four units selected in the Bloemfontein area. The survey strategy was to conduct the Bloemfontein survey and proceed to the four selected units in the Kimberley area, due to their geographical proximity. On the way back to Saldanha the Lohatla and Upington units in the Northern Cape would be surveyed, so completing a regional clean sweep. By surveying these 10 units during one field trip would have accounted for 40% of the units in less than two weeks, with concomitant time and cost savings.

Unfortunately, the survey campaign turned out a failure. Although the units were all contacted three weeks in advance and the contact persons were again reminded of the survey on the Wednesday prior to the commencement of the survey journey, on arrival not a single unit in Bloemfontein was ready to participate in the survey. The contact person in Bloemfontein had been summoned to an unscheduled military exercise, was unavailable by phone and had not confirmed the final arrangements with the selected units. As appointments to survey the Kimberley units from Wednesday 27 June had already been finalised, stand-in research assistance had to be recruited for the Bloemfontein task and furnished with the required blank questionnaires to conduct the survey later.

Figure 5.4 shows the survey route and the survey success rates at the units visited. The
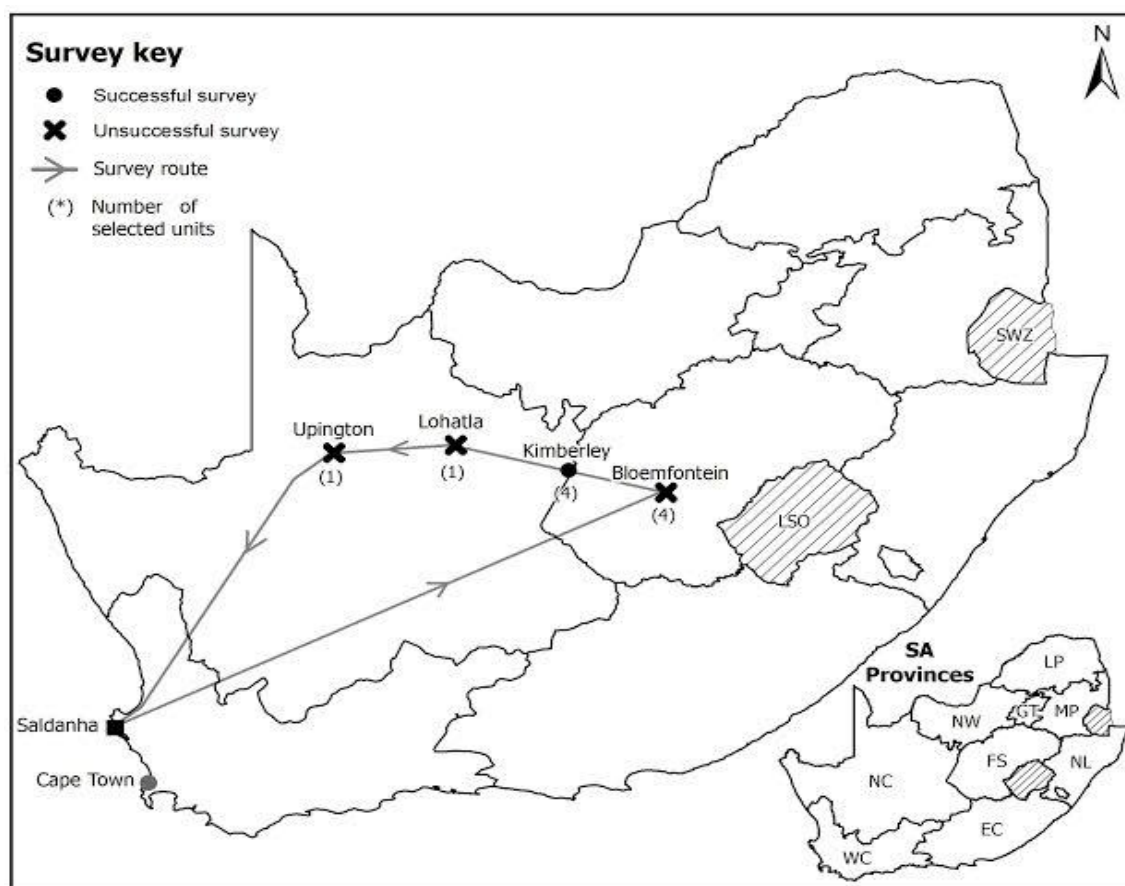
Figure 5.4 The survey route

survey team left Bloemfontein empty-handed for Kimberley and during the next three days successfully surveyed four units for a total of five units, including the Cape Town unit.

The success of the Kimberley survey can be attributed to the recruiting of a reliable contact person to handle all the logistics of the survey at the Kimberley bases, allowing the survey team to concentrate on conducting the actual survey. This success was the last on the field trip − the selected units in both Lohatla and Upington had become unavailable − again despite assurances from contact persons that the units were ready to be surveyed. The lessons learnt from the trial surveys emphasised the crucial importance of recruiting reliable research assistants to facilitate and undertake surveys in local contexts.

The inflexibility of the units regarding suitable time slots to conduct the survey and the sudden changes to unit routine (typical of operations-ready military units), showed external survey visits to be an unsuitable survey method.

5.3.1.4   Initial survey experiences: A summary

The trial surveys yielded a number of important lessons that led to the adoption of a practicable survey strategy. The survey at Army Support Base Western Cape taught valuable lessons. The 100% response rate (all questionnaires completed) was thanks to careful planning and execution of the survey process. It had been recognised in advance that a single survey team would not be able to effect surveys at all the units due to the spatial spread of the units. Extended time periods elapsed to obtain unit name lists and inflexible unit schedules precluded survey execution on field visits. Unreliability and inflexibility of time scheduling made effective survey organisation a logistical ordeal. The features of the various initial and the proposed revised survey strategies are summerised in Table 5.5.

The major outcome of the failures encountered during the initial surveys was the decision to enlist the help of resident research assistants to facilitate contact with the respective units, arrange dates for the visits, locate and administer name lists and invigilate the survey arrangements and venue. Throughout, the selection of the respondents remained the researcher's responsibility.The research assistants were carefully selected, extensively briefed and constantly monitored, both before and during the actual survey. Questionnaire packages were dispatched and returned by courier agencies. With the lessons learned during this process in mind, a revised strategy was developed to survey the remaining units.

Table 5.5 Comparison of the modes of survey

STRATEGY	MODE OF SURVEY EXECUTION	STAFF	UNITS SURVEYED
Initial survey	Researcher survey visit to units • Researcher contacts unit • Obtain name list • Randomly select respondents • List with target respondents returned to unit • Arrange survey date • Researcher executes survey.	Researcher + research assistant	1
Field survey	Ditto	Ditto	5
Revised strategy	Research assistants survey units • Research assistant contacts unit • Obtain name list • E-mail name list to researcher • Researcher randomly selects respondents • List with target respondents, and survey material returned to research assistant • Research assistant arranges date for survey • Research assistant executes survey	Researcher + local research assistants	19

5.3.2 A revised strategy: Survey assistance

A well-established practice in survey research is the use of research assistants who are carefully selected, briefed and monitored to ensure the integrity of surveys (Sheskin 1985, Bourque 2003; Babbie 2008; Ornstein 2013). Such assistants must be attentive to their personal appearance, trustworthy, be good at managing tasks and problem solving, skilled in communication and familiar with the survey. If research assistants do not possess these attributes, the ethical and academic integrity of the survey can be compromised and low response rates expected (Sheskin 1985; Bourque 2003; Babbie 2008; Ornstein 2013). For this survey the research assistants had to be uniformed members of the Army working at or in close proximity to the surveyed units. Besides the obvious practical necessity of geographical proximity and familiarity with the organisation and functioning of the Army, Iarossi (2006) contends that respondents are more willing to comply with requests from people who are similar or familiar to them. The recruitment of research assistants and the execution of the revised research strategy are deliberated next.

5.3.2.1   Recruitment of research assistants

Three honours graduates in military geography at the SAMA who were also former academic assistants of the researcher, were recruited. They held staff positions at Army units elsewhere, complied with the above attributes of an assistant and were well known to the researcher. After recruitment they assisted with surveys at eight units, namely the remaining unit

in Cape Town, two of the four units in Bloemfontein and five units near Potchefstroom. Three other assistants who had been involved in the development of the questionnaire and/or had helped to secure permission for the survey, and who were thus familiar with the background and aim of the study, were recruited to manage the survey at six units: two in the Bloemfontein area; two in Pretoria and one in Lohatla. The researcher personally executed the Oudtshoorn survey during a scheduled visit.

The importance of using existing networks and building new ones as quickly and prudently as possible when doing research in a large, highly structured, bureaucratic organisation like the SA Army was confirmed by the effortless tracing and selection of the research assistants. The constant maintenance of such networks must be stressed, since using and building networks in the Army bureaucracy proved to be the only effective way of conducting the MEL survey.

With the research team taking responsibility for six units, five units remained for which research assistants needed to be found. The selected research assistants, as well as other alumni of the SAMA were consulted to identify (by a snowball process) and select five suitable candidates to conduct the survey in the remaining five units (Bethlehem, Dunnottar, Ladysmith, Phalaborwa and Upington). Each assistant was furnished with a letter of appointment (see Appendix T). A letter to the commanding officer of the unit(s) they had to survey (Appendix U) explained the survey and emphasised the endorsement (an important step emphasised by Sheskin (1985) and Iarossi (2006)) by the Chief of the Army that accompanied the letter of appointment. A list with specifications for conducting the survey (Appendix V) was included in the training package sent to each research assistant. These specifications standardised the rules of engagement with respondents; explained how to select a substitute respondent for one unable or unwilling to participate in the survey and gave the mode and time of contact with the researcher. These steps and precautions accorded with prescriptions given in the literature (Bourque 2003; Babbie 2008; Bless, Higson-Smith & Sithole 2013). The researcher could be contacted by mobile phone throughout the duration of the survey should unforeseen problems arise. These precautions enabled the research assistants to independently and effectively conduct the surveys at the units assigned to them.

5.3.2.2   Execution of the assisted survey

Each research assistant had to secure permission from the commanding officer(s) of the unit(s) allocated to them and supply a name list of the unit to the researcher. After selection of possible respondents, the list was returned to the research assistant who arranged a date and time for the survey. While the research assistants were doing these tasks, a box containing the required number of questionnaires and consent forms, as well as pens and lollipops, was dispatched to them

by courier. Completed questionnaires were couriered back to the researcher on completion of a survey. Another form of dispatch to the researcher was used for five units via internal systems or by students or staff members returning from a surveyed unit to the SAMA. In such cases the questionnaires were sealed inside a box to ensure security and data integrity.

Once survey dates were set and materials dispatched, a second phone call was made to the research assistant to ensure that there were no uncertainties and that survey execution was set. Although the researcher could always be reached by mobile phone, no calls were received during any of the surveys – merely post survey calls to report successful completion. When no contact was made by the research assistant before the end of the day following the survey, contact was initiated by the researcher to ascertain the successful completion of the survey and to enquire when the questionnaires could be collected. These results confirmed the adequacy and thoroughness of the survey's organisation. The last unit was surveyed on 27 September 2012, almost four months after the first unit was surveyed.

5.4   FINAL SURVEY OUTCOMES

The time it took to complete the questionnaire was noted throughout. The first questionnaire at each venue was handed in between 18 and 22 minutes after the start of the survey. Eighty per cent of the respondents completed the questionnaire within 30-35 minutes, while the last questionnaire was handed in between 35 and 48 minutes after the commencement of the survey. Few if any questions regarding questionnaire clarity were asked during the sessions, confirming that the concise, user-friendly questionnaire could be completed within the one-hour time frame initially envisaged. The one-hour maximum time limit therefore did not appear to have constrained any participants from answering at their ease.

Table 5.6 reports the survey response rates. A total of 1203 questionnaires was dispatched to the units and 1112 (92.4% of the questionnaires sent out) completed sets were returned. Of the returned questionnaires, 22 (0.02%) were unusable[20]. Thus, the total number of usable questionnaires received was 1090 (90.6% of the questionnaires sent out). This final number of usable questionnaires captured in the database represented a sample proportion of 3.2% of Army personnel.

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[20] A questionnaire was deemed unusable if more than five items were not answered or if three or more of the vital biographical variables, such as rank level, gender or mother tongue were not filled in.

Table 5.6 Number and percentages of questionnaires involved in the military environmental survey

FORMATION	REQUIRED QUESTIONNAIRES (%)	ADAPTED TOTALS (%)	DISPATCHED QUESTIONNAIRES (%)	USABLE QUESTIONNAIRES (%)
Air Defence Artillery	30 (3.0%)	50 (4.7%)	60 (5.0%)	59 (5.4%)
Armour	45 (4.5%)	50 (4.7%)	60 (5.0%)	60 (5.5%)
Artillery	48 (4.8%)	50 (4.7%)	60 (5.0%)	51 (4.7%)
Engineer	84 (8.4%)	84 (7.9%)	100 (8.3%)	93 (8.5%)
Infantry	380 (38.0%)	380 (36.0%)	420 (34.9%)	369 (33.9%)
Intelligence	23 (2.3%)	50 (4.7%)	60 (5.0%)	49 (4.5%)
Signal	117 (11.7%)	117 (11.1%)	135 (11.2%)	118 (10.8%)
Support	226 (22.6%)	226 (21.5%)	248 (20.6%)	233 (21.4%)
Training	47 (4.7%)	50 (4.7%)	60 (5.0%)	58 (5.3%)
TOTAL	**1000 (100.0%)**	**1057 (100.0%)**	**1203 (100.0%)**	**1090 (100.0%)**

To ensure that target totals were reached, 1203 questionnaires were couriered to the units, i.e. 146 more than the adapted totals. Two formations, Infantry and Intelligence, did not render the required numbers of questionnaires, but the small shortfalls were negligible so that analysis of the questionnaire data could commence – a decision supported by statistical consultants at the CSC (Kidd 2012, Pers com). The returned questionnaires were subjected to a quality evaluation and control process to ensure the integrity of the database.

5.5 DATA QUALITY ASSURANCE

Iarossi (2006: 188) advocates a quality-control framework consisting of four procedures namely "editing, coding, electronic data entry and cleaning of data." Bourque (2003), Thomas (2004) and Ornstein (2013) confirm these four as operational steps which are reported in detail in this section.

5.5.1 Editing returned questionnaires

Editing is the "process through which the completed questionnaires are reviewed to detect and correct errors" (Iarossi 2006: 189). When the completed questionnaires arrived back from the survey locations, they were scrutinised to ensure completeness, accuracy and consistency. Twenty-two questionnaires were deemed unusable and removed from the set.

5.5.2 Electronic data capture

The 1090 usable questionnaires were scanned and primed for statistical analysis. The Formware software optically scanned the response sheets and generated an Excel spreadsheet with

raw data for each unit. Qualitative responses, as well as the responses to items that required written responses were manually typed directly on the spreadsheet of each questionnaire.

As a final measure of quality control, the database produced by this process was compared to the paper originals to double-check the accuracy of the scanning and typing (Punch 2003). This was done by randomly selecting 20% of the questionnaires from each unit and manually comparing them with printouts of the Excel spreadsheet for the unit. Initially it was planned to enlarge the sample if any significant differences emerged. A total of 224[21] questionnaires was selected and compared. Appendix W is an example of the verification table completed for each unit to aid in the process. The number of the questionnaire, the unit where the questionnaire originated and the nature of the discrepancy were indicated in the verification tables.

The first three sections of the questionnaire captured through Formware yielded no inconsistencies. In the sections where data had been typed manually, dissimilarities were found in six of the questionnaires, and in total only seven were found in the 224 questionnaires investigated. The verification procedure confirmed that the responses recorded by the respondents were indeed captured accurately in the database. Because all the cases involved were either misspelt words or double entries (e.g. typing 'history' as a subject twice) which had no real influence on the integrity of the data, the verification process was discontinued. In hindsight this was a mistake and was rectified later in the verification process.

The resultant database consisted of 25 separate Excel files in spreadsheet format, one per unit. Each file had three separate spreadsheets, namely Formware results, biographics and verbatim responses. In each Excel file the three sheets were combined onto one sheet by adding extra columns per case, (the sets of columns were determined by the format of each sheet, i.e. all variables per unit in the columns, until all 25 fields had the same total number and sequence of columns). All files were combined into one file (the final single database) through the Excel procedure of concatenation, i.e. the addition of the second file at the bottom of the first file and so on for all 25. This rendered a final database with individual cases in 1090 data rows.

During the process of merging the databases, some further discrepancies were found. An example is that letters were used to number results in one unit, whereas in all the other units numbers were used. To ensure final database integrity, the responses in all the completed questionnaires were verified against the final database. This entailed an assistant reading out the responses from the questionnaires, while the researcher verified each response in the database. In

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[21] Two-hundred and twenty-four questionnaires were selected and not 218 (20% of 1090) because 20% of each of the 25 units was selected and if a fraction (0.4 of a questionnaire) was computed, one more questionnaire was added to make sure that the 20% target was reached.

a two-week long effort, all 1090 questionnaires were scrutinised in this manner. The results of this verification process are the following:

- In the Formware records section of the database, no discordances were found. This testifies to the accuracy of the software in automatic, optical data capture, as experienced earlier during the pilot study.

- A further 47 incongruities occurred in the other two sections, all occurring in only 45 of the 1090 usable questionnaires.

- Twelve typing errors were found where the number of the response was incorrectly recorded (e.g. 2 and not 3).

- In 24 questionnaires, numbers were substituted by letters.

- Six ranks were indicated incorrectly.

- Five spelling mistakes were detected.

All the errors were rectified. The time spent on the verification process was worth the effort as it contributed to the accuracy of the database. Given that each questionnaire generated 70 possible response items or 76 300 variable values, the number of errors detected was reassuringly small. The reason for this rather cumbersome verification approach was that some discrepancies were undetectable by simple frequency count. While variable values in the database outside legitimate stipulations would be revealed by frequency count, simply incorrect numbers would not (e.g. where a 2 was typed when a respondent recorded a 3). Deemed a true reflection of the responses in the questionnaires, the data were readied for analysis as documented in the next section.

5.5.3   Data coding

The coding of responses is normally done by summarising the answers from a survey into meaningful categories to aid analysis (Iarossi 2006). The coding of the responses to the MEL questionnaire is set out in this subsection. Attitude and behaviour responses were coded similarly in one coding table, while knowledge measurements, the narratives, biographical and service history measurements required separate coding tables. The results of the analyses of the coded data are superficially dealt with here and discussed fully in Chapters 6 and 7.

5.5.3.1   Coding of quantitative attitude and behaviour measurements

The first two sections of the MEL questionnaire dealt with the quantitative measurement of attitude and behaviour. The codes for each item and the variable names are listed in Table 5.7.

Responses for these two components of MEL were coded similarly in a raw-value range for identical types of analysis. Predetermined, hardcoded ordinal data values in a Likert scale of five response categories ranging from 1(strong agreement, positive attitude or behaviour) to 5 (strong disagreement, negative attitude or behaviour) were recorded. This data allowed for the calculation of descriptive statistics, composite scores, MEL scores and ANOVA analysis. No reclassifications or recodings of response categories were required for these two scales.

Table 5.7 Quantitative attitude and behaviour variables: Database content, variable typology, recoding and analyses

VARIABLE CODE	VARIABLE NAME	DATA TYPE	RAW VALUE RANGE	ANALYSIS TYPE
AQUAN 1	Need for military environment protection	Ordinal	1-5	Collate all responses in an attitude and behaviour scale; calculate descriptive statistics, composite scores, MEL scores and ANOVA.
AQUAN 2	Need for cultural environment protection: training			
AQUAN 3	Need for cultural environment protection: peace support			
AQUAN 4	Need for cultural environment protection: armed conflict			
AQUAN 5	Need to consult military environmental officer			
AQUAN 6	Need to avoid harm to animals			
AQUAN 7	Concern about waste production			
AQUAN 8	Importance of environmental management plans			
AQUAN 9	Military subjected to environmental laws			
AQUAN 10	Importance of antipollution measures			
AQUAN 11	Importance of recycling			
AQUAN 12	Importance of environmental rehabilitation			
AQUAN 13	Concern about soil erosion			
AQUAN 14	SA Army as an environmentally-responsible force			
AQUAN 15	Respect for religion, customs and languages			
BQUAN 16	Follow correct procedures: oil spill			
BQUAN 17	Contribute to energy saving			
BQUAN 18	Avoid littering			
BQUAN 19	Adhere to regulations: temporary base construction			
BQUAN 20	Respect cultural environment: training			
BQUAN 21	Respect cultural environment: peace operations			
BQUAN 22	Respect cultural environment: armed conflict			
BQUAN 23	Destroy vegetation: training			
BQUAN 24	Destroy vegetation: peace operation			
BQUAN 25	Destroy vegetation: armed conflict			
BQUAN 26	Participate in recycling			
BQUAN 27	Does not adhere to route discipline			
BQUAN 28	Respect religion, customs and language			

5.5.3.2   Coding of quantitative knowledge measurements

The third section of the MEL questionnaire gauged the military environmental knowledge of respondents. Variable codes appear in Table 5.8. Knowledge items yielded quantitative counts on multiple-choice right or wrong responses. With the exception of items 33 and 40, all items had five possible answers. The former two had only three nominal choices: 'true', 'false' and 'I do not know'. Correct responses were converted to collated percentages, allowing the generation of descriptive statistics, calculation of composite scores, MEL scores and performance of ANOVA.

Table 5.8 Quantitative knowledge measurement: Database content, variable typology, recoding and analyses

VARIABLE CODE	VARIABLE NAME	DATA TYPE	RAW VALUE RANGE	ANALYSIS TYPE
KQUAN 29	Cognisant of the international convention prohibiting environmental destruction during war	Hardcoded, quantitative, nominal (yes/no)	Multiple choice, 5 options. KQUAN 33 and 40 only 3 options. Last option always 'I do not know'.	Convert correct responses into percentages; collate all responses in a knowledge scale; calculate descriptive statistics, composite and MEL scores and ANOVA
KQUAN 30	Familiar with acronym 'ITAM'			
KQUAN 31	Familiar with the acronym 'MIEM'			
KQUAN 32	Know whose environmental rights must be protected: war			
KQUAN 33	Cognisant of to whom national environmental law applies			
KQUAN 34	Familiar with storage procedures for hazardous materials			
KQUAN 35	Familiar with rubbish- and refuse-handling procedures			
KQUAN 36	Know how to site fuel storage sites correctly			
KQUAN 37	Familiar with battery-disposal procedures			
KQUAN 38	Familiar with definition of recycling			
KQUAN 39	Know how mass movement of troops should be executed			
KQUAN 40	Know that cultural environment should not be damaged			
KQUAN 41	Comprehend that vegetation may not be used as targets			
KQUAN 42	Cognisant of the correct procedures for the handling of unexploded ordnance			

5.5.3.3   Coding of qualitative attitude, behaviour and knowledge measurements

The fourth section of the MEL questionnaire elicited responses through open-ended, qualitative items. The responses are intended for the military environmental narrative described in Chapter 7. Table 5.9 lists the qualitative measurement counts as well as the number of classes to which raw responses were reclassed. The first two items invited responses for assessing attitude, the second two behaviour and the last two knowledge attainment. Responses were initially coded in raw-value ranges between 6 and 19 (positive responses) and between 1 and 9 (negative responses). Content analysis facilitated recoding of value ranges to 4 to 13 (positive) and 1 to 5 (negative) per item.

Table 5.9 Qualitative attitude, behaviour and knowledge measurements: Database content, variable typology, recoding and analyses

VARIABLE CODE	VARIABLE NAME	DATA TYPE	RAW VALUE RANGE	RECODED VALUE RANGE	ANALYSIS TYPE
AQUAL	*ATTITUDE: QUALITATIVE MEASUREMENT*				
AQUAL 43	Importance of environmental protection in SA Army	Open-ended, qualitative	1-15 (positive responses) 1 (negative response)	1-11 (positive response classes) 1 (negative response)	Content analysis of responses and triangulation with quantitative results
AQUAL 44	General environmental concern		1-19 (positive responses) 1-9 (negative responses)	1-13 (positive response classes) 1-6 (negative response classes)	
BQUAL	*BEHAVIOUR: QUALITATIVE MEASUREMENT*				
BQUAL 45	Environmental practices and mission success	Open-ended, qualitative	1-8 (positive responses) 1-6 (negative responses)	1-4 (positive response classes) 1-4 (negative response classes)	Content analysis of responses and triangulation with quantitative results
BQUAL 46	Minimise negative effect on environment		1-14 (positive responses) 1-8 (negative responses)	1-9 (positive response classes) 1-5 (negative response classes)	
KQUAL	*KNOWLEDGE: QUALITATIVE MEASUREMENT*				
KQUAL 47	Adequate environmental education and training	Open-ended, qualitative	1-6 (positive responses) 1-8 (negative responses)	1-4 (positive response classes) 1-6 (negative response classes)	Content analysis of responses and triangulation with quantitative results
KQUAL 48	Environmental education and training need		1-11 (positive responses) 1-5 (negative responses)	1-6 (positive response classes) 1-3 (negative response classes)	

5.5.3.4   Coding of biographical and service history information

The last section of the MEL questionnaire contains 16 items to elicit information about the biographical characteristics and service history of the respondents. Table 5.10 shows the coding scheme for item 49 as hardcoded into eight formations and one 'other' category. These categories were recoded into nine categories and used in the analysis of representativeness and also as

Table 5.10 Biographical and service history: Database content, variable typology, recoding and analyses

VARIABLE CODE	VARIABLE NAME	DATA TYPE	RAW VALUE RANGE	RECODED VALUE RANGE	ANALYSIS TYPE
BIOS	*BIOGRAPHICAL AND SERVICE HISTORY*				
BIOS 49	Service formation	Hardcoded , qualitative (8); Open (1) nominal	1-8; 9	1-9	Representativeness analysis; explanatory variable for investigating relationship with components of MEL
BIOS 50	Unit	Open ended, qualitative, nominal	1-25	1-25	Representativeness analysis; not used as explanatory variable
BIOS 51	Rank level		Rifleman to Lieutenant Colonel	**Senior Officers** (Maj, Lt Col) **Junior Officers** (CO, 2Lt, Lt, Capt) **Senior Warrant Officers** (SSGT + all classes of WO) **Junior Warrant Officers** (LCpl-Sgt) **Riflemen**	Representativeness analysis; explanatory variable for investigating relationship with components of MEL
BIOS 52	Service duration	Quantitative, ordinal	0-35	0-5; 6-10; 11-15; 16-20; 21-25; 26-30; 31-35	Explanatory variable for investigating relationship with components of MEL
BIOS 53	Current post & responsibility	Not analysed	Open	Not recoded	Not analysed
BIOS 54	Environmental management experience	Quantitative, ordinal		Yes:1, No:2	Explanatory variable for investigating relationship with components of MEL
BIOS 55	Age		20-60	20-25; 26-30; 31-35; 36-40; 41-45; 46-50; 51-55; 56-60	

Continued overleaf.

Table 5.10 continued.

VARIABLE CODE	VARIABLE NAME	DATA TYPE	RAW VALUE RANGE	RECODED VALUE RANGE	ANALYSIS TYPE
BIOS 56	Gender	Hard coded, qualitative, nominal	Male Female	Male: 1, Female: 2	Representativeness analysis; explanatory variable for investigating relationship with components of MEL
BIOS 57	Marital status	Hard coded, qualitative, nominal	Married, Unmarried, Divorced, Widow/ Widower	Married: 1, Unmarried: 2, Divorced: 3, Widow/ Widower: 4	Explanatory variable for investigating relationship with components of MEL
BIOS 58	Home language	Hard coded (11); Open (1), qualitative, nominal	Eleven official languages; Other	1-12	Representativeness analysis; explanatory variable for investigating relationship with components of MEL
BIOS 59	Highest level of education	Hard coded, qualitative nominal	Secondary school to Postgraduate diploma	Secondary school:1 Post school diploma:2 First university degree:3 Postgrad:4	Explanatory variable used in investigating relationship with components of MEL
BIOS 60	Highest level of Geography education		None to Postgraduate qualification	None: 1 Grade 10: 2 Grade 12: 3 Post school diploma: 4 First university degree: 5 Postgrad: 6	
BIOS 61	Main academic subjects		Open	Not recoded	Not analysed
BIOS 62	Environmental courses		Yes: No	Yes: 1 No: 2	Explanatory variable for investigating relationship with components of MEL
BIOS 63	Deployment		Yes: No	Yes: 1 No: 2	
BIOS 64	Place deployed	Hardcoded, qualitative, open, nominal	Open	Open	Descriptive analysis

explanatory variables for investigating relationships with components of MEL. Items 50 to 52 are open, qualitative items, dealing with the home unit, rank level and service duration of respondents. Unit and rank level were used for assessing representativeness, but home unit was not used as an explanatory variable (see Subsection 5.2.2.3 for an explanation why not). Gender and home language were used in determining representativeness and as independent variables to probe for relationship with the MEL components. With the exception of items 53, 61 and 64, all the other

variables were used as independent explanatory variables. Item 53 (current post & responsibility) and item 61 (main academic subjects) were not used in the analysis as proxies were available. The open, qualitative item 64 on place of deployment was analysed through descriptive analysis.

Numeric coding of response categories of item 51 grouped ranks together in five simplified categories: rifleman, junior non-commissioned officers, senior non-commissioned officers, junior officers and senior officers. Items 62 and 63 related to environmental courses completed, and deployment and were coded by awarding the value 1 to completion and deployment, and 2 to non-completion or non-deployment.

5.5.4   Data clean-up

Cleaning of the data constitutes the "final editing and imputation procedures used to enhance data quality and prepare data for statistical analysis" (Iarossi 2006: 195). The process of readying the database for analysis entailed making sure that the database contained all the sections of the questionnaire, that each questionnaire had a unique ID, that the IDs used corresponded to the selected sample and that labels corresponded to labels in the paper questionnaire. The uniformity in spelling and naming of ranks were checked in this phase of data management. The various formations use different names for their lowest ranks, for instance private and rifleman. These names were all changed to rifleman to ensure uniformity.

A frequency count of response values was made to make sure all codes were valid. This ensured that no invalid response values i.e. values of less than one and more than 5 for the Likert type scales, were entered into the database. No cases were found.

The quantitative items in the questionnaire were analysed in consultation with the CSC using LISREL 8.80 software. The qualitative items were analysed by the researcher without wider consultation since the researcher has wide experience in qualitative research.

5.6   ASSURANCE OF DATA REPRESENTATIVENESS

The stratification variables have been debated and presented in Section 5.2. The representativeness of the non-stratification independent variables is discussed in this section and respondent profiles on socio-demographics, education and training, and service profiles of respondents is established against which the empirical MEL results analysed in Chapters 6 and 7 can be probed.

5.6.1   Socio-demographic profile of the survey respondents

The socio-demographic profile of respondents is drawn from the records for gender, age, marital status and home language. The **gender** split in the survey sample leans heavily (78%)

toward male dominance which is typical of almost all militaries. The male proportion in the SA Army is 79.8%. The mean **age** of all the respondents is 33 years, with the largest group in the 20-30 age cohort and a secondary concentration in the 35-45 age cohort as Figure 5.5 shows. This indicates a young population with a sizable proportion of older, experienced soldiers.
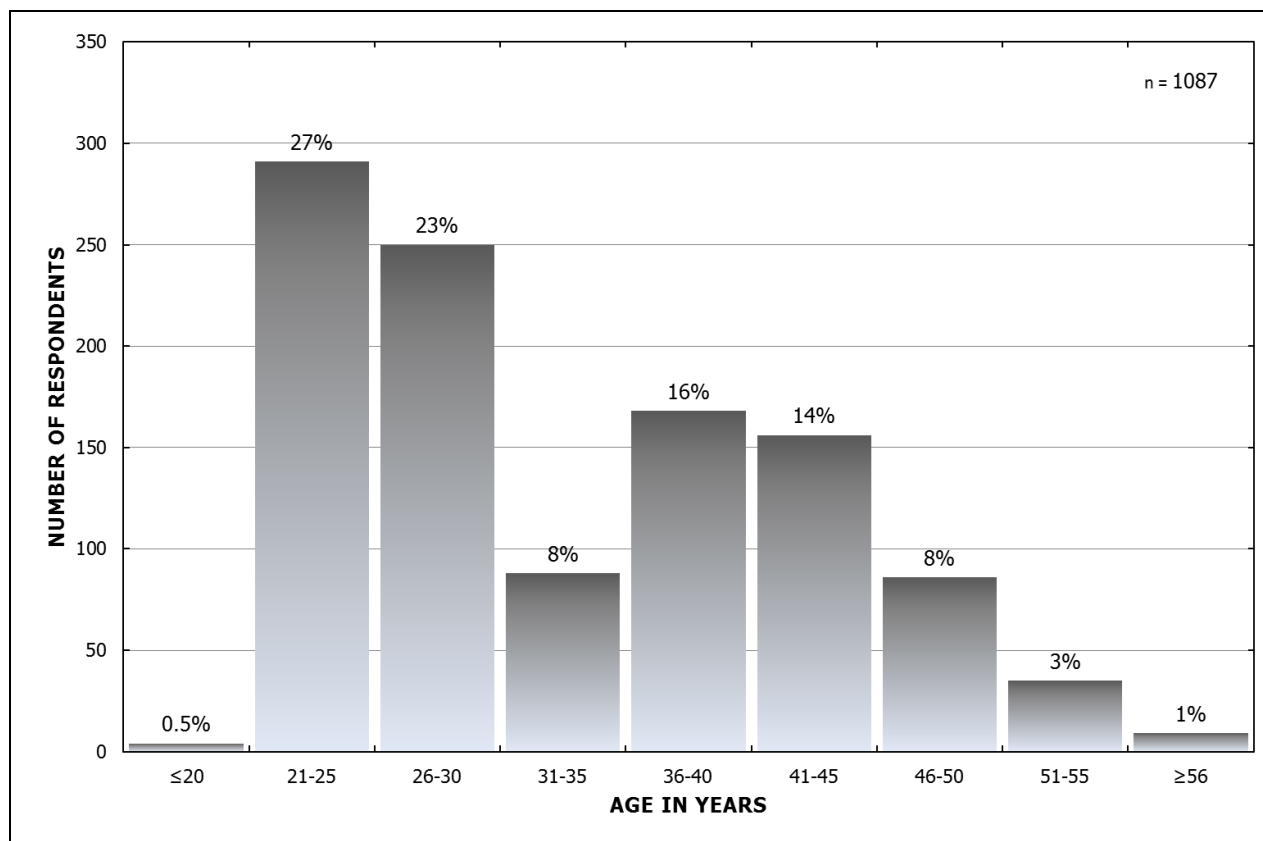
Figure 5.5 Age distribution of respondents

Because of the structuring of the sample the age cohorts depicted in Figure 5.5 reflect the different age cohorts in the SA Army. Being relatively young it is not surprising that 51% of the respondents have never been **married**. The rest of the respondents are predominantly married, with a small proportion divorced or widowed.

The distribution of **home language** warrants comment as it quite likely has implications for future environmental programmes in the DOD. Heinecken (2009) has compared the language distribution of the South African population with that of the DOD and found large differences between the populations. According to Table 5.11 Afrikaans and isiXhosa speakers are overrepresented in the DOD, while isiZulu are underrepresented. There was of course a large percentage of Afrikaans speaking members (both White and Coloured) in the pre-1994 SADF

Table 5.11 Percentage distribution of language groups in the DOD and South Africa in 2007

Language	Afrikaans	English	isiNdebele	isiXhosa	isiZulu	Sesotho	Sesotho sa Leboa	Setswana	Siswati	Tshivenda	Xitsonga	Other
DOD (%)	23.6	10.3	0.5	17.6	8.3	5.7	7.5	8.3	2.1	3.0	1.6	11.5
SA (%)	13.3	8.2	1.6	9.0	23.8	7.9	9.4	8.2	2.7	2.3	4.4	9.2
DOD over- or underrepresentation (%)	+10.3	+2.1	-1.1	+8.6	-15.5	-2.2	-1.9	+0.1	-0.6	+0.7	-2.8	+2.3

Source: Adapted from Heinecken (2009)

(Heinecken, 2009). Afrikaans speakers dominate in the sample so according with the situation in the SA Army (see Figure 5.6).
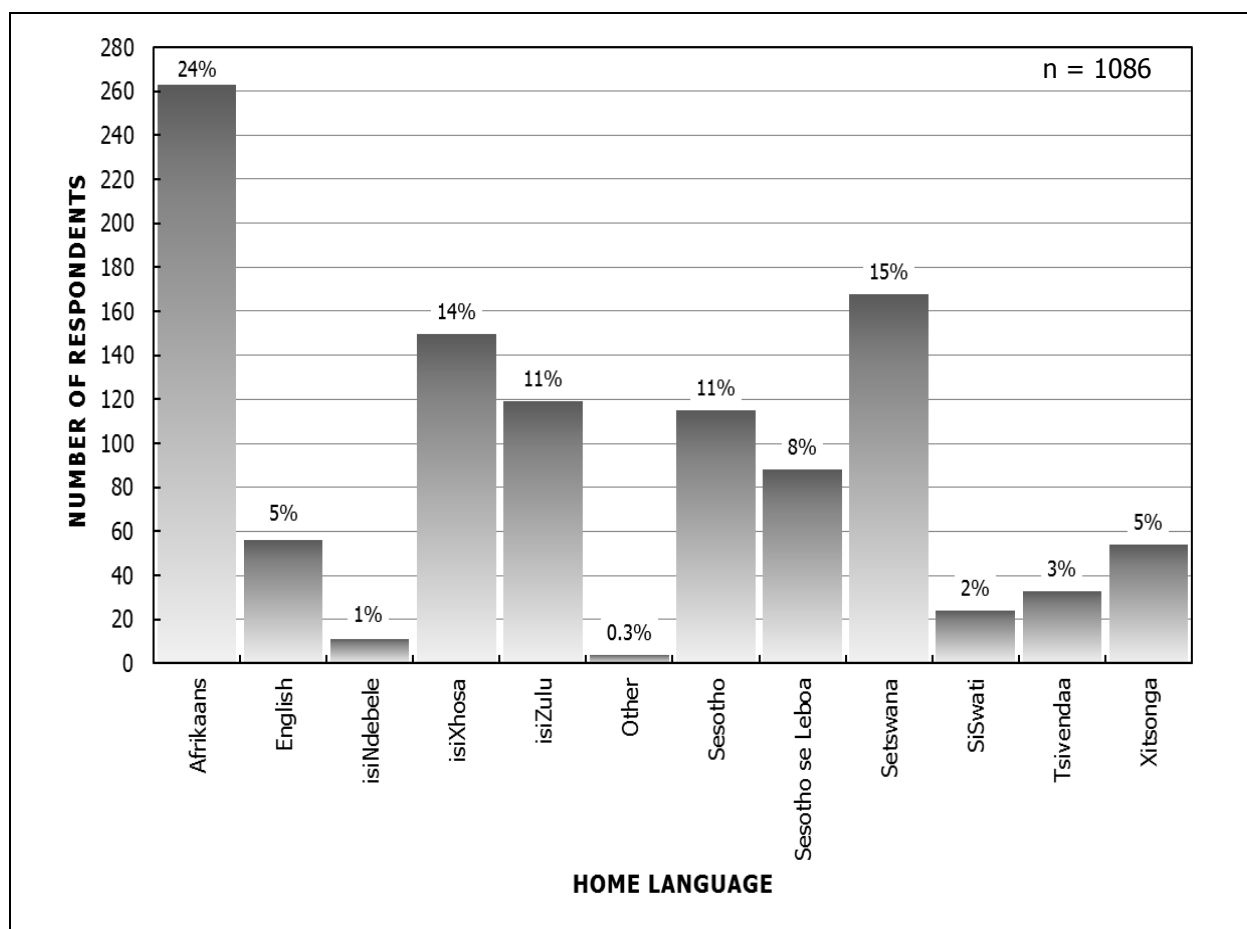
Note: The alphabetical order of the home language representation was decided on and kept throughout the dissertation to facilitate comparison.

Figure 5.6 Proportional representation per home language group of the survey respondents

5.6.2   Education and training profile of the survey respondents

The indicators of this profile are the levels of general, geographic and environmental education and training attained by respondents. As Figure 5.7 shows, four out of five respondents have a secondary school **education level**.

Since secondary school education is a prerequisite for employment in the SA Army, this is not surprising. About 20% of the respondents had some form of tertiary education. These figures clearly show that the sample constitutes a group with an education level far above the average in South Africa – a very significant characteristic given the universally accepted positive correlation between education and environmental awareness.
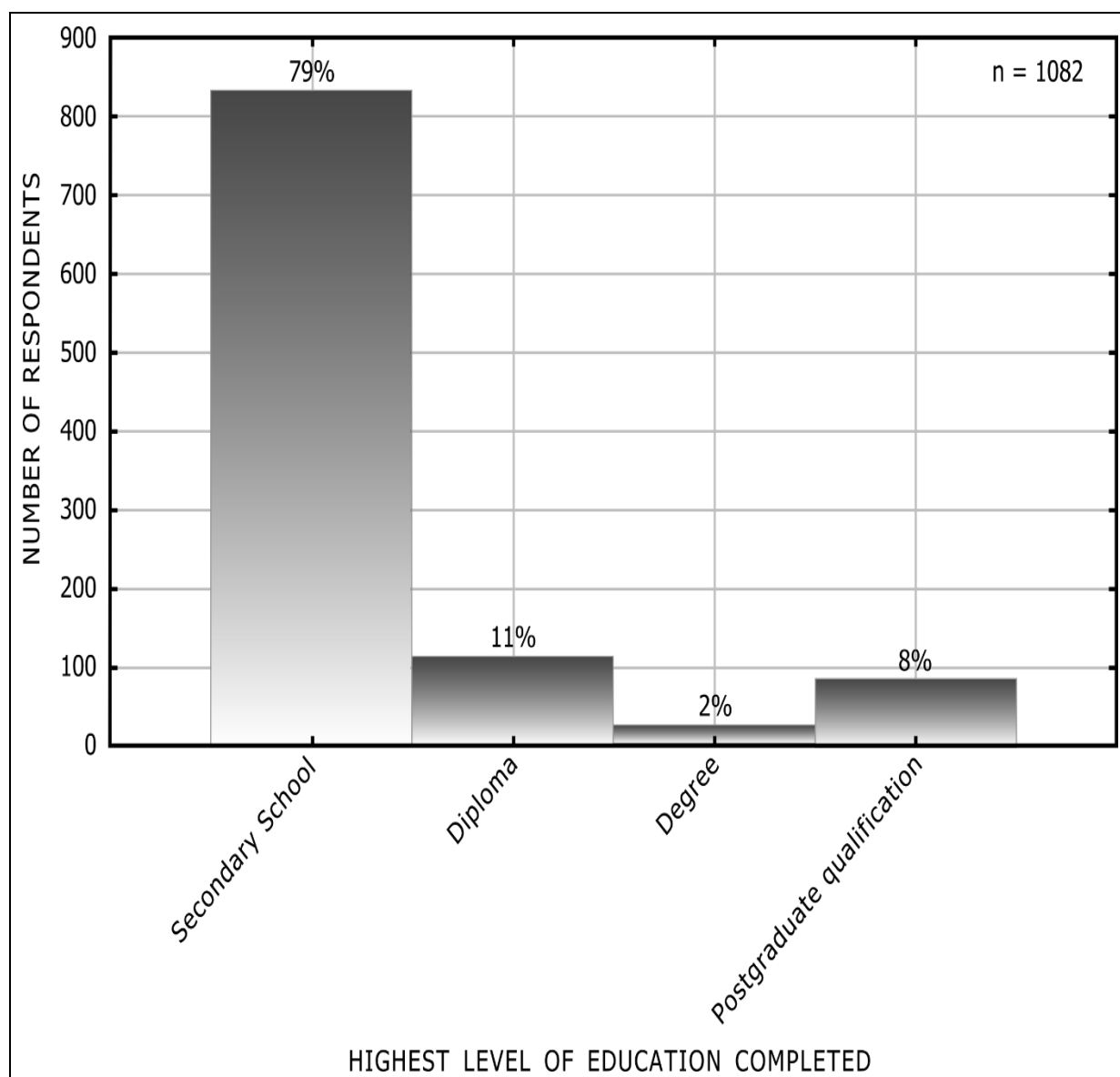
Figure 5.7 Education level of respondents

Since g**eography as subject**, especially at school level, provides learners exposure to a broad range of environmental phenomena, problems and their solutions, education in this subject

is a reliable indicator of EL. Figure 5.8 shows that more than 60% of respondents had had geography as subject at Grade 12 or tertiary levels and only 14% had none.
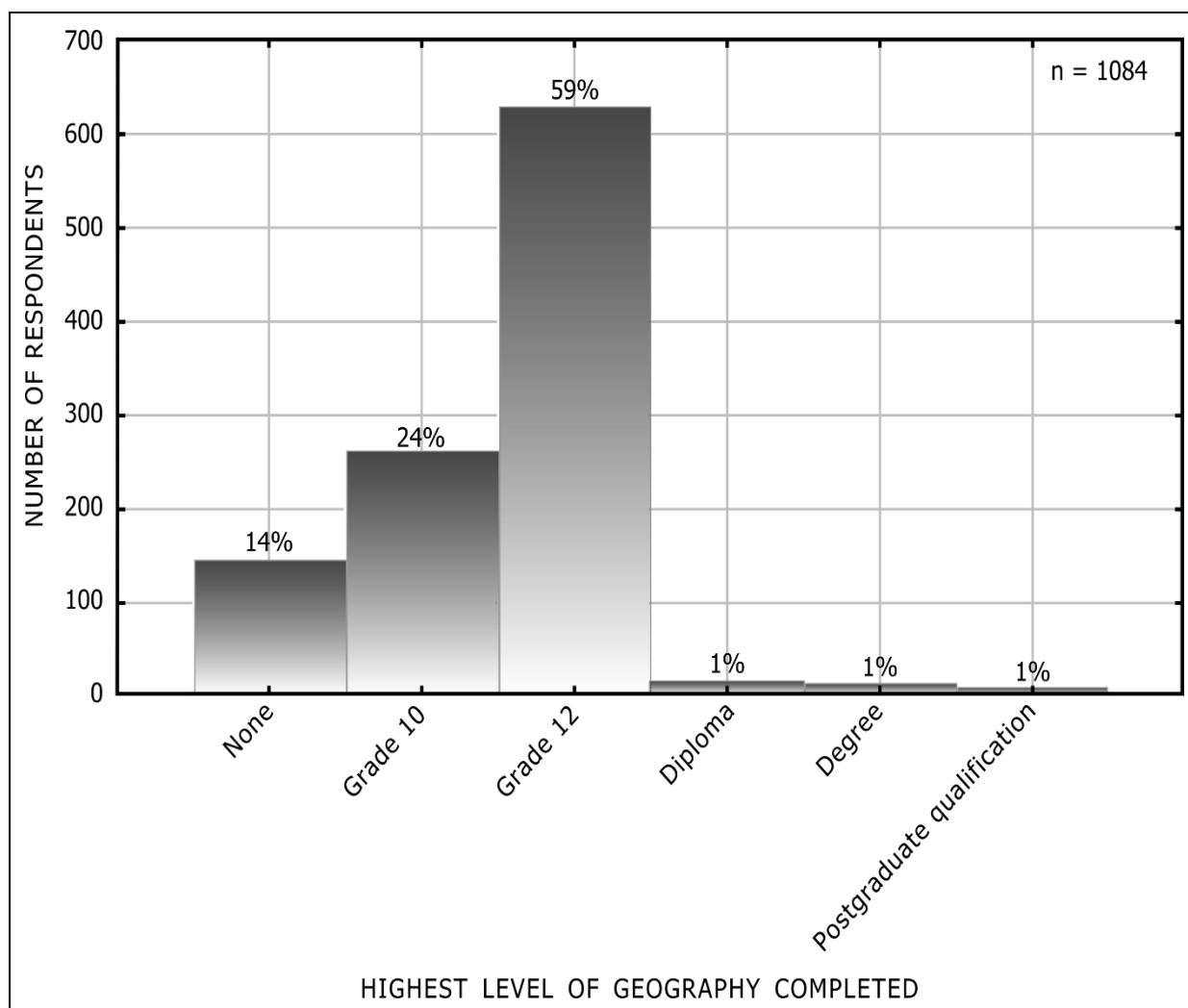
Figure 5.8 Highest level of geography education completed by the survey respondents

These are significant results since Pe'er, Goldman & Yavetz (2007), Smit (2009) and Karatekin (2013) have all found high levels of EL among respondents having had a geography education. Only 4% of the respondents had completed any other **environmental education and training course.** Environmental education and training deserves further investigation as a means to improve MEL through SA Army-sponsored and targeted training in EL.

5.6.3   Service profile of the survey respondents

The service profile of respondents is built on the proportional representation of Army formations and military rank as well as three types of relevant experience in the Army, namely service duration, experience of environmental management and deployment record. As Figure 5.9 shows, the majority (55%) of respondents do service in two **formations**: Infantry and Support. If
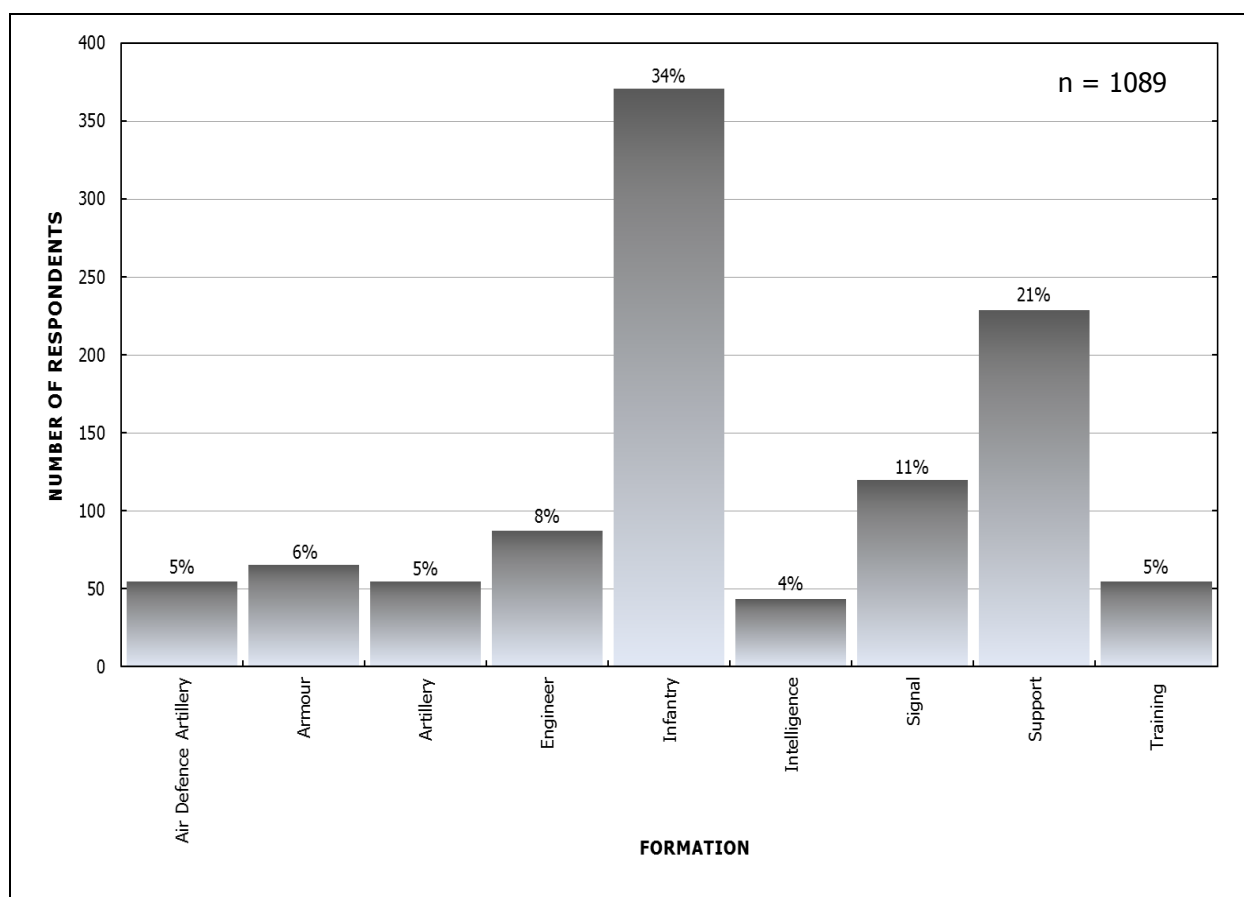
Figure 5.9 Proportional representation of Army formations in the survey respondents

compared to the actual percentages for each formation as reported in Table 5.2, this is representative of the 60.6% of possible respondents in these two largest formations.

Smaller formations contributed proportionally according to their size between four and twelve per cent of the respondents. The variation in formation proportions is attributable to the actual size difference between formations from which the representative samples at the same proportional level had been drawn – hence indicating the desired level of sample representation.

The representation of the **rank** groups was already graphically portrayed and explained in Table 5.4. In Figure 5.10 the rank of rifleman (actually no rank) dominates (almost 40%), with junior non-commissioned officers a close second (35%). Senior non-commissioned officers and the officer core make up the balance. With rifleman at 44.7% and junior non-commissioned officers at 34% the actual percentages of each rank in Table 5.4 closely matches the sample proportions depicted in Figure 5.10.
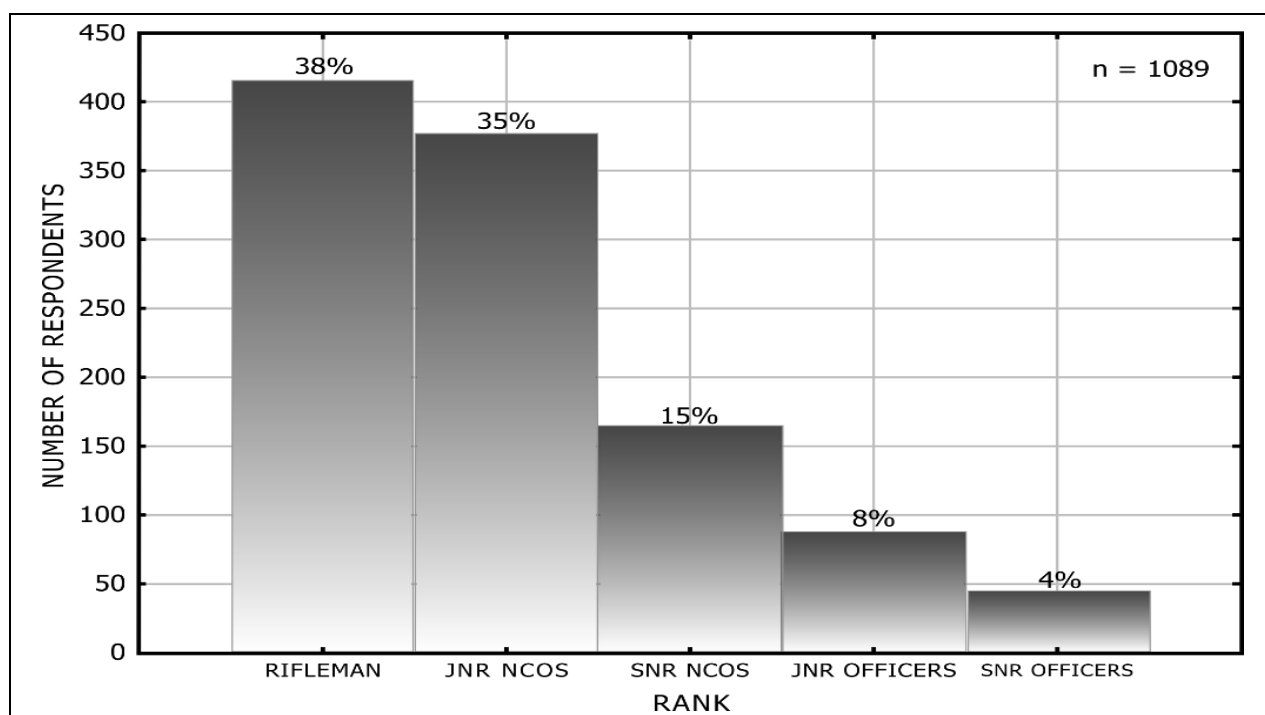
Figure 5.10 Representation of military ranks in the survey sample

From Figure 5.11 it is evident that **service duration** peaks for two prominent groups of respondents having served between 2 and 10 years, and between 15 and 24 years. These
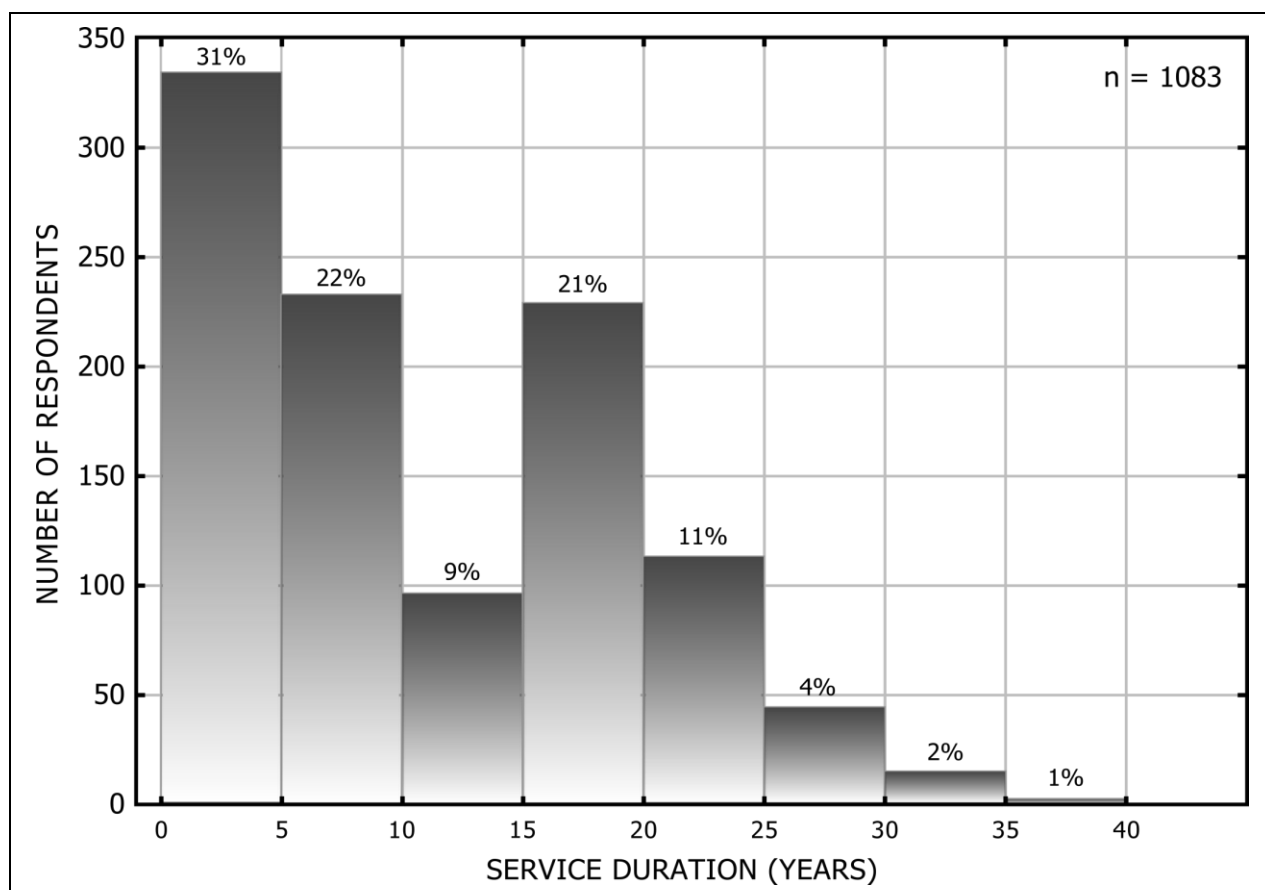
Figure 5.11 Representation according to service duration of survey respondents

distributions denote a large younger, less experienced group and a smaller more mature, experienced contingent (probably senior NCOs and officers). Very few respondents have served in the SA Army for longer than 25 years. This implies a lack of older, more experienced soldiers, also in the environmental services.

Unfortunately, **environmental management experience** (experience in any environmental management position, such as unit environmental officer) is severely lacking in the sample with only 4% reporting any environmental position or responsibility in their work. This is a surprisingly small proportion given the relatively long length of service of a considerable proportion of the respondents. **Deployment experience** outside the borders of South Africa is better represented, with 40% having done so. The significance of this is that the South African military footprint extends to the deployment countries, raising the need for a high degree of environmental literacy to an organisational imperative. A list of the 15 African countries where the respondents have been deployed is given in Appendix X. With data representativeness assured the validity and reliability of the questionnaire are discussed next.

5.7   ASSURANCE OF SURVEY RELIABILITY

Validity and reliability are two central concerns in developing and using a questionnaire (Neuman 1994; Kitchin & Tate 2000; Alwin 2010). Best practice was meticulously followed in the construction and development of the MEL questionnaire to ensure a valid and reliable product. Despite the various built-in controls to ensure reliability and validity it is customary to report on the reliability of the final questionnaire, after the survey had been completed (Dunlap 2008; Rosenberg et al. 2010; Dijkstra & Goedhart 2012) as the population studied is often not strictly comparable with the sample used in the pilot project (Falissard, 2012).

The MEL questionnaire used Likert-type items to measure attitude and behaviour, two components of MEL. Combining four or more Likert-type items to produce an overall score or measurement is accepted practice in survey research (Carifio & Perla 2007; Boone & Boone 2012; Wigley 2013). In this section the reliability of the results regarding attitude, behaviour and knowledge in the MEL survey are reported.

5.7.1   Survey reliability: Attitude scale

A Cronbach's alpha of 0.81 was recorded for the attitude scale, with a standardised alpha of 0.83 taken to indicate good reliability. In Table 5.12 the ITC and alpha-if-deleted values are recorded, noting that the latter values indicate what would happen to the total alpha if that specific item were deleted.

Table 5.12 Reliability of variables in the attitude scale

VARIABLE	ITEM TOTAL CORRELATION	ALPHA IF DELETED
Summary for the scale: Valid n: 1087, Cronbach alpha: 0.81 Standardised alpha: 0.83		
Item 1	0.40	0.81
Item 2	0.46	0.80
Item 3	0.51	0.80
Item 4	0.50	0.80
Item 5	0.51	0.80
Item 6	0.37	0.81
Item 7	0.35	0.81
Item 8	0.55	0.80
Item 9	0.52	0.80
Item 10	0.53	0.80
Item 11 (reversed)	0.20	0.82
Item 12	0.47	0.80
Item 13	0.35	0.81
Item 14	0.46	0.80
Item 15	0.40	0.81

As little movement as possible in the total alpha of the scale (0.81) is the ideal so that any value higher than this means that that item may have to be removed from the scale to improve the alpha. In Table 5.12 only item 11 will increase internal consistency, as expressed by the alpha, if deleted. Because the increase would be less than 0.1 (0.082, if the raw scores of 0.8134 and 0.8217 are considered) and because the scale has a high degree of internal consistency, its retention does not detract from the overall reliability of the scale.

5.7.2   Survey reliability: Behaviour scale

A Cronbach's alpha of 0.81 was recorded for the behaviour scale, with a standardised alpha of 0.84 indicating the good reliability of the scale. Inspection of Table 5.13 indicates that only

Table 5.13 Reliability of variables in the behaviour scale

VARIABLE	ITEM TOTAL CORRELATION	ALPHA IF DELETED
Summary for the scale: Valid n: 1090, Cronbach alpha: 0.81 Standardised alpha: 0.84		
Item 16	0.46	0.80
Item 17	0.42	0.80
Item 18 (reversed)	0.29	0.82
Item 19	0.51	0.80
Item 20	0.63	0.79
Item 21	0.63	0.79
Item 22	0.56	0.79
Item 23	0.51	0.80
Item 24	0.60	0.79
Item 25	0.61	0.79
Item 26	0.28	0.82
Item 27 (reversed)	0.20	0.83
Item 28	0.56	0.80

questions 18, 26 and 27 will increase the internal consistency, as expressed by the alpha, if deleted. However, their removal would give only a slight increase in the overall alpha of the scale and because the scale has high reliability, retention of these items does not detract from the scale's reliability.

5.7.3 Survey reliability: Knowledge scale

At the conclusion of the pilot project, item difficulty and item discrimination were used to identify items for possible removal from the knowledge scale. Item difficulty, item discrimination and the results of the process of item removal were discussed in Sections 4.4.3 and 4.4.4.

The results of item difficulty for the main survey listed in Table 5.14 indicate a spread of 41% to 91% correct responses. In the pilot study correct responses varied from 4% to 97% (Table 4.10). This reduced range of variation testifies to the effectiveness of item removal and indicates

Table 5.14 Reliability of variables in the knowledge scale

ITEM NUMBER	ITEM DESCRIPTION	ITEM DIFFICULTY (%) *	ITEM DISCRIMINATION **
29	Geneva convention	59	< 0.01
30	ITAM	47	< 0.01
31	MIEM	55	< 0.01
32	Respect environmental rights	73	< 0.01
33	National environmental law	83	< 0.01
34	Storage of hazardous material	56	< 0.01
35	Handling of rubbish and refuse	70	< 0.01
36	Fuel storage and rebunkering sites	55	< 0.01
37	Disposal of batteries	81	< 0.01
38	Recycling of waste products	60	< 0.01
39	Mass movement of troops during an exercise	41	< 0.01
40	Damage to cultural environment during training, routine daily activities or base management	91	< 0.01
41	Trees and shrubs as targets	84	< 0.01
42	Handling of unexploded ammunition	61	< 0.01

Notes: * All items scoring below 45% or above 85% were considered for removal during the questionnaire development process; ** All items where $p = < 0.05$ indicate adequate item discrimination.

a valid and reliable final questionnaire. Only two items recorded a proportion of correct responses outside the desired 45% to 85% range. During the pilot survey these two items recorded correct responses of 43% and 93% respectively, but it was decided to retain them as the issues addressed by these items were too important to leave out of the final questionnaire. The results of item discrimination were all well below the 0.05 limit, indicating adequate item discrimination for all the items included in the final questionnaire, so confirming the success of item selection described in Chapter 4.

In summary, both scales using Likert responses (attitude and behaviour) recorded alphas that well exceed the lower indicator (0.7) of acceptable reliability and they also exceed the more stringent 0.8 limit. Similarly, item difficulty and item discrimination values for the multiple-choice items of the knowledge scale indicate a valid and reliable questionnaire. The internal consistency, reliability and validity of all three scales are acceptable.

5.8 SURVEY BUDGET

Survey budgeting is a demanding task and unforeseen expenses can seriously disrupt survey execution (Sheskin 1985). Survey budgeting must account for item costs such as printing, personnel, mailing, travelling and incentives (Sheskin 1985; Bourque 2003). The budget for the MEL survey is summarised in Table 5.15. The printing of the questionnaires on good-quality paper ($80g/m^2$) ensured professional-looking documents for the pilot and main surveys, so aiming to enhance response rates and facilitate computer marking of the completed questionnaires (Bourque 2003; Thomas 2004).

Table 5.15 The survey budget

EXPENDITURE ITEM*	DESCRIPTION	AMOUNT (%)
Printing and paper	Printing of 1500 questionnaires (pilot & main survey)	R5 275 (10.2%)
Personnel	Research assistants to survey units	R4 750 (9.2%)
Mail	Courier costs	R1 420 (2.7%)
Travel	Two survey field visits (vehicle hire, fuel, accommodation and meals)	R15 600 (30.2%)
Stationery	600 black-ink pens to complete questionnaires	R1 800 (3.5%)
Incentive	1400 lollipops	R630 (1.2%)
Coding and keypunching	Preparing the database and typing of responses to open-ended items into the database	R22 237 (43%)
Total survey expenditure		**R51 712 (100%)**

Note: * The expenditures itemised in Table 5.15 reflect the costs incurred in 2012 and serve as a guideline only.

Research assistance was needed for 19 of the units surveyed and the assistants were paid R250 for each Army unit they surveyed once the completed questionnaires were received. This outlay was inexpensive and probably attributable to the military frame in which the survey was done. Private-sector fees for similar work would be significantly higher.

Courier costs for dispatching the questionnaires, pens and lollipops had to be budgeted for and UTI couriers were contracted for the job. A reliable mode of disseminating and returning survey material is essential (Iarossi 2006) to ensure that no questionnaires get lost as this would

severely damage the integrity of the survey (Sheskin 1985). Fortunately, no problems were experienced during the dispatching or return of the questionnaires. The cost to courier the questionnaires to the units varied between R55 and R85 per unit, depending on the number of questionnaires couriered to the unit. The couriering of the completed questionnaires back to the SAMA was more expensive, because many of the units were situated in places with no UTI office so that the package of completed questionnaires had to be collected at the unit. The cost in these cases varied between R60 and R160 per unit.

For the field surveys the survey team hired a small sedan for transport and used cost-saving military accommodation not available to civilian researchers. Stationery costs incurred were for black pens with which to complete the questionnaire. The pens were dispatched to the research assistants for use during the field surveys.

The most expensive survey item was the process of electronic data capture and entry, and the typing of responses to open-ended questions into the database. This expense accounted for almost half the budget. Thirty per cent of the expenditure was the travel cost for the two field surveys − in hindsight, a poor investment. Eventually, the field survey cost R3120 per unit, compared to R325 per unit for the units surveyed by research assistants. The lollipops cost R25 per unit or 58 cents per completed, usable questionnaire and turned out to be an indispensable cost item.

The total cost of executing the MEL survey was R51 712 or R2068 per unit surveyed or R47 per usable questionnaire.[22] The amounts and items in Table 5.15 ought to assist researchers in planning survey research in similar institutional frameworks and with similar scopes. The savings effected by using research assistants to conduct field surveys offer a valid pointer.

In the next two chapters the results of the analyses of the database information are presented, described, and interpreted.

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[22] Two grants from Research Sub-committee A at Stellenbosch University covered much of these expenses.

CHAPTER 6   SEGREGATED MEL PROFILES OF SA ARMY SOLDIERS

Statistiek maak sin uit syfers. (Statistics make sense out of numbers) Steyn et al. (1994: 1).

In this chapter the results of the statistical analyses of the final survey data are reported. Military environmental literacy profiles of attitude, behaviour and knowledge are built through statistical analysis. Combined indices are constructed by averaging Likert-scale measurements (Bradley, Waliczek & Zajicek 1999; Said 2003; Carifio & Perla 2007; Beth & Volk 2010; Boone & Boone 2012; Levine & Strube 2012; Wigley 2013). The causal relationships between socio-demographic, educational and military service characteristics of the respondents and their environmental attitudes, behaviour and knowledge are investigated. In so doing, the research endeavours to provide targets for education and training goals to the host organisation. Military environmental attitude is reported first.

6.1   MILITARY ENVIRONMENTAL ATTITUDE (MEA) IN THE SA ARMY

Following the general practice in environmental attitude studies (Bradley, Waliczek & Zajicek 1999; Said 2003; Carifio & Perla 2007; Beth & Volk 2010; Boone & Boone 2012; Levine & Strube 2012; Wigley 2013) an overall indicator of environmental attitude, the arithmetic averages of Likert-code values for the 15 items recorded in Section A of the questionnaire were calculated (see Chapter 1, Section 1.6.1). Histograms are used to graphically illustrate the results as recommended by McKillup (2012). Figure 6.1 shows that the results are positively skewed, i.e. a preponderance of cases at the lower end of the scale − agreement level being indicated toward the lower end of the scale (ideally 1) and disagreement by the higher values (5 maximum). The lower values indicate an increasingly strong positive attitude toward the environment and the environmental issues raised over the domains in which the military operates.

Both the mean and the median of the attitude scale was 1.8, with the non-outlier range[23] between one and two. On the five-point Likert scale this means that the average response to attitude items lies between 'agree', and 'agree strongly'. This is a highly significant result that indicates a dominant positive attitude by the majority of respondents toward the environment in which the military operates.

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[23] The non-outlier range is the range that includes all non-outlier observations, i.e. all observations that are not excessively different from all the others (Field 2013).
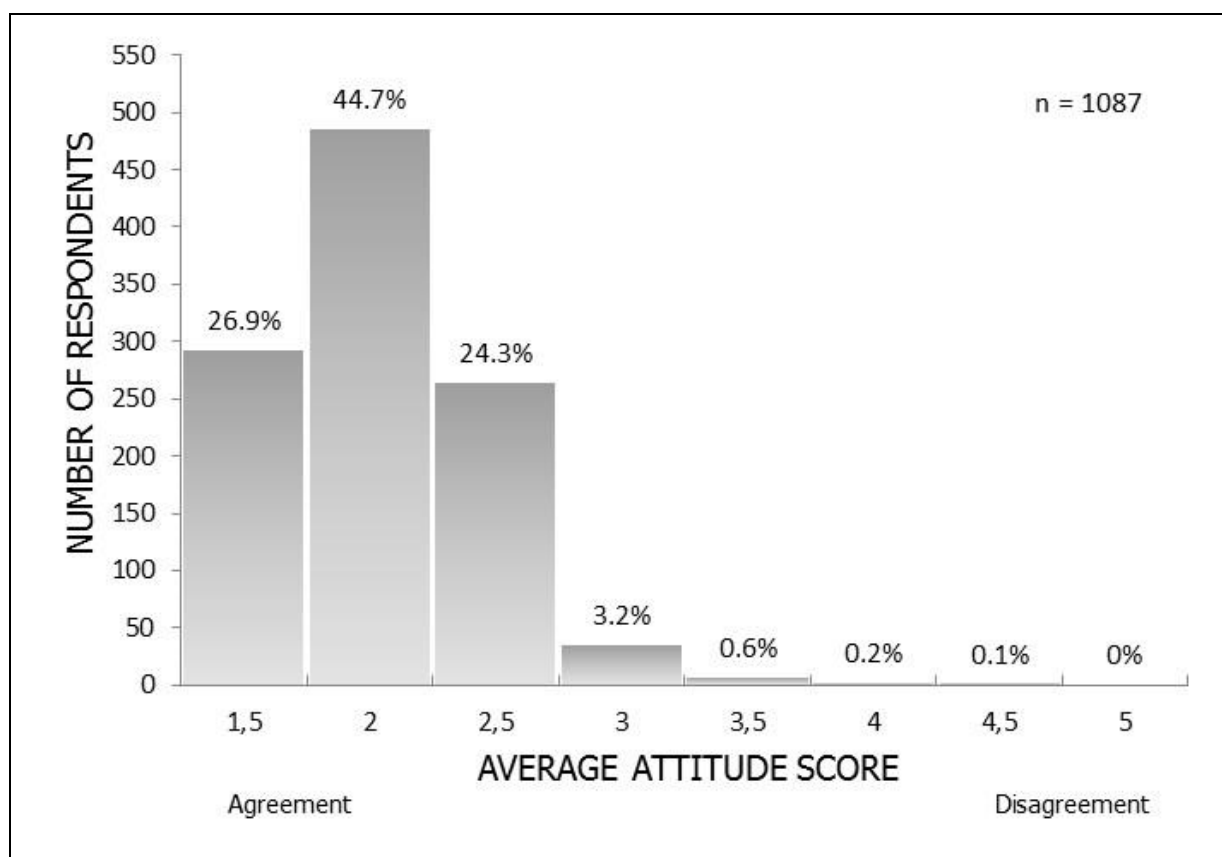
Figure 6.1 Average attitude score for all the attitude items combined

6.2   DETERMINANTS OF MEA IN THE SA ARMY

The socio-demographic, education and training and service history information was used as independent variables to statistically explain variations in the MEA of soldiers in the SA Army. The results are reported in this section.

6.2.1   MEA according to socio-demographic determinants

There is no consensus among scholars about interrelationships between any of the independent variables age, gender, marital status and home language, and environmental attitude. Home language is used here as a proxy for ethnicity, cultural affiliation, value system and geographical origin of population groups.

6.2.1.1   MEA by age

Conflicting evidence exist about age as a determinant of environmental attitude. A positive relationship (increasing age related to improved environmental attitude) was reported by Levine & Strube (2012), a negative relationship (increasing age related to poorer environmental attitude) reported by Elliot, Seldon & Regens (1997) and no relationship was found by Al-Dajeh (2012) nor Xiao, Dunlap & Hong (2013). The effect of continuous (scalar) variables, contrary to discrete

variables, has to be statistically analysed through Pearson correlation coefficients (Falissard 2012). Pearson product-moment correlation analysis was performed to reveal the extent to which the variables are related (McKillup 2012). The statistic (r) assumes any value between -1, indicating a perfect negative bivariate relationship, and +1, indicating a perfect positive bivariate relationship. Field (2013: 82) recommends discrete values of r to indicate the strength of the effect: "r = 0.10 can be interpreted as a small effect, r = 0.30 is a medium effect, while 0.50 indicates a large effect." For this study, r-values of below 0.10 was taken as a slight effect.

Pearson's product-moment correlation coefficient (r = 0.02) for age and attitude indicates a slight positive correlation, but a negligible correlation. The *p*-value of 0.48, greater than 0.05, confirms that the relationship is statistically insignificant.

Although it was expected that older soldiers would have a more positive attitude toward the environment, the result confirmed Xiao, Dunlap & Hong's (2013) conclusion of no significant relationship. The implication of this for military environmental management in the SA Army is that environmental education and training does not have to take the age of soldiers into consideration when designing interventions. More disturbing is that it also implies that longer exposure to military environmental education and training does not seem to improve MEA.

6.2.1.2   MEA by gender

The available literature on gender and attitude (Lopez et al. 2007; Alp, Ertepinar & Tekkaya 2006; Chu et al. 2007; Alp et al. 2008; Özden 2008) reported superior environmental attitudes among females, while Shields & Zeng (2012) found Chinese men to be more environmentally aware, a result corroborated by Xiao, Dunlap & Hong (2013). Teksoz et al. (2014) has pointed out that the type of concern about environmental issues differs between the sexes. While females were more concerned about ecocentric issues, males were more concerned about anthropocentric matters. However, Lee (2008) and Al-Dajeh (2012) reported a lack of statistically significant differences based on the gender of respondents.

The plot in Figure 6.2 contrasts the attitude of males and females. The *F*-test assesses the hypothesis that attitude is the same, regardless of gender. Here ($F_{1,\ 1085} = 1.12$, $p = 0.29$) the hypothesis that there is no difference between the sexes is supported. With both of the sexes recording a mean rounded attitude value of 1.8, all results indicate that the attitude of males and females does not differ significantly. However, Figure 6.2 shows a slightly higher score with less variability for males than for females, i.e. females have a slightly better attitude. However, since this difference is not statistically significant, it can be postulated that no difference exists between male and female respondents.
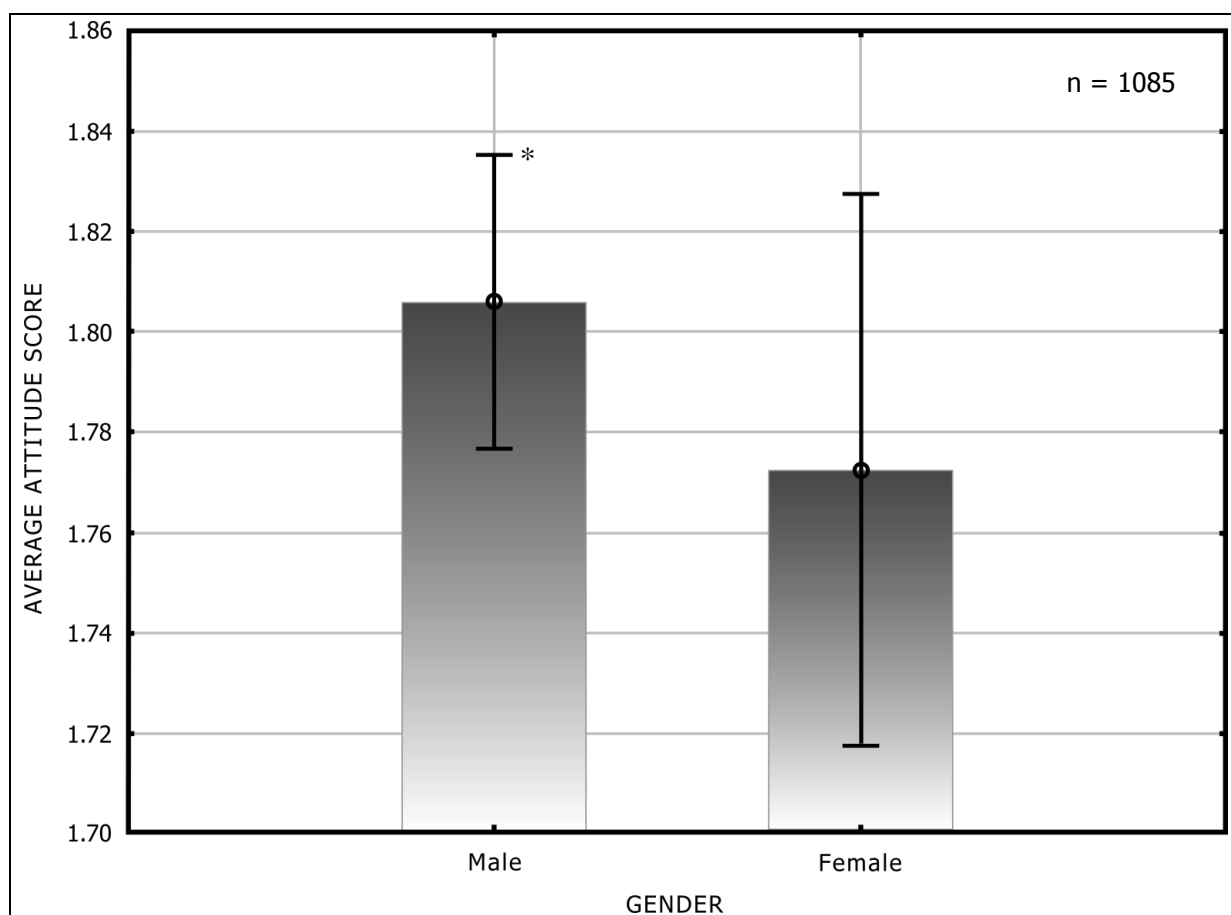
Note: * Where group means are numbered with the same letter, the difference between those group means are not significant. If no letter appears on the lines, the difference are also not significant. The distance of the line in the middle of each column indicate the spread in responses around the mean. The shorter the line, the smaller the variation between responses.

Figure 6.2 Average attitude score by gender

Some of the previously mentioned literature, notably Xiao, Dunlap & Hong (2013) and Shields & Zeng (2012) related differences between male and female environmental attitudes to traditional roles in the societies in which they function. The role of women as carers for the family is emphasised and this is seen as a possible reason for being less concerned about the environment when environmental concern had to be balanced with the needs of the family. Should the traditional-role thesis hold true, a rationale for the lack of a significant difference between female and male soldiers can be postulated. Of course, the MEL questionnaire focused on attitude, behaviour and knowledge in the workplace alone – and traditional gender roles do not prevail in a male-dominated workplace such as the Army. Therefore the traditional distinction between men and women does not apply here and, consequently, it is reasonable that the MEL survey should report no attitudinal differences between the sexes.

6.2.1.3   MEA by marital status

Conroy & Emerson (2014) found that married respondents have less environmental concern, while Schumacher (2014) found no statistically significant relationship between marital status and environmental attitude. Figure 6.3 demonstrates the different attitude values of respondents according to four categories of marital status. The F-test ($F_{3, 1059} = 0.78$, $p = 0.50$, and the p-value thus larger than 0.05) confirms the hypothesis that attitude is the same, regardless of marital status.
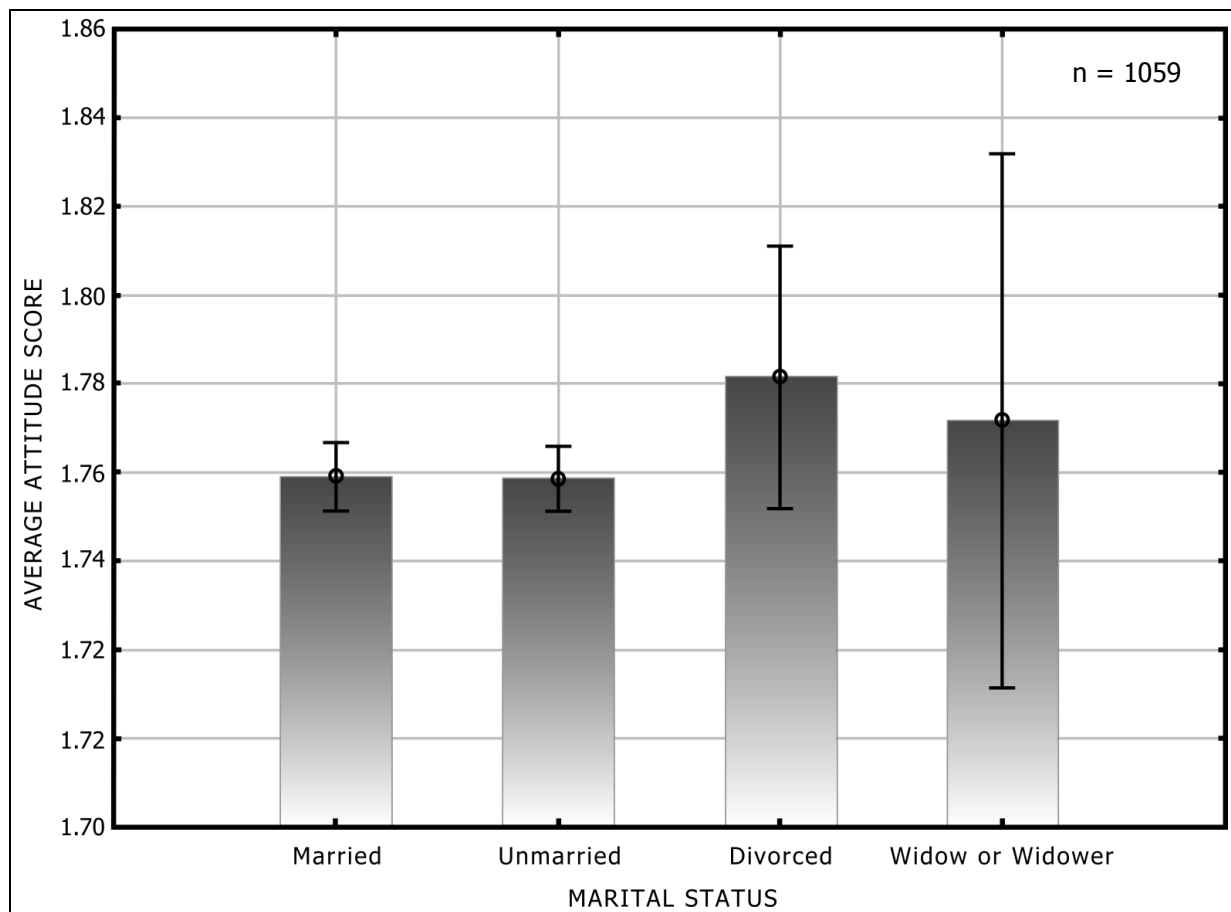
Figure 6.3 Average attitude score by marital status

With the first two status classes recording a mean attitude of 1.8 and the last two a slightly higher 1.9 on the five-point Likert scale, the results support the contention that no statistically significant difference exists between respondents of different marital status. Again, it seems as if the nature of the survey – targeting environmental literacy in a workplace context – negates the traditional family roles that may have an influence on independent variables such as marital status and gender.

6.2.1.4   MEA by home language

In military contexts De Klerk & Barkhuizen (1998) reported that language differences between respondents leads to differences in attitudes to language use in the SANDF, while Van Zyl (2007) recorded home language as a powerful predictor of success and satisfaction at the SAMA, with Afrikaans and English home-language speakers being more successful and satisfied. In the general literature on environmental literacy, Schultz, Unipan & Gamba (2000) found differences in the perceptions about the interrelationships of humans and nature, between English- and Spanish-speaking Americans. Laroche et al. (2002) reported that French-speaking Canadians are more concerned about environmental issues, while Zecha (2010) found that Asturian Spanish speakers outperformed Bavarian German speakers regarding environmental attitude. In South Africa, Rousseau & Venter (2001) found that home language impacts on environmental concern among Afrikaans-, English- and Xhosa-speaking consumers in the Eastern Cape. These studies confirm that a relationship between language and environmental attitude does exist and served as a reason why language was included in the MEL study.

Figure 6.4 scales attitude values according to home language groups. Respondents were requested to name their home language, i.e. the language spoken at home from birth and the 11
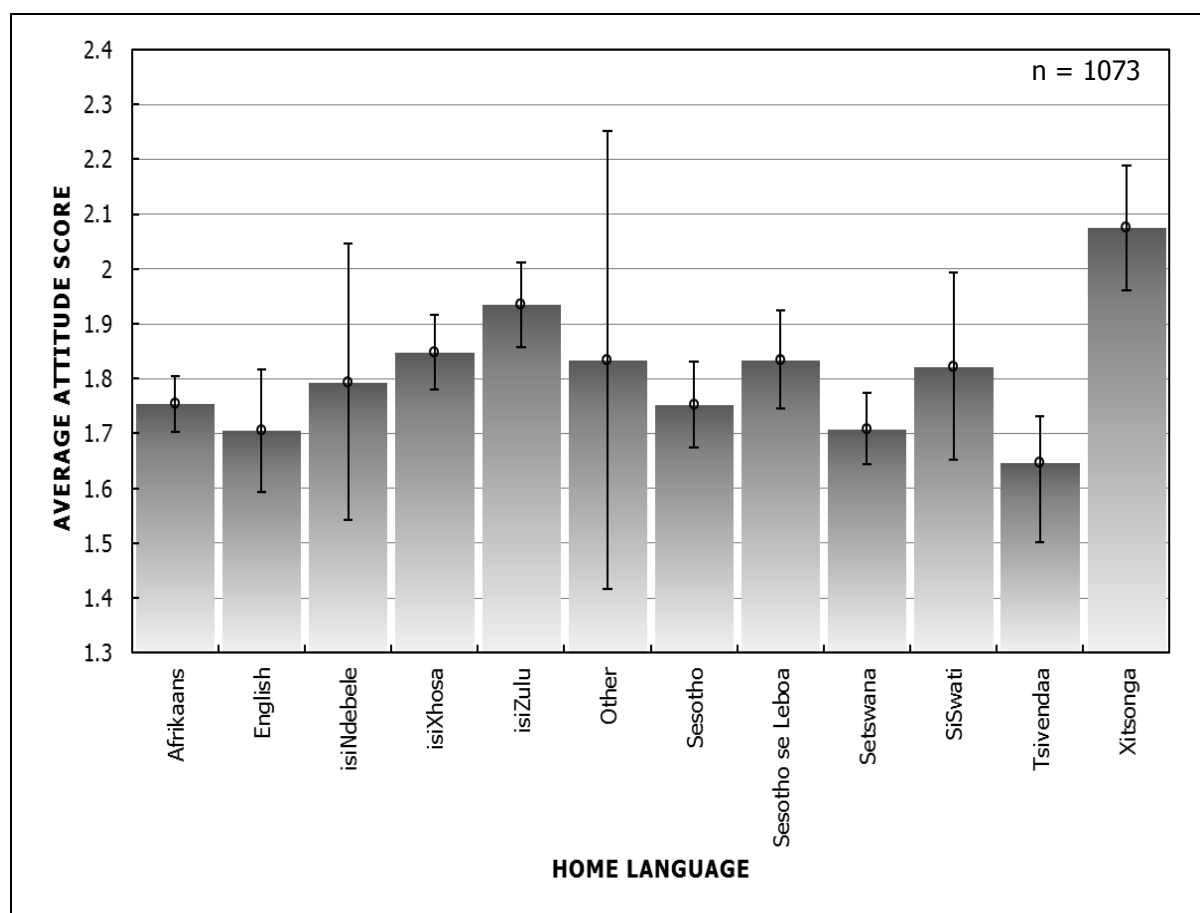
Figure 6.4 Average attitude score by home language

official languages of South Africa were offered as options, with an 'other' category added as an option. Only four respondents marked the 'other' category, leading to its exclusion from the analysis and discussion. The 'other' category was however retained in the figures and tables for the sake of completeness.

The *F*-statistic expressing this relationship ($F_{11,\ 1073} = 5.12$, $p < 0.01$) confirms that the hypothesis that attitude is the same, regardless of the language spoken, can be rejected. The post hoc test indicated a mean attitude value of 2.1 for Xitsonga speakers and 1.7 for Tsivenda, Setswana and English speakers, with the other language groups located in between these extremes. This result clearly shows a statistically significant difference between language groups. Further research to probe the extent and meaning of this finding is called for. It is noteworthy, that, with the exception of the 56 English home language speakers, the other 95% of the respondents are educated and trained in the DOD in their second or third language (English). This includes environmental education and training. The DOD therefore needs to consider the possible implications for their environmental education and training programmes when engaging with different language groups to ensure that the environmental message reaches the receiver in the right format.

6.2.2   MEA according to education and training determinants

It is generally accepted that education is an useful indicator of environmental literacy with increased level of education indicative of more positive environmental attitudes, behaviour and knowledge (Tikka, Kuitunen & Tynys 2000; Kollmuss & Agyeman 2002; Alp, et al. 2006; Özden 2008; Xiao, Dunlap & Hong 2013; Conroy & Emerson 2014). The education and training profile of respondents in this survey comprises their general level of education, level of geography education and extent of environmental courses completed. The use of these three measures as independent variables to explain difference in environmental attitude is described in the next three subsections.

6.2.2.1   MEA by general level of education

Level of education is often quoted as an indicator of environmental literacy (Tikka, Kuitunen & Tynys 2000; Kollmuss & Agyeman 2002; Alp et al. 2006; Özden 2008; Xiao, Dunlap & Hong 2013; Conroy & Emerson 2014). Given the SA Army policy to set secondary school as minimum educational requirement, survey respondents could only select an education level ranging between secondary school, post school diploma, first university degree or postgraduate qualification. Only 20% of the respondents had an education beyond secondary school. This

subsection probes the extent to which variations in the small range of education level is related to attitudes toward the environment.

The Pearson correlation of -0.09 and a *p*-value below 0.01 attest to a slight negative, yet significant correlation and a negligible relationship between highest level of education completed and environmental attitude. Contrary to expectations, this result implies that the better educated soldiers tend to display a less positive attitude toward the environment. Possible explanations are that the military workplace is not conducive to building positive environmental attitudes, or that covariance with independent explanatory variables like rank or age complicate the relationship. Nevertheless, the tendency should be given attention by environmental services personnel in the military.

6.2.2.2   MEA by level of geography education

An education in specific subjects has been found to contribute to environmental literacy (Pe'er, Goldman & Yavetz 2007; Smit 2009; Karatekin 2013). Here level of education in geography is probed for its explanatory power to account for variation in environmental attitude.

The Pearson correlation coefficient (r = -0.03) for the relationship between the respondents' environmental attitude and their highest level of education completed, indicates a negligible correlation. The *p*-value of 0.33, which is greater than 0.05, further indicates that there is no significant relationship.

Given that most of the respondents had had an education in geography (only 14% had none) this result is surprising, since geography education normally influences attitude toward the environment. The same rationale as that postulated for general level of education applies, but does not satisfactorily explain the results reported by Smit (2009), who found a strong correlation between geography education and MEA among students at the SAMA. This inconsistent result with the MEL research is probably due to the more focussed nature of the questionnaire used in this research.

6.2.2.3   MEA by environmental education and training

A number of soldiers complete a comprehensive, nine-week military environmental course each year and the assumption is that having completed such courses the environmental attitudes of the graduates would have been positively affected. This assumption is corroborated by research done by Culen & Mony (2003), Smit (2009) and Karatekin (2013), and tested further in this subsection.

Figure 6.5 contrasts the attitude of respondents who had completed an environmental course with those who did not. The *F*-test assesses the hypothesis that the attitudes are similar, regardless of whether respondents completed environmental courses or not. The *F*-statistic ($F_{1, 1085}$ = 8.9, $p < 0.01$) indicates that this is not the case, and the hypothesis can be rejected. A mean
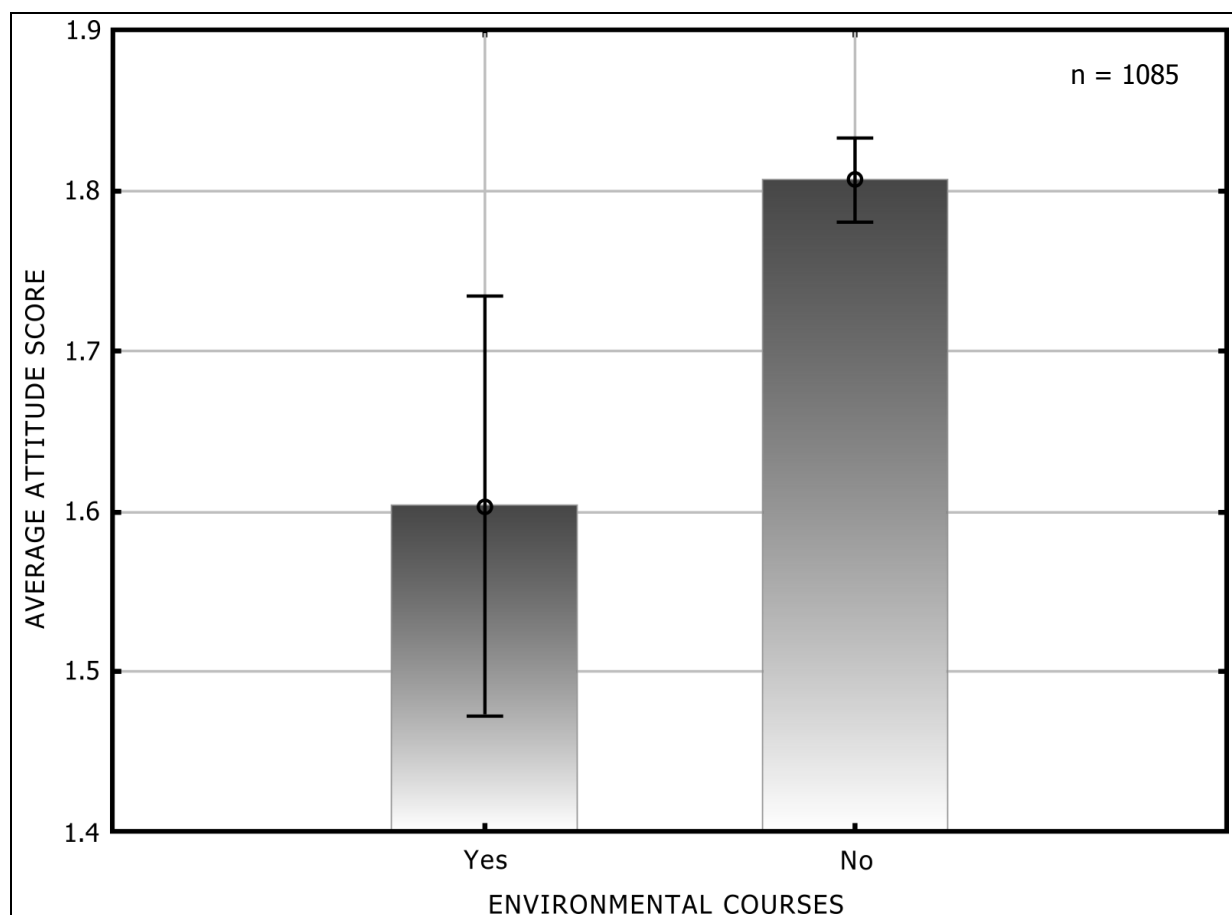
Figure 6.5 Average attitude score by completion of environmental courses

attitude score of 1.6 for respondents who completed an environmental course and a mean score of 1.8 for those who did not, underscores the statistically significant difference that exists, namely respondents who completed an environmental course have better environmental attitude than those who did not. This is noteworthy because it confirms that military environmental courses do improve the attitude of members and that DOD management could further improve the MEA of soldiers through the existing programme. Given that fewer than 4% of respondents had attended an environmental course, the result is exceptional and points to an urgent need to enhance access to these courses.

The educational results reported in Section 6.2.2 confirm that relationships between environmental attitude and education levels differ for military and civilian populations. Focused, military-specific environmental courses presented by military environmental specialists must be

incorporated into military environmental education and training as they do have a significant positive influence on MEA.

6.2.3   MEA according to service profile determinants

There is no consensus among scholars on whether formation membership, military rank group, service duration, experience in environmental management and deployment experience determine MEAs. These independent variables are investigated in this section to determine whether these explain variations in MEA among the respondents. This should lead to a better understanding of military service determinants of MEA and call attention to the changes that need to be made to military environmental education and training to address possible shortcomings in the curricula.

6.2.3.1   MEA by formation membership

Nine formations constitute the Level 3 divisions of the SA Army and can be related to the departments in a large civilian corporation. Each of these formations exists to make a specific contribution to executing the military mission. Each formation has its own leadership, size, military subculture and unique mode of operation (DOD 2009). The relevance of formations as a variable determining attitude resides in the way the survey informs about and disseminates environmental policy. Policy recommendations are tailor-made for the different formations and implemented through formation leadership. This subsection examines how variations in environmental attitudes can be explained by respondents' membership of a specific military formation.

Multivariate comparative analysis among more than two groups customarily involves analysis of variance (ANOVA) to explain differences in the means of the groups. ANOVA estimates the probability that observed differences between groups can be attributed to chance and not to real differences between the means of the corresponding groups (Bless, Higson-Smith & Sithole 2013), in this case the various formations. ANOVA generates a statistic that increases with increasing difference between group means (McKillup 2012).

Figure 6.6 records the means of each formation on the attitude scale. ANOVA renders an *F*-statistic where, when group means are similar (*F* near 1), the ability to make predictions from the observed data is poor. When means differ, discrimination between different groups become possible and the *F*- statistic would be large (Field, 2013). In this case, the *F*-test assesses the hypothesis that means for attitude is the same across all formations. *P*-values smaller than 0.05 indicate that the hypothesis can be rejected (Remenyi, Onofrei & English 2011; McKillup 2012;
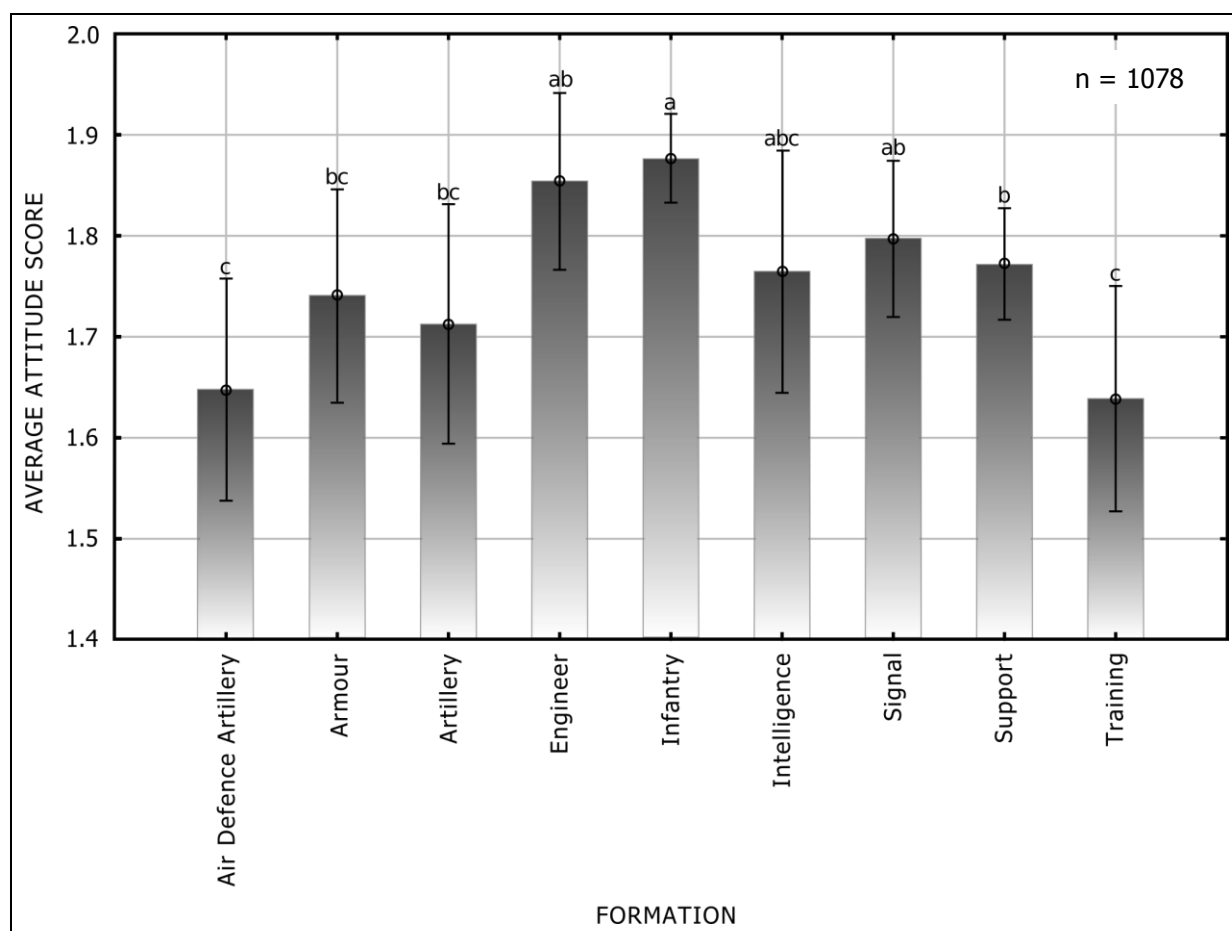
Figure 6.6 Average attitude scores by military formation

Field 2013). ANOVA results for attitude and formation ($F_{8, 1078} = 4.18$, $p = < 0.01$) and a p-value <0.01, indicate significantly different attitude results across formations and that the hypothesis can be rejected. Although this means that in at least one case the attitude of that formation will differ from the rest, it must still be determined whether statistically significant differences exist between other formations or not. This was done through post hoc testing (see Section 1.6).

The results for attitude and formation depicted in Figure 6.6 are: respondents from the formations Training (mean = 1.6) and Air Defence Artillery (mean = 1.7) recorded the most positive attitudes, differing considerably from the least positive results for Infantry and Engineer formations (means = 1.9)[24]. The remaining formations all posted results between 1.7 and 1.9. In the absence of logical explanations for these findings in the literature, it is worth noting that the Infantry formation is by far the largest and most diverse in the Army, and also the most diverse in terms of function and impact. The Engineer formation is fourth largest, also with a diversity of functions and environmental impacts. Together these two formations represent more

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[24] To a certain extent smaller differences between means are masked by rounding to one decimal. The actual means for the Infantry formation was 1.88, while the mean for the Engineer formation was 1.85. These differences are nonetheless not significant, but might be confusing.

than 40% of the respondents. When interpreting these results, it is necessary to recognise that 1.9 on the five-point Likert scale represents a solid pro-environmental result. The diversity of functions that inhere in these two formations makes it difficult to improve their EA by influencing them with formation-specific environmental information, something much easier to do in the smaller formations with more homogeneous functions. The sheer size of these two large formations, coupled to the fact that they usually bear the brunt of external deployment, make it difficult to institute sustainable environmental education and training programmes.

Respondents in the small formations posted the most positive results regarding attitude, probably because good environmental practices are more easily established among small numbers. When a limited number of members from small formations attend a military environmental course, the whole formation becomes influenced, contrary to larger formations (Laubscher 2014 pers com).

6.2.3.2   MEA by rank

Individual military ranks were recoded into five category levels: rifleman, junior non-commissioned officer, senior non-commissioned officer, junior officer and senior officer. In this subsection the relationship between variations in MEA by respondents' military rank is considered.

Average attitude scores and rank are portrayed in Figure 6.7. The F-test assesses the hypothesis that attitude is the same, regardless of rank group. The F-statistic ($F_{4, 1082} = 4.66$, $p = < 0.01$) and a p-value below 0.01 allows the hypothesis to be rejected. Post hoc testing generated the following significant results: riflemen (mean = 1.9) scored the least positive results and differed significantly from the other ranks. Small differences between the other ranks are not statistically significant − a logical, yet very important result. Most riflemen are new, young recruits with service experience between a few months and two years. This implies limited exposure to military environmental education and training and may be indicative of a progression in MEA with increased exposure to military environmental education and training. This raises expectations of an association between attitude and time in DOD employment. Improved opportunities for and cumulative exposure to environmental education and training based on rank level might provide a better explanation for the positive relationship between rank and attitude.

Although not statistically significant, it is also worth noting that the officers (both junior and senior) exhibited better attitude values than NCOs. This has two implications: 1) officers do indeed provide the leadership expected of them and 2) focused military education and training of
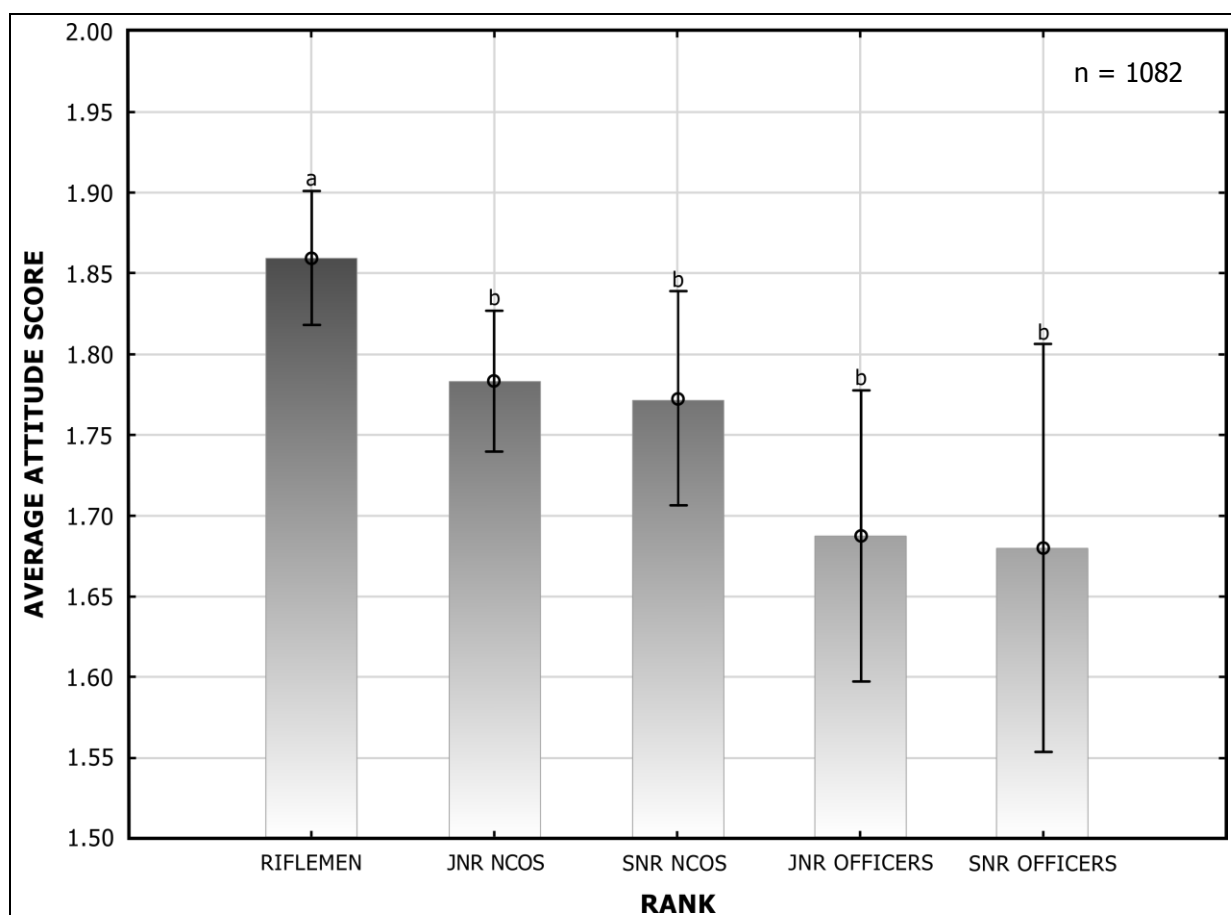
Figure 6.7 Average attitude score by military rank

NCOs are required since they are usually directly responsible for training and the execution of military tasks. NCOs must be empowered to influence the attitude of riflemen at grassroots level.

6.2.3.3   MEA by service duration

Respondents' duration (in completed years) of service in the DOD is an important indicator of the amount of time a respondent has been exposed to the shaping of MEA through education and training. An effective military education and training programme would cultivate higher attitude scores among respondents with longer service durations. This is corroborated by Culen & Mony (2003), Smit (2009) and Karatekin (2013) who found a positive correlation between years exposed to environmental education and a positive environmental attitude. This subsection looks at the extent to which variations in environmental attitude can be explained by the duration of respondents' military service. The calculated Pearson correlation coefficient for service duration and attitude was zero, that is no correlation, no relationship and, of course, a p-value indicating statistical insignificance.

Surprisingly, time in DOD employment does not contribute to nor detract from the MEA of the respondents. The implication for the SA Army is that it does not seem as if service duration

(thus time exposed to military environmental education and training) improves the environmental attitude of soldiers. This finding should be a stimulus for a re-evaluation of the scope and nature of military environmental education and training.

6.2.3.4 MEA by experience in environmental management

Kruse & Card (2004) found that experience in environmental management (i.e. holding an environmental management position, such as unit environmental officer) leads to a more favourable environmental attitude. Since data on the environmental position held or environmental responsibility borne during DOD employment was captured by the MEL questionnaire, the influence of these independent variables could be established statistically.

In Figure 6.8 the attitude of respondents with some kind of environmental responsibility is
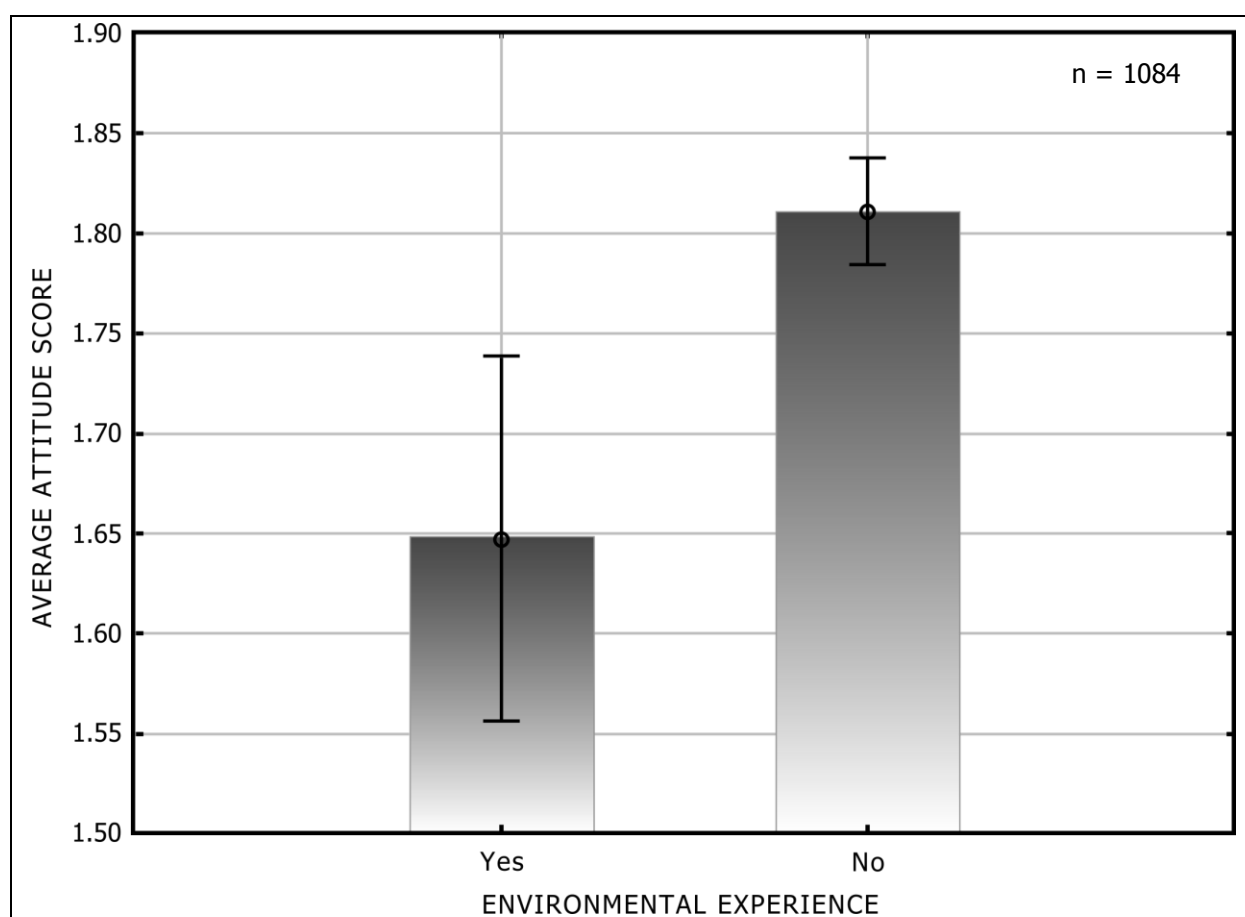
Figure 6.8 Average attitude score by experience of environmental management

plotted against those without. The F-test ($F_{1, 1084} = 11.39$, $p = < 0.00$) with p-value below 0.01 confirms that the hypothesis that their attitudes are similar can be rejected. There is indeed a statistically significant difference between respondents with environmental responsibility (mean attitude 1.65) and those without (mean attitude 1.8).

This relatively small, yet statistically significant difference points to members holding a position associated with the military environment as having a more positive attitude toward the environment. This finding corroborates that by Kruse & Card (2004) and suggest an avenue for enhancing the attitude of soldiers toward the military environment.

6.2.3.5   MEA by deployment experience

In keeping with military conduct worldwide, the SA Army is regularly required to deploy its soldiers outside the borders of the home country. These deployments may involve fighting a war, helping with disaster relief or doing peacekeeping. Often this exposes soldiers to a foreign social, cultural and physical environment. In such conditions, military environmentally illiterate soldiers can cause long-lasting damage to the environment which might endanger their own lives and compromise mission success (Mosher et al. 2008). Therefore soldiers deployed to a foreign location should ideally have a better environmental attitude than those remaining in their own country. This subsection examines whether variations in environmental attitude can be explained by the soldiers' deployment to foreign military service.

Figure 6.9 plots the attitude of respondents with experience of deployment outside South
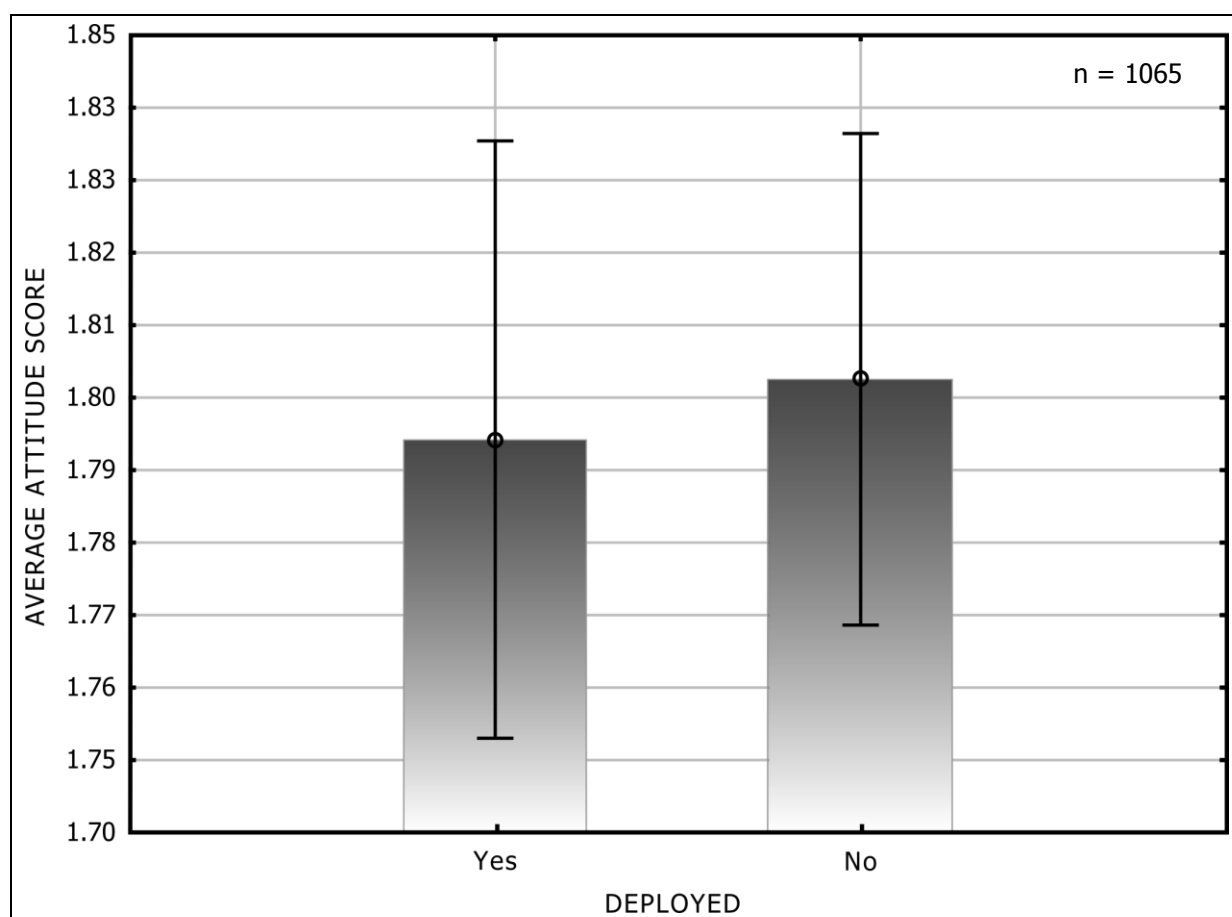
Figure 6.9 Average attitude score by deployment experience

Africa ('Yes') against those with no deployment experience ('No'). The F-test ($F_{1, 1065} = 0.9$, $p = 0.76$) signifies that the hypothesis that attitude remains similar regardless of deployment experience can be accepted. A rounded mean attitude of 1.8 for both categories of respondents implies that no statistically significant difference exists between the two groups.

This result attest to deployed soldiers being placed in situations where they might seriously damage the environment of a foreign country in which they operate and blemish the image of the SA Army, not being more likely of having a better environmental attitude. Appendix X shows that soldiers of the SA Army deployed to 15 different African countries in the period 1970 to 2012.These soldiers should have been educated and trained regarding the environmental realities they would encounter on these deployments and they should have been instilled with a different attitude to those without deployment experience. The absence of such effect point to a potentially serious deficiency in the environmental education and training of soldiers prior to deployment. This deficiency might jeopardise future foreign missions, especially when related to peacekeeping and highlight a prominent pointer to military management.

With the MEA results discussed, attention can now shift to military environmental behaviour (MEB), the second component of MEL. The MEB of the soldiers in the SA Army is investigated in the next section.

6.3   MILITARY ENVIRONMENTAL BEHAVIOUR (MEB) IN THE SA ARMY

Environmental behaviour constitutes the action component of EL and the term 'environmental action' is sometimes used in the literature as a synonym for behaviour (Zecha 2010). Corral-Verdugo (1997) and Gifford & Nilsson (2014) highlight the fact that the vast majority of environmental behaviour studies address self-reported and not observed behaviour. Self-reporting of environmental behaviour is relatively undemanding, inexpensive and it can accommodate the diverse components of behaviour, such as energy-saving measures and respect for the cultural and religious environment, something not always possible with observed behaviour, especially in the military. Jenner et al. (2006), Chen, Pahilan & Orlander (2009) and Dobbinson et al. (2014) have all compared the results of self-reported and observed behaviour and found that self-reported behaviour usually overstates observed behaviour. Huffman et al. (2014) found a weak correlation between observed and reported behaviour, while Dobbinson et al. (2014) reported similar trends over time when comparing self-reported and observed behaviour of the same phenomenon. The MEL survey measured self-reported and not observed environmental behaviour, the reason being ease of measurement, time economy, cost-effectiveness and ability to capture diverse behaviour associated with military actions. Since most research focuses on self-reported environmental behaviour, comparison of results with a large corpus of research is

possible. An important caveat is that, according to literature, self-reported behaviour overstates actual behaviour.

The behaviour scale of the MEL questionnaire used similar Likert-type response items as for the measurement of attitude, hence the same statistical techniques are used here. The histogram (Figure 6.10) for self-reported behaviour is positively skewed, with the majority of respondents reporting strong positive environmental behaviour when working in the environment in which the military operates.
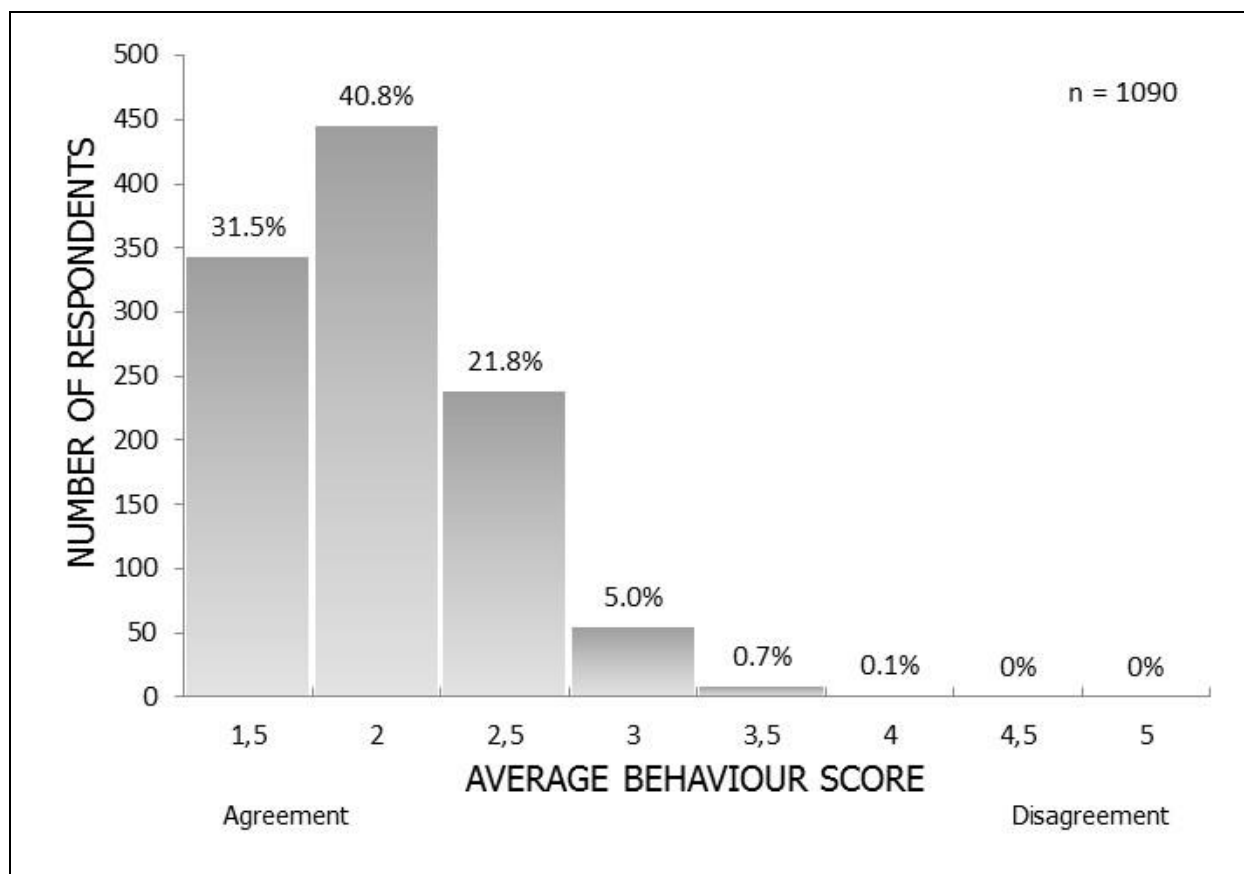
Figure 6.10 Average behaviour score for all the behaviour items combined

Both the mean and the median of the behaviour scale was 1.8, with a non-outlier range between one and 2.2. On the five-point Likert scale this relates to an average response to behaviour items between 'agree strongly' (1), and 'agree' (2). The result is highly significant, indicating a high level of self-reported environmentally-friendly behaviour at the workplace.

6.4   DETERMINANTS OF MEB IN THE SA ARMY

The biographical and service history information was employed as independent explanatory variables to statistically explain variations in the MEB of soldiers in the SA Army. This section describes and interprets the results.

6.4.1 MEB according to socio-demographic determinants

The demographic profile of respondents and the relevance of the elements constituting it were discussed in previous chapters. No consensus exists among scholars about the interrelationships between any of the independent variables age, gender, marital status and home language and MEB. Again it must be noted that home language is useful as a proxy for ethnicity, cultural affiliation, value system and geographical origin of population groups.

6.4.1.1 MEB by age

As with most other EL components, the results of studies on the causal relationships between age and environmental behaviour results are inconclusive. Elliot, Seldon & Regens (1997), Alp et al. (2006), Al-Dajeh (2012) and Dijkstra & Goedhart (2012) found that younger respondents recorded more positive behaviour patterns, while Klineberg, McKeever & Rothenbach (1998) and Xiao, Dunlap & Hong (2013) found no such influence. Rousseau & Venter (2001) reported improvement of environmental behaviour with increased age. In the present study a slight positive Pearson correlation coefficient ($r = 0.09$) indicating only a negligible relationship between behaviour and age was in evidence. A *p*-value below 0.05 indicates statistical significance.

This result suggests that the older respondents are marginally more positive in their MEB than younger ones. This accord with the findings of Rousseau & Venter (2001) in South Africa but contradicts international literature on civilian environmental behaviour.

6.4.1.2 MEB by gender

Gender is used regularly as an independent explanatory variable in EL research. However, findings on the statistical relationship between gender and environmental behaviour are inconclusive. While some studies reported higher environmental behaviour scores among females (Meinhold & Malkus 2005; Chu et al. 2007; Alp et al. 2008; Zecha 2010; Vicente-Molina, Fernández-Sáinz & Izagirre-Olaizola 2013), others found no correlation between gender and behaviour (Klineberg, McKeever & Rothenbach 1998; Tikka, Kuitunen & Tynys 2000; Al-Dajeh 2012). Contrarily, Xiao, Dunlap & Hong (2013) found better self-reported behaviour among male respondents in China.

A gender-differentiated comparison of rounded self-reported behaviour scale scores showed no differences, both sexes scoring 1.8 (actually slightly below). Graphic display (Figure 6.11) shows a slightly higher score with less variability for males than for females. The *F*-test
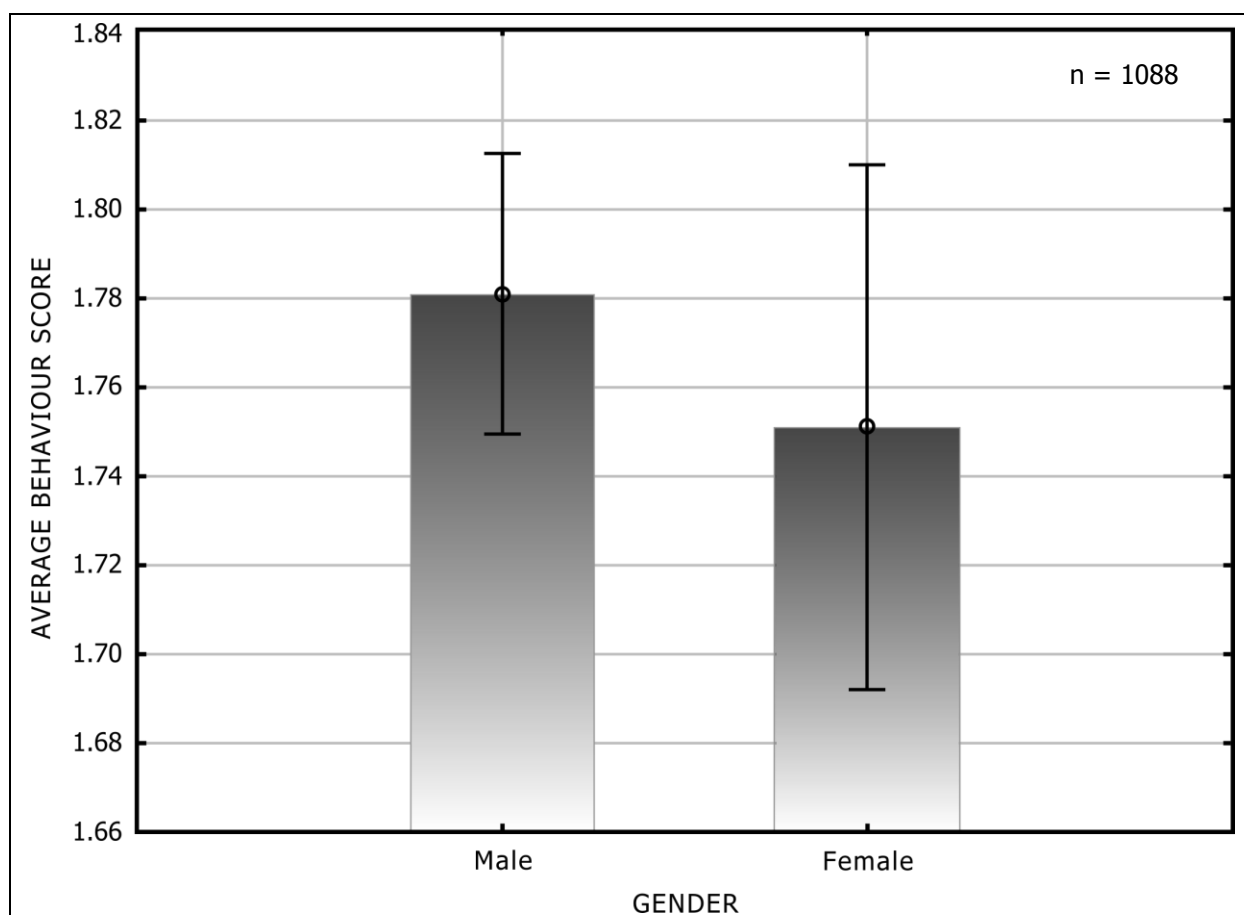
Figure 6.11 Average behaviour score by gender

result ($F_{1, 1088}$ = 0.77, p = 0.38) signifies that the hypothesis that behaviour is the same, regardless of gender, can be accepted. Hence, no significant difference is evident between the self-reported behaviour among the different sexes in the SA Army. This result matches the results for MEA by gender and corroborates some studies mentioned above, while contradicting others. Apparently, gender is not a simple explanatory variable to account for and might hide other cultural or human developmental dimensions. The significance for environmental education and training in the SA Army is that it obviates any differentiation between men and women in providing military environmental education and training to Army members.

6.4.1.3   MEB by marital status

According to Schumacher (2014) marital status does not influence environmental behaviour. Figure 6.12 demonstrates the self-reported behaviour values of respondents according to marital status. The F-test ($F_{3, 1088}$ = 4.3, p = < 0.01, and the p-value thus smaller than 0.05), confirms that the hypothesis that behaviour is the same, regardless of marital status can be rejected. There is indeed a significant difference in self-reported behaviour according to marital status. The mean reported behaviour for the large groups of married (score = 1.8) and unmarried (score = 1.7)
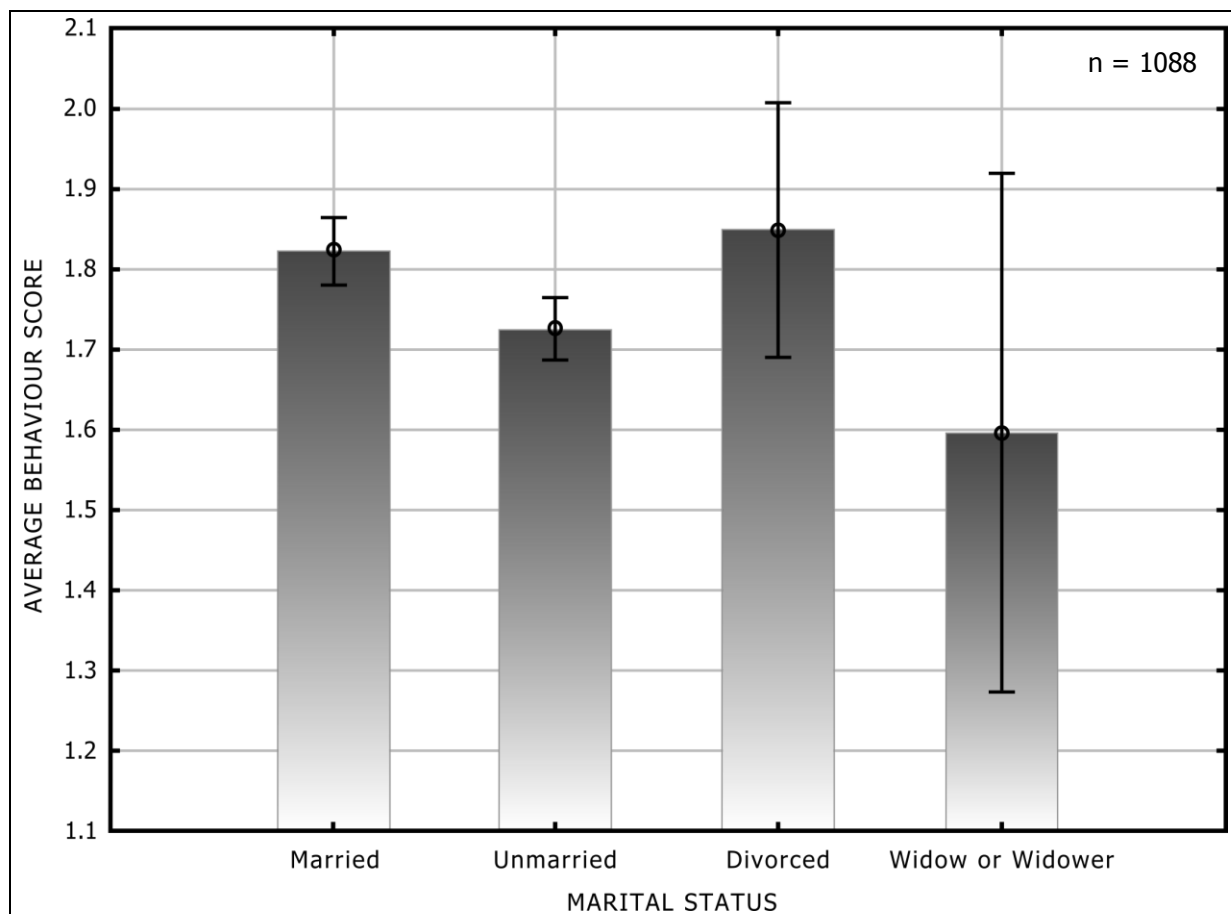
Figure 6.12 Average behaviour score by marital status

respondents dominate the small numbers in the other two groups. The results posted for this component counter those regarding attitude and warrant further investigation.

6.4.1.4   MEB by home language

A number of studies has focused on the effect of language on EL. According to Schultz, Unipan & Gamba (2000) no difference in self-reported behaviour between English- and Spanish speaking Americans exists. Laroche et al. (2002) found that English-speaking Canadians are more likely to recycle than their French-speaking compatriots, while Zecha (2010) found that Asturian Spanish-speakers have better environmental behaviour patterns than their Bavarian German-speaking counterparts. Opinions in extant literature seem divided about relationships between language and EB, making its investigation in a military context a novel pursuit.

Figure 6.13 scales the reported behaviour values of respondents according to their home language. The F-statistic expressing this relationship ($F_{11,\ 1076} = 2.8$, $p < 0.01$) confirms that the hypothesis that behaviour is the same regardless of the language spoken, can be rejected.
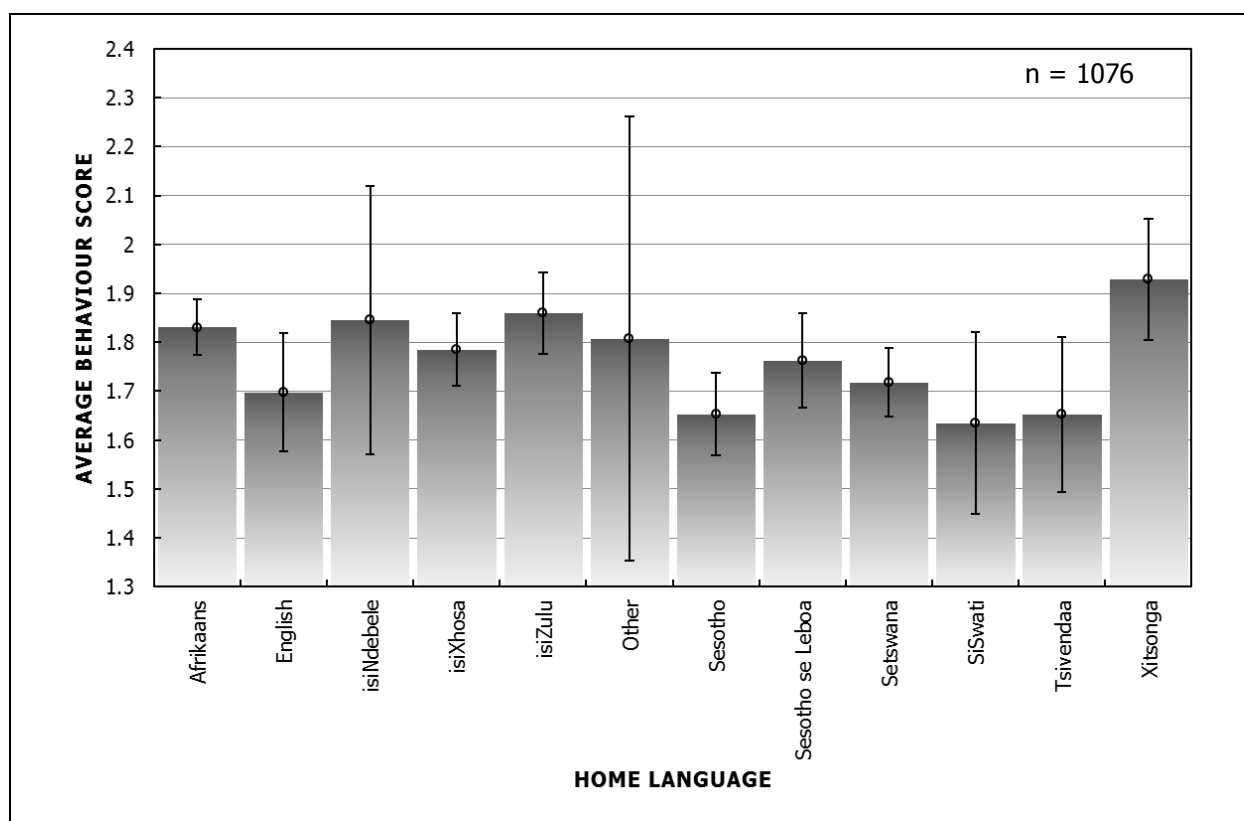
Figure 6.13 Average behaviour score by home language

The post hoc test indicated a mean behaviour value of 1.9 for both Xitsonga and isiZulu speakers, and 1.6 for SiSwati speakers, with the other language groups having in-between positions. It is clear that a statistically significant difference between language groups does exist, with SiSwati speakers recording the most positive results and Xitsonga and isiZulu speakers the least positive results. This outcome accords with the findings by Laroche et al. (2002) and Zecha (2010), but refutes those of Schultz, Unipan & Gamba (2000). As with MEA, it is imperative for the SA Army to ensure that the message of military environmental education is unambiguous, especially in an organisation where the language of instruction and communication is English, and where both the presenters and listeners might have English as a second or third language only. It is also imperative to remember that language is a proxy for culture and ethnicity, something that can further complicate the reception of the environmental message if not correctly packaged.

6.4.2   MEB according to education and training determinants

The environmental literature (Tikka, Kuitunen & Tynys 2000; Kruse & Card 2004; Özden 2008; Xiao, Dunlap & Hong 2013; Conroy & Emerson 2014) generally cites education as an important indicator of EL with increased level of education being directly related to positive environmental behaviour. The education and training profile of respondents in this study comprises general level of education, geography education, and environmental courses completed.

These three measures are employed in the next three subsections as education-based independent explanatory variables to account for variations in environmental behaviour.

6.4.2.1   MEB by level of general education

According to Zilahy & Huisingh (2009), Zsóka et al. (2013) and Vicente-Molina, Fernández-Sáinz & Izagirre-Olaizola (2013) education is an important variable explaining environmentally-conscious behaviour. The higher the education level of respondents, the more pro-environmental were the reported behaviour patterns of the respondents in their studies.

The slight negative correlation evidenced by the Pearson coefficient of -0.06 for behaviour and highest level of education completed indicates a negligible relationship and a significant *p*-value of < 0.05 implies that respondents with higher levels of education reported less positive behaviour patterns. Despite its statistical significance, the correlation is so weak that definitive deductions are highly speculative.

These results correspond with those regarding attitude and the earlier argument that MEB is a specific type of environmental literacy with different relationships with causal variables than those recorded in studies of civilian respondents. It is probable that the military workplace is not conducive to fostering positive patterns of environmental behaviour and also that covariance with independent explanatory variables like rank or age could complicate the results.

6.4.2.2   MEB by level of geography education

Education in specific subjects has been found to contribute positively toward EL through exemplary behaviour (Pe'er, Goldman & Yavetz 2007; Özden 2008; Smit 2009; Karatekin 2013).

Here the level of education in geography as a subject is probed for its explanatory power to account for variation in environmental behaviour. As with highest level of education completed, the Pearson coefficient of -0.02 indicates a slight negative correlation and the *p*-value of 0.53, greater than 0.05, indicates non-significance of the negligible relationship.

This result implies that a higher level of geography education appears to correspond with a slightly less positive behaviour pattern but that the relationship is not significant. Very little variation in geography level exists among the respondents so that the result was expected. As with the MEA there is an incongruity between military and civilian environmental behaviours in relation to geography education.

6.4.2.3   MEB by environmental education and training

A comprehensive, nine-week, military focused environmental course is presented to a small number of SA Army soldiers each year. Kruse & Card (2004) concluded that focused environmental education programmes can positively influence environmental behaviour. Figure 6.14 contrasts the self-reported behaviour of respondents who had completed an environmental course with those who had not. The *F*-test assesses the hypothesis that behaviour is the same, regardless of attendance of environmental courses. The *F*-statistic ($F_{1, 1088} = 2.6$, $p = 0.10$) supports, and the hypothesis can be accepted.
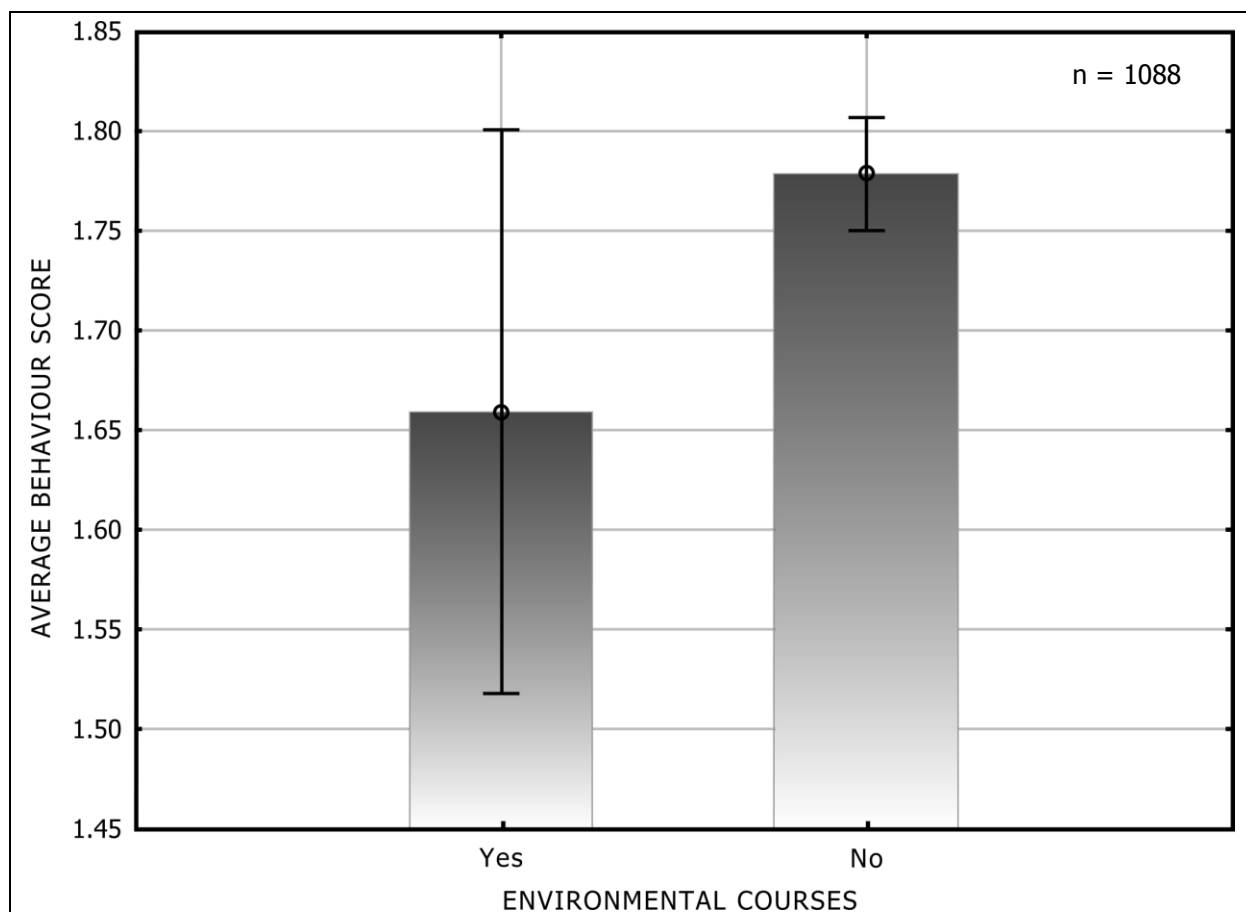
Figure 6.14 Average behaviour score by completion of environmental courses

There is indeed no significant difference between the self-reported behaviour among respondents who completed environmental courses and those who have not. The mean reported behaviour for respondents who completed an environmental course is 1.7, while those who have not completed such a course recorded a mean score of 1.8 on the five-point, Likert scale. The small difference between the two groups is not statistically significant. This result differs from the findings about MEA, namely that the positive attitude gained from military environmental education and training did not translate into positive environmental behaviour. Kollmuss & Agyeman (2002) allege that environmentally conscious environmental attitudes have a limited impact on pro-environmental behaviour. This view is shared by Gifford (2011) who identified 30

psychological barriers to behaviour change and later (Gifford & Nilsson 2014) reported 18 personal and social factors mediating and moderating environmentally conscious environmental behaviour. To complicate matters further, Klineberg, McKeever and Rothenbach (1998) suggested that the use of different components of environmental behaviour to measure EB influence results. To conclude, environmentally conscious behaviour is a complex construct influenced in different ways by an array of context-specific independent variables, making the capture of its educational and other behavioural determinants very difficult.

6.4.3   MEB according to service profile determinants

There is a paucity of literature on the relationship between military service variables like formation membership, military rank, service duration, experience of environmental management and deployment experience, and MEB. In this section these independent variables are investigated to determine whether they do explain variance in MEB among the survey respondents. It is hoped that the findings will lead to a better understanding of the determinants of MEB and the changes needed to military environmental education and training to address shortcomings in the curriculum. The discussion endeavour to give guidance on how environmental education might improve soldiers' environmental behaviour by targeting personnel with particular service characteristics.

6.4.3.1   MEB by formation membership

Army formations exist for the specific contributions they make to the execution of military missions. Formation leadership and conduct are tailored to fulfil that purpose (DOD 2009). ANOVA is used to probe the extent to which variance in environmental behaviour can be explained by respondents' military formation membership. Figure 6.15 records the means of each sampled Army formation on the environmental behaviour scale.

ANOVA results for behaviour by formation ($F_{8, 1081} = 3.5, p = < 0.01$) indicate significantly different behaviour results across formations and that the hypothesis can be rejected. Post hoc testing revealed that Training (mean = 1.6) and Air Defence Artillery (mean 1.7) formations recorded the most environmentally conscious self-reported environmental behaviour. The Infantry and Signal and Support formations (both mean values = 1.8) yielded the least environmentally conscious environmental behaviour. The former two formations also recorded the most positive results for attitude and the latter two the least positive results for attitude. This indicates probable covariance between attitude and behaviour, something that will be further explored later. The same explanation (the military context) furnished for the attitude results will thus also hold true for the behaviour results.
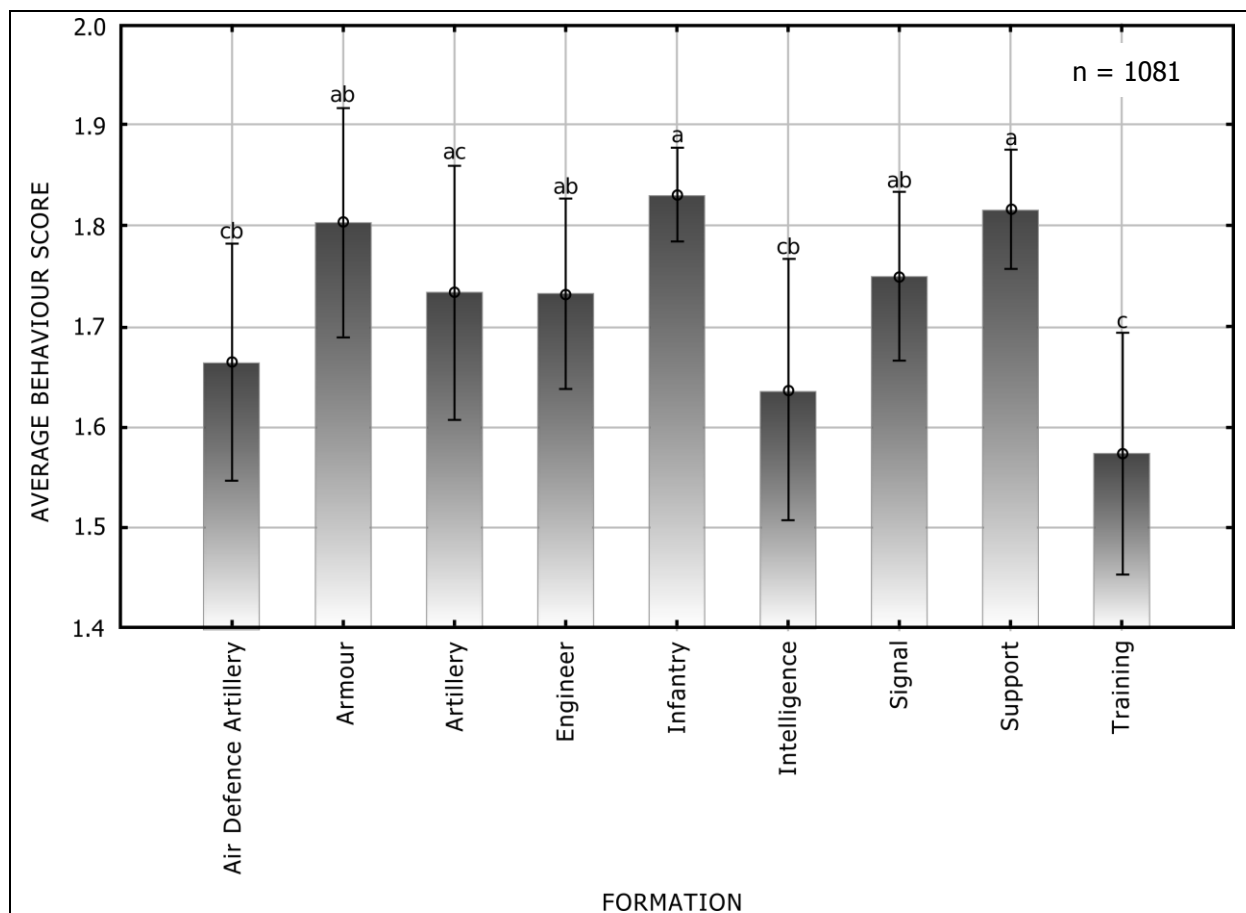
Figure 6.15 Average behaviour score by Army formation

6.4.3.2   MEB by military rank

The rank system in the SA Army reflects the hierarchical structure of all militaries (Esterhuyse 2013) and rank is also a proxy for service duration, age and seniority. The relationship between environmental behaviour and rank is investigated in this subsection. Mean behaviour scores by rank are portrayed in Figure 6.16 and the *F*-test assesses the hypothesis that behaviour is the same, regardless of rank group. The *F*-statistic ($F_{4, 1085} = 0.9$, $p = 0.45$) and a *p*-value above 0.05 allows the hypothesis to be accepted, which means there is indeed no significant difference between the self-reported behaviour among the different ranks. Post hoc testing determined that none of the rank groups vary significantly from one another regarding MEB.

This result is different to those found for attitude, and warrants further analysis. The finding that riflemen's behaviour average was not statistically different from those of other ranks, although together with Senior NCOs they posted the least positive behaviour values, might indicate selective responses by riflemen to make themselves look better, a good example of social desirability bias

(Dobbinson 2014). They could have done this either on purpose because they feared the consequences should the results implicate them or because they genuinely believe that they 'do
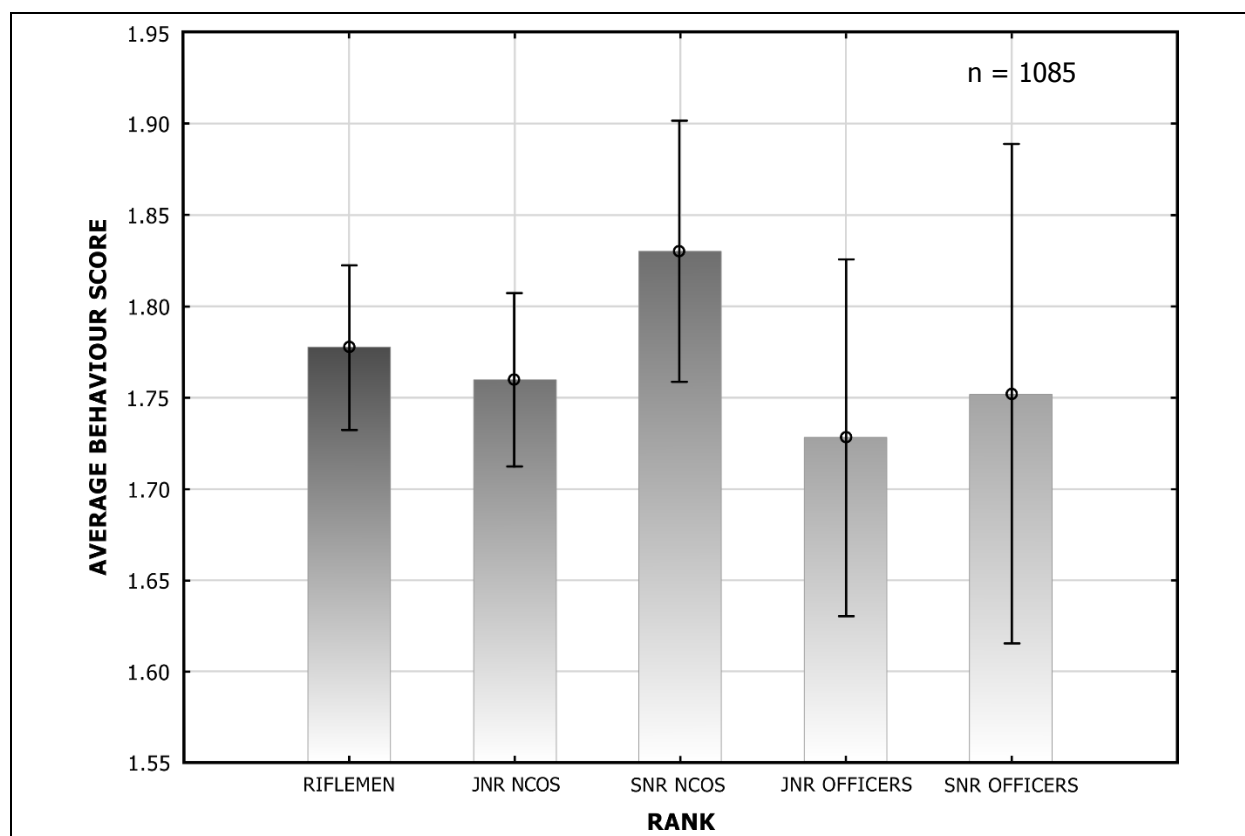
Figure 6.16 Average behaviour score by military rank

the right thing' environmentally speaking. But why would they not have similarly inflated their attitude responses? A plausible reason is that the lower ranks do what they are told, without even knowing or caring why. According to this logic, respondents do not require a positive attitude about the military environment to 'do the right thing'; they only have to behave under command. This explanation stems from teaching experience at the SAMA where enrolled students attributed their own reported environmental behaviour to being told to do so (Flügel 2014, Pers com). This observation was corroborated by a senior military environmental practitioner (Laubscher 2014, Pers com).

6.4.3.3   MEB by service duration

Respondents' duration (in completed years) of service in the DOD is an important indicator of the amount of time the respondent has been exposed to MEB building through education and training. An effective military education and training programme is expected to cultivate better behaviour scores among respondents with longer service duration. This subsection looks at the extent that environmental behaviour can be explained by the duration of respondents' military service. The Pearson correlation coefficient for service duration and behaviour (r = 0.08), is a

positive but slight correlation and a negligible relationship, but the low p-value indicates statistical significance.

The slight correlation implies that time spent in DOD employment cultivates a more positive behaviour pattern, but because it is so inconsequential it has little practical importance. Clearly, time in DOD employment does not contribute the expected positive influence on environmental behaviour (or attitude) – an observation that should be of concern to the SA Army.

6.4.3.4   MEB by experience of environmental management

Kruse & Card (2004) has reported more positive attitudes and more pro-environmental behaviour with an increase in experience of environmental management. The information captured in the present study on environmental position held or environmental responsibility during DOD employment made it possible to statistically establish whether these variables influence environmental behaviour. In Figure 6.17 the average behaviour scores of respondents with some
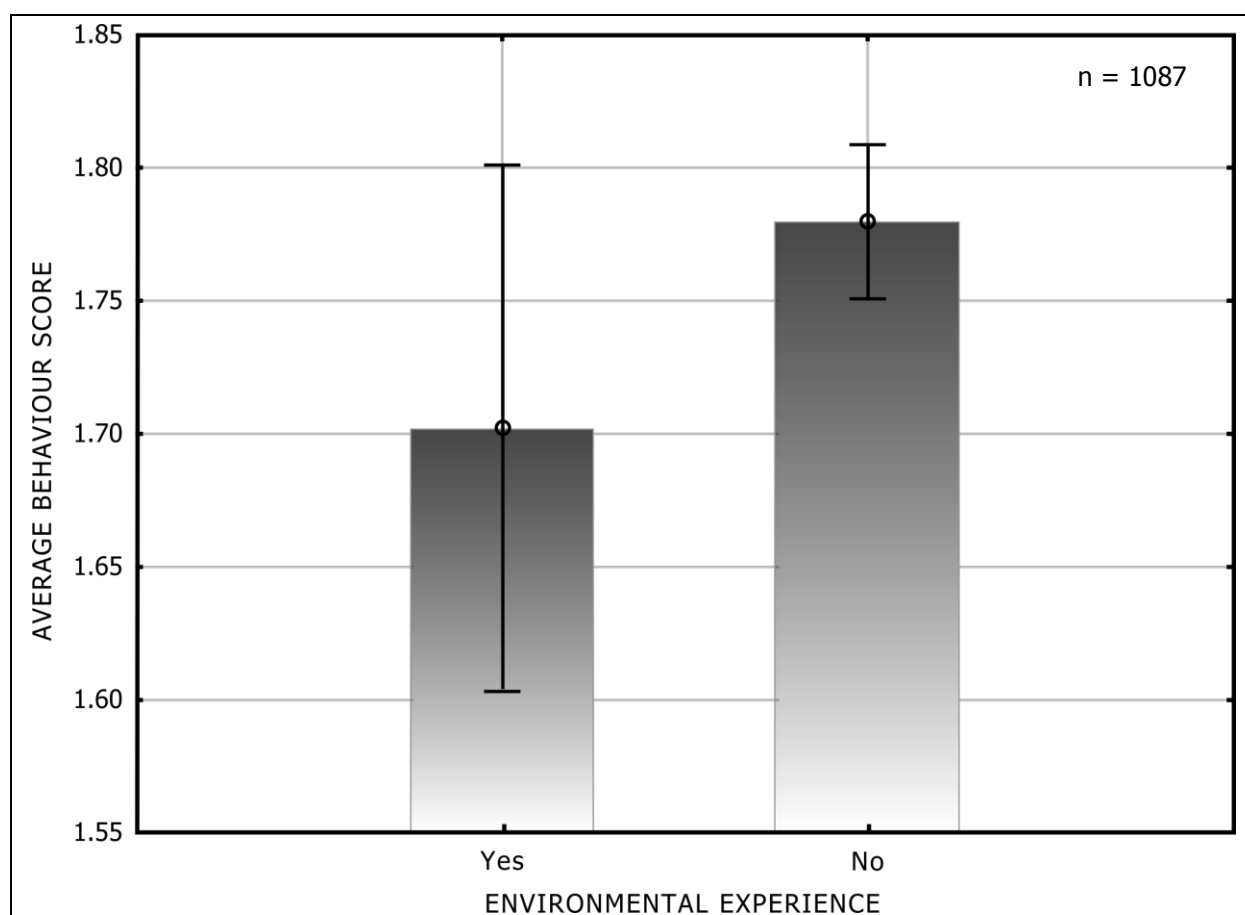
Figure 6.17 Average behaviour score by experience of environmental management

kind of environmental responsibility are plotted against those without. The F-test ($F_{1, 1087} = 2.2$, $p = 0.14$) with p-value above 0.01 confirms that the hypothesis that their behaviour is similar must

be accepted. There is indeed no statistically significant difference between respondents with environmental responsibility (mean attitude 1.7) and those without (mean attitude 1.8).

This result differs from that found between attitude and experience of environmental management, namely that respondents with environmental responsibility have a more positive attitude toward the environment than those without. Apparently, the positive attitude did not translate into positive behaviour in the environment in which the military operates.

6.4.3.5   MEB by deployment experience

Ideally, internationally deployed soldiers should display better environmental behaviour than those lacking the experience, as they 'export' their environmental behaviour to the countries they deploy to, potentially endangering not only the mission success, but also themselves (Moser et al. 2008; Bonds 2015). This subsection enquires whether environmental behaviour can be explained by exposure to foreign military service deployment.

Figure 6.18 plots the average behaviour scores of respondents with experience of deployment outside South Africa ('Yes') against those with no deployment experience ('No'). The F-test ($F_{1, 1068} = 3.8$, $p = 0.05$) poses a problem with the p-value at exactly 0.05 – the usual cut-off value for accepting or rejecting the hypothesis. McKillup (2012) advocates strict adherence to the
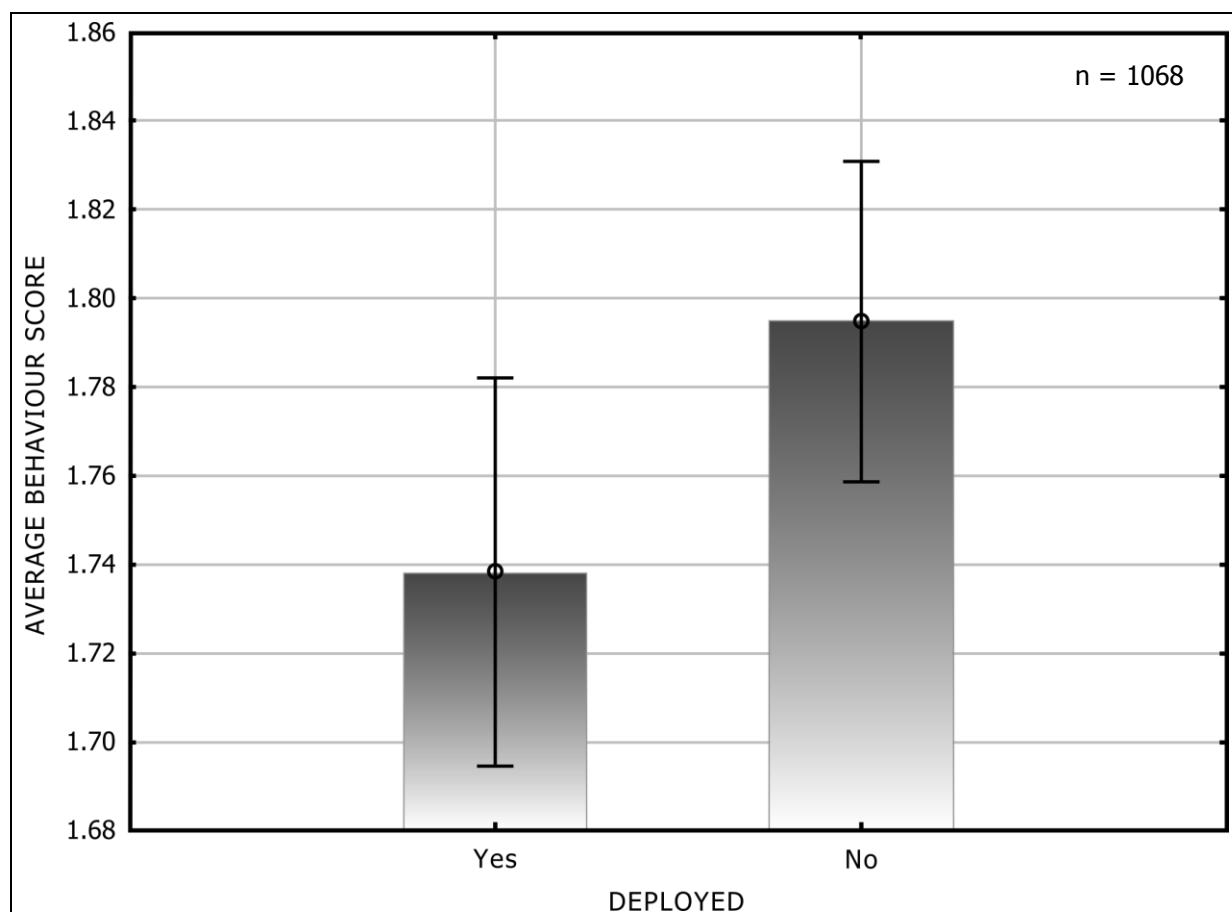
Figure 6.18 Average behaviour score by deployment experience

cut-off value, but admits that statisticians sometimes use the 'smaller-than-or-equal-to' rule. Expert statistical advice (Kidd 2014, Pers com) ruled against application of the strict rule, so allowing the hypothesis that the behaviour is the same to be rejected.

The mean reported behaviour for respondents who have deployment experience is a favourable 1.7, while those without scored 1.8 on the five-point, Likert scale. This slightly positive outcome differs from the attitude findings where no difference was found. It might be that, although the respondents who deployed did not have a better attitude toward the environment, they nevertheless behaved in a more environmentally responsible way. The reason for the reported positive behaviour may be found in the command-and-control nature of the Army where soldiers do as they are told, without necessarily knowing why it has to be done or even them wanting to do it. De Groot & Steg (2009) and Matthies, Selge & Klöckner (2012) call this kind of behaviour 'subjective norm' behaviour where the expectation that significant other's expectation of a certain behaviour leads to the expected behaviour. In the case of deployed soldiers they would have been briefed on expected environmental-friendly behaviour, and when surveyed they reported such expected behaviour.

Determinants of MEB was investigated and discussed in the previous section. Attention now shifts to military environmental knowledge, the third component of MEL.

6.5   MILITARY ENVIRONMENTAL KNOWLEDGE (MEK) IN THE SA ARMY

The knowledge component of EL reflects the cognitive strand of EL (Pe'er, Goldman & Yavetz 2007). In the context of MEL, MEK refers to the ability to correctly identify environmental and management concepts and expected behaviour related to the military environment. Researchers employ two approaches to investigate environmental knowledge, namely subjective and objective knowledge (Berber et.al. 2009). Subjective knowledge is a respondent's own estimation of knowledge about an issue – also known as perceived knowledge. Objective or actual knowledge relates to real, measurable knowledge about an 'issue' (Dodd et al. 2005). Regarding environmental knowledge, an 'issue' is some kind of environmental matter. The present survey tested objective knowledge levels to ascertain what respondents really know as opposed to what they think they know.

Studies of objective environmental knowledge performance conducted among various groups of adults in different countries have produced knowledge scores as low as 36% and as high as 83% (see Table 6.1). Generally the higher knowledge scores are attained in developed countries,

but there are exceptions. Educated target populations scored highest with an average of 60.2% for all the studies plotted in Table 6.1. It appears that Malaysia is the most environmentally

Table 6.1 Average environmental knowledge scores from international studies

KNOWLEDGE SCORE	GROUP	COUNTRY	SOURCE
55%	Schoolchildren (aged 17-19)	Chile	Survey in four countries (De Chano 2005)
63%		USA	
69%		England	
71%		Switzerland	
36%	Students	Mexico	Pe'er, Goldman & Yavetz (2007)
39%		Israel	Al-Dajeh (2012)
41%		USA	Survey in three countries (Vicente-Molina et al. 2013)
42%		Spain	
51%		Brazil	
54%		Turkey	Tikka, Kuitunen & Tynys (2000)
56%		Jordan	Karatekin (2013)
60%		Finland	Ivy et al. (1998)
71%		Malaysia	Survey in two countries (Esa 2010)
72%		USA	
74%		USA	Levine & Strube (2012)
76 %		Singapore	Kaplowitz & Levine (2005)
58%	Adults	USA	Karatekin (2013)
58%		Ohio, USA	Morrone, Mancl & Carr (2001)
74%		Malaysia	Haron, Paim & Yahaya (2005)
83%	Teachers	Malaysia	Said et al. (2003)
Mean: 60.2%			

knowledgeable nation. The knowledge scores of the MEL study will be interpreted in the light of these results.

Interpreting these results, researchers use different scoring matrices to qualitatively indicate what constitutes good, average or bad[25] environmental knowledge scores. Ehrampoush & Moghadam (2005) consider scores ≤50% as bad, 50-84% as moderate and >85% as good. Kaplowitz & Levine (2005) employ the American National Environmental Education & Training Foundation (NEETF) score norm of ≥70% as 'adequate' environmental knowledge and all else as 'inadequate' (Coyle 2005). To Karatekin (2013) ≤40% is bad, 41-70% is medium and ≥70% is good environmental knowledge. Rating the applicability of these knowledge scales is not easy but it is noteworthy that Coyle (2005: 2) described the NEETF questionnaire as testing only "basic environmental knowledge." This may explain NEETF's high 70% cut-off for adequate environmental knowledge, with respondents failing the test if they score below this cut-off level.

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[25] These scholars quantify categories and ranges of scores into discrete normative categories of good, average and bad.

If the NEETF grading system is applied for all the studies reported in Table 6.1, only four university results, one group of schoolchildren and one group of adult respondents passed the knowledge test.

Given this terminological confusion a study-specific scale was developed to accommodate the advanced environmental concepts involved in the MEL study. A measure that combines the rating scales of Ehrampoush & Moghadam (2005) and Karatekin (2013) was developed with scores of ≤40% interpreted as 'below standard', 41-60% as 'adequate', 61-79% as 'good' and ≥80% as 'excellent' MEK.

In the MEL survey's Knowledge scale 14 multiple-choice items assessed the MEK of respondents. Combined or average results for the knowledge scale representing the objective MEK of respondents (Haron, Paim & Yahaya 2005; Esa 2010; Karatekin 2013; Vicente-Molina, Fernández-Sáinz & Izagirre-Olaizola 2013) and graphically displayed in histograms (McKillup 2012) form the cornerstone for analytical discussions in this section.

The combined average knowledge scores of respondents portrayed in Figure 6.19 indicate good to excellent environmental knowledge among most of the respondents. The frequency
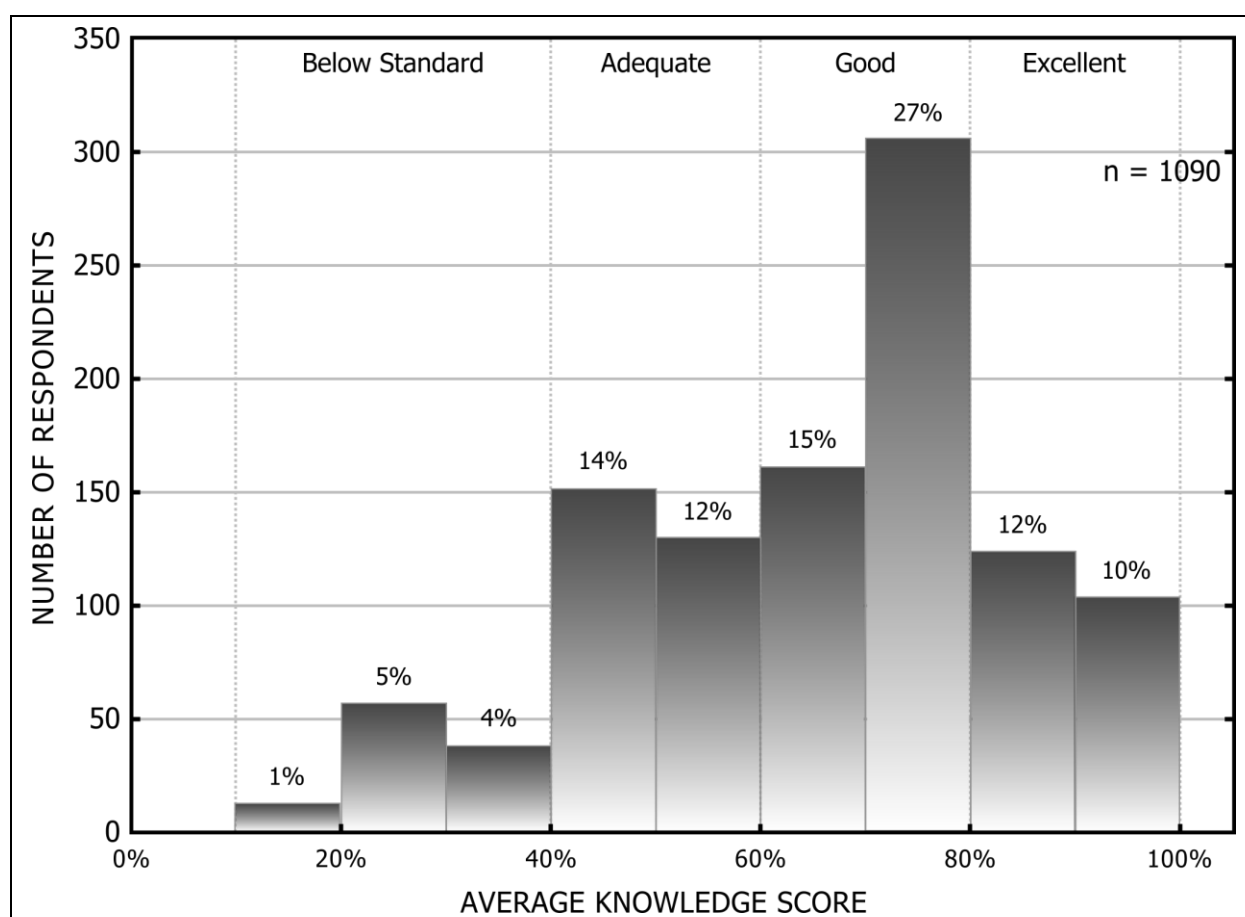
Figure 6.19 Average score for all environmental knowledge items combined

distribution were positively skewed, with the mean and median scores at 65%, and the range between 20% and 100%. A definitive peak is evident between 70% and 80%. If these scores are compared with those listed in Table 6.1, it is evident that the mean score is higher than the mean for all the studies, indicating relatively high military environmental knowledge among the respondents.

According to the rating scale employed for the MEL survey respondents achieved good scores for their knowledge about the environment in which the military operates. This accords with the high scores attained on attitude and self-reported behaviour which suggests the possibility of covariance between the three scales as composite variables − an avenue of investigation pursued later.

6.6   DETERMINANTS OF MEK IN THE SA ARMY

In this section the biographical and service history information of the respondents is employed as independent explanatory variables to account for variances in average MEK.

6.6.1   MEK according to socio-demographic determinants

No consensus exists among scholars about the relationship between environmental knowledge and the demographic variables age, gender, marital status and home language. Home language again serves as a proxy for ethnicity, cultural affiliation, value system and geographical origin of the population groups.

6.6.1.1   MEK by age

Conflicting evidence exists in the literature regarding age as a demographic explanatory variable. Rousseau & Venter (2001) and Levine & Strube (2012) recorded improved results with an increase of age in respondents, while Alp, Ertepinar & Tekkaya (2006), Dijkstra & Goedhart (2012) and Conroy & Emerson (2014) reported improved results with a decrease in age. Haron, Paim & Yahaya (2005) and Al-Dajeh (2012) found no correlation between age and environmental knowledge, while Robelia & Murphy (2012) indicated that middle-aged people recorded the most positive results for environmental knowledge.

In this study the Pearson correlation coefficient (r = -0.05) between age and knowledge was found to be slight and the relationship negligible. The *p*-value of 0.14, greater than 0.05, confirms the correlation as being not significant. The negative correlation implies that older respondents recorded lower knowledge scores, but this relationship is not significant.

6.6.1.2   MEK by gender

Gender is routinely included as an independent variable in EL studies (Meinhold & Malkus 2005; Chu et al. 2007; Alp et al. 2008; Shields & Zeng 2012; Stevenson et al. 2013). A number of studies (Tikka, Kuitunen & Tynys 2000; Meinhold & Malkus 2005; Robelia & Murphy 2012; Stevenson et al. 2013) concur that males outperform females regarding environmental knowledge. Other studies concluded that gender had no significant influence on the environmental knowledge of respondents (Haron, Paim & Yahaya 2005; Alp et al. 2006; Al-Dajeh 2012; Zecha 2012), whereas (Chu et al. 2007; Alp et al. 2008) found that females outperformed males.

In the MEL survey respondents were sampled to represent the gender split in units. The plot in Figure 6.20 contrasts the average knowledge score of males with that of females. The F-test assesses the hypothesis that knowledge scores are similar, regardless of gender. Here ($F_{1,\,1088}$ = 4.64, p = 0.03) the hypothesis that there is no difference between the sexes is rejected. With males recording a mean rounded knowledge score of 66% with narrower variance and females a mean of 63% with wider variance, the overall result is that the environmental knowledge of males and females does differ significantly.
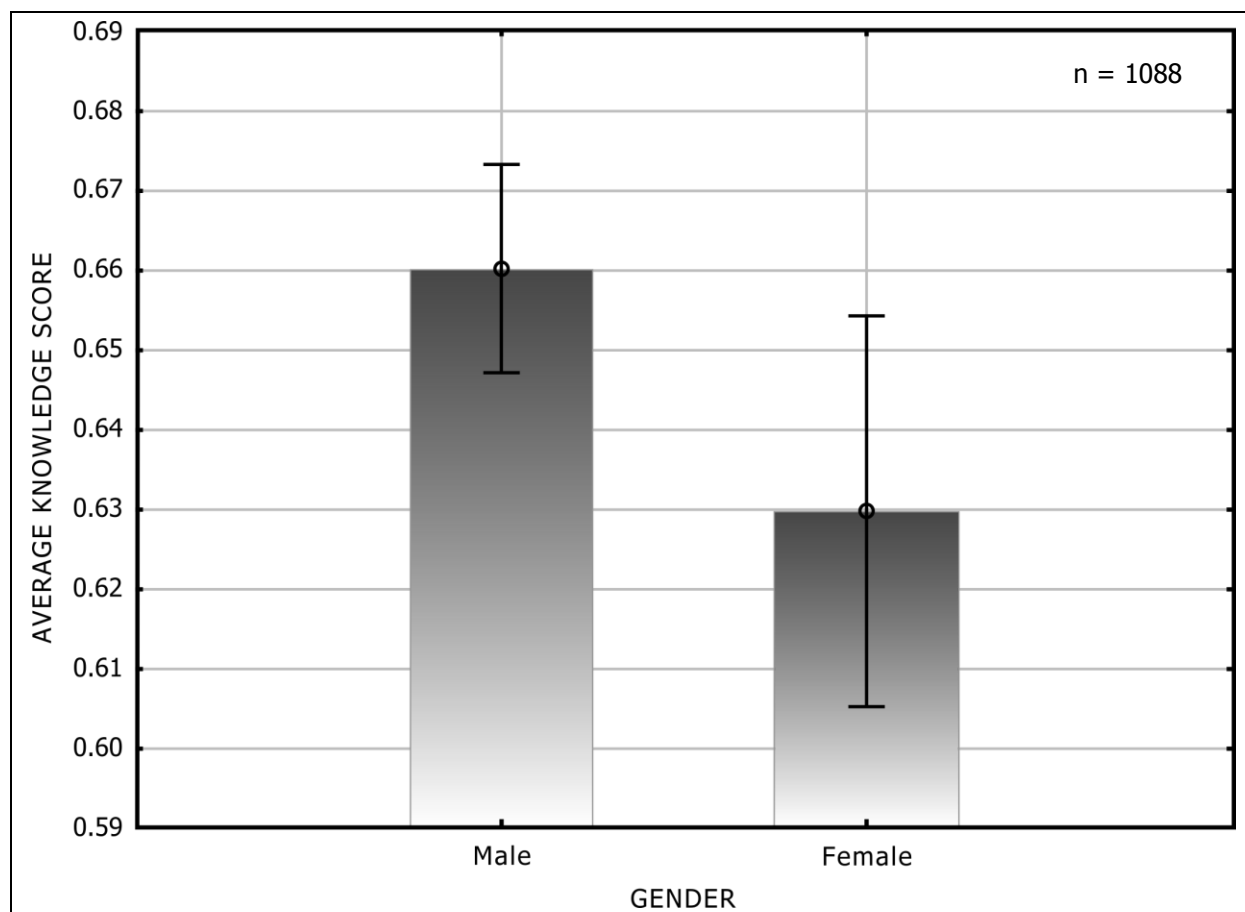
Figure 6.20 Average environmental knowledge score by gender

This finding concurs with those of Tikka, Kuitunen & Tynys (2000), Meinhold & Malkus (2005), Robelia & Murphy (2012), and Stevenson et al. (2013), who all reported that males outperformed females in their level of environmental knowledge. In a male-dominated organisation such as the SA Army, this finding should cause concern as well as a re-evaluation of the way in which the military environmental message is delivered. This is especially relevant since some research reported conflicting results with no difference in environmental knowledge found between the sexes, or where women outperformed men.

6.6.1.3   MEK by marital status

Haron, Paim & Yahaya (2005) and Schumacher (2014) concluded that marital status does not influence EK although Conroy & Emerson (2014) disagreed by reporting lower EK levels among married respondents. Figure 6.21 contrasts the average knowledge scores of respondents
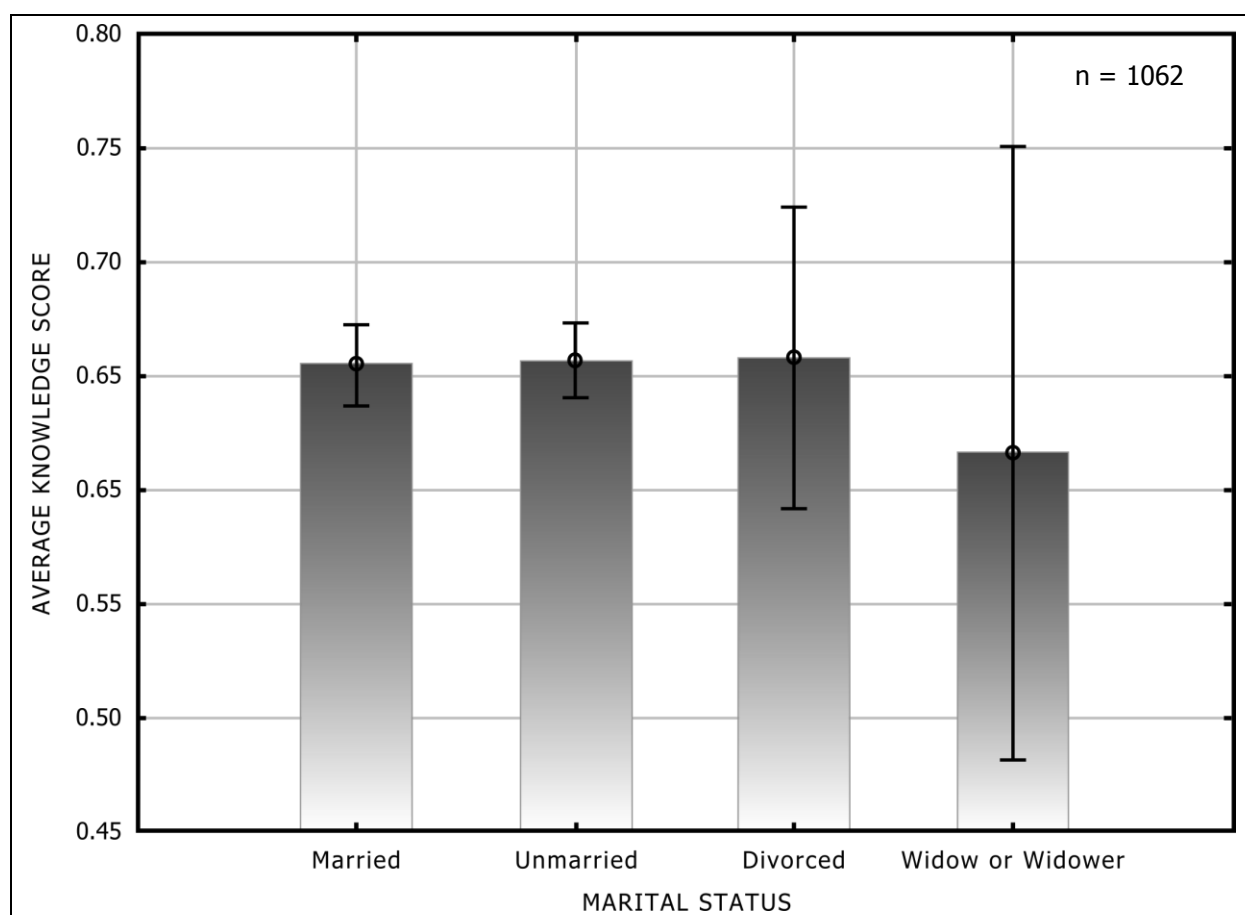
Figure 6.21 Average environmental knowledge score by marital status

according to their marital status. The F-test ($F_{3, 1062} = 0.1$, $p = 0.95$, and the p-value thus larger than 0.05) confirms the hypothesis that knowledge is the same, regardless of marital status. It once again seems as if the nature of the survey – targeting EL in a workplace context – negates the

traditional family roles that may have an influence on determinants such as marital status and gender.

6.6.1.4   MEK by home language

A number of studies emphasise the importance of language usage in the South African military (De Klerk & Barkhuizen 1998; Van Zyl 2007; Heinecken 2009), indicating that the use of English as only means of communication and instruction can lead to misinterpretation of intended messages and feelings of alienation amongst soldiers. General EL literature reported that language influence environmental concern, with Laroche et al. (2002) reporting that French Canadians scored higher on environmental knowledge than English-speaking Canadians, while Zecha (2010) contend that Asturian Spanish speaking respondents have better environmental knowledge than Bavarian German speakers.

Respondents were requested to name their home language, i.e. the language spoken at home from birth and the 11 official languages of South Africa being offered as options. Figure 6.22 scales knowledge values according to home language. The F-statistic expressing this relationship ($F_{11, 1076} = 2.8$, $p < 0.01$) confirms that the hypothesis that knowledge is the same, regardless of the language spoken, can be rejected.
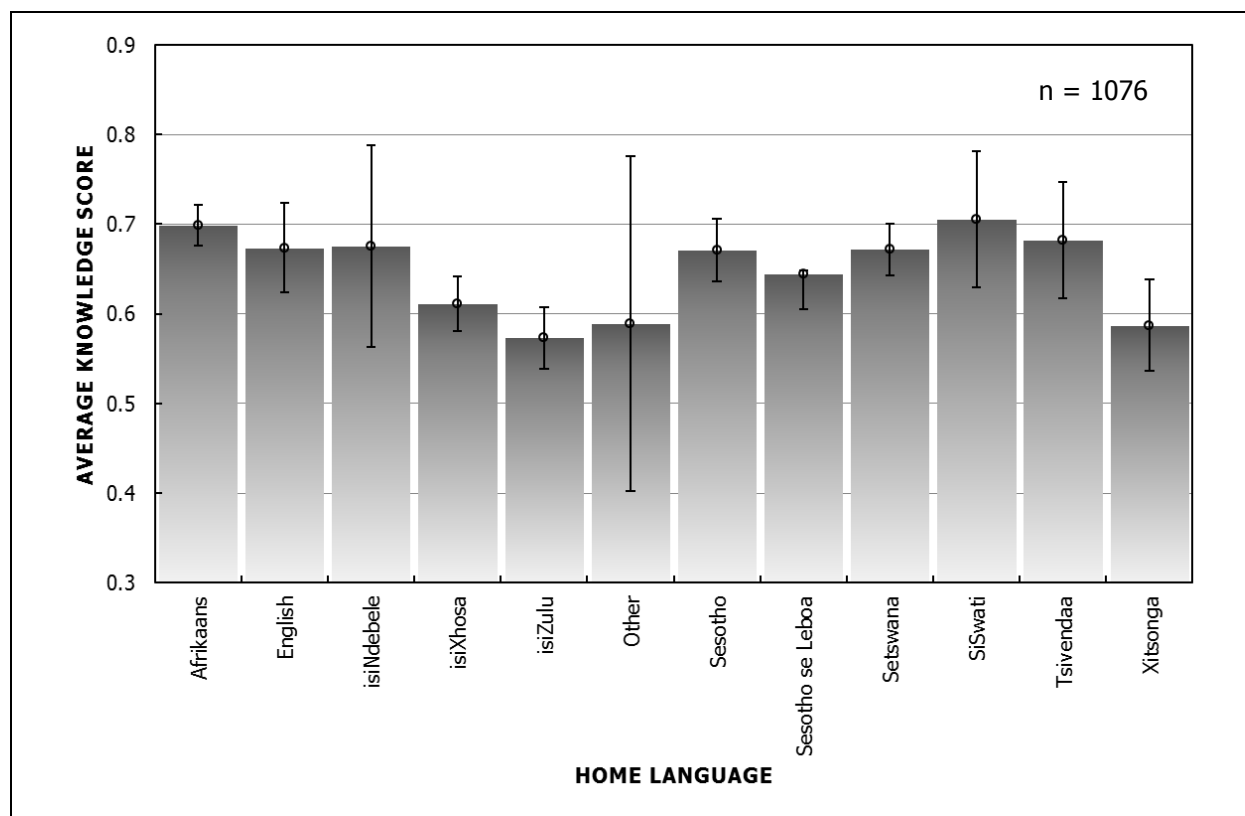
Figure 6.22 Average environmental knowledge score by home language

The post hoc test indicated a mean knowledge value below 60% for the isiZulu and Xitsonga groups, and above 70% for the SiSwati and the Afrikaans speakers. The latter group also posted a very narrow value range around its average, denoting consistency in the group. The high knowledge scores of the Afrikaans group are due to the generally higher education status of its constituent White and Coloured population components (Heinecken 2009). The implications for SA Army environmental education and training are similar to those reported for attitude and behaviour.

6.6.2   MEK according to education and training determinants

The environmental literature generally affirms education as an important indicator of general EL with an increase in the level of education indicative of improved environmental knowledge (Tikka, Kuitunen & Tynys 2000; Kollmuss & Agyeman 2002; Alp, et al. 2006; Özden 2008; Xiao, Dunlap & Hong 2013; Conroy & Emerson 2014). The education and training profile of respondents in this survey comprises general, geography subject and environmental education. These three measures are employed in the next three subsections as education-based independent explanatory variables to account for variance in environmental knowledge.

6.6.2.1   MEK by general education level

General education levels are often cited as indicators of EL (Kaplowitz & Levine 2005; Pe'er, Goldman & Yavetz 2007; Erdogan 2011; Robelia & Murphy 2012). This subsection reports on the extent to which the variations in level of education are related to variance in environmental knowledge. The Pearson correlation coefficient (r = 0.10) and a *p*-value below 0.01, attest to a small positive, yet significant correlation between highest level of education completed and environmental knowledge. The relationship is nevertheless negligible. This result implies, as expected, that higher educated soldiers tend to display higher levels of knowledge about the environment. This finding is supported in the literature where it is noted that a statistically significant positive relationship exists between level of education and EK (Haron, Paim & Yahaya 2005; Robelia & Murphy 2012).

6.6.2.2   MEK by level of geography education

As with general level of education, education in specific subjects has been found to contribute to EL (Pe'er, Goldman & Yavetz 2007; Smit 2009; Karatekin 2013). Lang (2011) offers the compelling perspective that students consciously choose subjects according to their level of environmental concern, rather than only being influenced by the content of the subjects. The respondents' level of education in geography as a subject is examined as a determinant of their

environmental knowledge. As with the respondents' highest level of education completed, the Pearson coefficient of 0.08 indicates a slight correlation and a negligible relationship. The *p*-value below 0.01, indicates a significant correlation. This implies that respondents with higher levels of geography education scored very slightly better in the knowledge section of the questionnaire than the others. This finding supports research results from various studies that reported that geography education normally influences environmental knowledge positively. (Pe'er, Goldman & Yavetz 2007; Smit 2009; Karatekin 2013).

6.6.2.3   MEK by environmental education and training

The annual military environmental course presented to a small group of soldiers targets military integrated environmental management and provides contextualised military environmental education and training (Laubscher 2009a, Pers com). The assumption tested in this subsection is that having completed such courses the soldiers' environmental knowledge is improved. This would be consistent with a study by Culen and Mony (2003), that found that youths exposed to environmental education activities scored higher on environmental knowledge scales.

Figure 6.23 contrasts the knowledge of respondents who completed an environmental course with those who did not. The *F*-test assesses the hypothesis that their knowledge is similar,
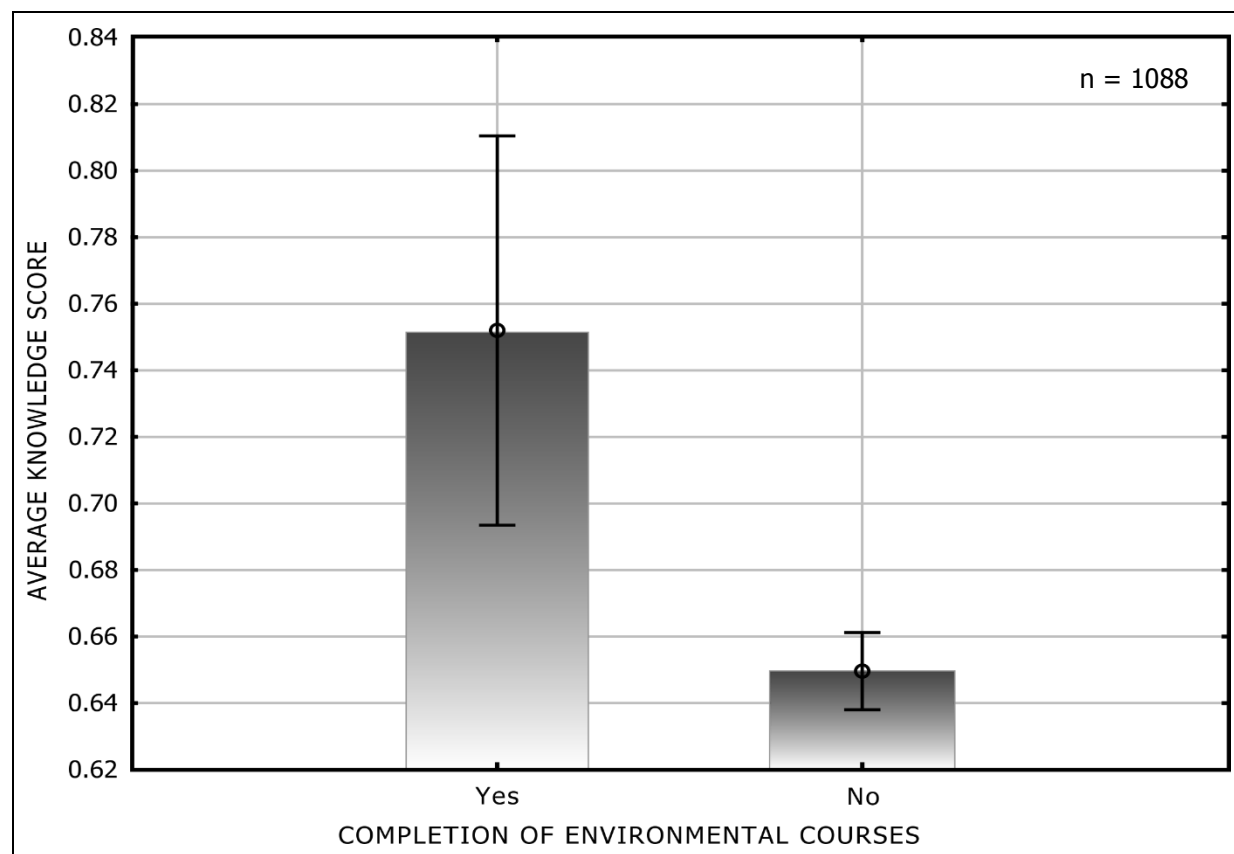
Figure 6.23 Average environmental knowledge score by completion of environmental courses

regardless of whether respondents completed environmental courses or not. The *F*-statistic ($F_{1,1088} = 11.3$, $p < 0.01$) shows that this is not the case and that the hypothesis can be rejected. A mean knowledge score of 75% for respondents who completed an environmental course and a mean score of 65% for those who did not underscores the statistically significant difference. Because of the highly specific military content of the military environmental course, it did improve the MEK of respondents to a greater extent than generic education does. This is a significant result since it indicates a possible avenue for improving the MEK of SA Army soldiers.

6.6.3 MEK according to service profile determinants

Consensus is lacking among scholars about the effect military service variables such as formation membership, military rank group, service duration, experience of environmental management and deployment experience have on MEK. These independent explanatory variables are probed in this section to identify which help to explain variance in MEK among the respondents. This should give a better understanding of the determinants of MEK and the changes that need to be made to military environmental education and training curricula to address shortcomings when dealing with soldiers with specific characteristics.

6.6.3.1   MEK by formation membership

The nine formations of the SA Army exists to make a specific contribution to the execution of military missions, so requiring each formation to have specialist knowledge and abilities, obtained through exclusive leadership, size, military subculture and mode of operation (DOD 2009). In this subsection the use of ANOVA to explain the extent to which environmental knowledge is determined by respondents' military formations is investigated.

Figure 6.24 records the mean values of each formation on the knowledge scale. Application of ANOVA to knowledge and formation resulted in $F_{8,1081} = 7.00$, $p = 0.00$ and a *p*-value <0.01 which indicate significantly different knowledge results across formations and rejection of the hypothesis.

Post hoc testing showed that respondents in the Air Defence Artillery formation scored highest (77%). According to the grading scales advocated by Kaplowitz & Levine (2005) and Karatekin (2013), as well as in the scale developed for the MEL survey, this score constitutes 'good' environmental knowledge. Infantry respondents recorded the lowest knowledge level at 62%. Respondents from Training posted the second highest results, with a mean percentage of 74%, not significantly higher than the group of mid-level formations. This pattern of results for formations closely matches those for environmental attitude and behaviour. Although the Infantry
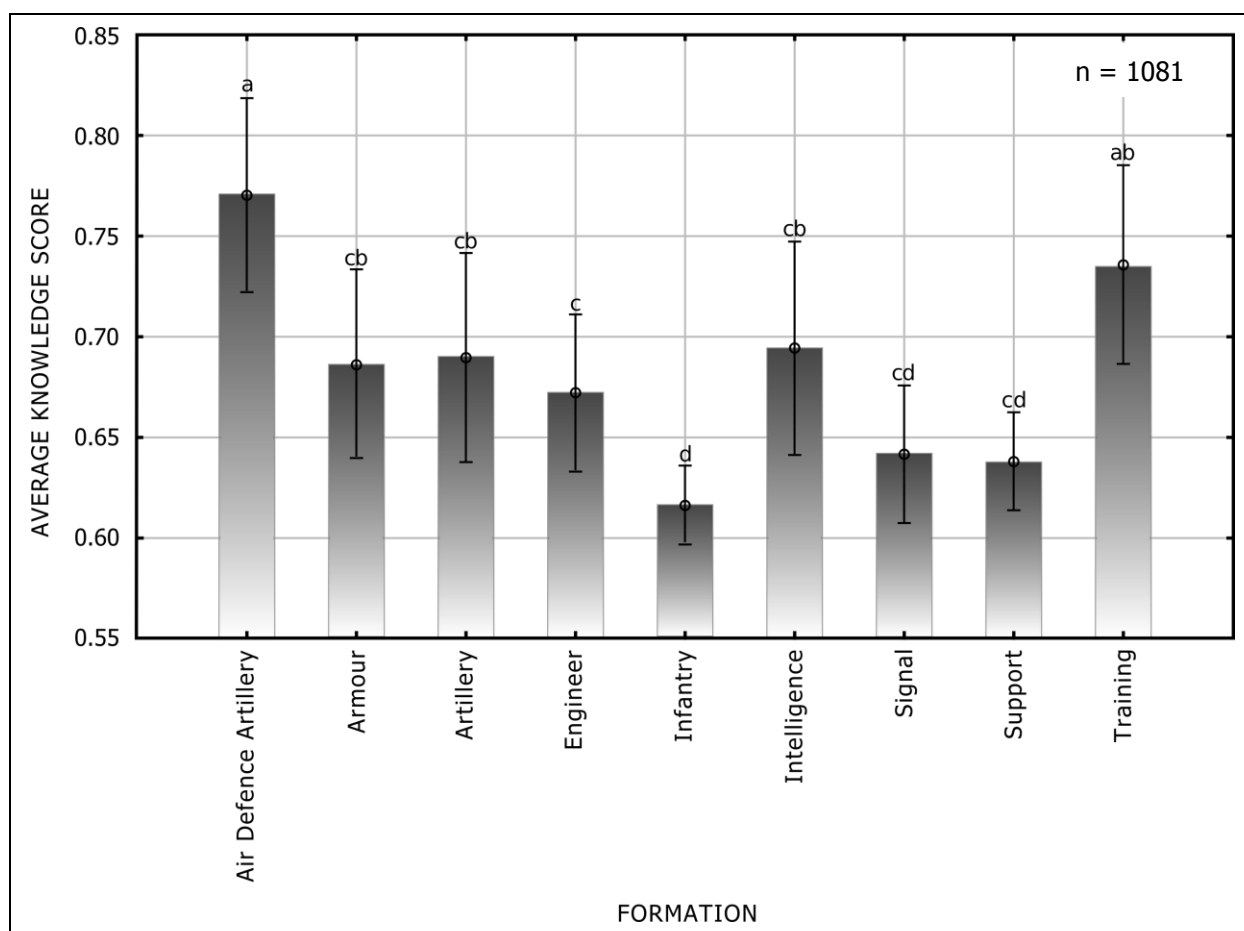
Figure 6.24 Average environmental knowledge score by Army formation

formation achieved the lowest score, it still falls well within the same 'good' category as the formations recording the highest scores. This result accords well with the general USA (Karatekin 2013) and Ohio residents (Morrone, Mancl & Carr 2001) at 58%.

6.6.3.2 MEK by military rank

This subsection reports whether the ranks of rifleman, junior NCO, senior NCO, junior and senior officers determine the degree of environmental knowledge soldiers have. Elsewhere an increase in environmental knowledge as seniority increases in an organisation has been reported by Kaplowitz & Levine (2005), Negev et al. (2008) and Levine & Strube (2012). However, Alp, Ertepinar & Tekkaya (2006) and Dijkstra & Goedhart (2012) found no difference in results for junior and senior respondents. This impression gained from available literature is thus inconclusive.

Knowledge scores by rank are portrayed in Figure 6.25 and the F-test assessed the hypothesis that knowledge is the same, regardless of rank group. The F-statistic ($F_{4, 1085} = 9.0$, p < 0.01) and a p-value below 0.01 mean that the hypothesis should be rejected. Post hoc testing
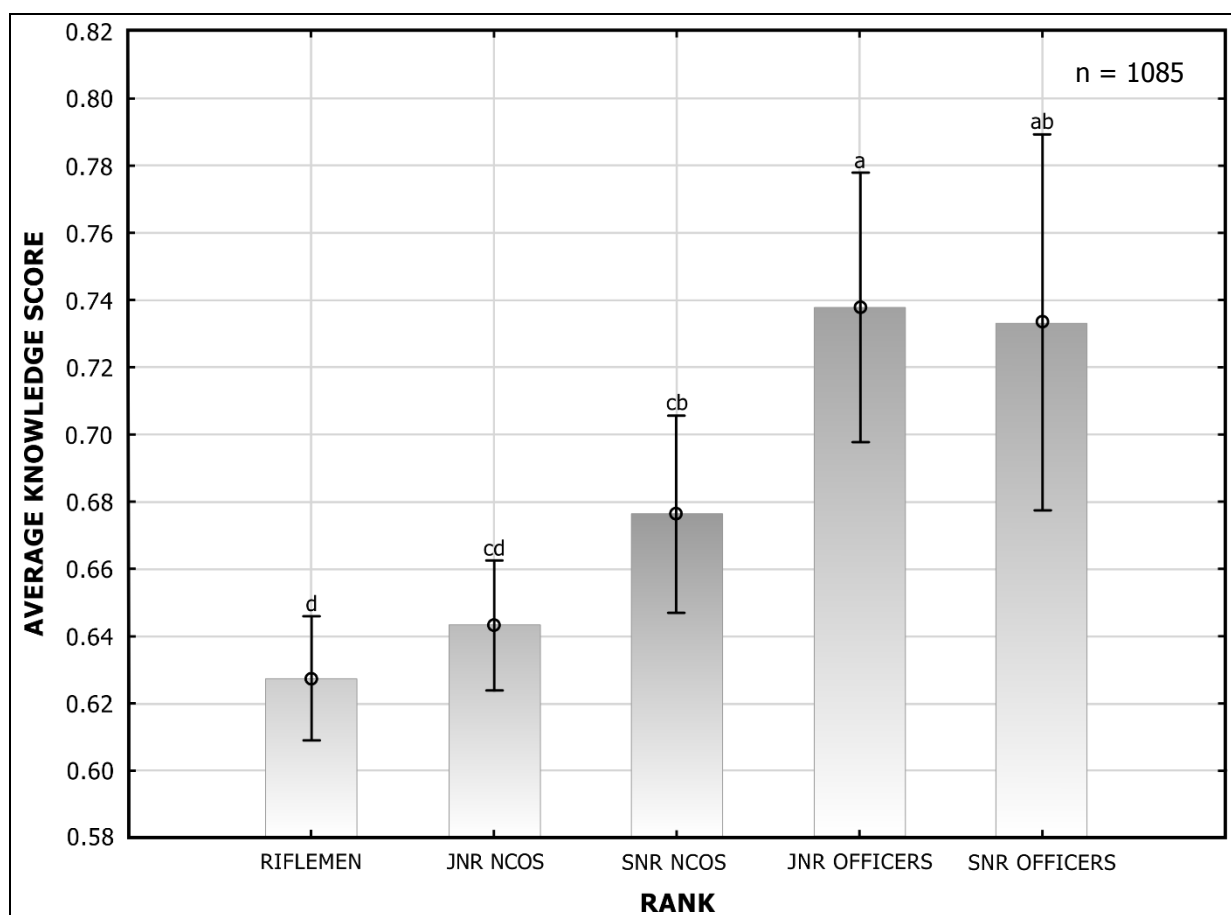
Figure 6.25 Average environmental knowledge score by military rank

generated the following significant results: The riflemen (mean = 63%) scored the lowest and differed significantly from the remaining rank groups. Small differences between the other ranks are not statistically significant − a logical, yet very important result. Junior (mean = 74%) and senior (mean = 73%) officers, were most knowledgeable and did not differ significantly from each other. It is also notable that the higher the knowledge score, the larger the scores' range per group.

The EK scores are similar to those for attitude, with riflemen scoring significantly lower than the other ranks, with junior NCO's performing only slightly better than the riflemen. Because the junior ranks can be used as a proxy for time in service of the DOD, age and seniority, these results reflect the short time most of these soldiers had been exposed to military environmental education and training. This confirms the positive impact of military environmental education and training on the levels of MEK of soldiers.

6.6.3.3   MEK by service duration

Respondents' duration (in completed years) of service in the DOD should be a reliable indicator of the amount of time a respondent has been exposed to MEK building through education and training. An effective military education and training programme is expected to cultivate

improved knowledge scores among respondents with longer service duration. Alp, Ertepinar & Tekkaya (2006) and Dijkstra & Goedhart (2012) found no seniority level differences in environmental knowledge, but Kaplowitz & Levine (2005), Negev et al. (2008) and Levine & Strube (2012) recorded increased levels of EK among more senior respondents. This subsection looks at the relationship between EK and duration of respondents' military service.

The Pearson correlation coefficient (r = -0.03) between service duration and knowledge is slight and negative and the p-value indicates no statistically significant correlation. This implies that the relationship is negligible. This result means that time in DOD employment does surprisingly not contribute to or seriously detract from the knowledge of respondents and that prolonged exposure to military environmental education and training alone did not improve the MEK of soldiers. It does confirm findings elsewhere of no differences between senior and junior respondents, but contradicts others where increased EK was recorded by senior respondents. It also counters findings regarding rank where improved MEK was recorded among senior ranks. One can conclude that better opportunities associated with senior ranks, rather than time in employment, may be responsible for improved MEK.

6.6.3.4   MEK by experience of environmental management

In Figure 6.26 the knowledge scores of respondents with some kind of environmental
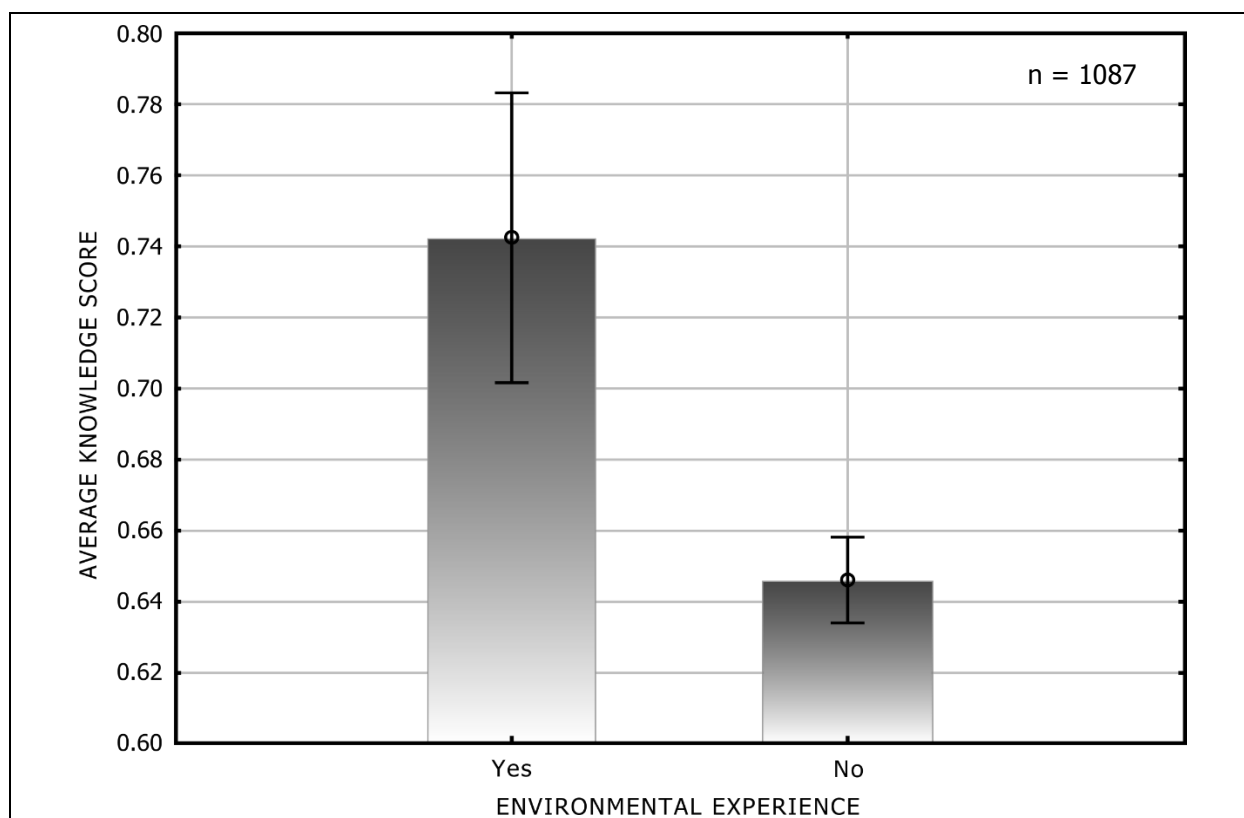
Figure 6.26 Average environmental knowledge score by experience of environmental management

responsibility are plotted against those without. Experience of environmental management has been found to positively influence EK (Kruse & Card 2004). Since data on environmental position held or environmental responsibility during DOD employment is available, the relationship between these variables and MEK could be investigated.

The F-test ($F_{1, 1087} = 19.9$, $p = < 0.01$) with p-value below 0.01 confirms that the hypothesis that their knowledge levels are similar can be rejected. There is indeed a statistically significant difference between respondents with environmental responsibility (mean level 74%) and those without (mean level 65%). Yet, both groups declared 'good' knowledge scores. This finding should be used to enhance the MEK of soldiers by creating more opportunities for soldiers to shoulder some environmental responsibility.

6.6.3.5   MEK by deployment experience

Ideally, soldiers deploying to a foreign location should have better environmental knowledge than domestic soldiers. This subsection probes the extent to which variance in environmental knowledge scores can be explained by soldiers' exposure to deployment to other countries.

Figure 6.27 plots the knowledge of respondents having experience of deployment outside
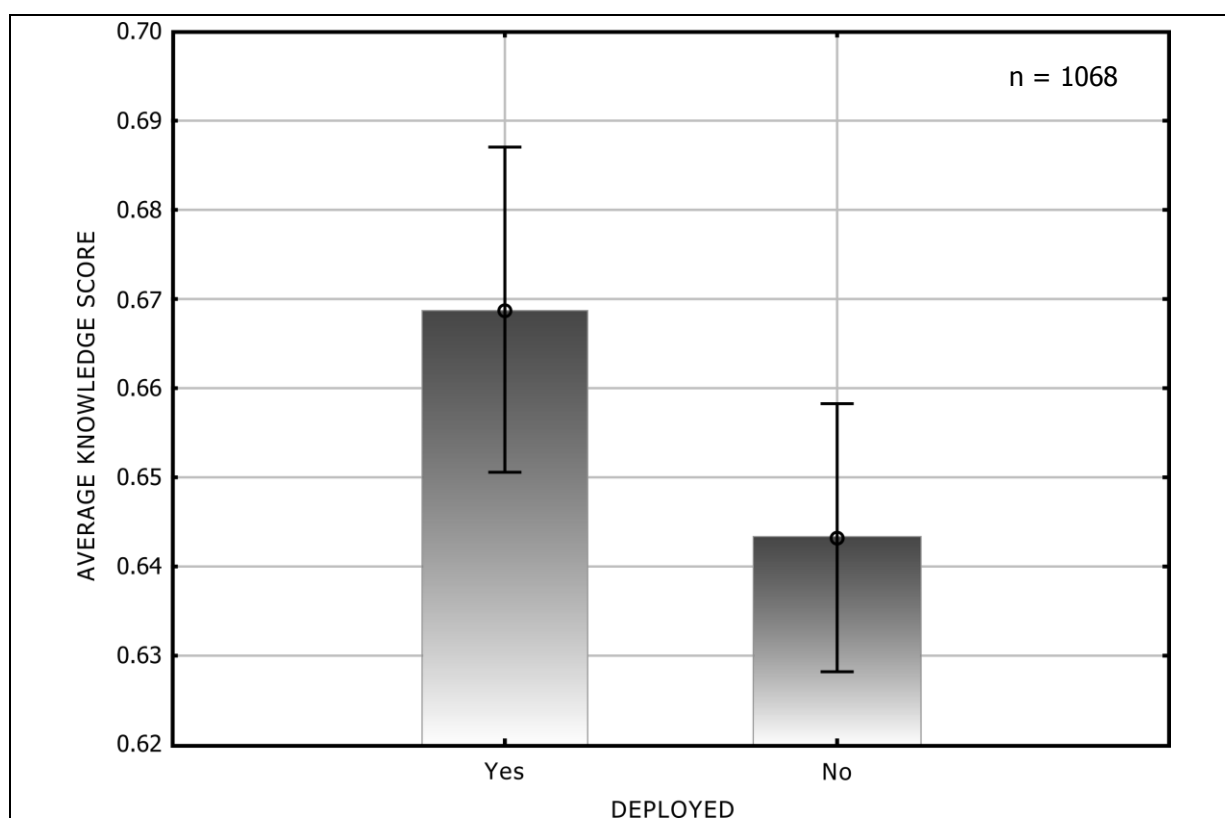
Figure 6.27 Average environmental knowledge score by deployment experience

South Africa ('Yes') against those with no such deployment experience ('No'). The F-test ($F_{11, 1068}$ =4.50, p = 0.03) shows that the hypothesis that attitude remains similar regardless of deployment experience can be accepted. The mean attitudes of 67% and 64% for the respective categories of respondents imply that no statistically significant difference exists between the two groups. This is disturbing since deployed soldiers need more environmental skills to successfully operate in a foreign environment and can cause serious environmental harm if deployed while lacking these skills.

The relationships between socio-demographic, educational and military service characteristics of the respondents and MEA, MEB and MEK was investigated and reported in Chapter 6. In Chapter 7 attention shifts to composite MEL and the military environmental narrative derived from the open-ended items in the MEL survey.

CHAPTER 7   COMPOSITE MEL PROFILES OF SA ARMY SOLDIERS

Who should be environmentally literate and to what degree? Roth (1992: 8).

It is common practice in EL research to report the amalgamated environmental literacy results after the individual components of environmental literacy, namely attitude, behaviour and knowledge have been analysed separately (Pe'er, Goldman & Yavetz 2007; Chu et al. 2007; Negev, et al. 2008; McBeth & Volk 2010; Karatekin 2013; Teksoz et al. 2014). In this chapter the three components of MEL are brought together and their composite profile is explained. The composite index for MEL of the SA Army (explained in Section 1.6) is also discussed to establish reference points for future surveys. The interrelationships of the three components of MEL are examined to establish whether any of the components are more important than others when assessing MEL. Thereafter, the MEL narrative is explored to reveal the status of MEL in the SA Army from a qualitative perspective. The chapter is concluded by presenting a model of MEL to clarify, categorise and encapsulate the effects on MEL of the variables tested in this study.

7.1   COMPOSITE MILITARY ENVIRONMENTAL LITERACY

Calculating a composite score for **each of the components** of EL is common practice in EL studies (Falissard 2012). For the present MEL study the composite scores for each component were simply calculated for attitude, behaviour and knowledge as arithmetic means. In the MEL study, two of the scales (attitude and behaviour) used Likert-type scores, while environmental knowledge was scored as a percentage. The general attitude toward the environment in which the military operates translated into a mean score of 1.8 on the five-point, Likert scale. This highly significant result affirms the positive attitude of SA Army soldiers towards the environment in which they operate. The same result was obtained for behaviour: a mean for all the responses of 1.8, an equally significant result pointing to reported behaviour of SA Army soldiers in the environment in which they operate, as positive. On the knowledge scale, the mean for all the respondents was 65% which is a significant overall score that testifies that the knowledge of South African soldiers about the environment in which they operate is good.

A **single, composite EL score** can also be calculated, although this is not common practice (McBeth 2016, Pers com), because the scientific basis for doing so is still being developed (Marcinkowski 2016, Pers com). The usefulness of a composite EL score is, however, to be found in its practical application (for instance to compare similar EL studies or repeat surveys of the same population). McBeth et al. (2008) calculated a composite EL score based on results from the National Environmental Literacy Project as a baseline for middle grade students in the United States. McBeth et al. (2008) also developed a scoring system for composite EL results in which

they contended that scores below 40% indicate a low level of EL, between 40% and 70% a moderate level and above 70% a high level of EL. McBeth & Volk (2010) reported a moderate level of EL for both grade 6 and grade 8 respondents, and in a follow-up study McBeth et al. (2011) investigated the influence of a dedicated environmental programme on the EL of grade 6 and 8 respondents and compared it to the 2008 results. Although the results showed an improvement in the respondents enrolled in the environmental programme, the composite EL results remained at the moderate level for both grades. Karatekin (2013) used a five-part environmental literacy questionnaire and the same scoring system as McBeth et al. (2011) to test EL levels of pre-service teachers in Turkey and also found a medium level of EL.

To meet the stated objective of the MEL study to provide a baseline for future studies, a composite MEL score was calculated using the method developed by McBeth et al. (2008). The questionnaire developed for the MEL study purposely balanced the measurement of the attitude, behaviour and knowledge scales that ranged from 13 to 15 items each, negating the necessity of transforming the scores. However, two of the scales (attitude and behaviour) used Likert-type questions, while environmental knowledge was scored as a percentage. To calculate a composite MEL score, the Likert scores were converted to percentages using the formula: Percentage = (Likert score minus 1)/4 x 100. The converted Likert scores ranged between 0% (value 1) and 100% (value 5). The composite MEL scores were calculated as an average of the three subscales, with the attitude and behaviour scores reversed, where MEL = (100 minus attitude score) + (100 minus behaviour score) + knowledge)/3. These composite MEL scores can be used in comparative studies.

The composite MEL score for the SA Army was 75%. Compared to the composite scores reported by McBeth et al. (2008), McBeth et al. (2011) and Karatekin (2013) a score of 75% constitutes a 'high' level of environmental literacy. According to the scoring system developed by McBeth et al. (2008) the composite scores of all three the above studies indicated a 'medium' level of EL. This high level of MEL in the SA Army underlines the pro-environmental attitudes, behaviour and knowledge of soldiers in the SA Army. This is the most fundamental finding of this research endeavour.

To further elucidate the MEL of the SA Army the composite MEL scores for the variables used in the study are presented and discussed in Sections 7.2 and 7.3. The military environmental narrative is explained in Section 7.4 and the MEL model reported and examined.

7.2   DETERMINANTS OF MEL IN THE SA ARMY

The socio-demographic, education and training and the biographical and service history information of respondents are employed as explanatory variables to account for variance in average composite MEA, MEB and MEK. While ANOVA results or Pearson correlation coefficients for each of the components (attitude, behaviour and knowledge) of MEL were reported in isolation in Chapter 6, here the focus shifts to reporting on the components together to portray the MEL as deduced from the components. A composite MEL score was also calculated for each variable and recorded and discussed together with the composite MEA, MEB and MEK.

7.2.1   MEL according to socio-demographic determinants

As before, the respondent profile variables available from the socio-demographic profile recorded in the survey (age, gender, marital status and home language) were employed. The literature provided no consensus on their effects, as the discussions in the following subsections show.

7.2.1.1   MEL by age

As became evident in the earlier discussion (Chapter 6) the strength of the individual correlations between age and the three EL scales (attitude, behaviour and knowledge) concur with findings of no significance from literature (Haron, Paim & Yahaya (2005); Al-Dajeh (2012); Dunlap & Hong (2013); Xiao, Dunlap & Hong (2013)). The composite MEL results reflect a slight, but statistically insignificant relationship with age (Pearson correlation coefficient $r = 0.02$; *p*-value 0.63). While this result seems to contradict Conroy & Emerson (2014) relating to behaviour in the US, the correlation in this research was so weak that in practical terms it obviates meaningful deductions.

7.2.1.2   MEL by gender

Gender is routinely included as variable in environmental literacy studies with some authors reporting better attitude and behaviour scores for females, while males outperform females on the knowledge scale (Lopez et al. (2007); Meinhold & Malkus (2005); Ehrampoush & Moghadam, (2005); Özden (2008)). Contrarily, Lee (2008) and Al-Dajeh (2012) detected no gender difference for knowledge and attitude, while Chu et al. (2007) reported that in a study among Korean children, girls outperformed boys on all four scales (knowledge, attitude, behaviour and skills).

In the MEL survey respondents were sampled based on the gender split in their units. As far as gender is concerned, for the components attitude and behaviour, no statistically significant

difference between the sexes was recorded, while males displayed slightly better military environmental knowledge than females. This is not reflected in the composite MEL (males 75%; females 75%), for which Shields & Zeng (2012) and Xiao, Dunlap & Hong (2013) offer a possible explanation. They reported a better environmental concern by males in China and concluded that the different contexts in which women operate to be the reason. In the Army traditional sex roles are not sharply differentiated with male and female soldiers being expected to fulfil the same roles. The present study centers on *military* environmental literacy, that is how the respondents feel about, operate in and know about their military work environment, and not on general environmental issues. Had the survey had general environmental literacy as focus, like most studies reported in the literature, the social roles assigned to the different sexes outside of their work environment may have had a greater influence on their EL.

7.2.1.3   MEL by marital status

Haron, Paim & Yahaya (2005) found no significant differences in environmental knowledge according to marital status, a finding echoed by Schumacher (2014) who found no difference in the preferences of married and unmarried voters in Germany. Conroy & Emerson (2014) reported that married people were less concerned about the environment (as indicated by their lack of support for environmental spending by the United States government). In the MEL study, on both the attitude and knowledge scales no significant difference between groups was recorded, but unmarried respondents recorded slightly better results than married ones for the behaviour scale. The results posted for the composite MEL were inconclusive (married 75%, unmarried 74%, divorced 76% and widow or widower 75%) to establish any relationship between MEL and marital status. This corresponds with the results of Haron, Paim & Yahaya (2005) and Schumacher (2014).

7.2.1.4   MEL by home language

A number of studies have emphasised the importance of language in South African contexts. De Klerk & Barkhuizen (1998) have reported that the language of respondents led to different attitudes toward the use of language in the SANDF and Rousseau & Venter (2001) found that home language impacted on consumers' environmental concern in the Eastern Cape. Van Zyl (2007) found that the language of instruction at the SAMA was cited as the third most important reason for underperformance. Furthermore respondents who reported the most bad current and past life situations were not Afrikaans or English speakers.

Home language was significantly related to the attitude, behaviour and knowledge components of MEL. The Tshivenda, Setswana and English speakers recorded the best attitude

scores; Tshivenda, Setswana, Sesotho, English and Siswati speakers reported the best behaviour; and SiSwati and Afrikaans speakers had the best level of environmental knowledge. Xitsonga speakers scored the worst on attitude; Xitsonga and isiZulu speakers scored the worst on behaviour and knowledge.

The composite MEL for language indicates that Tsivenda and SiSwati (79% and 78%) recorded the best overall MEL results, and Xitsonga and isiZulu (70% and 71%) the worst. Language is a complex and contentious issue. English is the language of instruction and communication throughout the DOD, while for many Army soldiers it is a second or even third language (Heinecken 2009). In the present study only 5% of the respondents reported English as their home language. This is consistent with the less than 10% of respondents having English as first language in a study of soldier-students at the SAMA (Van Zyl 2007). Ultimately, it makes sense that English is the language for command and control purposes but it is not necessarily the ideal language for explaining complex environmental issues to soldiers. This complicated situation is exacerbated when the person teaching the military environmental curriculum is also not a first-language English speaker.

If basic communication principles are taken into account, it is clear that if neither the creator nor the interpreter of the environmental message is clear about what exactly the message in fact entails, a non-fitting response to the desired message is likely to ensue, and should come as no surprise (Van Zyl 2014, Pers com). This is another area that can benefit from further research.

7.2.2   MEL according to education and training determinants

The environmental literature generally supports the notion of education as an important indicator of general EL: higher levels of education foster positive environmental conduct (Tikka, Kuitunen & Tynys 2000; Kollmuss & Agyeman 2002; Alp, et al. 2006; Özden 2008; Xiao, Dunlap & Hong 2013; Conroy & Emerson 2014). The education and training profile of each respondent comprises general education, geography subject education and environmental education. These three measures are the education-based explanatory variables used to account for variances in EL.

7.2.2.1   MEL by general education level

General education levels are often quoted as indicators of EL in studies on EL (Kaplowitz & Levine 2005; Pe'er, Goldman & Yavetz 2007; Erdogan 2011; Robelia & Murphy 2012; Xiao, Dunlap & Hong 2013). Özden (2008) even found a significant increase in the positive environmental attitudes of students based on the education level of their fathers. Alp et al. (2008)

also reported a link between the father's level of education, and positive environmental attitudes of Turkish elementary school learners.

Environmental attitude, behaviour and knowledge rendered statistically significant results regarding level of education attained. But the result is complicated by the weak negative correlation between level of education and attitude, as well as behaviour but a weak positive correlation between level of education and knowledge.

These results imply that the higher the level of education, the lower the environmental attitude and behaviour levels, and the higher the knowledge levels. However, all three correlations are very slight and despite the statistical significance the negligible relationships make any deductions questionable. The composite MEL (r = 0.01; *p*-value 0.69) has a similarly slight correlation with highest education level.

An explanation for this discordance between the results of the MEL survey and other studies of EL is that for the MEL survey a focused, organisation-specific questionnaire was used that emphasises MEL and not general environmental literacy. It is likely that general education level may be a strong predictor of EL, but this does not axiomatically hold true for MEL, a specific type of EL. The fact that all of the respondents had at least completed secondary school education, a prerequisite for entering service in the DOD, may also negate the influence of general education level in so far as all the respondents have a minimum level of education that is adequate for sustaining a relatively high level of EL. Further research is needed to clarify these issues.

7.2.2.2   MEL by geography education

As with general level of education, specific subjects have been shown to contribute to EL. Pe'er, Goldman & Yavetz (2007) concluded that students in environment-affiliated subjects, including geography, demonstrated significantly higher levels of positive attitude and knowledge than those in other fields of study. Students at the SAMA registered a positive correlation between level of geography education and environmental attitude and conduct (Smit 2009). In agreement with these studies, Karatekin (2013) found that pre-service geography teachers had the best levels of environmental attitude and knowledge compared to teachers with other majors.

Regarding geography education, no correlation was found for attitude and behaviour, but a weak positive correlation between geography education and knowledge was registered. The composite MEL (r = 0.05; *p*-value 0.12) reflects a slight positive relationship, but the *p*-value indicates that it is not significant, and as such confirms that no relationship exist between geography education and MEL.

The results for the MEL survey differ from those of similar studies reported in the literature. An explanation lies in the focused, military nature of the questionnaire used in the MEL survey that investigated MEL and not general EL. The relationship between MEL and geography education appears much weaker than in the case of general EL. A reason is that most of the respondents regularly receive military environmental education and this negates the positive influence of geography education by empowering the soldiers without geography education with the same knowledge, attitude and behavioural intentions already found among soldiers who studied geography.

7.2.2.3   MEL by environmental education and training

Culen & Mony (2003), Smit (2009) and Karatekin (2013) have found a positive correlation between environmental education and training and EL. In all three studies exposure to environmental education and training opportunities led to better EL. The military environmental course presented each year to a small group of soldiers focuses attention on military integrated environmental management and provides contextualised military environmental education and training (Laubscher 2009a, Pers com). Only 4% of the respondents had completed a military environmental course and their results for both attitude and knowledge were better than those who had not. Regarding knowledge they were a significant 10% better.

The good knowledge and favourable attitude apparently did not make any difference to the behaviour of the respondents as no significant difference between the two groups was found for the behaviour scale. The composite MEL results (yes 81%; no 75%) points to a significant difference in MEL between the two groups with soldiers who completed the military environmental course outscoring those who did not. It appears that a good attitude and sound knowledge are not prerequisites for good environmental behaviour. Thus, these are uncorrelated constructs. This is investigated further in the next section.

7.2.3   MEL according to service profile determinants

No consensus exists about the effect of any of the variables included in the military service profile reported on in this section, namely Army formation membership, military rank, military service duration, environmental and deployment experience. Together, these service variables constitute the military service profile of the respondents.

7.2.3.1   MEL by Army formation

When the nine formations of the SA Army are compared regarding attitude, behaviour and knowledge significant differences emerged between the formations. Respondents from the Air

Defence Artillery and Training formations recorded the best results on all three scales. Infantry and Engineer formation respondents recorded the worst results on the MEA scale with Armour, Infantry, Signal and Support formations posting the worst results on the MEB scale. Respondents from Infantry formation displayed the worst MEK. The composite MEL results clearly indicate two formations, Air Defence Artillery and Training (both 81%), with the best results, while the Infantry formation (72%) posted the worst MEL results. Although no literature exists on the relationship between MEL and Army formations, interviews with senior military environmental officers rendered some explanations:

- The small size of the formations that recorded the best EL results makes it easy to positively influence the formation members. In the Training formation, with only four small units, dedicated, knowledgeable environmental personnel drive environmental education and training with good effect (Van Rensburg 2014, Pers com).

- The situation at the Air Defence Artillery formation (only three small units) is similar. According to Laubscher (2014, Pers com) a number of members from this formation attended the nine-week Integrated Environmental Management Learning Programme. Apparently the exposure impacted positively on their MEL.

- A very different situation exists in the Infantry formation which is the largest of the formations. Its members must usually bear the brunt of deployment and other activities, making it difficult for the necessary attention to be given to environmental education and training.

- Structurally, no environmental post is staffed at headquarters level in the Army and no environmental posts exist at unit level (Laubscher 2014, Pers com; Van Rensburg 2014, Pers com). This means that there is no co-ordinating body at headquarters and no-one is responsible for executing policy at unit level. The solution proposed by the regional environmental offices is to use the personnel responsible for Occupational Health and Safety to manage environmental education and training. This is not an ideal situation since this person must execute over-and-above tasks, something he/she is most likely not trained for and/or does not have adequate time to do the tasks.

- The amount of time such a person can allocate to environmental education and training depends on the goodwill of individual commanding officers. With the Infantry already overstretched regarding deployment, border duty and other missions, environmental education and training is something to which commanding officers might not give high priority.

The explanation for the differences between the MEL of the two best performing formations and the worst are in the size and nature of each formation's missions. 'Champions' for environmental education and training do exist in the best units where they can make a measurable impact because of the smaller size of the formation. These are important issues that are addressed again in Chapter 8.

7.2.3.2   MEL by military rank

The respondents were grouped in five rank categories, namely riflemen, junior non-commissioned officers, senior non-commissioned officers, junior officers, and senior officers. The descriptive statistics for the attitude, behaviour and knowledge scales for each rank group and MEL clearly indicate that significant differences exist between the rank groups on the attitude and knowledge scales, with no significantly different results for the behaviour scale. On both the attitude and knowledge scales, riflemen posted the worst results and officers the best. The result is the same for the behaviour scale but the difference was not statistically significant. The composite MEL results show a similar pattern, with junior officers (80%) posting the best results and riflemen (74%) the worst.

Two potential explanations are possible. The riflemen either over reported their behaviour, or more logically, they display environmentally correct behaviour, neither because they have a good attitude toward the environment nor because their good environmental knowledge inspires them to do so, but simply because they are told to execute their mission in a certain (environmentally friendly) manner.

This speaks to the organisational nature of the Army and implies an external locus of control (Kollmuss & Agyeman 2002; Meinhold & Malkus 2005) that has a number of implications for environmental education and training. Acting on instructions enforces good environmental practices even in the absence of a corresponding attitude and knowledge base. Stern (2000: 417) refers to this as "standard operating procedure", but it also implies a number of possible situations that are not conducive to environmentally responsible military conduct. If the attitude and behaviour of the source of external locus of control is counter-environmental, few if any of the subordinates will be prepared to question or contradict such attitudes or behaviour for fear of the consequences or the mere discomfort associated with interpersonal, intraprofessional conflict. It also might be that soldiers without an adequate environmental attitude and knowledge base find themselves in a situation where the external locus of control is absent and they don't have the skills set to take the correct environmental decisions. The burning of the Koran incident in Afghanistan is an example that might be traced to such a scenario (Rubin 2012).

The weak results posted by the riflemen (and to a lesser extent the junior NCOs) is a worrying phenomenon because within a few years some of them will be the officers, non-commissioned officers and warrant officers who will have to take responsibility for the caring for the environment under military auspices. They will become the external locus of control for the next generation of riflemen. This makes it imperative that the structural deficiencies in the environmental education and training departments be rectified as soon as possible and that senior management will pay urgent attention to this aspect. It is hoped that the results of this military environmental study will facilitate this process.

7.2.3.3   MEL by military service duration

Respondents in the MEL survey were asked to indicate their length (in completed years) of service in the DOD. The descriptive statistics for the attitude, behaviour and knowledge scales according to the service duration of respondents are reported below. A discussion of the MEL of respondents according to their service duration concludes this subsection. The positive correlation between service duration and behaviour is weak but significant. Regarding the correlation between service duration and knowledge no significant differences emerged.

Although the result implies that the longer the service duration the better the behaviour, the relationship is negligible and does not allow meaningful deductions to be made. The composite MEL result (r = 0.01; p-value 0.63) also indicates that time in DOD employment does not significantly influence the MEL of soldiers. This finding should be alarming to the DOD as it suggests that time spent in DOD employment does not contribute to increased MEL despite the efforts of military environmental services personnel to supply adequate environmental education and training.

7.2.3.4   MEL by experience in environmental management

Respondents were asked to indicate any environmental position they held and/or any environmental responsibility they had during their time in DOD employment. About 8% of the respondents reported that they hold or held some kind of environmental position. On all three scales better scores were recorded by respondents with environmental experience than those without. Results for the attitude and knowledge scales are significantly different and for behaviour the result is not significant.

The finding about behaviour suggests that the positive attitude and good knowledge of the respondents who had some kind of environmental experience does not translate into significantly better behaviour. These contradictory findings again emphasise the complexity of EL and the barriers that may impact on environment-friendly behaviour (Kollmuss & Agyeman 2002). The

composite MEL (yes 80%; no 75%) does, however, confirm that respondents with environmental experience performed better than those who had none. This implies that by giving more soldiers exposure to some kind of environmental position the MEL of soldiers in the SA Army will be strengthened.

7.2.3.5 MEL by deployment experience

The respondents were asked whether they had been deployed outside of South Africa or not. The results for attitude and knowledge were not significant. However, deployed soldiers reported significantly better military environmental behaviour than those without deployment experience. The composite MEL (yes 76%; no 75%) also differed only slightly between the two groups.

According to Laubscher (2014, Pers com) and Van Rensburg (2014, Pers com), both experienced military environmental managers, the command-and-control way of conducting business in the Army may explain the findings. Prior to deployment, soldiers are subjected to a few periods of environmental education and training, albeit of a generic nature. The results point to this pre-deployment exercise not significantly improving the soldier's attitude or knowledge. But the deployed soldiers reported better behaviour, quite likely because they do as they are told. According to Laubscher (2014, Pers com) when not on active duty deployed soldiers spend many hours confined to their bases and this provides opportunities for them to perform basic environmental actions, such as picking up litter and doing base-cleaning duties. This might be the environment-friendly behaviour these soldiers reported.

Whether this is the case or not, these should be worrying results for DOD management. Sending soldiers into foreign countries with neither a good attitude nor a sound knowledge about the environment in which they must execute their task, carries a high risk. No military can take the risk of their soldiers ignoring the customs and traditions, both secular and religious, of the countries in which they operate. Neither can they allow their soldiers to harm the physical environment by polluting or destroying scarce water- or food resources.

When on deployment to other countries on peacekeeping missions or to render humanitarian aid, soldiers behaving badly create a negative perception among the local population of South African soldiers which can even cause serious resistance from the very people they are there to help. Environmentally damaging behaviour can also impact on the health of the soldiers and the surrounding civilian population (Mosher et al. 2008; Bonds 2015). This means that environment-unfriendly behaviour can seriously jeopardise mission success, something no military commander can tolerate.

Having concluded explanatory variable discussions on individual components of MEL, the relationships between the three components of MEL are addressed in the next section.

7.3   RELATIONSHIPS BETWEEN MEL COMPONENTS

The statistical correlation between the three components of MEL is investigated in this section to uncover the relationships between the three components. These relationships are important because an understanding of them can be used by environmental educators and managers to direct interventions to improve the EL of a target group (Kaiser, Wolfing & Fuhrer 1999; Grodzinska-Jurczak et al. 2003; Meinhold & Malkus 2005; Esa 2010). A further benefit of this assessment is that a high degree of covariance between any or all of the components points to statistical redundancy; i.e. the possibility that various items in a scale measure the same dimension of MEL and future surveys can therefore be slimmed down by not analysing as extensively or over such a wide range of issues. Both cost and effort might be saved.

The three components attitude, knowledge and behaviour comprise the construct MEL and analysis of the interrelationships between them would be instructive to better understanding and management guidance. According to Kollmuss & Agyeman (2000) and Negev et al. (2008) one of the most important debates in environmental education literature revolves around the relationships among environmental attitude, knowledge and behaviour. While some authors posit that pro-environmental attitude can correlate with and predict pro-environmental behaviour (Kaiser, Wolfing & Fuhrer 1999; Meinhold & Malkus 2005), others found no significant relationship (Vicente-Molina, Fernándes-Sáinz & Izagirre-Olaizola 2013). Similarly the relationship between attitude and knowledge and between knowledge and behaviour have been reported to be inconclusive (Grodzinska-Jurczak et al. 2003; De Chano 2006; Esa 2010).

Pearson product-moment correlation analysis was performed to reveal the extent to which the EL component variables are linearly related (McKillup 2012). The values advocated by Field (2013: 82) to indicate the strength of the effect ($r = 0.10$ equals a small effect, $r = 0.30$ is a medium effect and 0.50 indicates a large effect) are employed here to judge the relationships between MEA, MEB and MEK.

7.3.1   Relationship between attitude and behaviour

Most sources report a large effect and thus a strong positive relationship between attitude and behaviour. Chu et al. (2007) reported a positive correlation ($r = 0.56$) between attitude and behaviour among Korean children while Pe'er, Goldman & Yavetz (2007) reported a correlation of 0.49 which was the strongest correlation found between any two of the three components of EL tested by them. Negev et al.'s (2008) study of Israeli high school students similarly identified the

correlation between attitude and behaviour as the strongest (r = 0.56). Esa's (2010) recent study found a correlation of 0.26 between the two variables, the second highest reported in his study. Contrarily, Lee (2008) reported a small positive correlation of 0.12 between attitude and recycling behaviour. An explanation for this small correlation is possibly that the focus of his study was specifically on recycling behaviour and not environmentally responsible behaviour in general.

The scatterplot and regression line of the respondents' scores for attitude and behaviour reflect a positive linear relationship between attitude and behaviour (Figure 7.1). This means that the better the attitude of respondents, the better the self-reported behaviour.
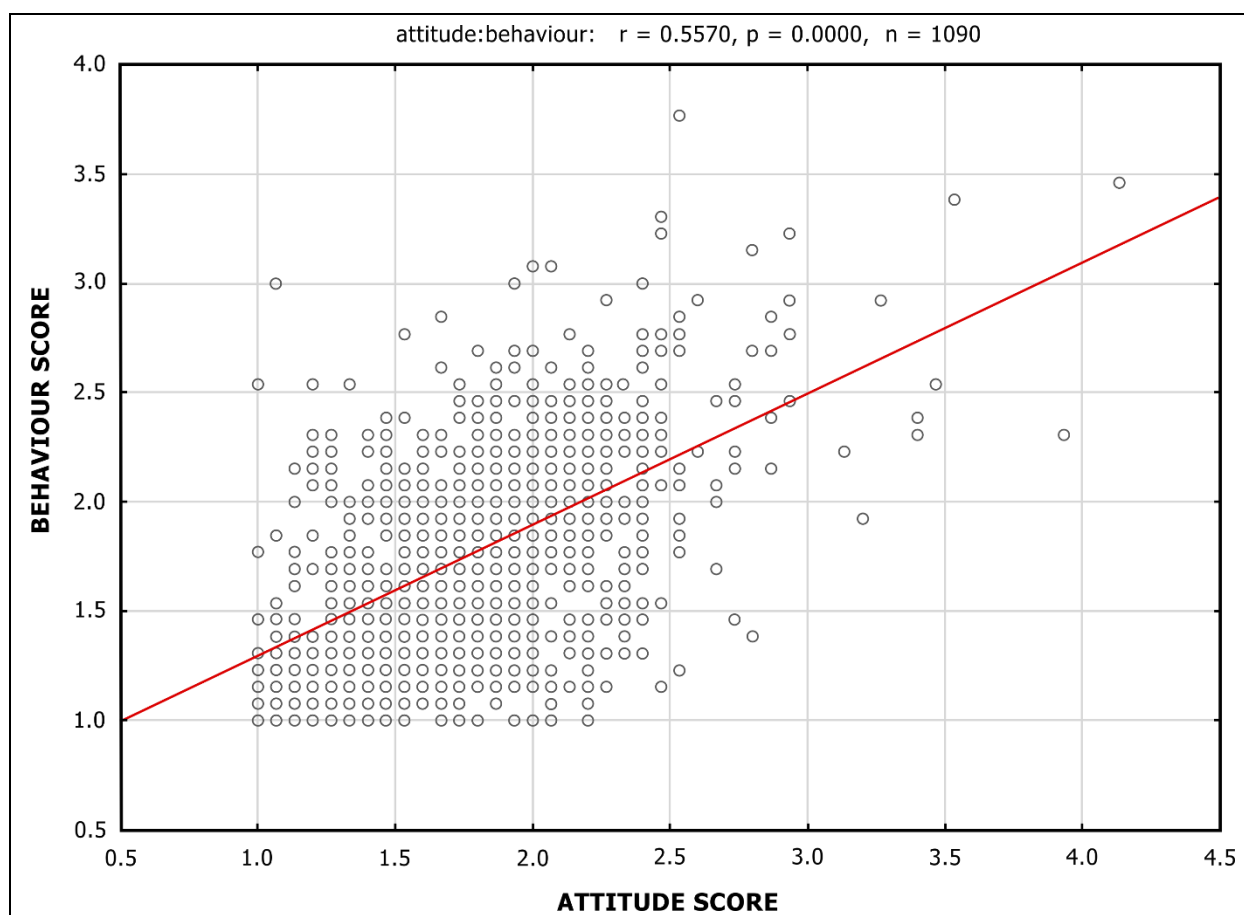
Note: The standard regression lines on these scatterplots merely visually depict the nature of the relationship between the two variables and do not imply the ability for variable value prediction based on the regression equations.

Figure 7.1 The relationship between the attitude and behaviour scores of respondents

The correlation (r = 0.56), with a *p*-value of 0.0 indicates a large effect and thus a strong positive relationship between these two variables (although r^2 indicates that only 31% of variance in one variable can be explained by variance in the other). This is the strongest correlation between the MEL variables and corresponds with the findings reported earlier. Evidently, the fostering of a positive attitude among soldiers in the SA Army will influence their environmental behaviour

positively. This must be taken into account when designing and delivering military environmental interventions.

7.3.2 Relationship between knowledge and attitude

Most studies reported in the literature found the association between knowledge and attitude to be the second strongest correlation between the three components. Chu et al. (2007) found a correlation of 0.24 (their second strongest) and Pe'er, Goldman & Yavetz (2007) concur with their reported correlation coefficient of 0.33 for knowledge and attitude. Negev et al. (2008) found a correlation of 0.23 between the two components, also the second strongest correlation recorded in their study. Esa's (2010) study among student teachers in Malaysia, found the strongest correlation between these two variables ($r = 0.56$). According to these studies it seems that positive environmental knowledge positively influences environmental attitude.

The scatterplot and regression line for knowledge and attitude scores (Figure 7.2) reflect a positive linear relationship between knowledge and attitude. This implies that the better the knowledge of respondents, the better the attitude scores of respondents. The correlation of $r = 0.35$, with a *p*-value of 0.00 indicates a medium effect and a medium positive relationship between these two variables, with r^2 indicating that 12% of the variance in one variable can be explained by variance in the other.
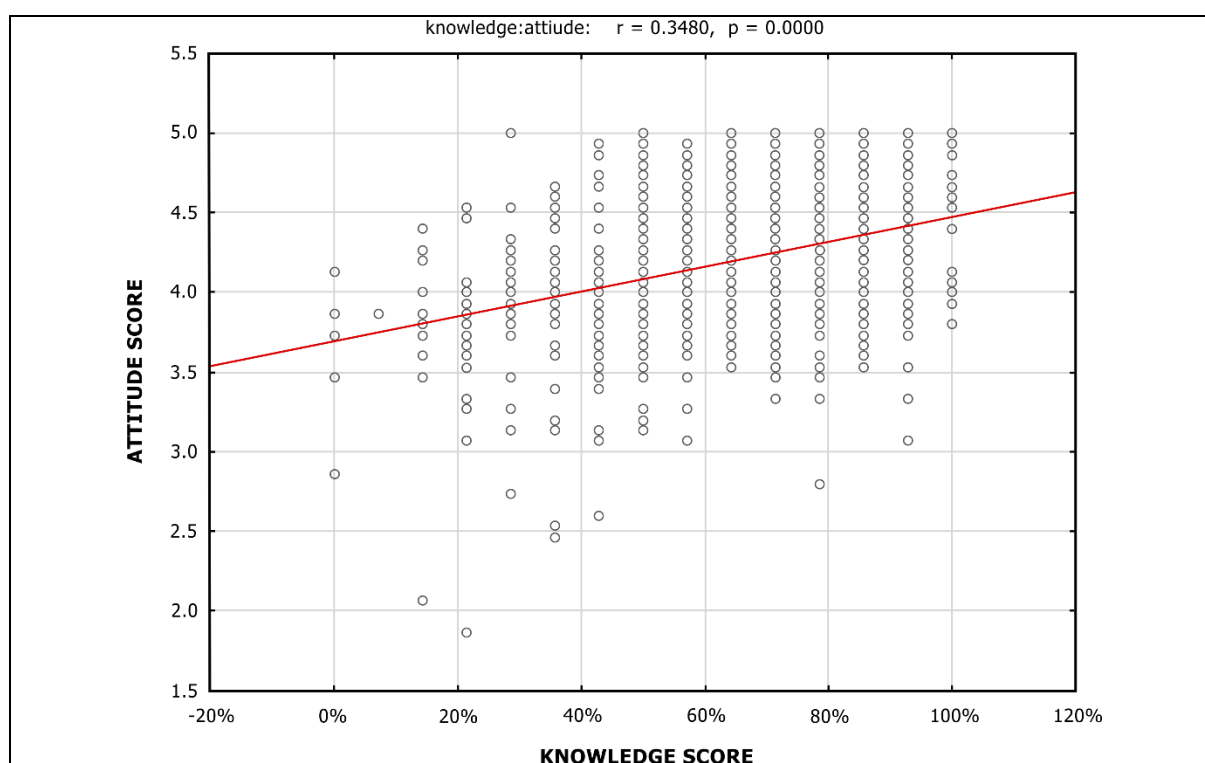
Figure 7.2 The relationship between the knowledge and attitude scores of respondents

As with attitude and behaviour (although to a slightly lesser degree), this result corroborates those reported in the literature that an increase in knowledge leads to an increase in positive attitude. This implies that by imparting more military environmental knowledge to soldiers in the SA Army their environmental attitude will be influenced positively. A military environmental curriculum that emphasises knowledge about the military environment will have a beneficial effect on environmental attitude.

7.3.3 Relationship between knowledge and behaviour

The weakest correlations between the EL variables reported in the literature were found between knowledge and behaviour. Chu et al. (2007) recorded a correlation of 0.11, whereas Pe'er, Goldman and Yavetz (2007) found a correlation of $r = 0.23$ between knowledge and behaviour. Negev et al. (2008) found no valid correlation ($r = 0.04$) in their study of Israeli high-school children and the results of Esa's (2010) finding was a correlation of 0.26. These results indicate that good environmental behaviour is not strongly influenced by knowledge.

The scatterplot and regression line of knowledge and behaviour (Figure 7.3) reflects a positive relationship between knowledge and behaviour. The correlation coefficient of $r = 0.29$, with a *p*-value of 0.00 indicates a small effect and a weak positive relationship between these two variables, with r^2 indicating that only 8% of the variance in one variable can be explained by variance in the other.
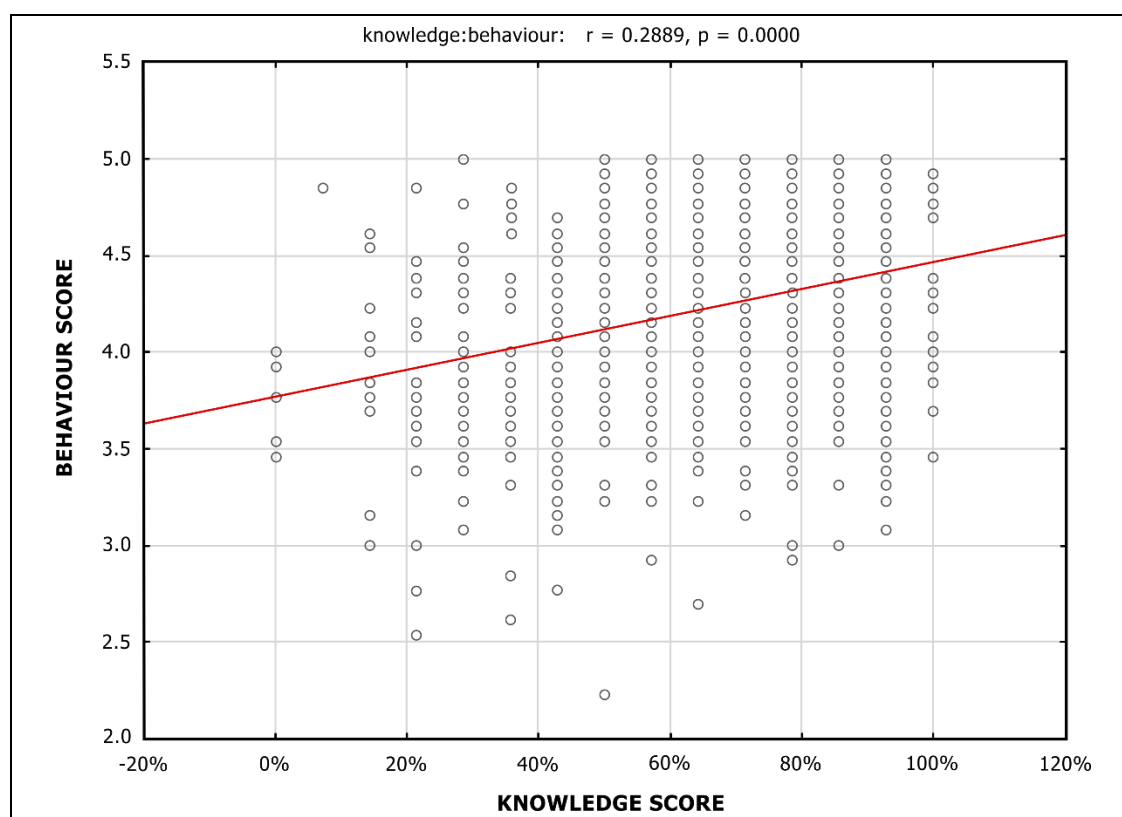
Figure 7.3 The relationship between the knowledge and behaviour scores of respondents

Having said this it must be emphasised that the relationship is so weak that to make meaningful deductions is difficult and that an increase in MEK will quite likely not lead to a corresponding increase in MEB, corroborating the general research consensus. A curriculum designed to foster good military environmental behaviour should take cognisance of the fact that improving environmental knowledge alone will not lead to an increase in MEB, but that fostering sound MEA should also be included in the curriculum.

Section 7.3 investigated the relationships between the components of MEL, i.e. MEA, MEB and MEK. The attention now turn to the open-ended items included in the MEL questionnaire. A content analysis of these items will lead to a military environmental narrative, the qualitative report on the MEL of SA Army soldiers.

7.4   THE MILITARY ENVIRONMENTAL NARRATIVE

The military environmental narrative[26] was construed by using a content analysis to investigate the responses to the open-ended questions in Section 4 of the MEL questionnaire. The six questions were designed to qualitatively mirror the MEL components attitude, behaviour and knowledge investigated quantitatively in the first three sections of the questionnaire. The open-ended questions allowed respondents to justify and expand on the answers they gave in the quantitative sections. The qualitative information also allows triangulation with the quantitative results to establish the consistency of the responses. This was done through comparison of the qualitative and quantitative results.

In this section the environmental narrative as reflected by responses to the six open-ended questions is analysed to construct the MEL narrative of the SA Army. The first statement and the first question of Section 4 of the MEL questionnaire (items 43 and 44) investigate the attitude of respondents, mirroring the first subscale of the questionnaire. The next two questions (items 45 and 46) correspond to the behaviour subscale, while the last two questions (items 47 and 48) accord with the knowledge subscale of the questionnaire.

The first statement elicited responses about the perceived importance of environmental protection in the SA Army. The environmental protection question is followed by a question about

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[26] Narrative communication utilizes direct responses from subjects to build knowledge of subjects' understanding. While logical-scientific information in the foregoing sections followed deductive reasoning, narrative information allows inductive reasoning (Dahlstrom 2014).

the general environmental consciousness of respondents. Questions three and four enquired whether good environmental practices can improve mission success, and if respondents minimise their impact on the military environment. The last two questions asked about the adequacy of environmental education and training received by respondents from the DOD and their military environmental education and training requirement.

In the next six subsections the answers to each of these questions are content analysed to construct the military environmental narrative. The responses are also triangulated with the quantitative responses to the attitude, behaviour and knowledge items in Sections 1 to 3 of the MEL questionnaire to uncover congruence's and divergences in the response patterns.

7.4.1   Attitude narrative on environmental protection in the SA Army

Van Riper & Kyle (2014) have identified a number of assigned values (perceived qualities of an environment) people use to assign value to the environment. The assigned values range on a continuum from anthropocentrism (human centered), through ecocentrism (nature-centered) to biocentrism (life-centered) (Miller & Spoolman 2012). These assigned values together with 12 other values identified in the literature are used to structure the discussion on the qualifications to items 43 to 48. These other values encompass 'aesthetic' (attractive scenery, sights, sounds, or smells); 'future oriented' (allows future generations to experience a place); 'spiritual' (spiritually significant); 'biological diversity' (variety of plants, wildlife, marine life, and other living organisms); 'intrinsic' (in and of itself for its existence); 'recreation' (provides a place for outdoor recreation activities); 'cultural' (historic places and archaeological sites); 'learning' (learn about natural and cultural resources); 'therapeutic' (makes one feel better, physically and/or mentally); 'economic' (fisheries, recreation, or tourism opportunities); 'life sustaining' (produce, preserve, clean, and renew air, soil, and water); and 'scientific' (provides an opportunity for scientific observation or experimentation) modes.

An overwhelming majority (1071; 99%) of respondents agreed with item 43, that is the statement that it is important for the SA Army to protect its environment. This response corroborates the positive attitude and behaviour reported earlier and testifies to a consistency in response integrity.

Qualitative rationales (711 in total) for the (positive) responses were coded into the eleven response categories listed in Table 7.1. Only one negative qualification was recorded. Most (23%) of the **positive responses** regard *ensuring environmental sustainability* as the reason for the South African Army (SA Army) to protect the environment. The common verbatim response signifies that the simple need of having to use an area again for the same purpose (conducting

military operations) drives the narrative. Because the SA Army as an organisation is inherently utilitarian in outlook, the rationale for environmentally sustainable use was expected.

Table 7.1 The attitude narrative on the importance of environmental protection

Item 43	Do you agree with the following statement? *"It is important for the South African Army to protect the environment in which it operates."* Yes/No.	
	Agreement response: Yes (99%), No (1%) n = 1080	
POSITIVE RESPONSE CATEGORY*	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE****
Ensures environmental sustainability (utilitarian)	161 (22.6)	*"We have to take care of the environment and protect it in order for us to make use of the area again."*
Confirms or recognises the intrinsic value of nature	108 (15.2)	*"All life must be protected and preserved and their habitats whether plants, animal or people."* *"Keep nature as it is."*
Creates future legacy for next generations	89 (12.5)	*"The reason we protect the environment is because we want to leave a legacy to our children."*
Recognises an organisational imperative	85 (12.0)	*"It is the duty of Army to protect the environment."*
Preserves environmental resources and services	85 (12.0)	*"Because we get fresh air from trees and they absorb carbon dioxide."* *"Yes, because at the end of the operations we will need the environment to live."*
Not applicable***	57 (8.0)	*"It needs to develop."*
Avoids health risk to personnel	56 (7.9)	*"It is a health risk to SA Army members."*
Recognises biodiversity concerns	52 (7.3)	*"It is important for SA Army to protect the environment in which it operates, because of the vegetation and the wildlife."*
Clichéd responses	8 (1.1)	*"Just because it's the right thing to do."*
Protects cultural heritage	8 (1.1)	*"Protect graves."*
Values scientific investigation	2 (0.3)	*"Research"*
TOTAL	711 (100.0)	
NEGATIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Not an organisational imperative	1 (100.0)	*"We don't do environmental."*

Notes: * For the qualitative analysis of structured data, such as those derived from open-ended questions in a questionnaire, codes were attached to responses, resulting in response categories that reflect some common characteristic of the text (Bless, Higson-Smith & Sithole 2013; Saldaña 2013). This approach was discussed in more detail in Section 1.6.2; ** Verbatim responses are used in content analysis to "amplify the voices of people who participated in the research" and to "prevent researchers from imposing their own interpretation on respondents' words, thereby changing their meaning" (Bless, Higson-Smith & Sithole 2013: 239); *** The responses (8%) labelled 'not applicable' are those where no meaningful connection to the question could be made. These responses are most likely due to a lack of comprehension or inadequate communication skills.

Van Riper & Kyle (2014) regard it to be 'future' orientated where respondents recognise inherent future value for the environment, similar to the ***creates future legacy for next generations*** category. Together these two categories constitute more than one third of the recorded responses.

The responses also confirm the results of Ramos et al.'s (2008) study on the Portuguese defence force where they found that most of the response categories they identified were of a utilitarian nature. These responses were expected as the questionnaire deals specifically with the workplace of the respondents and the nature of the work done by militaries. Teksoz et al. (2014) also pointed out that females are more concerned about ecocentric issues, while males are more concerned about anthropocentric issues. Given the fact that 78% of the respondents are males, the more anthropocentric nature of the viewpoints expressed is explicable.

Recognition of the ***intrinsic value of nature*** by respondents (15%) is captured in the responses advocating the protection and preservation of all life and habitats and to protect nature in its original state. These environment-focused responses testify to an ethical, ecocentric worldview in which the inherent value of nature is emphasised. Recognition of the intrinsic value of nature rather than following a more utilitarian line of reasoning (Miller & Spoolman 2012) signifies a high level of environmental sensitivity and a well-developed level of environmental concern among a significant group of soldiers. Adhering to a more ecocentric worldview means that a deeper understanding of the value of the environment in which the military operate exists among some respondents. This understanding goes beyond the mere utilitarian value assigned by the majority of the respondents and indicates progression on the continuum of increasing environmental literacy postulated by Roth (1992), explained in Section 1.1.2.

A significant portion (12.5%) of respondents considers it an ***organisational imperative*** of the SA Army to protect the environment as a legacy. The recognition of the organisational imperative to care for the environment does not feature in the general EL literature and is inherent to soldierly duty. This type of response can be attributed to the influence of norms, specifically subjective norms – the sense that 'significant others' expect a certain pattern of behaviour (Gifford & Nilsson 2014). In the SA Army the 'significant others' would be senior ranks, including the environmental-services personnel. Therefore, this reassuring response can be used by the SA Army's environmental-services personnel to further instil a sense of environmental care into its soldiers.

The responses (12%) coded to the ***preserve resource and service supplies*** category match so-called 'life-sustaining values' (Van Riper & Kyle 2014) and originate from respondents who recognise the life-sustaining importance of ecosystem services provided by the (military) environment. They are also an indication of a high level of environmental concern and knowledge. Coupled to this category is the recognition of ***biodiversity*** (7%) which translate to biocentric concern and not only an anthropocentric worldview (Van Riper & Kyle's 2014 'biological diversity' concerns).

Some minor response categories, such as avoidance of health risk, need to protect cultural heritage, scientific investigation and clichéd answers were extracted from the responses. The recognition that the environment might impact negatively on the **health** (8%) of soldiers if the former is not protected, can be interpreted as the opposite of the 'life sustaining' value and indicate a realisation that bad environmental practices can be harmful to soldiers, something verified in the environmental literature (Mosher et al. 2008; Bonds 2015).

Scientific value is a realisation that the environment can be the subject of research and the protection of the *cultural heritage* denotes the scientific and cultural assigned values of Van Riper & Kyle (2014). Although the protection of cultural heritage was only recorded eight times, its mention is important and has potentially far-reaching implications. These responses indicate that a few respondents do recognise the importance of the cultural heritage value of the areas where they execute their missions and, contrarily, emphasises a deficiency of knowledge among most of the respondents about this vital issue. Its failure to feature more prominently in the narrative may indicate a shortcoming regarding cultural heritage in the environmental education and training programmes of the DOD. If this is indeed true it is a crucial issue that needs to be addressed. It is especially during peacekeeping and humanitarian aid missions, but also during more traditional military activities that respect for the traditions and culture of the inhabitants of the area in which the military mission takes place are vitally important. Without a genuine show of respect, mission success can be seriously compromised (Mosher et al. 2008).

Very few (1%) subjects made *clichéd responses* such as it is the '*right thing to do.*' Clichéd responses may indicate a misunderstanding of the question, lack of communication skills or unwillingness to answer. Therefore, the many respondents who did not resort to clichéd responses attest to good comprehension of the question and a willingness and ability to give meaningful responses. Fifty-seven (8.0%) of the respondents recorded responses that was deemed ***not applicable*** because they were nonsensical.

The fact that the responses matched six of the 12 assigned values identified by Van Riper & Kyle (2014) indicates a diversity of responses ranging from utilitarian values to the more ecocentric values relating to the intrinsic worth of the military environment. Generally, the recognition of the importance of environmental care during military activities corroborates the evidence of good environmental attitudes revealed in the quantitative results. One can conclude that the environmental education and training programmes of the DOD do have a beneficial impact on the environmental attitude of soldiers, at least for those in the SA Army.

Only one **negative response** that the SA Army ***does not engage in environmental management*** was recorded. Although this is a mistaken impression, the fact that only one

respondent responded negatively to the question makes it difficult to attach any significance to it. The response did, however, raise the question whether more respondents hold the same view, but felt that it would not be the 'politically correct' answer to this question and were hesitant to record a negative response. Closer scrutiny of the respondent who posted this response revealed that he is an Afrikaans-speaking, unmarried, male rifleman, 25 years of age, with six years of service in the Engineer corps. He had no environmental experience, no deployment experience and completed secondary school with grade 12 geography. Based on this profile, it is clear that the respondent is a young, junior member of the SA Army with little responsibility or influence. This does not imply that he may not hold a position of more influence in the future, but it does draw attention to the importance of rectifying faulty impressions like these. Overall, there is a willingness among the respondents to accept the responsibility of the SA Army to protect the environment in which it operates.

More than one-third 399 (36.6%) of the respondents did not make any qualitative responses. This relatively high ***non-response rate*** warrants further comment. Kelly et al. (2003) and Negev et al. (2010) have commented on the non-response rates generally associated with open-ended questions and they contended that open-ended questions are more demanding of respondents and that a higher non-response rate is likely, especially among less-motivated (or survey-fatigued) respondents. Kelly et al. (2003) reported a non-response rate of 20%, while a non-response rate of more than double that (41, 3%) was recorded in the survey by Negev et al. (2010). Compared to the non-response rate of these two studies, it seems that the non-response rate recorded here is acceptable.

In qualitative research the validity of the data does not imply representativeness of the total population, but on transferability as ensured by detailed description of the setting in which the research is conducted (O'Cathain & Thomas 2004). This detailed description was done for the MEL study and discussed in Section 5.3.2.

7.4.2 Attitude narrative on environmental consciousness

Item 44 required respondents to indicate whether they do or do not consider themselves generally environmentally conscious and then to motivate their answers. The question queried the rationale behind their perceived environmental consciousness or lack thereof. Table 7.2 marshals the response rates and examples of verbatim responses according to categories of responses.

The majority 965 (90%) of the survey participants who answered the question, recorded a positive response, i.e. they indicated that they consider themselves generally environmentally conscious. The remainder 105 (10%) recorded a negative response.

Table 7.2 lists the 13 categories into which positive responses were classified. This constitutes the largest number of response categories and consequently the most diverse responses recorded for any of the questionnaire's six qualitative items. The negative responses were subsumed under six categories, the most such categories for any of the six items. Clearly, there is a greater diversity of responses than found for the other five items.

Table 7.2 The attitude narrative on general environmental consciousness

Item 44	Do you consider yourself as being generally environmentally conscious? Yes/No.	
	Agreement response: Yes (90%), No (10%) n = 1070	
POSITIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Recognises duty of care for the environment	368 (57.9)	*"I do not like littering and I get very disturbed when people litter."* *"Because I make sure that I don't destroy the environment."* *"Because I have a great passion for nature and its resources."*
Values knowledge attainment	54 (8.5)	*"Because I get information about environmental affairs."*
Not applicable	52 (8.2)	*"So that I can have more say."*
Fosters recycling habit	45 (7.1)	*"I try and re-use/recycle as much as I can, for example plastic bottles and plastic bags."*
Confirms organisational imperative	41(6.5)	*"It is part of our plan before any military operation in the SA Army."*
Recognise social responsibility	28 (4.4)	*"Because is not only me who will use that environment."* *"Whenever we go as soldiers people look at us so we must be environmentally conscious."*
Creates future legacy	15 (2.4)	*"Because we have to look after our resources for future generations."*
Clichéd response	11 (1.7)	*"It is always right to do the right thing."*
Preserve resource and service supplies	9 (1.4)	*"Because some of our food supplies come from the environment."*
Respects personal or cultural conviction	5 (0.8)	*"Was brought up that way."*
Recognises organisational duty	3(0.5)	*"I report all environment-related incidents."*
Respects religious motive or obligation	3 (0.5)	*"As a Christian I am obligated to protect what God entrusted me to look after."*
Protects cultural heritage	1 (0.2)	*"Protect grave sites."*
TOTAL	635 (100.0)	
NEGATIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Lack of knowledge and/or training	17 (38.6)	*"I don't know much about environmental issues because it's not promoted by the Army."* *"I still need more knowledge and training in terms of how to preserve the environment."*
Disregards institutional imperative	13 (29.5)	*"Because when the army operates it does not think of the environment."*
Not applicable	8 (18.2)	*"To help in the SANDF."*
Lack of duty of care for the environment	3 (6.8)	*"I sometimes litter myself."* *"I throw my cigarette butts on the ground."* *"There is no way I can be environmentally conscious."*
External locus of control	2 (4.5)	*"There are a lot of things to improve on that is sometimes out of my hands."*

Knowledge enhancement	1 (2.3)	*"At first I didn't see the importance of looking after the environment in operations, but after answering this questionnaire I know I have to take care of the environment."*
TOTAL	44 (100.0)	

Ninety-four per cent (635) of the answers recorded in the open section of item 44 were **positive responses**. Table 7.2 shows that nearly three out of five responses represent a concern for *duty of care* toward the environment and/or a passion for the environment.

These attest to their general environmental consciousness. Typical responses to this question were that respondents take care not to harm the environment and that they are passionate about nature. This response category has important theoretical and practical implications. On a theoretical level it conforms with the idea posited by De Groot & Steg (2009) and Gifford & Nilsson (2014) that the social context in which people live influences their beliefs and actions. A personal norm (the feeling of moral obligation to perform certain actions) is an important factor influencing behaviour in the social context.

On a practical level, the principle behind this response category is captured in Section 24 of the South African Constitution (South Africa 1996) as well as in Section 28(1) of the National Environmental Management Act (NEMA) (South Africa 1998). This important principle is also included in both the first and second Environmental Implementation plans for Defence as well as in the Corporate Environmental Policy Statement contained in them (South Africa 2001; 2008). The *organisational duty* (58%) and *organisational imperative* (6.5%) categories are closely related to the principle of duty of care for the environment, but with the emphasis on the organisation and not the individual. If the responses in these two categories are added to the category concerning duty of care for the environment, almost two thirds (64.4%) of the respondents motivated their environmental concern according to this principle. This explains why they perceive themselves as being environmentally conscious and it signals the existence of a strong theoretical and practical basis for the perceived environmental concerns reported by the respondents. These findings are compatible with the results of the quantitative investigation of environmental attitude discussed in Section 6.1.

The second most (8.5%) responses were classified under the *knowledge attainment* rubric. A typical response was that respondents receive information about environmental affairs. Although knowledge is not seen per se as an indicator of pro-environmental behaviour, it is a necessary component of informed action (Robelia & Murphy (2012). This implies that knowledgeable soldiers have acquired one of the components that may lead to pro-environmental action.

The practice of regularly (almost by habit) engaging in pro-environmental behaviour, such as *recycling*, substantiated the general environmental consciousness of seven per cent of the respondents. This is an important class of responses because pro-environmental behaviour is seen as the most important yardstick of environmental concern (Chao 2012) and is thus valid evidence of environmental concern.

The *recognition of social responsibility* (4.4% of responses) is a subjective norm which Ajzen (1991: 188) defines as the "perceived social pressure to perform or not perform certain behaviour."

The *religious motive* advanced here by only three respondents has been researched elsewhere by Peterson & Liu (2008) who concluded that Christian respondents formed the middle ground between people with no religious affiliation (most environmentally orientated) and Mormons (least environmentally orientated) in the Teton Valley, USA. Gifford & Nilsson (2014) identified religion as a factor that can influence environmental concern. This kind of response is consistent with the assigned values of Van Riper & Kyle (2014). The religious motive is thus a valid rationale for environmental concern. The 52 (8.2%) *'not applicable'* responses probably signifies that the respondents could or would not justify the selected option coherently.

The nature and explanations of the responses of the *legacy, preserve resource and service supplies, protection of cultural heritage and clichéd responses* are similar to those discussed about item 43 in Section 7.4.1.

Only 44 (6%) **negative responses** were recorded. More than one third of these indicated that the respondents did not consider themselves to be generally environmentally conscious because they *lack sufficient knowledge* about military environmental matters. A typical response was the need for more knowledge and training about environmental protection. This points to a willingness to learn, even among soldiers not considering themselves environmentally conscious. This rationale of lack of knowledge for not being environmentally conscious has been identified as a valid reason by other studies. (Morrone, Mancl & Carr 2001; Kaiser & Fuhrer 2003; Negev et al. 2008; Teksoz et al. 2014).

A sizable 30% of the negative responses blandly considered environmental issues to be unimportant for the SA Army, thereby implying that soldiers do not have to care about the environment as it is *not an organisational imperative*. This potentially harmful misconception should be noted by military leaders and it needs to be addressed by military environmental education and training. This response echoes the only negative response posted for item 43. Pro-environmental behaviour is an accepted organisational imperative explicitly stated in both the first and second Environmental Implementation plans for Defence, as well as in the Corporate

Environmental Policy Statement contained in them (South Africa 2001; 2008). This makes it vitally important that this false impression should be corrected among soldiers.

Three respondents indicated that they do not think the Army *cares for the environment* in which it operate and/or that it is not important to care for the environment. Although only 6.8% of the respondents hold this view, it is essential that the SA Army takes note of and dispel this illusion. From legal and ethical viewpoints, such an attitude courts controversy. It takes only a few soldiers who are ignorant of the importance of environmentally responsible conduct for the SA Army to become involved in costly lawsuits, or worse, to compromise mission execution because of the environmentally insensitive behaviour of soldiers. This is especially true of missions in other countries. Examples are the pollution of water in water-scarce countries, the desecration of religious places or artefacts and ignoring the traditions of inhabitants of areas in which the military operates (Mosher et al. 2008). Only three other negative responses were recorded. *External locus of control* indicates an inability to take ownership of environmental behaviour. A single response stated that *completing the questionnaire* had sensitised the subject to the responsibility of caring for the environment. This was a fortuitous consequence of completing the questionnaire! Eight (18.2%) of the answers were *not applicable* due to their incomprehensibility.

Only 44 (6.5%) of respondents who gave **negative answers** to this question offered any explanation, and of these, 38.6% indicated a *lack of knowledge and training* as the reason for not being environmentally conscious but notably, they expressed a desire to be educated and trained in this regard. A further 29.5% reported that they believe the SA Army *disregards its institutional imperative*, while *lack of duty of care* was advanced by 6.8% of the respondents, and 4.5% blamed the *external locus of control* for their lack of environmental consciousness. One respondent indicated that *knowledge enhancement* made him/her more environmentally conscious. The *not applicable* category attracted 18.2% of the responses, while the *non-response rate* for item 44 amounted to 436 (40.0%) of the respondents.

The narrative of this question about environmental consciousness tells of a high degree of adherence to or recognition of the principle of duty of care toward the environment as the primary reason for the positive responses, while others offered environmental-friendly actions, like abhorrence of littering, as their motivation. Again the results are consonant with the generally good attitude and reported behaviour reported in the discussion of the quantitative part of the questionnaire. This testifies to the consistency of convictions expressed by the respondents.

7.4.3   Behaviour narrative on good environmental practice and mission success

Item 45 required respondents to indicate whether they think that good environmental practices in the SA Army can improve mission success. The majority 986 (92%) of respondents wrote positive responses to the question, i.e. they are of the opinion that good environmental practices in the SA Army can improve mission success. Only 84 (8%) respondents recorded negative responses. This result is noteworthy, not only because it indicates that respondents understand the importance of sound environmental management practices and their impact on mission success, but also that the literature confirms the truth of this assumption. Moser et al. (2008) have indicated that poor environmental practices adversely affect operational costs, increase liability, strain diplomatic relations and pose risks to the health of soldiers and civilians alike. Unfortunately, all of these can jeopardise mission success. Rubin (2012) has reported on the consequences of ignorance about cultural and religious practices when US Army soldiers inadvertently burned Korans in Afghanistan. The action led to widespread protests, the death of a number of US soldiers and a lack of credibility in the eyes of the local population. The danger unsustainable waste management practices posed to the health of soldiers and civilians in Afghanistan has been investigated by Bonds (2015). He reported that open-air burn pits used to dispose of solid waste caused health problems for soldiers and Afghan civilians. He also noted that it was an environmentally literate soldier with a PhD in Environmental Engineering who first alerted leadership to the problems associated with the US Army's mode of waste management.

A large percentage (92%) of SA Army soldiers recognise that environmentally sustainable practices can strengthen mission success. It is hoped that this implies that unsustainable practices, such as those reported by Bonds (2015), will not be repeated by South African soldiers. Potentially highly negative health, environmental, legal and image problems associated with bad military environmental conduct must be averted.

Table 7.3 presents four positive response categories, four negative response categories, the respective response rates and examples of verbatim responses. A total number of 564 (92%) **positive responses** were recorded for item 45, but an alarming 256 (45.4%) of the written responses had to be classified as *not applicable* because they were incomprehensible. A typical verbatim response was: '*Yes, because we will have food*'. This type of nonsensical response implies that almost half of the respondents either did not understand the question or were not able to post a logical response. No explanation for this is readily forthcoming. Neither during the initial development stages of the questionnaire nor during the pilot project did any test respondent have any problem with the question. During the completion of the questionnaire, none of the research assistants recorded any issues regarding this question and the researcher never fielded any queries in this regard at any of the survey venues. A possible explanation is that some respondents

misunderstood the question while under the false impression that they did understand it. The respondents possibly believed that good environmental practices can improve mission success, but could not motivate their responses succinctly. Another explanation is that the respondents tried to

Table 7.3 The behaviour narrative on environmental practices and mission success

Question 45	Do you think that good environmental practices in the South African Army can improve mission success? Yes/No.	
	Agreement response: Yes (92%), No (8%) n = 1069	
POSITIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Not applicable	256 (45.4)	*"Yes, because we will have food."*
Confirms environmental sustainability (utilitarian)	191 (33.9)	*"Of course it will because we need a good environment to conduct good training and for missions."* *"If we take care of the environment it will benefit us even in years to come."*
Recognises social responsibility	68 (12.1)	*"As we are busy with peace operations we can set an example for members in other countries and educate them to make Africa a better place. By doing that we uplift the name and image of the SANDF."*
Avoids health risk	49 (8.7)	*"Yes, if an area gets contaminated with unexploded ordinance, the area becomes unusable: good environmental practices can prevent this."*
TOTAL	564 (100.0)	
NEGATIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Ignore organisational imperative	17 (43.6)	*"I think focusing too much on the environment will hamper the success of any military operation."*
Impossible mandate	12 (30.8)	*"Armed conflict that does not harm the environment is a myth, War/Weapons = destruction."*
Disregard link to mission success	6 (15.4)	*"I don't think the environment has anything to do with any mission whatsoever".* *"Mission success does not depend on environmental regulations."*
Not applicable	4 (10.3)	*"Because we won't be able to use or test our materials."*
TOTAL	39 (100.0)	

answer the question according to what they perceived to be the 'correct' response based on the perceived expectations of the researcher. Matthies, Selge & Klöckner (2012: 278) call this type of behaviour the 'subjective norm' and define it as the "perceived expectations of significant others." In this case the significant other is the higher ranking researcher. But it can be argued that this is not likely to be the case. This effect appears in none of the other answers to the questions, something one would expect if perceptions of 'good' responses existed among the respondents. The fact that the research assistants did not necessarily have higher ranks than the respondents,

negates the subjective norm reasoning. This question will have to be evaluated further to ascertain why it was misunderstood.

Thirty-four per cent of the remaining responses confirms *environmental sustainability (utilitarian)* as cause of better training conditions and, consequently, improve mission success. A typical comment was that a 'good environment' is needed to execute missions and conduct training. Van Riper & Kyle (2014) call this type of assigned value as 'future oriented', indicating that respondents assigned a future value to the military environment. Giving this value to the military environment signifies an ability to look beyond the immediate utilitarian value of the environment and express a desire to protect it for use by future generations.

A relatively large selection of responses 68 (12.1%) indicated that the SA Army has a *social responsibility* even during mission execution. Typical responses stressed the importance of setting a good example and educating members of other militaries to make Africa a better place. By doing this, they will enhance the image of the SANDF. Ajzen (1991) labels this social responsibility behaviour as adhering to the subjective norm where a perceived social pressure exists to engage in certain types of behaviour. This type of response demonstrates a willingness to take the importance and effects of good environmental practices beyond the immediate group or area into the continent. This is especially true during deployments. These responses are very significant because during peacekeeping, and peacemaking and humanitarian aid missions, mission success is compromised when the environment is adversely affected by mission execution that is environmentally unfriendly. Examples of such compromising practices are the pollution of vital water resources, destruction of vegetation used for firewood and other household activities, and the damaging or desecration of culturally important buildings such as mosques and churches and other artefacts (Mosher et al. 2008; Rubin 2012; Bonds 2015).

The other positive response category 49 (8.7%) responses connote that a good environment means an environment that does not imperil soldiers' *health* and remains usable. A typical remark in this regard is that good environmental practices can prevent contamination of the environment by unexploded ordinance that could render certain areas unusable. The responses also stress the importance of good environmental practices as prerequisite to the good health of soldiers and thus to mission success. The influence of environmental factors on the health of soldiers is well documented in military history, and military geography. This should be emphasised by environmental education and training. Breytenbach (1983) has described the ordeal of British soldiers who drank contaminated water at the battle of Paardeberg during the Anglo-Boer War. Palka & Galgano (2011) examined how poor sanitary and other environmental conditions hampered the Buna-Gona campaign during World War II. They aver: "Bear in mind that the Buna-

Gona campaign is only a representative example. We can surely look to virtually any war and discover specific examples of where disease and/or adverse environmental conditions rendered soldiers and units combat ineffective" (Palka & Galgano 2011: 170).

Regarding item 45, as with the other items, only a small number 39 (6 %) of the recorded responses were **negative.** Two out of five negative responses rest on a belief that the *mission takes preference* and that environmental issues should not interfere because they are perceived to have compromising influences. A typical response is that military operations will be prejudiced if the SA Army focuses too much on the environment. These concerns must be addressed by military environmental education that stresses the importance (and possibility) of incorporating good environmental practices that enhance mission success (Mosher et al. 2008, Rubin 2012; Bonds 2015).

Thirty-one per cent of the negative responses were classified as it being an *impossible mandate* to combine good environmental practices with military missions. A typical response said that it is a myth that armed conflict does not harm the environment: war is inherently destructive. It appears that most of the responses classified in this category refer only to armed conflict and take no account of any other type of military mission such as peacekeeping. Equating the waging of war to the total and only mandate of militaries is a popular misconception which was also encountered in informal discussions with soldier-students at the SAMA where the researcher is a lecturer. During peacekeeping and other types of non-violent missions, but also during war, good environmental practices do actually improve mission success (Mosher et al. 2008, Rubin 2012; Bonds 2015).

Another 15% of the responses believe that good *environmental practices have no link with mission success.* This misconception has been disproved by research (Mosher et al. 2008, Rubin 2012; Bonds 2015). Only 4 (10.3%) of the responses were *not applicable.* The *non-response rate* for this item was 44.7%.

Although the small number of negative responses suggests that they are negligible, one aspect that comes to the fore is that respondents tend to think in terms of fighting wars, i.e. the traditional role of militaries. This ineptitude to take the full scope of modern military activities into consideration, should be addressed during environmental education and training. The meaningful responses to item 45 corroborate the results regarding positive behaviour reported in Section 6.4.

7.4.4   Behaviour narrative on minimised environmental impacts

According to Ajzen (1991) the subjective norm indicates a perceived social pressure to engage in a certain type of behaviour, while Matthies, Selge & Klöckner (2012: 278) define the

subjective norm as "perceived expectations of significant others." In both definitions the social context of the SA Army can be seen to influence the pro-environmental behaviour of soldiers if they perceive the social pressure and expectation of significant others to be in favour of good military environmental conduct.

Item 46 required respondents to mark whether they try, in their work environment, to minimise their negative impact on the environment and to motivate their answer. The responses in Table 7.4 present the results for this item.

Table 7.4 The behaviour narrative on minimising negative environmental impacts

Item 46	In your work environment, do you try to minimise your negative impact on the environment? Yes/No.		
	Agreement response: Yes (92%), No (8%) n = 1076		
POSITIVE RESPONSE CATEGORY	RESPONSE COUNT (%)		EXAMPLE VERBATIM RESPONSE
Displays environment-friendly conduct	201 (32.4)		"Limit the damage to environment/nature during training in terms of movement on established tracks, do not harm/kill wildlife, try not to spill fuel in training areas."
Recognises organisational imperative	125 (20.1)		"We adhere to regulations such as those relating to the disposal of batteries, oil, fluorescent tubes, scrap metal etc." "It is military discipline."
Not applicable	104 (16.8)		"It is important."
Creates future legacy	75 (12.1)		"Because if we destroy it there will be nothing left for our children."
Fosters recycling and energy conservation habit	62 (10.0)		"Recycle and reuse where possible." "Computers etc. are switched of when not in use."
Avoids health risk	35 (5.6)		"So that my working environment must be safe."
Confirms environmentally sustainable use	10 (1.6)		"Yes, by frequently changing the areas where we erect temporary bases and operate in, in order for that specific area to rehabilitate."
Show respect	6 (0.1)		"To show respect."
Recognise external locus of control	2 (0.03)		"To avoid getting into trouble."
TOTAL	620 (100.0)		
NEGATIVE RESPONSE CATEGORY	RESPONSE COUNT (%)		EXAMPLE VERBATIM RESPONSE
Lack of knowledge attainment	9 (39.1)		'Did not receive any training to change my thinking about the environment."
Ignore duty of care	7 (30.4)		"Training comes first."
Lack of motivation	3 (13.1)		"No, I don't even try."
Impossible mandate	2 (8.7)		"It is quite difficult due to the vehicles that we use and number thereof."
Not applicable	2 (8.7)		"I don't have an answer."
TOTAL	23 (100.0)		

Some 994 (92%) of the respondents gave a positive answer to the question, i.e. they do try to minimise their negative impact on the environment at their workplace. Eighty-two (8%)

recorded that they did not. Item 46 interrogates the pro-environmental behaviour of respondents at their workplace. Responses to this question should agree with those recorded in the investigation of the behaviour scale in the MEL questionnaire.

Nine response categories relating to positive responses were identified and five for negative responses. The reasons put forward for the **positive responses** numbered 620 (96.4%) of all the captured responses. About one third of these suggest that the soldiers *display environment-friendly conduct* as a measure of their trying to minimise their negative impact on the environment. Respondents recorded pro-environmental behaviour such as trying to limit damage to vegetation and wildlife, and not spilling fuel during training as their contributions.

One fifth of the reasons related to the *organisational imperative*. Adherence to regulations governing environmental conduct is a typical stimulus for impact-minimising behaviour. Responses reflecting an adherence to the perceived ethos of the SA Army are important as they indicate knowledge about and acceptance of the military environmental imperative of the SA Army.

The *legacy for future generations* category comprises 75 (12.1%) of the responses. These responses argue that respondents minimise their impact for the sake of creating a legacy. A typical response is that destruction of the environment will leave nothing to their children. The legacy rationale has been discussed already.

The *foster a recycling and energy conservation habit* category constitutes 62 (10%) of the responses. The recycling and reuse of material and energy conservation are typical rationales included in this category.

Categories containing small numbers of responses are *avoidance of health risk* where having a safe working environment was important to respondents; *locus of control* where respondents indicated that their environmental conduct helps them not to get into trouble; and *environmentally sustainable use* where responses point to a need to protect resources for future exploitation. An interesting category is *out of respect*, in which six respondents revealed that they minimise their impact 'to show respect'. Unfortunately, it was not possible to discern from the answers whether the environment or some other entity or person is the object of this respect. One-hundred-and-four (16.8%) of the responses were deemed to be *not applicable*.

The 23 **negative responses** to this question accounted for only 4% of all the responses recorded for item 43. The *lack of knowledge* category contains typical responses like no training has been received to foster a positive environmental attitude. Another reason for not trying to minimise their negative impact on the environment was that training or the objectives set by the

organisation must come first, thus ignoring the ***duty of care*** principle. Ironically, it is one of the stated objectives of the SANDF to be an environment-friendly organisation and to minimise their impact on the environment. Other minor categories are ***lack of motivation*** to minimise one's impact so that respondents do not even try; and it is an ***impossible mandate*** due to it being too difficult to execute. Only two responses were ***not applicable***. A ***non-response rate*** of 471 (43.2%) was recorded for item 46.

The generally good behaviour reported regarding the quantitative items of the questionnaire is echoed in the above narrative. This is evidence that respondents answered the questions consistently and truthfully, and that the MEL questionnaire developed for the survey of the soldiers is a valid and reliable instrument for surveying MEL in the SA Army. The responses to items 47 and 48 contains the narrative about military environmental knowledge and are investigated in the next two sections.

7.4.5   Knowledge narrative on adequacy of environmental education and training

Generally, in EL surveys the sources of environmental education are usually given as newspapers, the Internet, television and books (Ivy et al. 1998; Hsu & Roth 1999; Haron, Paim & Yahaya 2005; Al-Dajeh 2012). Gifford (2011: 290) refers to barriers to pro-environmental behaviour as "structural barriers" which implies that even if all other factors encourage pro-environmental behaviour, like recycling, but no such avenues are available, recycling cannot take place. This part of the environmental narrative focuses on the attainment of environmental knowledge through organisational education and training initiatives, and it also touches on another organisational imperative namely the importance of removing structural barriers to environmental behaviour.

Item 47 required a respondent to consider whether they think that the SA Army provided him/her with adequate environmental education and training to take care of the environment in which the military operates while executing his/her tasks. After giving an affirmative or a negative answer, respondents had to motivate their answer. A compendium of response categories, response rates and examples of the reasons is given in Table 7.5.

Six-hundred-and-sixty-nine (62.1%) participants answered in the affirmative, i.e. they indicated that they thought the SA Army did provide them with adequate environmental education and training to take care of the environment in which the military operates while they execute their tasks. Four-hundred-and-eight (38%) marked a negative option, the highest number for any of the qualitative items.

Four response categories were created for the positive responses and six for the negative responses. A total of 375 (60%) respondents gave reasons for their **positive responses.** The majority (55.5%) wrote that an *environmental specialist* was their regular source of information about military environmental matters, thus providing them with adequate environmental education and training to take care of the environment in which they operate. Another four per cent of the

Table 7.5 The knowledge narrative on the adequacy of environmental education and training

Item 47	Do you think that the South African Army provided you with adequate environmental education and training to take care of the environment in which the military operates while you execute your tasks? Yes/No.	
	Agreement response: Yes (62%), No (38%) n = 1077	
POSITIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Source of information: Military environmental specialist	216 (57.6)	*"Every course at the SA Army, CTC has environmental awareness periods to make learners aware of the environment and its surroundings."*
Not applicable	106 (28.3)	*"Sometimes terrain is not sufficient for training."*
Recognises organisational imperative	38 (10.0)	*"After every operation and exercises we do chicken parade and mark the unexploded ammunition."*
Source of information: Environmental education	15 (4.0)	*"Attend meetings and seminars, doing courses."*
TOTAL	375 (100.0)	
NEGATIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Inadequate knowledge attainment	136 (55.5)	*"We should be made more aware of how our practices impact on the environment and be given possible solutions to help diminish our impact."*
No knowledge attainment	75 (30.6)	*"In my 8 years being in the organization I have never received any lessons of how to take care of the environment."*
Differential availability of information	20 (8.2)	*"More courses should be available to all rank groups and all formations."*
Not applicable	7 (2.9)	*"No comment, but I did it myself."*
Not organisational imperative	4 (1.6)	*"Most military exercises are conducted in a manner that is detrimental to the environment."*
Structural barriers	3 (1.2)	*"Lack of recycling processes and disposal of items such as batteries".*
TOTAL	245 (100.0)	

respondents indicated that *environmental education* was their source of information. The fact that the main sources of environmental education and training are the military environmental specialist and environmental education and training, distinguishes the MEL survey from civilian surveys that evaluate general EL literature. The impact of military environmental specialists bodes well for the efforts of the SANDF to promote environmentally literate soldiers. A typical response was that environmental awareness is stimulated during all the courses to help foster environmental consciousness among soldiers. This is an extremely important result, as it indicates that the

environmental education and training programs work and emphasise the importance of a dedicated military environmental specialist, something lacking in some units. Nearly 30% were classified as *not applicable* and recognition of the *organisational imperative* was given as the rationale by 10% of the respondents for their positive response to item 47. This result corroborates the good environmental knowledge possessed by the respondents as assessed in the knowledge section of the MEL questionnaire and discussed in Section 6.5.

A total of 245 (40%) respondents gave reasons for their **negative answers.** Although many of the respondents answered that they receive regular environmental education and training, an unexpected large number alleges exactly the opposite. This unanticipated result is a warning signal that in some formations and units there is less environmental education and training available than in others.

Most (56%) of the negative responses testifies to *inadequate knowledge attainment* taking place and that more education and training was needed by soldiers to take care of the environment in which the military operates while executing their task. A typical response stated that soldiers should be empowered with knowledge and skills to help mitigate their impact on the environment. The vital implication of this is that although the responses do not necessarily imply that the respondents received no environmental education and training, they need more and are willing to learn. This must be taken into account when considering whether education and training interventions are needed.

Almost one third of the negative responses point to *no knowledge attainment* having taken place. Managerially, this should be a major cause of concern. The prevalence of this sentiment contradicts that held by other respondents that an environmental expert regularly provided military environmental education and training. A typical verbatim response was that "In my 8 years being in the organization I have **never** (researcher's emphasis) received any lessons of how to take care of the environment." This is a serious allegation of dereliction of duty by an organisation that has a stated objective to conduct its business in an environmentally sustainable manner.

The allegation is strengthened by statements that *information is differentially available* to certain groups and not across the board in the SA Army. A typical response expressed the need for environmental courses to be available to all rank groups and in all formations. Furthermore, some written responses connoted that environment-friendly conduct was not an *organisational imperative* as most military exercises are detrimental to the environment. Although *structural barriers,* such as a lack of disposal and recycling processes and facilities, that hamper the execution of environmentally responsible conduct were only mentioned by a small number of respondents, the existence of such must be recognised and addressed. Only 7 (2.9%) of the responses were *not*

applicable, an indication that the respondents read and understood the question well, and they knew exactly what they wanted to say to support their responses. The ***non-response rate*** for item 47 was 43.1%.

The dominant message in this narrative is the need for more education and training. Clearly, the respondents do not only believe that they have inadequate military environmental education and training, but they are also adamant that they need more. Moreover, this implies a willingness to learn more about the environment and how to operate more responsibly in it. This sentiment was expressed repeatedly by respondents during informal discussions after they had completed their questionnaire. The DOD must take cognisance of this openness when considering their military environmental education and training initiatives.

Almost one third of the respondents said that they have never received information about military environmental management. Obviously, in certain formations and/or units, environmental education and training do not receive the attention they should. Likely reasons are that the post of environmental officer is not staffed, or staffed by an unqualified, unmotivated or overburdened member, or that there is a lack of interest in environmental education and training in that specific unit or formation (Laubscher 2015, Pers com). In the earlier discussion on formations it transpired that South African military environmental practitioners agreed that this is indeed the case (see for instance Section 7.2.3.1). Preferential access to environmental education and training was also advanced as the reason for the lack of MEK. Again, the findings of the quantitative analyses are corroborated.

7.4.6 Knowledge narrative on environmental education and training requirements

Although environmental knowledge alone is not a causal factor in pro-environmental behaviour (Stern 2000; Kollmuss & Agyeman 2002; Barr & Gilg 2007; Vicente-Molina, Fernández-Sáinz & Izagirre-Olaizola 2013), it does influence environmental behaviour positively, especially if mediated by other variables (Frick, Kaiser & Wilson 2004; Barr & Gilg 2007; Vicente-Molina, Fernández-Sáinz & Izagirre-Olaizola 2013). Consequently, it is essential to ascertain the need by soldiers for more environmental knowledge.

Item 48 required respondents to indicate whether they have a need to learn more about the environment in which the SA Army operates. Table 7.6 reports the results of this exercise. Ninety-two per cent (998) participants answered in the affirmative and only 83 (8%) gave a negative response. Six response categories were created for positive responses and three for negative responses.

A total of 595 written reasons were given for the **positive responses** of which 304 or one half argued that the need to learn more about the environment in which the SA Army operates rests in the *value of knowledge attainment*, i.e. they subscribe to the concept of lifelong learning or learning for the sake of gaining more knowledge. Another 30% stated that they want to learn more to enable them to take better care of the environment in which they operate – the *duty of care* principle. A typical response was that respondents need more knowledge to be able to care for the

Table 7.6 The knowledge narrative on environmental education and training requirements

Item 48	Do you have a need to learn more about the environment in which the South African Army operates? Yes/No.	
	Agreement response: Yes (92%), No (8%) n = 1081	
POSITIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Values knowledge attainment	304 (51.1)	*"To gain more knowledge."*
Recognises duty of care	181(30.4)	*"So that I can know how to take care of the environment I operate in".*
Not applicable	61 (10.3)	*"Garden".*
Recognise social responsibility	21(3.5)	*"So that I can educate other people about it".*
Creates future legacy	18 (3.0)	*"Yes we need to learn more to protect our environment so that the future generations will have it to use it."*
Avoids health risk	10 (1.6)	*"Most exercise areas have a lot of unexploded cartridges and unfortunately, every year people become collateral damage."*
TOTAL	595 (100.0)	
NEGATIVE RESPONSE CATEGORY	**RESPONSE COUNT (%)**	**EXAMPLE VERBATIM RESPONSE**
Sufficient knowledge	27 (87.1)	*"The information I know or have is enough."* *"Because environmental presentations cover everything we need to know."*
Lack of motivation	3 (9.7)	*"Not really interested."*
Not applicable	1 (3.2)	*"Same"*
TOTAL	31 (100.0)	

environment in which they operate. These two important categories accounted for 82% of the responses and they are significant as they testify to the respondents' subscription to an ethos of lifelong learning and a receptiveness for more military environmental education and training. The implication for military environmental education and training is that there is a need and openness for such education and training, as well as a meritorious motivation, namely duty of care. This is an ideal situation in which to deliver any educational programme and should be acted on by the military environmental educators with strong support by the SA Army's top management. The EL literacy literature recommends that education and training must not concentrate on knowledge building alone, but should also target the development of military environmental skills, including

the affective domain (moods, feelings and attitudes), while identifying and removing structural and psychological barriers that prevent pro-environmental behaviour.

Categories with less than 5% of the responses are ***social responsibility*** (3.5%)***, creating a legacy for future generations*** (3%) and ***avoidance of health risks*** (1.6%). Some 10% of the responses were deemed to be ***not applicable***.

Very few (31) **negative responses** were forthcoming, principal of which 27 cited ***sufficient knowledge***. This is not a negative response per se as it may imply that the respondents do receive regular, high-quality environmental education and training and regard it as adequate.

Furthermore, a few respondents mentioned a ***lack of motivation*** or interest in gaining more knowledge and are not interested to gain more knowledge. This is disturbing as it reveals an unwillingness to be educated regarding military environmental issues. Gifford (2011) has suggested an explanation for the unwillingness to be educated when he contended that people have multiple goals and values, some of which may not be compatible with environmental literacy. Nonetheless, these negative responses must be dealt with by military environmental education and training because MEL is too important a matter to be ignored by soldiers unwilling to be informed about its relevance. Only one response that was ***not applicable*** was captured, while the **non-response rate** was 42.9%.

These findings corroborate the sound quantitative knowledge results discussed in Chapter 6 and suggest an opportunity for the DOD to enhance the scope, quality and quantity of its offering of environmental education and training. This, coupled to an already good MEL, will impact beneficially on future military activities, be they routine base maintenance, exercises or the full spectrum of military activities both in South Africa and abroad.

The military environmental narrative was investigated and the 'story' of military environmental education and training in the SA Army as told by the soldiers themselves constructed in Section 7.4. Triangulation with the quantitative findings discussed in Chapter 6 revealed a strong agreement between the two sets of findings. Together the qualitative and quantitative findings were used to develop a model of MEL.

7.5   A MODEL OF MILITARY ENVIRONMENTAL LITERACY

A number of models exist for predicting the environmental conduct of people displaying particular characteristics. The models identify variables that influence pro-environmental behaviour and they indicate interrelationships among these variables (Oreg & Katz-Gerro 2006; Chao 2012). The best-known and most cited of these models in environmental literacy literature are the model of environmentally responsible behaviour (Hines et al. 1986/87) and the theory of

planned behaviour (Ajzen 1991). Although Kollmuss & Agyeman (2002) have declared that environmental behaviour is too complex to be adequately encapsulated in any one model applicable in all contexts, they do concede that most models have some validity in certain contexts (in the case of the MEL study, the military context) and, consequently, they developed a model of pro-environmental behaviour to explain their research results. A decade later the contentions about the explanatory power of EL models and the need to develop models applicable to certain contexts were echoed by Robelia & Murphy (2012). These models were discussed briefly in Section 1.6.3.

Kollmuss & Agyeman (2002) also reported that sustainable environmental behaviour, if not based on fundamental supporting values, easily degenerates into unsustainable environmental behaviour. Implicit in the construct of MEL is the assumption that three components, namely attitude, behaviour and knowledge are related to each other and they influence each other. Each component can potentially be impacted on by a host of variables, augmenting or restricting the influence of the components on MEL profiling. Thus, an MEL model should also build a profile of soldiers displaying better or poorer MEL.

No dedicated models exist for MEL. Consequent to the above recommendation and assumptions, a model that can be used to clarify and categorise the variables tested and reported on in this study, and their effects on MEL, was developed.

The MEL model, graphically illustrated in Figure 7.4, has the three components determining MEL as basis. The model incorporates the three components and indicates the direction and strength of the interrelationship of the components. In EL literature various scholars have singled out structural and psychological barriers to pro-environmental behaviour (Tudor, Barr & Gilg 2007; Gifford 2011; Gifford & Nilsson 2014). These barriers prevent the behaviour component of EL from occurring, effectively obstructing the development of improved EL. Certain variables either restrict or augment the development of improved EL. These so-called restricting and augmenting variables were distinguished from the results of the present study and included in the MEL model.

The direction and strength of the **relationship** between the components of MEL, as exposed by the results of the foregoing MEL research, are indicated by the degree of prominence of directional arrows. The strongest relationship exists between attitude and behaviour, the weakest between knowledge and behaviour.

Certain variables that enhance or augment one or more of the components were isolated from the quantitative study of MEL. This enabled the identification of types of MEL component-specific or general variables that either augment or restrict the acquisition of military environmental literacy. **Component-specific augmenting variables** are included in the model for

attitude, behaviour and knowledge. For instance, belonging to the Air Defence Artillery or the Training formations, having some kind of environmental responsibility and having completed an environmental course are all associated with higher levels of MEA, as are English or Tsivenda home-language speakers. The set of **general augmenting variables,** identified through the open-ended questions, include fostering a habit of pro-environmental actions.

Source: MEL survey (2012)
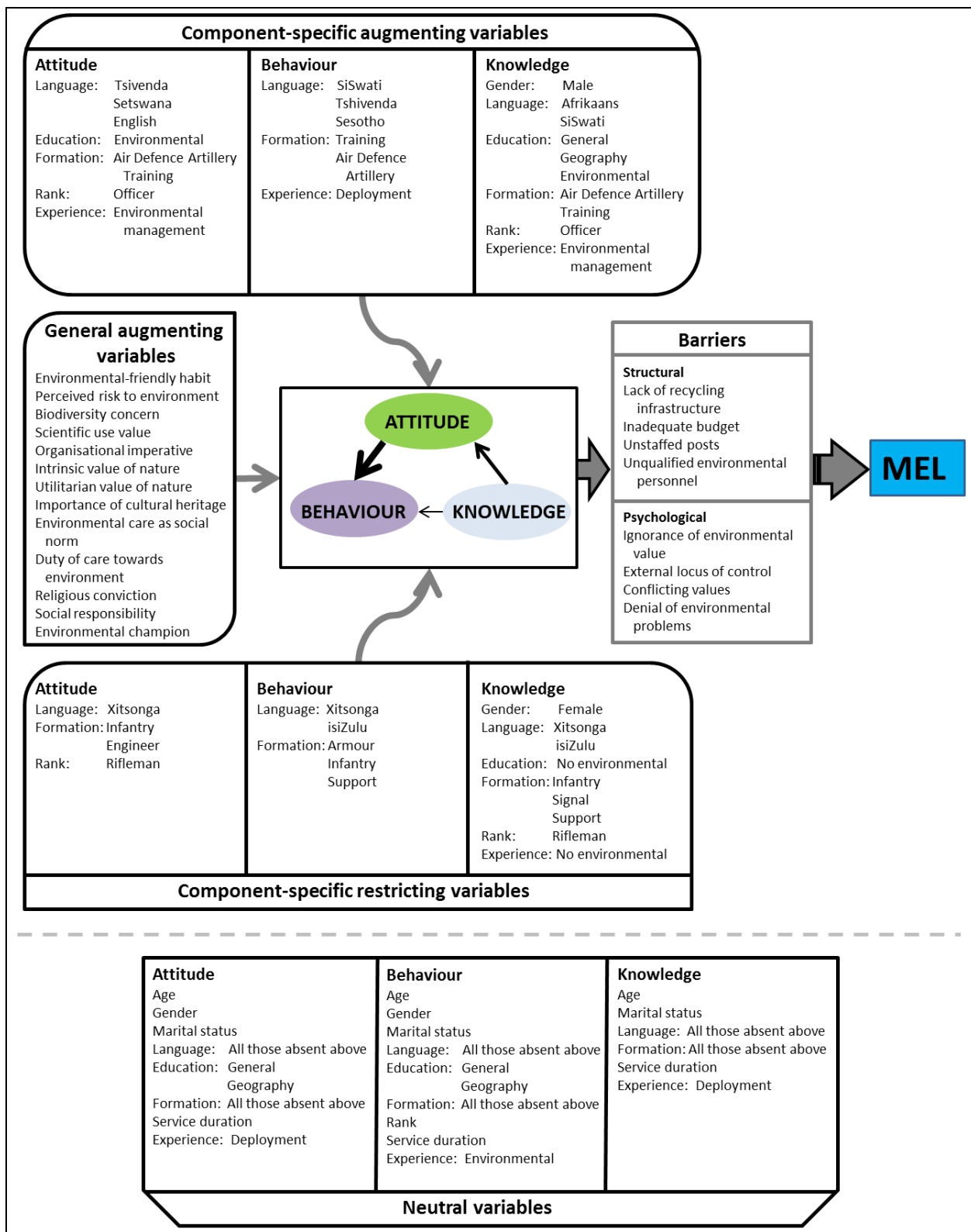
Figure 7.4 The military environmental literacy (MEL) model

Countering the augmenting variables, **component-specific, and general restricting variables** were identified by the same processes. In this case, **general restricting** variables are the opposite of the general augmenting variables. Component-specific restricting variables are those that inhibit an improvement in MEA, MEB or MEK. The MEL model postulates that belonging to Infantry or Engineer Formations, being a rifleman or speaking Xitsonga as home language could be restricting variables to scoring a respectable MEA rating.

A selection of **neutral variables** (not augmenting nor restricting any component) was isolated. No general neutral variables were identified. In the MEL model, belonging to any formation not mentioned under component-specific augmenting or restricting variables, service duration, deployment experience, age, gender, marital status, general level of education and geography education are neutral variables for determining MEA.

Similar to the **structural and psychological barriers** identified in literature (Tudor, Barr & Gilg 2007; Gifford 2011; Gifford & Nilsson 2014), respondents in the MEL survey identified barriers to environmental literacy to be included in the MEL model. A lack of recycling infrastructure (structural barrier) was reported by some respondents. According to them, this would effectively negate the possibility of recycling, even if all other components (knowledge and attitude) are in favour of engaging in recycling. Other structural barriers identified by the respondents include an inadequate budget, unstaffed posts and unqualified environmental personnel. Similarly, a range of psychological barriers was reported. Ignorance of the value of the environment, external locus of control, conflicting values toward environmental engagement and denial of environmental problems was reported. Together the components of MEL, their interrelationships and the augmenting and restricting variables impacting on them, constitute the model of MEL if not obstructed by structural or psychological barriers. It must be emphasised that this model is the outcome of the research results of the MEL survey, and as such it may be used to comprehend, manage and develop MEL in the context of the SA Army and serve as benchmark to be revisited and improved through further research.

In Chapter 7 the MEL profile of SA Army soldiers were reported through an investigation of the composite MEL and the construction of a MEL narrative, the former by interrogating the quantitative findings and the latter by qualitatively analysing the open-ended questions. Both the quantitative and qualitative findings were then used to develop a MEL model.

This chapter completes reporting on the empirical results from the research. The concluding chapter revisits the objectives, summarises the findings, draws conclusions, records

the contentions made, points out some of the study's limitations, make recommendations and lists some further avenues of research.

CHAPTER 8   CONCLUSION

It's not easy being green (Kermit the frog).

I can say that environmental concern is a part of our culture here because it is right, it is required by law and regulation, and we want to avoid any more CNN moments and negative impacts on our information operations (Corson 2011, Pers com).

The investigation documented in this dissertation has its genesis in the reality that militaries worldwide conduct their operations over considerable areas, both in their own countries and, on occasion, externally in international space. They are involved in traditional military tasks such as training, base management and war fighting and with more non-traditional missions, such as peacekeeping, humanitarian assistance or disaster-relief operations. Due to this mission diversity, the large areas impacted on by military missions, and the inherent destructive nature of some military activities, the military environmental footprint can be enormous. Recent examples of soldiers inadvertently harming their own interests by displaying environmentally insensitive behaviour, coupled to a global emphasis on environmentally responsible behaviour, have forced militaries worldwide to rethink their conduct when executing missions. Not only is it expected from an ethical, moral and legal perspective, but there is a growing recognition that environmentally responsible conduct toward the environment in which the military operates can improve mission success.

From a South African perspective, our legal regime holds our military responsible for the areas in which they train, live and operate in South Africa and moreover, they are bound through international conventions and treaties to conduct their mission in an environmentally responsible manner when operating outside the country. South Africa has a long history of officially caring for the military environment, with only the United States of America (USA) armed forces having a longer official track record as an environmental carer. Two military environmental implementation plans for South Africa's defence sector have been drafted and promulgated, the South African Department of Defence (DOD) has a corporate environmental policy statement, each year environmental awards are presented to units with excellent environmental performance records, and the vital importance of sound environmental practices is routinely advocated by senior members of the DOD. A number of policies and plans exist regarding military environmental management, a bilateral agreement with the USA DOD is in place and a small but committed environmental subdirectorate ensures that these policies and plans are executed. To crown all these environment-enhancing directives and practices, the DOD has developed and piloted an environmental management system (EMS) for Defence.

At face value it appears that the DOD complies with all the requirements of environmentally responsible military conduct. However, two issues identified prior to commencing with this military environmental literacy (MEL) research, mar this seemingly excellent environmental performance record. First, the EMS has only been piloted, never implemented. The reasons were not investigated in this study. Second, and the focus of this research, no data existed on the impact of these management initiatives at grassroots-level. Furthermore, this untenable position nevertheless accorded the DOD with a seemingly long track record of caring for the military environment given the impressive list of environmental management initiatives, policies and plans. But, contrarily, little information existed on the effects of these management initiatives on the environmental attitudes, behaviour or knowledge of soldiers operating in military environments. These soldiers are the agents directly responsible for the military's environmental footprint. This dilemma was the fundamental issue confronted by the present research into the MEL of South African Army (SA Army) members.

In this chapter the aim and objectives of the MEL research are revisited; the salient findings are presented, their implications are explained and conclusions are drawn; the value and contributions of the research are briefly deliberated; some limitations are outlined; recommendations are made for enhancing the MEL of SA Army soldiers; and finally some unanswered questions are highlighted and directions for future research are identified.

8.1   AIM AND OBJECTIVES REVISITED

This MEL research commenced with the formulation of research questions emanating from the predicament in the DOD about the appropriateness of existing instruments, such as questionnaires, to survey a South African military population. Should no suitable instrument exist, who should develop such an instrument, what components of environmental literacy (EL) the instrument should include and in what format? This led to the question of whether different instruments are needed for the different arms of military service, i.e. Army, Navy, Air Force and Military Health Services. Following an informed decision to develop an Army-specific instrument, the next question arose about what constitutes context-specific indicators of MEL. The final research question called for the choice of an appropriate methodological foundation and the selection of applicable methods to conduct a MEL survey and analyse the results.

Consequently, the overarching aim was to evaluate existing instruments for measuring EL, identify context-specific indicators of MEL in the SA Army, develop and apply a valid and reliable instrument (questionnaire) to measure MEL, to analyse the survey results and interpret the findings for their relevance to military operations and policy.

Seven objectives were identified to realise the research aim. The first was to analyse and evaluate existing survey instruments to determine their suitability for use in a SA Army context. The second was to identify and formulate contextualised MEL questionnaire items. Third was the development and testing of a pilot instrument that culminates in a final MEL questionnaire. Fourth was the execution of a military environmental survey in selected units of the SA Army. The fifth objective was to analyse the data and interpret the results. The sixth objective entailed the development of a model to clarify and categorise the tested variables and profiling of MEL. The final objective was to formulate recommendations for military environmental management policy. The outcomes of pursuing each objective are summarised respectively in the next seven subsections.

8.1.1   Suitability of existing questionnaires to assess MEL in the SA Army

No suitable extant questionnaire to assess MEL in the SA Army was found despite an extensive literature survey which identified five questionnaires with the potential to measure MEL effectively but when subjected to thorough evaluation none was found suitable for application in the SA Army. Unsuitability was gauged by the generic nature of the questionnaires, the lack of military specificity and focus on the SA Army, an absence of South African terminology and a focus on the wrong age group. Although some of the questionnaires contained some of the required features, none included an adequate number to satisfy the specific needs of the MEL survey. Consequently, the necessity of developing an organisation-specific, valid and reliable questionnaire for use in the SA Army became evident.

Concurrent exercises to obtain organisational and ethical permission to conduct the research were undertaken with the DOD and the Research Ethics Committee of Stellenbosch University, respectively. This process was exceptionally time consuming and fraught with challenges any researcher seeking a similar survey path in a large government institution should be aware of. Some pertinent conclusions and pointers on this matter were reported in Sections 3.3.2 and 3.3.3.

8.1.2   Item generation for the initial questionnaire

The achievement of this objective is deliberated in Chapter 3. This objective of identifying and formulating questions to evaluate MEL in the SA Army was realised through a survey of policy documents which produced a list of questions to which more were added from academic literature. A series of face-to-face interviews were conducted with relevant role-players in the South African military environmental establishment, as well as telephonic and email interviews over an extended period. The list of questions grew accordingly.

Concurrent with the search for questions, a military-environmental expert group was founded and functioned to aid the development and refinement of a first version questionnaire. The expert group represented the most experienced environmental role players in the DOD, both serving and retired. In addition, two military environmental experts in the US Army served on the panel. A draft questionnaire was developed and emailed to panel members to test and make their comments and suggestions. Their feedback on iterative versions of the questionnaire was judiciously incorporated in the questionnaire.

8.1.3   Questionnaire development and pilot testing

The third objective of the MEL research entailed the development of a questionnaire through the formal processes of draft development, panel scrutiny and pilot testing. The piloting and finalisation of the MEL questionnaire are reported fully in Chapter 4. The early versions of the questionnaire could not be satisfactorily structured because of undue focus on identification of the most relevant questions and they were too long. Researchers at the US Military Academy at West Point and the Centre for Statistical Consultation (CSC) at Stellenbosch University were used as sounding boards to ensure a statistically valid product suitable for gathering meaningful quantitative and qualitative data. A panel of experts was convened to evaluate the final version of the questionnaire. Following a thorough 'trashing' session and a presentation at an international conference of Military Geoscientists, a final valid and reliable instrument was constructed for live testing by a convenience sample of 15 military geography first-year students at the South African Military Academy (SAMA). The outcomes of the test were used to improve questionnaire design. The final questionnaire was language edited by a military language practitioner and prepared for direct electronic coding by means of Formware software and printed. More complete descriptions of these processes are given in Section 3.2.

The final questionnaire was pilot tested at the SAMA in Saldanha, yielding 153 usable questionnaires. Formware delivered an Excel table of the results which were used to test the validity and reliability of the attitude and behaviour scales. Analysis of item difficulty and item discrimination of the knowledge scale detected questions for removal. The final MEL questionnaire included an introductory letter and an informed consent form. Three sections dealing with attitude, reported behaviour and knowledge respectively, constitute the first part of the questionnaire. A section of open-ended items was included to afford respondents the opportunity to motivate their answers. The last section elicited details about the biographical and service history of respondents. The final, SA Army-specific, valid and reliable MEL questionnaire was printed and administered in the survey to establish the MEL of SA Army members. This questionnaire is attached as Appendix R.

8.1.4   The military environmental survey and database

The fourth objective was to apply the final questionnaire to a sample of members of SA Army units. The conducting of the MEL survey was expounded in Chapter 5. A stratified sample of units, representative of the size and number of units in each of the nine SA Army formations was drawn using the RAND function in Microsoft Excel. Twenty-five active military units were selected from the 90 active units of the SA Army. To ensure meaningful results at formation level, at least 50 respondents were selected from each formation. Although 1000 respondents would have been sufficient, to cater for non-response, 1203 respondents were selected to participate in the survey.

Following the unit sampling, each Commanding Officer of the selected units was entreated by letter for permission to do the survey and to supply a name list of unit members. Names were randomly selected from the lists, stratified proportionally by gender and rank. Only members with ranks below Colonel were included to ensure anonymity and avoid compromising the ethical integrity and validity of the research. It is noteworthy that this research focus on the viewpoints of ordinary soldiers, not those of managers.

Dates, times and venues were arranged for the surveys. Originally it was intended that a research team would administer all the surveys to ensure high return rates and allow for personal supervision by the researcher. The practical realities of the spatial spread of units throughout South Africa, coupled to an inability to establish suitable dates and times forced a re-evaluation of the intended procedures. The practical resolution was the recruitment of 11 local research supervisors who after careful briefing executed the surveys. Respondent selection was centralised and the names of selected members were mailed to the units to arrange attendance. Questionnaires, informed consent forms, final instructions on how to conduct the survey, pens and a reward lollipop for each respondent were couriered to the research assistants and afterwards the completed questionnaires were couriered back to the SAMA.

This system functioned effectively and all the surveys were completed within four months from commencement. Of 1203 questionnaires dispatched to the units, the survey process rendered 1112 returned questionnaires (92.4% of the questionnaires dispatched) of which 22 (0.02%) were unusable. This yielded an exceptional 1090 (90.6%) usable questionnaires. The sample assured representative coverage of the formations, with only two failing to do so by inconsequential margins.

Subsequent to quality control the questionnaires were scanned to yield an Excel spreadsheet database for further analysis. The electronic database was cross-checked against the paper copies of the completed questionnaires to ensure data integrity. Only 54 discrepancies

(0.07%) in 76 300 items were uncovered during this process. This testifies to the integrity of the survey and data management. After rectification, recoding of the data and data clean-up the database was analysed by LISREL 8.8 software in consultation with the CSC. Pairwise deletion of cases was done to deal with missing data. These processes ensured a database of extremely high integrity.

8.1.5 Analysis and interpretation of questionnaire data

The fifth objective, the analysis and interpretation of the questionnaire data, and the formulation of management policy recommendations, was dealt with in two chapters of the dissertation. In Chapter 6 the results of the analysis of the quantitative data were presented and interpreted. Chapter 7 was dedicated to a discussion of the composite MEL and an account of the military environmental narrative deduced from the answers to open-ended items in the questionnaire. A summary of these findings are presented in Section 8.2.

8.1.6 The MEL model

The development of a model of MEL from the results of the MEL study is discussed in Chapter 7. The MEL model categorises the results of the MEL study, explains the influence (both positive and negative) of different variables on the three components of MEL and examines neutral variables, i.e. variables with no apparent influence on the components of MEL. Profiling of respondents in terms of MEL was also performed by means of the model, and barriers to MEL identified. Ultimately, the model is the main theoretical contribution of the study.

8.1.7 Formulation of management policy recommendations

The survey results and findings were used to formulate the set of research-related and management policy recommendations reported on in Section 8.5. These recommendations are intended to inform future research, initiatives for military environmental education and training and to aid the further enhancement of MEL in the SA Army.

8.2 FINDINGS, IMPLICATIONS AND CONCLUSIONS

Three important products stem from the research. First, the novel organisation-specific, valid and reliable questionnaire for surveying MEL in a SA Army context; second, the baseline database for MEL in the SA Army and its nine formations; and third the military environmental narrative derived from responses to the open-ended items. The *questionnaire* (its development was reviewed above) constitutes a first for the SA Army and one of only two developed specifically

for any army.[27] The survey *database* for MEL derives from the survey of soldiers in 25 units and it establishes a baseline for MEL in the various formations and for the SA Army as an organisation. This study can be replicated by using the MEL questionnaire to measure changes in MEL in any formation, or those in the SA Army as an organisation. The absence of a survey instrument was a notable deficiency in military environmental management in the SA Army, prior to the present MEL survey. The *environmental narrative* was extracted through content analysis from responses to the open-ended items in the MEL questionnaire. Contributions to the MEL narrative gave soldiers of the SA Army an opportunity to explain their individual understanding of the components of MEL, as well as their roles and functions in MEL.

The main research results are highlighted, summarised and interpreted in the following subsections. Their implications for the DOD and the way military environmental issues are managed in the department are also outlined. The reporting is done seriatim for the MEA, MEB and MEK components of MEL; the composite MEL; the environmental narrative; and the MEL model.

8.2.1   The MEL components

The baseline MEL was structured according to the respondents' rank, age, gender, marital status, language group, environmental experience, environmental course qualifications, deployment experience, level of education and service duration in the DOD. The main findings regarding the three components of MEL, attitude, behaviour and knowledge, are presented in this section and the section concludes with a summary of the strength and direction of the interrelationships between the three components.

8.2.1.1   MEA in the SA Army

The **general military environmental attitude (MEA)** to the environment in which the military operates is positive as indicated by the *combined mean* of **1.8** for the MEA scale. The average response for attitude items on the Likert scale measures between 'agree strongly' (1), and 'agree' (2) – a positive result[28]. The attitude values varied according to the socio-demographic, education and training, and service profiles of the respondents.

Four **socio-demographic** independent variables, namely age, gender, marital status and

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[27] The questionnaire developed for the USA Army was used in a survey but it did not go through the rigorous development processes followed for the South African questionnaire, and no results from the US Army research were published.

[28] For the sake of clarity the reader is reminded that 1 on the Likert scale indicates strong agreement, 2 is agreement, 3 indicates neutrality, 4 disagreement and 5 strong disagreement.

home language were inspected for causal relationships with MEA. Only *home language* rendered a statistically significant relationship, with *age, gender* and *marital status* having no influence on the MEA of respondents. These findings has two important implications. First, it substantiates the military-specific lens of the survey instrument which negated the traditional influence of gender and marital roles through the specificity of the military workplace environment. Second, the significant relationship between home language and attitude accentuate the reality that the military environmental message has to be very carefully packaged in the multilanguage, multicultural and multi-ethnic SA Army to be fully effective.

The examination of the effect of **education and training** variables (general education, geography education and environmental education and training) on MEA generated surprising results. Contrary to findings reported in the literature on environmental attitude, *general education level* and *geography subject education* had no statistically significant relationship with MEA. However, respondents who had completed *military environmental courses* registered a significantly more positive attitude to the environment than those who had not attended any. These results confirmed the dissimilarity between MEA and general environmental attitude – a premise of this MEL survey. Consequently, attitude is not influenced by the chosen independent variables in the normal manner reported in civilian EL literature. It is noteworthy that focused, military environmental courses improved the MEA of soldiers, while general and geography education did not.

The influence of **service profile** variables (formation membership, rank, environmental management, service duration and deployment experience) has similarly been probed for relationships with MEA. Two large *formations*, Infantry and Engineers, recorded notably lower, while two small formations, Training and Air Defence Artillery recorded notably higher MEA values than the average formation. The sheer size of the two large formations might preclude quick MEA interventions, but successful interventions would impact the general MEA of the whole SA Army positively. Training and Air Defence Artillery formations are small formations where the presence of suitably qualified 'champions' drive environmental education and training that influenced the MEA of members positively.

Using *military rank* as indicator of MEA, the group with the lowest rank of riflemen, recorded the least positive attitude outcomes, with no statistically significant difference between other rank groups. This underlines the need for intervention to foster good environmental attitudes early in the careers of SA Army soldiers.

Respondents with some form of previous or current *military environmental experience* recorded better environmental attitudes than those without any such environmental

responsibilities. This is a significant finding confirming that formal military environmental courses and environmental management responsibilities do improve MEA in the workplace. *Service duration* and *deployment experience* produced no statistically significant results, implying that these two factors did not improve or decrease the MEA of soldiers. The finding that internationally deployed soldiers had no distinctively better MEA revealed a serious deficiency in military environmental education and training in the SA Army and underscores the urgent need to reassess predeployment interventions. The findings on MEA suggest that the general MEA of soldiers in the SA Army is good and that the unique nature of the military environmental environment is confirmed. Areas of intervention to improve the MEA of soldiers was also identified.

8.2.1.2 MEB in the SA Army

The general environmentally conscious behaviour toward and in the environment in which the military operate is evidenced by the *combined mean* of **1.8** recorded for the **military environmental behaviour (MEB)** scale. This is a positive result. The MEB of soldiers varied according to their socio-demographic, education and training, and service profiles.

The **socio-demographic profile** variables *marital status* and *home language* showed statistically significant relationships with MEB whereas *age* and *gender* had none. Two implications are worthy of note. The military focus of the questionnaire negates the influence of traditional gender roles on behaviour because it investigates experiences in the workplace and not the domestic environment. The significant relationship between home language and MEB again confirms that in the SA Army environment, the military environmental message must take multilanguage, multicultural and multi-ethnic realities into account to be really effective.

Regarding **education and training**, it was unexpected that level of *general education* and *geography education* would have no statistically significant influence on MEB. Respondents who had completed *military environmental courses* and those who did not also displayed similar behaviour values. These results confirm that MEB and general environmental behaviour are dissimilar – a basic premise of the MEL research. Consequently, MEB is also not influenced by the chosen education and training variables in the same manner as what is reported in civilian EL literature. The anomaly here is that focused, military environmental courses improved the MEA of soldiers, but not their behaviour.

Regarding environmental behaviour and the soldiers' **service profile,** the three largest *formations* – Infantry, Support and Signal formations – recorded the least positive results, while two small formations, Training and Air Defence Artillery, recorded the most positive MEB results. These results correspond with the MEA results and the rationale for this holds true for MEB as

well. The former three formations constitute 72% of the total number of SA Army soldiers. Because of their dominant size, military environmental interventions there would not only improve the MEB in these poor performing formations, but also impact positively on the general MEB of the whole SA Army.

The investigation of *military rank* as an indicator of MEB found no statistically significant differences between soldiers with different ranks. This is contrary to the findings regarding attitude where riflemen − the lowest rank − recorded the least positive attitude results, and no statistically significant difference was found between the other rank groups. This anomaly – riflemen reporting the least positive attitude but recording no difference between themselves and other ranks in terms of behaviour – can be best explained in terms of the command-and-control structure in the SA Army. Soldiers are taught to follow orders, even though they may not want to. It seems as if this way of operating had been transferred to the environmental message, at least at the lowest rank of soldiers. This behaviour is in line with the subjective norm theory that postulates behaviour to be influenced by the expected behaviour from significant others, in this case the person conveying the military environmental message. If this postulation is accurate, early intervention to foster good environmental behaviour in SA Army soldiers is required.

No significantly different results were obtained for soldiers with current or past *military environmental responsibilities* and those without. This contradicts the MEA findings that respondents with some environmental responsibility recorded better results than those without. Better attitudes resulting from having environmental responsibilities did not translate into better environmental behaviour, a finding supported by the literature. Finally, *time served in DOD employment* rendered a statistically significant result, but the slight correlation indicated an almost negligible relationship.

Contrary to the findings regarding MEA, soldiers who had been *deployed* manifested better environmental behaviour, the explanation must likely be found in subjective norm behaviour. Prior to deployment, soldiers attend special environment-oriented lectures which probably inspire them to exhibit pro-environmental behaviour despite their not having a corresponding positive environmental attitude.

8.2.1.3 MEK in the SA Army

The respondents registered a mean **military environmental knowledge (MEK)** score of **65%** which is an appropriate overall achievement if compared to civilian environmental knowledge scores reported in literature. The finding attests to satisfactory environmental

knowledge among South African soldiers. MEK scores varied to the socio-demographic, education and training, and service profiles of the respondents.

Two variables comprising the respondents' **socio-demographic profile**, namely, *gender* and *home language* rendered statistically significant relationships, while *age* and *marital status* had no influence on the MEK of the respondents. The recorded relationships between knowledge, gender and home language accord with findings reported in literature. This presents a challenge to the SA Army to package its environmental message in a gender- and language-friendly manner if it is to be effective.

Consistent with findings reported in the literature on the relationship between the **education and training profile** of respondents, higher levels of *general education*, more favourable levels of *geography education* and more *military environmental education and training* were found to influence MEK in a statistically significant positive way. However, this does not accord with the findings for MEA and MEB.

Regarding **service profile,** the largest *formation*, Infantry, recorded the least positive MEK result, while two small formations, Air Defence Artillery and Training formations had the highest level of MEK, the same as reported for MEA and MEB. Again, the large size of the Infantry formation imply that military environmental interventions there would improve the behaviour of soldiers in this formation, but also impact beneficially on the general MEK of the whole SA Army.

Concerning the *rank* of soldiers as indicator of MEK it transpires that junior and senior officers posted the most positive MEK results and riflemen the least positive. It is again worth noting that the results regarding riflemen, if compared to civilian results, are still good. This findings should spur the SA Army to launch early interventions to improve the MEK of riflemen, a group that represents a large proportion of the soldiers in the SA Army.

Soldiers with *experience of environmental management* posted significantly better MEK results compared to respondents without such experience, while *service duration* and *deployment experience* rendered no statistically significant differences in MEK.

8.2.1.4   Correlation of the three components of MEL

Correlation analysis of MEA, MEB and MEK produced relationships similar to those found in the literature. The *strongest correlation* (**r = 0.56**, indicating a large effect and strong relationship) was found between attitude and behaviour. The *second strongest correlation* (**r = 0.35**, showing a medium effect and medium relationship) was recorded for knowledge and attitude, and the *weakest correlation* (**r = 0.29** indicating a small effect and weak relationship) was found for knowledge and behaviour. All of the correlations were positive.

These associations have some important *practical implications*. The weakest relationship recorded between knowledge and behaviour implies that MEK does not necessarily translate into pro-environmental behaviour. The medium positive relationship between knowledge and attitude implies that a change in one may effect a change in the other, implying that improving the knowledge of soldiers can improve their attitude. The substantial relationship between attitude and behaviour implies that by improving the attitudes of soldiers, their pro-environmental behaviour will be affected accordingly. These findings can have far-reaching consequences for military environmental education and training in that the SA Army should focus their efforts not only on improving the MEK of soldiers but, more importantly, strive to fostering a supportive attitude toward military integrated environmental management among its soldiers.

The evidence that correlations between pairs of MEL components are *consistent* with those reported in the literature on civilian studies testifies to the validity and reliability of the questionnaire designed for the MEL survey.

8.2.2   Composite MEL

The main results of the composite MEL calculated by combining the scores of attitude, behaviour and knowledge are recapped in this subsection, first for the SA Army, then according to the soldiers' service, socio-demographic and education and training profiles.

8.2.2.1   Composite MEL for the SA Army

The *composite MEL score* for the SA Army registered an excellent **75%**. This is a high score compared to the routinely reported examples in the literature of composite MEL scores between 60% and 70%. In the present study, the quantitative results of the MEL investigation produced good scores for the attitude, behaviour and knowledge scales, and an above average composite score for MEL in the SA Army. *One can conclude that the MEL of SA Army soldiers is at a high level, the primary question this research has endeavoured to answer.*

8.2.2.2   Composite MEL and service profile

The MEL of soldiers in the nine *formations* differed significantly regarding the three components. The same two formations (Air Defence Artillery and Training) achieved consistently good results for all three scales and the weakest results were also achieved by the same two formations (Infantry and Engineer) for attitude and behaviour, with Infantry also the weakest on knowledge. It appears that the Infantry bears the brunt of deployment responsibilities, leaving scant resources for environmental education and training. In the two best-performing formations, champions of environmental education and training made valuable contributions to environmental

efforts and, due to the small size of the formations, the differences they made are measurable. The absence of staffed environmental posts at SA Army headquarters, and the lack of environmental posts at unit level exacerbates the less than ideal situations in the larger formations.

Officers outperformed the other *ranks* in all three MEL components, with riflemen scoring the lowest although the result for the behaviour scale was not statistically significant. This finding was expected given that riflemen have had the least exposure to environmental programmes in the DOD due to their relatively short time of employment in the DOD: less than one year of service for a large cohort of riflemen. The officers, on the other hand, usually have more exposure to environmental programmes, they are expected to provide leadership within the SA Army and they are inevitably exposed to a wide range of areas of interest, among which environmental management. Riflemen scored poorly on attitude and knowledge, but no difference was found for behaviour. This is probably the result of the way the SA Army operates in which soldiers with lower ranks are used to following orders without necessarily understanding the rationale behind the orders. They do as they are told to do. The danger of this is obvious. If not told what to do, they have only a weak knowledge and attitude base to fall back on to direct their behaviour toward the environment.

Regarding *environmental responsibility*, respondents who hold or held a position demanding environmental responsibility, outperformed those without on the attitude and knowledge scales, with inconclusive results for behaviour. This is contrary to the strong correlation between attitude and behaviour for the whole group. Why the favourable attitude and knowledge recorded for the group did not translate into good behaviour is unclear, but is consistent with results reported in academic literature.

The findings for *time in DOD employment* were inconclusive. Although a weak positive correlation for behaviour scale was recorded, the relationship had negligible significance. The results for attitude and knowledge were not statistically significant.

Deployment of soldiers to areas outside of the country's borders spotlights their behaviour. Improper behaviour can have repercussions that not only jeopardise missions, but, depending on the severity of the transgressions, may escalate into situations with international consequences. The assumption was that soldiers with deployment experience would, on all three scales, outperform those without. Unexpectedly this occurred only for behaviour, with no significant results for attitude and knowledge. This can probably be related to the situation pertaining to rank, as well as insufficient predeployment environmental education and training and competing with other training needs that enjoy preference over environmental issues. This is especially true if deployment must be effected unexpectedly and quickly.

8.2.2.3   Composite MEL and socio-demographic profiles

A weak positive correlation was found to exit between *age* and MEB and the relationship between age and MEB and MEK were not statistically significant. Apparently, age does not influence MEL.

Regarding *gender*, no statistical differences between the sexes could be found for attitude and behaviour, whereas males outperformed females on the knowledge scale. While this result was corroborated by some studies, other scholars reported different findings. As an indicator of environmental attitude, behaviour and knowledge gender is an especially complex factor, with researchers reporting social status, the traditional role of women in the societies they live in and the effect of the traditional nurturing role as other variables that might determine the way an analysis of gender differences must be approached. The female soldiers in the MEL survey do of course operate in a traditionally male-dominated environment. Differentiation of gender roles is not pronounced in the SA Army with male and female roles subject to similar expectations. This, coupled to the survey's focus on their attitude, behaviour and knowledge in the work environment and not on domestic life, may nullify some of the differences between the sexes, leading to this rather undifferentiated picture when gender is taken under scrutiny.

Concerning *marital status*, the only statistically significant component was behaviour, where unmarried respondents outperformed those who were married. The literature is divided on this issue with some studies reporting no difference and others reporting more favourable results for married individuals. But it must be emphasised, that the difference between the means of the four different marital groups were only 0.1 on a five-point scale, thus not a big difference, although statistically significant.

With the amalgamation of the different armed forces in South Africa after 1994 it was decided that English would be the *language* of instruction and communication in the DOD. This was done for practical purposes, because when commands must be issued and instantly obeyed in the heat of battle, confusion among an armed force cannot be afforded. The reality in the SA Army is that in many situations, both the listener and the speaker may have English as their second or third language. In this study, only 5% of the respondents reported English as their home language. The results for the three components bear evidence of significant differences between the language groups. Afrikaans- and English speakers, together with those with Tsivenda, Setswana, Sesotho and Siswati outperformed the rest, with Xitsonga speakers reporting the worst results for all three components and isiZulu speakers performing weakly in behaviour and knowledge. Language is a difficult and complex variable to analyse, especially in South Africa where it is culturally, socially and economically intertwined. In consequence the military environmental message must be

carefully packaged to reach the whole range of language groups constituting the intended audience. The reality of 11 official languages being represented in the SA Army, with four respondents indicating another language as their home language, testifies to the language diversity within the organisation and further complicates the scenario. More research into the role of language in MEL is needed to better comprehend this complex variable.

8.2.2.4   Composite MEL and the education and training profile

General level of education is mentioned by various authors as a primary driver of EL, but this was not reflected in the MEL research. A weak negative correlation was found for attitude and weak positive correlations for behaviour and knowledge. In practice, none of these results has any practical value, since the relationships the correlations represent are negligible. Why then does it seem as if level of education has little or no influence on the EL of soldiers in this study, contrary to the results reported in other studies? A likely explanation is that all the respondents had completed at least grade 12, that is they all have a basic level of education which tends to mask the influence of various levels of education on MEL. Moreover, the military nature of this survey makes direct comparisons with other studies on EL problematic. Whereas civilian education impacts on the general level of EL, this study evaluated the attitude, behaviour and knowledge of respondents regarding their interaction with military environments. Conceivably, the positive effects of education does not translate into the same results regarding such a focused, military-specific EL, especially if the effects of regular military environmental education and training are factored in.

The same situation applies to level of *geography education*. No significant results were recorded for attitude and behaviour, and only a weak positive correlation registered between level of geography education and environmental knowledge. Although other research has found higher levels of positive attitude and knowledge among geography students than those in other fields of study, this research does not demonstrate this. The reasons are probably the same as those advanced for general level of education.

Some respondents had completed *environmental courses*, and they significantly outperformed their counterparts, who had not completed any environmental courses, regarding their environmental attitude and knowledge, but no significant results were reported for behaviour. Given the strong relationship found between attitude and behaviour in this survey, the reasons for this incongruity are not clear.

The MEL of SA Army soldiers as manifested in the findings of the quantitative analyses, reveals a high level of MEL among members of the SA Army. However, certain aspects of the

MEL warrant further research and/or action from the SA Army leadership. Attention now turns to the military environmental narrative constructed from the open-ended items included in the MEL questionnaire.

8.2.3 The military environmental narrative

The qualitative items in the MEL questionnaire served two purposes. First, they *enriched* the quantitative results by requiring respondents to explain their answers to the questions. Whereas the respondents were given no opportunity to comment in the quantitative sections on their attitude, behaviour and knowledge, the qualitative items invited respondents to express their views about the issues addressed by the questions. This produced a more complete and realistic picture of the nature of MEL than provided by only taking the quantitative results into account.

The second purpose of the open-ended items was to enable *triangulation* of the results. Had most respondents recorded positive results in all three component sections but negatively to the open-ended items, a disturbing inconsistency would have been present. This would have signalled that respondents had not answered the questions consistently and truthfully. But the agreement obtained from the qualitative results with the quantitative results testifies to exceptionally consistent responses throughout.

The MEL narrative was constructed from respondents' written answers to six open-ended items in the MEL questionnaire. Content analysis was used to construe the narrative. Ninety-nine per cent of the respondents indicated their agreement or not with the statement that *it is important for the SA Army to protect the environment in which it operates.* Although most of the reasons given for this response were either utilitarian or human-centered in nature, a substantial number of ecocentric reasons were also recorded, indicating that a superior level of environmental concern is also present in the SA Army.

On the question of whether *respondents regard themselves as generally environmentally conscious,* 90% replied in the affirmative, again testifying to the positive environmental attitude recorded in the quantitative analysis. As justification for this response, the duty of care principle and positive behaviour, such as recycling, not littering and picking up litter were cited most often. A considerable cohort of respondents named knowledge attainment as their rationale. For those who did not agree it was a matter of lack of knowledge about military environmental issues, while a significant group also felt that exemplary military environmental conduct is not an organisational imperative of the SA Army.

When asked whether they *think that good environmental practices can improve mission success,* 92% of the respondents answered that they did but of whom a sizable portion gave

incomprehensible reasons why they did. The reason for this failure to produce coherent responses is unclear. Among the coherent response the rationales given included that sustainable environmental practices will improve mission success, that the social responsibility of the SA Army are part of mission execution and that the health of soldiers will not be imperilled during missions where good environmental practices prevail. The rationales for negative responses revolved around ignorance about the organisational imperative or that it is an impossible mandate.

An item that focused attention on the reported behaviour of respondents enquired whether they try to *minimise their negative effect on the environment* at their workplace. The 92% affirmative responses accord with the high level of positive self-reported behaviour recorded in the behaviour scale. Main justifications for this are their striving to use the environment responsibly, that it is an organisational imperative and that they want to leave a legacy to future generations. These two questions again corroborate the good results posted for behaviour in the quantitative section of the questionnaire.

The item whether the *South African Army provided them with adequate environmental education and training* to take care of the environment in which they operate drew an affirmation of 62% that this is true. Fifty-seven per cent of the written explanations stated that an environmental specialist regularly informed them about their potential impacts on the environment, and how they can mitigate them. This testifies to the vital role of environmental services personnel in fostering an environmental ethos in the SA Army Army, and a major reason for the overall high level of MEL recorded in the research. Contrarily, more than half of the respondents who indicated that the SA Army had not provided them with sufficient education and training, maintained that they need more training and education. This must be welcomed as a positive result, showing a willingness to learn more about the environment in which soldiers must operate. A disconcerting reason given by 31% of the respondents who felt that the SA Army did not adequately equipped them was that they never received any environmental information. This serious allegation must be investigated by DOD management. Moreover, these are indicative of disparities in the environmental education and training received by soldiers in the various formations and a perception that environmental education and training opportunities only exist for some rank groups. Further research and intervention are called for.

Asked if they had a *need to learn more about the environment in which they operate,* 92% declared that they do want more environmental education and training. The prominent reasons indicate a tendency toward lifelong learning and a need to know more to be able to take better care of the military environment. This further emphasises a general willingness and need to receive more environmental education and training. Fulfilment of this need by the DOD will further

enhance the MEL of SA Army soldiers. The responses to these last two items endorse the high standard of MEK of the soldiers revealed in the quantitative study.

The excellent match between the positive results posted in the quantitative sections of the MEL questionnaire and the qualitative responses to the open-ended items indicate a high level of *consistency of responses* throughout the questionnaire, an important indicator that the respondents answered truthfully and consistently. The environmental narrative depicts the *real-life experiences* of soldiers in the SA Army describing their experience with environmental issues in their work environment in their own words. This is a valuable measure of MEL in the SA Army.

8.3 VALUE AND CONTRIBUTIONS

Militaries worldwide, including the SA Army, are under increasing pressure to *conduct their operations in an environmentally responsible manner*. It is the ethically and morally appropriate way to act and legally imperative, but it also makes sense from a business perspective. Military missions can be compromised by inappropriate environmental conduct and the fallout of poor military environmental practices can remain long after conflicts or interventions are over. Soldiers who have an appropriate degree of military environmental literacy can prevent this from happening. A soldier with apposite environmental attitude, enough knowledge and the controlled behaviour patterns that allow them to operate effectively in whatever environment they must execute their mission, will not burn religious books, destroy important cultural artefacts, ignore cultural taboos, contravene environmental laws or harm the physical environment in which they operate. Nor will they tolerate unsustainable environmental practices that may impact adversely on their own health and safety as well as that of the civilian population where the soldiers operate.

This is especially true for soldiers *deployed* to other countries where other written and unwritten rules regarding conduct in the environment might apply. Deployment also exports the military environmental footprint of the SA Army to the receiving countries. Soldiers with a high level of MEL will have a smaller military environmental footprint than those without. In any country to which deployment takes place, whether for humanitarian aid missions, peacekeeping missions or for fighting a war, the civilian population is unavoidably under varying levels of pressure. These populations do not want or deserve the additional burden of environmentally illiterate soldiers who leave the host environment, both physical and cultural, in a worse state than before their arrival. In many instances, relatively intact cultural and physical environments can help the rebuilding of communities in post-conflict or post-disaster scenarios. All of this can be compromised by environmentally illiterate soldiers but, fortunately prevented or mitigated by soldiers possessing and practicing military environmental literacy.

Legal repercussions that must be dealt with after the deployment of environmentally illiterate soldiers further burdens the scarce resources of the military. It is clear that environmentally illiterate soldiers can have wide-ranging detrimental effects with severe ramifications, both when operating inside their own country and during deployments abroad.

The research probed previously unchartered territory by using a recognised method (questionnaire survey) for assessing civilian environmental literacy and adapting and applying it in a *military context.* The results of this MEL survey should contribute to a sparse corpus of literature about the attitude toward, behaviour in, and knowledge of military personnel about the environment in which they operate, and in many respects be the only available literature on MEL. No comparable survey in terms of scope and rigour of questionnaire development could be found in the literature. Consequently, this research forms the baseline for future studies of MEL, not only in the field of military geography, but in other disciplines too, and not only in South Africa, but globally.

Although environmental literacy is a well-known construct and the scales attitude, behaviour, and knowledge are routinely used to develop questionnaires measuring environmental literacy, this is a novel approach for the military. As such *military environmental literacy* is a concept coined, defined, explained and empirically tested in this research.

Contrary to the findings in civilian environmental literacy studies, *gender* was not found to significantly influence MEA or MEB. This is quite likely because women operating in a traditionally male-dominated environment such as the Army will, regarding attitude and behaviour, assume the norms of their male counterparts in the military work environment. This confirms that the concept of MEL is distinct from environmental literacy and that factors do not influence MEL in the same way as in civilian environmental literacy. Knowledge results in this study mirrored the civilian pattern because knowledge is not as context sensitive as attitude and behaviour, and while the women soldiers relinquished their gender roles in their attitude and behaviour toward the military environment, the knowledge differences were less affected.

In respect of *general education level* and *geography education level*, and again contrary to civilian results, these variables had no significant influence on MEL. The relatively high level of education (all Grade 12 or above) probably nullified the influence of general education level and together with geography education level could not account for the military specificity of the survey. This implies that general education is dependent on a wider spread in education level than that prevalent in the SA Army and although geography does positively influence general environmental literacy, it fails to deliver the same result for the focused MEL.

The dissimilarity in responses by soldiers ranked as *riflemen* regarding the three components of MEL warrants comment. While riflemen recorded poorer statistically significant results for attitude and knowledge than other ranks, behaviour did not differ significantly by rank. This is attributable to the command-and-control nature of the Army, where the lower ranks do as they are told without necessarily having knowledge or attitude skills to match their behaviour. This type of behaviour is unique to the military and must be investigated further.

Convincing evidence was found of *correlation* between the three components of MEL and those reported in civilian literature on EL. The MEL correlations between attitude and behaviour (strongest), knowledge and attitude (second strongest) and knowledge and behaviour (least) mirror the civilian results. It is noteworthy that although the influence of individual variables differs between civilian environmental literacy and MEL, the relationships between the three components of environmental literacy remain the same. This confirms the stability of the EL construct, regardless of the context.

The encapsulation of the quantitative and qualitative research results in a *model* representing MEL in the SA Army is the definitive outcome of this research. The conceptual model of MEL is a first of its kind. The model constitutes a major contribution to EL scholarship and provides a yardstick to measure the MEL of other militaries, or that of the SA Army against in follow-up studies.

The three components of MEL and their interrelationships were integrated into the model. Variables can either augment or restrict the improvement of MEL impact on each of these components. Sets of general augmenting and restricting variables that impact on all the MEL components, that is they are not component-specific, are incorporated in the model. A set of neutral variables that neither augment nor restrict an improvement in MEL, was identified and included in the model too. The interplay of all these variables determines the level of MEL in a population, only if not prohibited by certain structural and psychological barriers that can prevent improvements in MEL, even if all the other variables are conducive to it. The most relevant implication for the SA Army is that the model helps to gain insights into the variables impacting either positively or negatively on the components of MEL, and thus on MEL itself. Application of the model will enable the personnel of the military environmental services to identify augmenting and restricting variables, and then institute interventions that increase the strength of the augmenting variables while isolating and rectifying the influences of restricting variables. Moreover, the psychological and structural barriers to improved MEL can similarly be identified and removed. All of this will further improve the already good MEL of the SA Army, while testing

and critiquing of the model will be essential parts of future studies of MEL, especially in a SA Army context, but also in MEL research in other militaries.

This present MEL research is an important first step to ensure that SA Army soldiers, and eventually all members of the SANDF and DOD, adhere to sound environmental management principles. For the first time ever the SA Army and Environmental Services management now have an *environmental baseline* for their soldiers at formation and Army levels. This, coupled to the more detailed information contained in this report, will enable them to focus interventions, do quality control, improve environmental education and training, and measure progress in cultivating MEL.

Having *environmentally literate soldiers* is not just a luxury in the Army, it is an organisational imperative. Application of the findings and recommendation of this MEL research will facilitate SA Army management and Environmental Services personnel to better understand MEL in the SA Army and to ensure the continued building of an environmentally responsible South African DOD.

8.4 LIMITATIONS

"As every student of psychology knows, explaining human behaviour in all its complexity is a difficult task" (Ajzen, 1991: 179). These words of the father of the theory of planned behaviour neatly encapsulate one of the limitations of MEL research. To gauge the soundness of the components of MEL is a formidable task influenced by disparate factors that are at best difficult, and at worst impossible, to account for comprehensively. In line with international best practice, this MEL research relied on self-reported behaviour which inevitably created room for over reporting of positive behaviour. It was neither possible in the wide scope and complexity of this study to cover observed behaviour nor to account for all the potential external influences on attitude and knowledge. To counter these limitations, best practice was meticulously followed in the development of the survey instrument and the execution of the survey, while triangulation with answers to open-ended items accounted for possible over reporting of positive behaviour patterns. Despite these measures to ensure the reliability and validity of the results, the complexity inherent to research into human behaviour remains an inevitable limitation, albeit not unique to this study.

Precise definition of 'environmental literacy' remains problematic. The definition operationalised in this study was by design for the purposes of the research, but it is an acknowledged limitation. Cultural differences unavoidably influence environmental literacy, but exactly how is less well understood. As a culturally and linguistically diverse organisation,

examination of EL in the SA Army, will always be confronted by the problematics of interpreting the results. Further investigation of these influences is needed.

An obvious deficiency of the research is the absence of the other major branches of the DOD, namely the Air Force, Navy and South African Military Health Service. The omission was occasioned by the extreme difficulty, if not impossibility of incorporating the diverse nature of MEL as impacted by all the branches of the DOD into a single questionnaire, while preserving the focus and integrity of the questionnaire. This sentiment was echoed by the military environmental expert group.

The exclusion of civilians in the service of the DOD from the survey constitutes a noteworthy shortcoming. The aforementioned reasons apply here as well. Nonetheless, civilian personnel sometimes play important roles in military environmental management so that the absence of their voices from the results is recognised as a limitation.

A final limitation was to only select respondents with ranks below full Colonel, but this was done explicitly to assess whether the environmental message extends to the lower positions in the hierarchy of the SA Army. The important roles of senior-ranking officers in military environmental management are however fully understood so that their exclusion is acknowledged as a limitation of the research. Despite the limitations mentioned in this subsection, adequate motivations were provided or steps taken to ensure that they did not impact on the validity of the study.

8.5   RECOMMENDATIONS

Recommendations made on the basis of this research are directed to future scholars and researchers who want to undertake investigations in the DOD, or similar large, command-driven institutions. First, general recommendations to aid research efforts are made, followed by recommendations specific to research in the DOD.

8.5.1   Recommendations for facilitating research

The difficulty and extended time of obtaining permission to do the research were major stumbling blocks to the research. While the security implications of doing research in an organisation of this nature are understandable, they present an almost insurmountable obstacle. It took many hours of preparatory work and then months of waiting to secure permission. Only the fortunate assistance of key personnel at Army headquarters helped to eventually overcome this problem. If the DOD is serious about research that can help the organisation, the process of obtaining permission for such studies has to be streamlined.

Two recommendations arise from the practical execution of this survey. First, help by locally-based research assistants can be invaluable in terms of time and money. The caveat is, however, that the assistants must be carefully selected, briefed and monitored, if not, poor research assistance can also ruin a research project. Second, much had been written about providing incentives for respondents to participate. In this research the reward of a lollipop proved to be a successful inducement to respondents to complete the questionnaire. The explanation is simple. Many of the respondents reported that they were often required to complete questionnaires which led to survey fatigue and reluctance. This survey was the first where the investigator materially thanked and rewarded them for their time. This deed aided in securing an adequate return rate, something researchers often struggle to achieve. In this research a small monetary outlay rendered a rich return.

8.5.2 Recommendations directed to the South African Department of Defence

The following recommendations for DOD and Environmental Services management have been formulated from the results of the research:

- The good level of MEL of SA Army personnel is testimony to the excellent work of the personnel of the Environmental Services. The vital importance of this subdirectorate cannot be overemphasised. Unfilled posts in the subdirectorate must be filled by well-trained, dedicated personnel as a matter of urgency. Military environmental services play a vital role in ensuring that SA Army soldiers are literate in a military environmental sense. It is essential that soldiers are supported by personnel, funding and equipment to execute their missions. The staffing of posts at headquarters, as well as the allocation of posts for environmental officers at unit level must be investigated and instituted urgently.

- The differences between Army formations regarding MEL results call for attention. Especially worrying is the finding that Infantry, the largest formation, consistently displayed the worst results and thus has the worst MEL of all the formations. Concentrating strategies to improve military environmental attitude in this formation will undoubtedly have far-reaching impacts on the total MEL status of the Army.

- While the language of instruction and communication in the DOD should remain English to cater for the language realities of South Africa, environmental services should ensure that their messages are delivered clearly, concisely, unambiguously and easily comprehensible. Complex environmental issues will have to be presented in such a way that soldiers for whom English is a second or even a third language can also understand the message. The reality is that about 5% of the members of the Army have English as their

first or home language. Consequently, the majority of members are subjected to receiving environmental instruction in a second or third language. In practice this means paying special attention to word use, clarity of message and making sure everyone understands what is being said by the deliverer of these environmental messages to the intended audiences when the first language of the audience (and most likely the messenger too) is not English.

▪ The environmental education and training of new recruits should start as early as possible. It seems that riflemen generally do what they are told without having the right attitude to or knowledge about military environmental concerns. This is fraught with danger if the soldiers must decide on courses of action for themselves. Environmental education and training must specifically focus on fostering a sensible attitude to military environments and military environmental issues, without neglecting the transfer of environmental knowledge and skills for dealing with the issues. The strong correlation between attitude and behaviour signifies that good attitude will translate into correct environmental actions, especially if supported by an adequate MEK and skills base.

▪ Soldiers who deploy are a special group representing their country and the DOD in other countries. Special programmes must be developed to cater for the environmental education and training of soldiers prior to deployment and sufficient time must be budgeted to conduct these pre-deployment interventions. The South African military cannot afford environmentally illiterate soldiers who are insensitive to the cultural, social and physical environments of the countries in which they operate. The environmental briefings presented to these soldiers should be expanded and focused to address attitudinal, behavioural and knowledge issues and they should encompass the whole environmental spectrum ranging from social and cultural milieus to the physical environment.

▪ It transpired that soldiers receive regular environmental education and training in some units and formations, while in others this is not the case. It is unclear if this is due to unfilled posts or to other structural or practical constraints. This raises the alarm that if unfilled environmental posts is the cause steps to rectify the situation must be given priority.

Some unanswered questions remain which point to avenues for future research as suggested in the next and final section.

8.6   DIRECTIONS FOR FURTHER RESEARCH AND FINAL WORD

A notable unanswered question emerging from the research is why the formations differ, sometimes to a fairly large extent, regarding the three components of MEL. Although some

explanations for the differences have been provided by the research, an enquiry to identify all the factors responsible for this situation will be worthwhile. The same applies to the discrepancy between the lower levels of attitude and knowledge reported by the lowest ranks and these ranks' relatively high levels of reported behaviour relative to the other ranks.

The relationship between language and MEL, and the lack of congruence regarding the effect of level of general education and level of geography education on MEL found in this research and reported in other EL studies, call for further investigation. Gender issues and the reasons why the good attitudes and knowledge of respondents occupying environmental positions and who have completed environmental courses do not translate into better behaviour are topics for further examination.

Research into the MEL of members of the Air Force, Navy and South African Military Health Service is imperative. This will help to complete the picture of MEL in the South African DOD, so supplying a baseline of MEL in the DOD, something now only available for the SA Army.

An assessment of the MEL of senior officers (above the rank of Lieutenant Colonel) will help to increase our understanding of MEL in the DOD. An exploration of the inability of the DOD to implement the Environmental Management System for Defence – after the pilot project to implement it was terminated in 2007 – will shed light on the status of military environmental management in the DOD.

It would be valuable to investigate why a high proportion of respondents indicated they had received enough environmental education and training to operate in the military environment, whereas a significant cohort indicated the opposite. This anomaly presented prominently in the narratives about this question, with respondents either indicating that they received regular environmental education and training or none at all.

The MEL questionnaire can be used in a number of other contexts. By surveying soldiers both before and after they completed environmental education and training courses, the effectiveness of these courses can be ascertained and possible inadequacies of the curricula can be identified. This will aid quality control and the improvement of the environmental education and training curricula in the SA Army. The same applies to improving the interventions aimed at deploying soldiers pre- and postdeployment. With small adaptations, the questionnaire can be used to conduct similar surveys in other armies, especially in English-speaking Africa. With the present study's results as benchmark, follow-up surveys of the same units will indicate progress or the lack thereof in the MEL of SA Army soldiers. Despite its stated limitations the results of the present

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research provide a solid foundation to build on, while the lessons learned should help researchers to avoid the pitfalls identified here.

Given the many findings, interpretations, conclusions and recommendations of this MEL research, it is fitting to echo the words of Brigadier General Corson quoted at the start of this chapter and, indeed, also those of Kermit the Frog. Although it is challenging 'to be green', possibly more so in the military, MEL must be part of our military culture. It is the right thing to do and it is required by South African and international law and regulations. By fostering adequate MEL among SA Army soldiers the embarrassing CNN, Aljazeera and South African Broadcasting Corporation moments and their negative implications for the missions of the SA Army can be avoided. This research is an important milestone on the road to achieving the goal of commendable MEL in the South African Army. The ultimate reason for continually pursuing this goal is the axiom of the grass-trampling elephants cited at the beginning of this report.

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APPENDICES

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APPENDIX A

Environmental survey, United States Military Academy, Centre for Environmental and Geographical Sciences (Corson & Morris 2001)

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United States Military Academy
Centre for Environmental and Geographical Sciences
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ENVIRONMENTAL SURVEY
ARMY
Version 1.10

Participation in this survey is completely voluntary and your answers will remain anonymous.

This survey is designed to assess the attitudes and knowledge of US Army soldiers concerning protection of the natural environment. You will remain anonymous and your answers will be combined with answers from many other soldiers so please answer truthfully. Data on rank, years of service, gender, and branch type (Combat Arms, Combat Support, Combat Service Support) will only be used for statistical evaluation purposes.

Please use a number two pencil to fill out the scantron card provided. Do not enter any administrative information on the scantron sheet except the last four digits of your Social Security Number, flush with the right.

Turn in to your survey proctor when completed.

Thank you for your participation!

Part I: Individual

Please rate the following statements on how strongly you agree or disagree with them. Remember, this information will remain anonymous so please be completely candid.

Use the following scale:
A. Yes
B. No
C. Not Sure

Before joining the Army:

1. Was protecting the environment important to you?

2. Did you receive formal environmental training in school or work?

3. Did you recycle as much as possible?

4. Were you a member of an environmental organization?

5. Did you participate in environmental protection and cleanup activities?

During entry level training:

6. Did you receive training on Army environmental policies and programs?

7. Did you receive training on your environmental protection responsibilities?
   (If the answer is no, go to question 9).

8. Did your training increase your environmental awareness?

As a soldier:

9. Is protecting the environment important to you?

10. Do you recycle on the job?

11. Do you recycle in your quarters or barracks?

12. Are you a member of an environmental protection organization?

13. Do you participate in environmental protection and clean-up activities?

Part II: Impact

14. Have you ever experienced a situation where training was cancelled or curtailed due to
    environmental protection concerns?

    A. Yes
    B. No
    C. Not Sure

15. In training, if faced with a choice between accomplishing my mission and protecting the
    environment I would:

    A. Accomplish my mission
    B. Protect the environment

16. In a real-world operation, if faced with a choice between accomplishing my mission and
    protecting the environment I would:

    A. Accomplish my mission
    B. Protect the environment

17. I feel that environmental considerations affect military training…

    A. Very Positively
    B. Positively
    C. Not at all.
    D. Negatively
    E. Very Negatively

Part III: Unit Practices

Based on your experience during your most recent troop assignment please answer the following

questions where:

    A. is Always
    B. is Usually
    C. is Sometimes
    D. is Never
    E. is Not Applicable/Do Not Know

18. Were environmental considerations part of training conditions and standards?

19. Did soldiers understand their roles and responsibilities in reducing damage to the
    environment?

20. Were all soldiers briefed on environmental restrictions concerning endangered species, use of
    camouflage, and other relevant topics?

21. Were spill response teams trained, rehearsed, and aware of their assignment?

22. Did you get approval to dig fighting positions, tank ditches, etc; were fighting positions
    and other holes filled in and leveled after training?

23. Did vehicle crews stay on trails and use secondary roads and bypasses, and move into assembly
    areas in column?

24. Did vehicle crews avoid knocking down trees, avoid stripping the ground bare of vegetation,
    and use camouflage nets whenever possible?

25. Did vehicle crews cross streams only at approved crossing sites?

26. Were sensitive and "off-limits" areas designated and well marked?

27. Did units refuel or conduct field maintenance operations near or in wetlands or surface waterways?

28. Did units avoid and protect cultural artefacts such as cemeteries and archaeological sites?

29. Did units police training areas after operations (to include communications wire and barrier material) to ensure they were as clean or cleaner than before their arrival?

30. Was wastewater from mess operations and showers allowed to drain wherever it flowed?

31. Were medical wastes treated as a bio-hazard and evacuated to a medical facility for disposal?

32. Was hazardous material such as ammunition disposed of in the normal garbage?

33. Did units dump POL products into sewers, ditches, streams, or soil?

34. Did your unit use spill prevention kits?

35. Did your unit report and cleanup all POL spills?

36. Did your unit use authorized wash racks to clean their vehicles?

37. Were environmental concerns addressed in the unit's After Action Review?

38. Use Field Manual 3-100.4, Environmental Considerations in Military Operations (FM 20-400) and/or TC 5-400, Unit Leaders' Handbook for Environmental Stewardship?

Part IV: Responsibilities

The following questions deal with environmental responsibility on a military installation. Please mark who is responsible for each statement.

A. Individual Civilians (Department of the Army civilians)
B. Individual Soldier
C. Leaders/Supervisors (military or civilian)
D. All

39. Comply with environmental policies, SOPs, and regulations.

40. Analyze the influence of environmental factors on mission accomplishment.

41. Prevent environmental damage.

42. Advise the chain of command on how to comply with environmental regulations.

43. Enforce compliance with environmental laws and regulations.

44. Support the Army's recycling program.

45. Be knowledgeable about the National Environmental Policy Act (NEPA), hazardous materials and waste, hazardous communication efforts, and spill contingencies.

46. Immediately report hazardous material and waste spills.

47. Build an environmental ethic in their soldiers.

48. Apply environmental awareness to daily activities and make good decisions that will not harm the environment.

49. Identify environmental risks associated with their tasks.

50. Plan and conduct environmentally friendly activities and training.

51. Discuss environmental considerations during After Action Reviews.

52. Protect the environment during training and other activities.

53. Ensure environmental concerns are addressed throughout the training cycle (evaluation, assessment, planning, execution, and after-action).

54. Use environmental risk assessment procedures when they plan activities.

Part V: Army Policy

Of the following statements, which do you feel describes the current Army policy? Please use the

following responses:

A. Yes, the statement describes current Army policy.
B. No, the statement does not describe current Army policy.
C. I am not sure.

55. I have a professional and personal responsibility to support the Army's environmental program.

56. The Army environmental ethic is that we will take care of the environment because it is the right thing to do.

57. The Army's environmental strategy is focused on compliance, restoration, prevention, and conservation.

58. Soldiers are required to comply with all federal, state, and local environmental laws.

59. Soldiers are protected from prosecution by civilian authorities for violating environmental laws because they are engaged in national defence.

60. Civilian environmental authorities have jurisdiction on military installations.

Part VI: Service Data

61. Rank

    A. Cadet
    B. Enlisted
    C. NCO
    D. Warrant Officer
    E. Officer

62. Years of Service

    A. Cadet
    B. 1-5
    C. 6-10
    D. 11-15
    E. 16-20+

63. Gender

    A. Male
    B. Female

64. Branch

    A. Combat Arms
    B. Combat Support
    C. Combat Service Support
    D. Not Applicable

65. Component

    A. Active
    B. Reserve
    C. National Guard
    D. Cadet--Not Applicable

Your answers will remain anonymous. Thank you for taking the time to support this research.

APPENDIX B

Environmental aspects, impacts and indicators of the Portuguese defence sector: questionnaire survey (Ramos et al. 2009: 36-52)

```
IDENTIFICATION
```

Unit Name

Phone   **Fax**   **E-mail**

Address

Postal Code

Municipality

NUTS II   **Military branch**

Açores   Navy

Alentejo   Army

Algarve   Air force

Centro

Lisboa e Vale do Tejo

Norte

Madeira

Main Mission:

Personnel (number)

Military

Resident
Non Resident

Civilians

Resident
Non Resident

Total

```
I. ACTIVITIES; ASPECTS AND IMPACTS
```

1. (a) Please mark with a cross the main activities conducted in your Unit.

(b) Activities in a military unit could cause significant environmental problems <u>Please assign the importance level (1=low; 2=medium; 3=high) relative to each problem identified in (a).</u>

ACTIVITIES	(a) UNIT ACTIVITIES	(b) SIGNIFICANCE OF ENVIRONMENTAL PROBLEMS (1/2/3)
Operational		
Military security		
Territorial defence		
Surveillance Economic exclusive zone Other? Please name it:		
Rescuing operations		
Maintenance of peace and public order		
Traffic control		

air naval ground Other? Please name it:		
Hydrographical survey		
Topographic survey		
Cartographic survey		
Photographic and printing processes		
Assembly and maintenance of electronic equipment		
Hospital/medical operations		
Laboratory activities		
Civil-military cooperation		
Civil Protection National System collaboration		
Forest fire prevention and action		
Pollution control prevention and action		
Humanity support		
Firing exercises Air Ground units Naval units Other? Please name it:		

```
Weapons tests
Military manoeuvres exercises
International military exercises
Construction and maintenance of military/non military
infrastructures:
Bridges ..................................................................
Roads.....................................................................
Sewerage system.........................................................
Buildings.................................................................
Home dwellings..........................................................
Storehouses .............................................................
Training areas ..........................................................
Lighthouses and radio lighthouses ...........................
Other? Please name it _____
Production / assembly
Ammunition ...............................................................
Heavy artillery pieces and components .....................
Light weapons .............................................................
Heavy conventional weapons ......................................
Anti-aircraft artillery .................................................
```

ACTIVITIES
(a)
UNIT ACTIVITIES
(b)

SIGNIFICANCE OF ENVIRONMENTAL PROBLEMS (1/2/3)
```
Land-launched weapon systems ..............................
Combat vehicles.........................................................
Surveillance vehicles....................................................
Transport vehicles.......................................................
Electric and electronic systems..................................
Components...............................................................
Military maps ............................................................
Pharmaceutical products ...........................................
Other? Please name it _____
Maintenance and repair:
Ammunitions ............................................................
Heavy artillery pieces and components .....................
Light ammunition.......................................................
Heavy ammunition ...................................................
Anti-aircraft artillery .................................................
Land-launched weapon systems ..............................
Combat vehicles.........................................................
Surveillance vehicles....................................................
Transport vehicles.......................................................
Electric and electronic systems..................................
Informatics equipments.............................................
Other? Please name it _____
Decommissioning / demilitarization
```

Ammunitions ....
Heavy artillery pieces and components ....
Light Ammunition ....
Heavy Ammunition ....
Anti-aircraft artillery ....
Land-launched weapon systems ....
Combat vehicles...
Surveillance vehicles..
Transport vehicles...
Components..
Other? Please name it _____
Wastewater drainage and treatment
Water treatment and supply
Pest control management
Green space management
Waste Management
Others? Please name it_____
Management/Administration
Management/Administration
Military instruction and training
Military instruction and/or training
Higher education
Scientific research
Others? Please name it_____
Logistics operations
Storage:
Provisions...
Office materials ....
Military uniforms..
Ammunitions ....
Heavy artillery pieces and components ....
Light Ammunition ....
Heavy Ammunition ....
Anti-aircraft artillery ....
Land-launched weapon systems ....
Combat vehicles...
ACTIVITIES
(a)
UNIT ACTIVITIES
(b)
SIGNIFICANCE OF ENVIRONMENTAL PROBLEMS (1/2/3)
Surveillance vehicles..
Transport vehicles...
Electric and electronic systems..................................
Paints ....
Fuel ....
Synthetic Oils and hydraulics.....................................
Others? Please name it _____
Military transport (air, ground and naval)
Refuelling operations
Other? Please name it _____

2. Please answer the following questions considering your answer at question 1:
(a) Identify the environmental aspects associated with the activities in your unit, and assign their
significance/relevance
Note: environmental aspect – unit's activities, products and services (or parts therefore) that may influence
the environment. A **significant environmental aspect** is an environmental aspect that has or can
have a significant environmental impact.
Environmental impact: any change to the environment, whether adverse or beneficial, wholly or
partially resulting from a unit's activities, products or services.

SIGNIFICATIVE ENVIRONMENTAL ASPECTS
Yes No
Consumption
Water
....
....
Electricity
....
....
Fuel (light oil, heavy oil, diesel fuel and others)
....
Paper
....
....
Toner and print cartridges
....

Paints
....
....
Oils and synthetic
lubricants...
Fertilizers and phytopharmaceuticals
....
Emulsions, solvents and other substances used in equipment maintenance
(cleaning and degreasing operations)
....
Other products and chemical substances
....
Other? Please name it _____
Wastewater generation:
Urban (e.g. effluents from
dwellings)...
Industrial (ex: effluents from laboratories and painting operations) ....
Pluvial (e.g. runoff from contaminated
areas)...
Aesthetics and topography alterations (e.g. cratering effects due high explosive use)
Vegetation removal
Vehicle circulation (e.g. mechanized infantry training and vehicle manoeuvres)
Noise:
Weapons use (e.g.: from artillery firing and airfields)
....
Vehicle traffic (air, naval and
ground)..
Other? Please name it _____
Air emissions:
Weapons utilization (e.g.: open burn/open detonation, explosions).........................
Waste disposal, such as incineration
....
Phytopharmaceuticals application
....
Pesticide application inside of buildings
....
Vehicle traffic (air, naval and
ground)..
Painting operations
....
...
Other? Please name it _____

SIGNIFICATIVE ENVIRONMENTAL ASPECTS
Yes No
Waste generation
Domestic solid waste (paper and cardboard, glass, metal, plastic, organics,
textile)...
....
Medical waste
....
....
Military equipment and ammunition
wastes...
Wastes from printing and photographing processes
....
Organic and inorganic chemicals deriving from de laboratory activities ....
Oil wastes
....
....
End-of-life
tyres..
....
Discarded
vehicles..
....
Packaging
....
....
Batteries and accumulators
....
Gardens
waste...
....
Construction and demolition
wastes...
Electric and electronic equipment wastes
....

Sludge from wastewater treatment facilities
....
Bottom ash and coal fly ash from thermal processes in combustion plants..............
Other wastes? Please name it _____
Non-controlled solid waste disposal
Fuel Spills
Suppliers/Contractors
Other(s) environmental aspects? Please name it
(b) Identify the negative environmental impacts associated with the environmental aspects identified below (at question 2 (a)) and assign their significance above (please, mark with a cross)

SIGNIFICATIVE ENVIRONMENTAL IMPACTS Yes No

Water quality and hydrological resources impacts
Changes on surface water quality
Changes on groundwater quality
Hydrological alterations (alteration on channel form due to changes in landforms, vegetation clearance and soil compaction; sedimentation of rivers)
Groundwater alterations (e.g. water table modification, depth to water table, permeability, location of recharge area)
Soil Impacts
Soil contamination
acidification
salinity
Soil compaction
Lost/perturbation of arable soil
Soil impermeabilization
Soil erosion
Land use/soil occupation
Climate and Air Quality Impacts
Effects on temperature, humidity and wind-speed
Effects on local climate
Indoor air quality effects
Air quality deterioration
Impacts on ecosystems
Habitats destruction
Vegetation destruction
Biotic communities disturbance (e.g. invasion of exotic species)
Biodiversity lost
Landscape and patrimonial Impacts
Landscape alterations
Cultural heritage degradation (e.g. Archaeological sites and structures, historic properties)

SIGNIFICATIVE ENVIRONMENTAL IMPACTS Yes No
Socio-Economics Impacts
Human health effects
Local and regional economic effects
Alterations on socio-economic, cultural and local communities well-being structures

Other impacts? Please, name it
(b) In the significance evaluation at the questions (2a) (2b) what were the main aspects that induced your answer? Please mark (X)
Legal constraints
Potential human health hazard/risk
Potential environment hazard/risk
Hygiene and safety work conditions at *unit*
Guidelines from military commands or Ministry of Defence
Pressure from stakeholders (e.g.: local communities; nongovernmental organizations)
Pressure from suppliers
Pressure from insurance companies
Pressures from decision makers
Economic motivations
Other(s) _____
_____
(d) Has been already identified the environmental aspects and impacts associated with the activities developed in your unit.
.... Yes No
(e) If so, in the identification process was used a formal procedure?
Yes?, please name it_____
_____
_____
No
(f) Characterize the environmental impacts identified as significative at question 2 (b) considering the following properties:

1 **Extent** I: total (whole unit area)
P: partial (specific sites within the unit area)
E: exterior (e.g. external to the unit)

2 **Frequency**: T: temporary
P: permanent

3 **Source** D: direct (caused directly by unit's activities)
I: indirect (caused indirectly by unit's activities)

4 **Magnitude**
– intensity or extent of the
alteration:
VH: very high
H: high
M: medium
W: weak
VW: very weak

IMPACTS PROPERTIES

ENVIRONMENTAL IMPACTS

EXTENT1 FREQUENCY2 SOURCE3 MAGNITUDE4

Water resources and quality
Changes on surface water quality
Changes on groundwater quality
Hydrological alterations (alteration on channel form
due to changes in landforms, vegetation clearance
and soil compaction; sedimentation of rivers)
Groundwater alterations (e.g. water table
modification, depth to water table, permeability,
location of recharge area)
Soil
Soil contamination
acidification
salinity
Soil compaction
Loss of arable soil
Soil impermeabilization
Soil erosion
Land use/soil occupation

Climate and air quality
Effects on temperature, humidity and wind-speed
Effects on local climate
Indoor air quality effects
Air quality deterioration

Ecosystems
Habitats destruction
Vegetation destruction
Biotic communities disturbance (e.g. invasion of
exotic species)
Biodiversity lost

Landscape and heritage
Landscape alterations
Cultural heritage degradation (e.g. archaeological
sites and structures, historic properties)

Social and economic
Human health effects
Local and regional economic effects
Alterations on socio-economic, cultural and local
communities well-being structures

Other

II. ENVIRONMENTAL PERFORMANCE AND INDICATORS
3. (a) Does your unit consider important and necessary to conduct environmental performance
evaluation and communication?
....
..................Yes No Don't know
(b) If so, identify the main drivers which justify the need to evaluate and communicate the
environmental performance of your unit
To promote image and reputation To become a benchmark
Innovative management Commitment to social responsibilities
To identify and mitigate environmental
impacts resulting from organization activities
To improve stakeholders' participation in

Unit activities
Expenditure reduction I To influence similar organizations
To increase mission/service/product
efficiency
To respond to decision-makers' pressure
To avoid environmental penalties
(nonconformity /legal non-compliance)
To respond to public pressure
To increase mission transparency To prevent health risks
Compliance with regulations To increase credibility with stakeholders
4. (a) Is the unit's persons in charge of environmental issues familiar with the ISO 14031 standard on
"environmental performance evaluation"?
.... Yes No
(b) If so (to a), has or will the unit implement this standard?
Yes, in addition to an environmental management system (ISO 14001 e/ou EMAS)
Yes, instead of an environmental management system
No, not yet set out
No, it will not be useful for the Unit
5. (a) Is the unit's persons in charge of environmental issues familiar with the "environmental indicator"
concept?
....
.... Yes No
If so (to **a**), please answer the following questions:
(b) Are environmental indicators used in your unit?
.... Yes No
(b.1) If so, identify the type of report where you use environmental indicators
Activity reports
Mission reports
Newsletters
Environmental reports
Financial reports
Data compendium
Others _____

_____
(b.2) Please, introduce the reference of this report (if possible, send a copy of the report or part(s)
which are used environmental indicators).
Report's Reference _____

_____
(c) Environmental indicators can be expressed in three distinct ways:
Absolute or original values (e.g. "water consumption": m3.year−1);
Normalized (e.g. "water consumption": m3/misson; m3/maps printed or m3/service provided);
Aggregated, resulting in a classification scale (e.g.: "water consumption": class A − high water
consumption; class B − moderate water consumption; class C − low water consumption))
What physical units do you consider more appropriate to report indicators for internal stakeholders
(e.g. inside your unit, among another branches of armed forces or Portuguese Ministry of
Defence)? Please check the option(s) you've considered more appropriated.
Absolute or original values
Normalized values
Aggregate values
Please, justify your answer _____

_____
What units do you consider more appropriate to report indicators for external stakeholders (e.g.
local communities, nongovernmental organizations, municipalities, schools and journalists)?
Please
check the option(s) you've considered more appropriated.
Absolute or original values
Normalized values
Aggregate values
Please, justify your answer _____

_____
(d) Please, identify the main advantages and limitations/drawbacks of using environmental
indicators in your Unit
Advantages Limitations/Drawbacks
To synthesize technical environmental data;
To identify key environmental variables;
To facilitate data communication;
To help in decision-making processes;
To identify priority areas and stress trends;
To provide support for environmental reports;
To facilitate control of environmental compliance
regulations;
To allow a continuous assessment of
environmental performance.
Lack of environmental monitoring data;
Identification of the best algorithm to transform
raw data into aggregated indicators (indexes);

Loss of information in data aggregation
processes;
Difficult association between theoretical Indicator
limits and environmental regulations;
Lack of rigorous criteria to support indicator
selection and development;
Absence of environmental management
practices;
Absence of an environmental management
system;
Lack of environmentally specialized human
resources in the unit;
Possibility of an excessive information relay to
external parties
DATA OF PERSON IN CHARGE TO COMPLETE THE QUESTIONAIRE (For further
contacts in case of doubt about the data presented)
Name
Department/Service Post
Phone Fax
E-mail
Signature _____Date

APPENDIX C

South African questionnaire (Smit 2009)

SOUTH AFRICAN MILITARY ACADEMY

MILITARY GEOGRAPHY SUBJECT GROUP QUESTIONNAIRE

The Department of Military Geography is interested in the perception of students regarding environmental issues in the military environment. Your co-operation with the filling in of the questionnaire below will be appreciated.

1. Academic Year	First year		Third year	
	Second year		Post graduate	

2. Did you have Geography as a subject up to Grade 12 (Std 10) level?	Yes	No

3. Did you have Geography as a subject at the Academy?	Yes	No

4. If yes to question 3 above, indicate: highest level completed or current level.	First year		Third year	
	Second year		Post graduate	

Indicate whether you agree/disagree with each of the statements below. Mark your answer with an X.

	Agree	Disagree
1. Military personnel must act in an environmentally responsible manner		
2. Unnecessary environmental destruction impoverish a country		
3. All soldiers must receive environmental education		
4. Environmental responsible conduct must be one of the core values of a soldier.		
5. The SANDF must become known as a "green" defence force		
6. The protection of the environment is a luxury that we cannot afford		
7. I am aware that environmental laws are applicable to the SANDF		
8. Noise pollution measures must be part of the management plans of all units		
9. Air pollution measures must be part of the management plans of all units		
10. The protection of the environment is an important part of the duty of a soldier		
11. Environmental management plans is necessary for the effective functioning of a unit		
12. During training the environment must be protected		
13. During peacekeeping operations in other countries the environment of that country must be protected		
14. In the planning of a military operation the environment(also cultural aspects like historical buildings) should always be taken into consideration		
15. It is important to protect the environment during peacemaking and peacekeeping operations		
16. It is important to protect the environment during base management		
17. It is important to protect the environment during operations in times of war		
18. Environmental education and management can save lives during a war		
19. It is important to save water during all military operations		
20. I am conscious of the negative effects of unnecessary destruction of the environment within training areas.		
21. I am a soldier and do not have to worry about the environment		

Thank you for your participation.

Cdr HA.P.(Hennie) Smit   Chair Military Geography   022-7023110 hennies@ma2.sun.ac.za

        Department of Military Geography ✝ Faculty of Military Science ✝ University of Stellenbosch

APPENDIX D
Children's Environmental Attitudes and Knowledge Scale (CHEAKS) (Leeming, Dwyer & Bracken, 1995).

Homeroom Teacher_____ESOL yes/no Date_____ Name_____Grade___
Girl___Boy____Age_____

Please circle what you would really do. (Verbal Commitment)

1. I would be willing to stop buying some products to save animal's lives.
a. very true b. mostly true c. not sure d. mostly false f. very false
2. I would not be willing to save energy by using less air conditioning.
a. very true b. mostly true c. not sure d. mostly false e. very false
3. To save water, I would be willing to use less water when I bathe.
a. very true b. mostly true c. not sure d. mostly false e very false
4. I would not give $15 of my own money to help the environment.
a. very true b. mostly true c. not sure d. mostly false e. very false
5. I would be willing to ride the bus to more places in order to reduce air pollution.
a. very true b. mostly true c. not sure d. mostly false e. very false
6. I would not be willing to separate my family's trash for recycling.
a. very true b. mostly true c. not sure d. mostly false e. very false
7. I would give $15 of my own money to help protect wild animals.
a. very true b. mostly true c. not sure d. mostly false e. very false
8. To save energy, I would be willing to use dimmer (less bright) light bulbs.
a. very true b. mostly true c. not sure d. mostly false e. very false
9. To save water, I would be willing to turn off the water while I wash my hands
a. very true b. mostly true c. not sure d. mostly false e. very false
10. I would go from house to house to pass out environmental information.
a. very true b. mostly true c. not sure d. mostly false e. very false
11. I would be willing to write letters asking people to reduce pollution.
a. very true b. mostly true c. not sure d. mostly false e. very false
12. I would be willing to go from house to house asking people to recycle.
a. very true b. mostly true c. not sure d. mostly false e. very false

Please circle what you really do. (Actual Commitment)

13. I have not written someone about a pollution problem.
a. very true b. mostly true c. not sure d. mostly false e. very false
14. I have talked with my parents about how to help with environmental problems.
a. very true b. mostly true c. not sure d. mostly false e. very false
15. I turn off the water in the sink while I brush my teeth to conserve water.
a. very true b. mostly true c. not sure d. mostly false e. very false
16. To save energy, I turn off lights at home when they are not in use.
a. very true b. mostly true c. not sure d. mostly false e. very false
17. I have asked my parents not to buy products made from animal fur.
a. very true b. mostly true c. not sure d. mostly false e. very false
18. I have asked my family to recycle some of the things we use.
a. very true b. mostly true c. not sure d. mostly false e. very false
19. I have asked others what I can do to help reduce pollution.
a. very true b. mostly true c. not sure d. mostly false e. very false
20. I often read stories that are mostly about the environment
a. very true b. mostly true c. not sure d. mostly false e. very false

21. I do not let a water faucet run when it is not necessary.

a. very true b. mostly true c. not sure d. mostly false e. very false

22. I leave the refrigerator door open while I decide what to get out.

a. very true b. mostly true c. not sure d. mostly false e. very false

23. I have put up a bird house near my home.

a. very true b. mostly true c. not sure d. mostly false e. very false

24. I do not separate things at home for recycling.

a. very true b. mostly true c. not sure d. mostly false e. very false

Please circle how you really feel. (Affect)

25. I am frightened to think people don't care about the environment.

a. very true b. mostly true c. not sure d. mostly false e. very false

26. I get angry about the damage pollution does to the environment.

a. very true b. mostly true c. not sure d. mostly false e. very false

27. It makes me happy when people recycle used bottles, cans, and paper.

a. very true b. mostly true c. not sure d. mostly false e. very false

28. I get angry when I think about companies testing products on animals.

a. very true b. mostly true c. not sure d. mostly false e. very false

29. It makes me happy to see people trying to save energy.

a. very true b. mostly true c. not sure d. mostly false e. very false

30. I am not worried about running out of water.

a. very true b. mostly true c. not sure d. mostly false e. very false

31. I do not worry about environmental problems.

a. very true b. mostly true c. not sure d. mostly false e. very false

32. I am not frightened about the effects of pollution on my family.

a. very true b. mostly true c. not sure d. mostly false e. very false

33. I get upset when I think of the things people throw away that could be recycled.

a. very true b. mostly true c. not sure d. mostly false e. very false

34. It makes me sad to see houses being built where animals used to live.

a. very true b. mostly true c. not sure d. mostly false e. very false

35. It frightens me to think how much energy is wasted.

a. very true b. mostly true c. not sure d. mostly false e. very false

36. It upsets me when I see people use too much water.

a. very true b. mostly true c. not sure d. mostly false e. very false

Please circle what you think. (Knowledge)

37. Most elephants are killed every year to provide people with:

a. trophies. b. ivory. c. meat. d. oil. e. skin.

38. Burning coal for energy is a problem because it:

a. releases carbon dioxide and other pollutants into the air. b. decreases needed acid rain.

c. reduces the amount of ozone in the stratosphere. d. is too expensive. e. pollutes the water in aquifers.

39. Ecology assumes that man is what part of nature?

a. special. b. related to all other parts. c. not important. d. the best part. e. the first part.

40. Phosphates are harmful in sea water because they:

a. cause cancer in fish. b. stop reproduction in fish. c. make fish nervous. d. make the water cloudy. e. suffocate fish by increasing algae.

41. Compared to other paper, recycled paper:

a. takes more water to make. b. takes less energy to make. c. is less expensive to buy. d. is harder to write on. e. produces more pollutants.

42. The most pollution of our water sources is caused by:

a. dams on rivers. b. chemical runoff from farms. c. methane gas. d. leaks in the sewers. e. human and animal wastes.

43. Ecology is the study of the relationship between

a. different species of animals. b. plants and the atmosphere. c. organisms and their environments. d. man and other animals. e. man and the environment.

44. The most common poisons found in water are:

a. arsenic, silver nitrates. b. hydrocarbons. c. carbon monoxide. d. sulfur, calcium. e. nitrates, phosphates.

45. Where does most of the garbage go after it is dumped from the garbage trucks?

a. to an aquifer where it is buried. b. into an ocean. c. recycled to make plastic. d. to a landfill where it is buried. e. to farmers to use as fertilizer.

46. Which is most responsible for creating acid rain?

a. sulfur dioxide b. carbon dioxide c. ozone d. nitrogen e. ultraviolet radiation

47. Catching tuna in the ocean:

a. is eliminating a main food source for whales b. protects baby sea turtles. c. also kills many dolphins. d. is now against the law. e. is necessary to keep the population size down.

48. Which is an example of a perpetual energy source?

a. nuclear b. oil c. wood d. uranium e. solar

49. Which of the following is the most dangerous to the earth's environment?

a. damming rivers b. overpopulation c. tornadoes d. household pets e. nuclear power plants

50. Most of the lead in our air is caused by:

a. cars. b. industrial plants c. airplanes.d. burning refuse. e. cigarettes.

51. Precyling means that:

a, people buy things that can be used again. b. more people should ride bicycles c, small children should wear the clothes of their older brothers or sisters. d. items should be tested before we buy them. e. environmental changes are always taking place.

52. Animals alive today are most likely to become extinct because:

a. natural selection kills weaker animals. b. where they live is getting too warm. c. they are unable to reproduce because of pollution.

d. the habitat where they live is destroyed. e. their food supply is destroyed by acid rain.

53. Coal and petroleum are examples of:

a. fossil fuels. b. renewable sources of energy. c. energy sources that are plentiful. d. alternative sources of energy. e. recycled resources.

54. Environmental problems are a threat to :

a. mostly people in small countries. b. only people who live in cities. c. only wild animals and endangered species. d. mostly tropical plants and animals. e. all living things in the world.

55. Which of the following does not do much to reduce the pollution by automobiles:

a. properly tuned engine. b. high octane gas. c. low lead gas. d. smog control devices. e. propane engines.

56. The main problem with landfills is that they :

a. take up too much space. b. are ugly to look at and smell bad. c. attract rats and other pests. d. prevent farming of nearby land. e. do not produce enough methane.

57. Building a dam on a river can be harmful because it:

a. makes the river muddy. b. can no longer be used to make electricity. c. increases level of pollution on the water.

d. causes the river to flood. e. damages the river's natural ecosystem

58. Where is water under the ground found?

a. in landfills. b. in ponds. c. in low pressure areas. d. in aquifers. e. in rivers.

59. Killing animals like wolves that eat others:

a. is necessary and should be done. b. may increase the number of other animals. c. does not affect other animals in the area. d. may decrease the number of other animals. e. will help protect the environment.

60. An example of a nonrenewable resource is:

a. petroleum. b. trees. c. ocean water. d. sunlight. e. animals raised for food.

61. Most air pollution in our big cities comes from:

a. cars. b. jet planes. c. factories d. big trucks e. landfills

62. An item which cannot be recycled and used again is:

a. disposable diapers. b. newspapers c. aluminium cans d. motor oil e. plastic bottles

63. What is the main problem with the use of aquifers for a water supply?

a. They recharge too quickly. b. They are becoming used up. c. They contain too much fresh water.

d. They contain too much salt water. e. It is hard to get the water out.

64. A species that no longer exists is:

a. protected. b. endangered. c. abundant. d. extinct. e. wild game.

65. Which uses the most energy in an average house in the United States?

a. lights. b. TV. c. hot water heater. d. telephone. e. refrigerator.

66. Which of the following groups is most interested in environmental issues?

a. Boy Scouts of America b. The Sierra Club c. Kiwanis d. 4-H Club e. The American Cancer Society

67. I have never taken a written environmental survey before.

a. true b. false

68. I would like to learn more about the environment and how to protect our Planet Earth.

a. true b. false

Answer	Topic	Item
		Practice
		I like to do fun things. I like to be sick. I get upset when bad things happen to me. I do not like to take vacations from school.
		Verbal commitment
True	Animals	1. I would be willing to stop buying some products to save animals' lives.
False	Energy	2. I would not be willing to save energy by using less air conditioning.
True	Water	3. To save water, I would be willing to use less water when I bathe.
False	General	4. I would not give $15 of my own money to help the environment.
True	Pollution	5. I would be willing to fide the bus to more places in order to reduce air pollution.
False	Recycling	6. I would not be willing to separate my family's trash for recycling.
True	Animals	7. I would give $15 of my own money to help protect wild animals.
True	Energy	8. To save energy, I would be willing to use dimmer light bulbs.
True	Water	9. To save water, I would be willing to turn off the water while I wash my hands.

```
True    General    10. I would go from house to house to pass
                        out environmental information.

True    Pollution  11. I would be willing to write letters
                        asking people to help reduce pollution.

True    Recycling  12. I would be willing to go from house
                        to house asking people to recycle.

                    Actual commitment

False   Pollution  1. I have not written someone about a
                       pollution problem.

True    General    2. I have talked with my parents about how
                       to help with environmental problems.

True    Water      3. I turn off the water in the sink while
                       I brush my teeth to conserve water.

True    Energy     4. To save energy, I turn off lights at
                       home when they are not in use.

True    Animals    5. I have asked my parents not to buy
                       products made from animal fur.

True    Recycling  6. I have asked my family to recycle some
                       of the things we use.

True    Pollution  7. I have asked others what I can do to
                       help reduce pollution.

True    General    8. I often read stories that are mostly
                       about the environment.

True    Water      9. I do not let a water faucet run when
                       it is not necessary.

False   Energy     10. I leave the refrigerator door open
                        while I decide what to get out.

True    Animals    11. I have put up a bird house near my
                        home.

False Recycling    12. I do not separate things at home for
                        recycling.

                    Affect

True    General    1. I am frightened to think people don't
                       care about the environment.

True    Pollution  2. I get angry about the damage pollution

                       does to the environment.
True    Recycling  3. It makes me happy when people recycle
                       used bottles, cans, and paper.

True    Animals    4. I get angry when I think about
                       companies testing products on animals.

True    Energy     5. It makes me happy to see people trying
                       to save energy.
```

False	Water	6. I am not worried about running out of water.
False	General	7. I do not worry about environmental problems.
False	Pollution	8. I am not frightened about the effects of pollutionon my family.
True	Recycling	9. I get upset when I think of the things people throw away that could be recycled.
True	Animals	10. It makes me sad to see houses being built where animals used to live.
True	Energy	11. It frightens me to think how much energy is wasted.
True	Water	12. It upsets me when I see people use too much water.

Knowledge

B	Animals	1. Most elephants are killed every year to provide people with: A) trophies. B) ivory, G) meat. D) oil. E) skin.
A	Energy	2. Burning coal for energy is a problem because it: A) releases carbon dioxide and other pollutants into the air. B) decreases needed acid rain. C) reduces the amount of ozone in the stratosphere. D) is too expensive. E) pollutes the water in aquifers.
B	General	3. Ecology assumes that man is what part of nature? A) special, B) related to all other parts. C) not important. D) the best part, E) the first part.
E	Water	4. Phosphates are harmful in sea water because they: A) cause cancer in fish. B) stop reproduction in fish. C) make fish nervous. D) make the water cloudy. E) suffocate fish by increasing algae.
B	Recycling	5. Compared to other paper, recycled paper: A) takes more water to make. B) takes less energy to make. C) is less expensive to buy. D) is harder to write on. E) produces more pollutants.
B	Pollution	6. The most pollution of our water sources is caused by: A) dams on rivers. B) chemical runoff from farms. C) methane gas. D) leaks in the sewers. E) human and animal wastes.
C	General	7. Ecology is the study of the relationship between: A) different species of animals. B) plants and the atmosphere. C) organisms and their environments. D) man and other animals.

E   Pollution   8. The most common poisons found in water are: A) arsenic, silver nitrates. B) hydrocarbons. C) carbon monoxide. D) sulfur, calcium. E) nitrates, phosphates.

D   Recycling   9. Where does most of the garbage go after it is dumped from the garbage trucks? A) To an aquifer where it is buried. B) It is dumped into the ocean. C) It is recycled to make plastic. D) To a landfill where it is buried. E) To farmers for use as fertilizer.

A   Water   10. Which is most responsible for creating acid rain? A) sulfur dioxide. B) carbon dioxide. C) ozone. D) nitrogen. E) ultraviolent radiation.

C   Animals   11. Catching tuna in the ocean: A) is eliminating a main food source for whales. B) protects baby sea males. C) also kills many dolphins. D) is now against the law. E) is necessary to keep the population size down.

E   Energy   12. Which is an example of a perpetual energy source? A) nuclear. B) oil. C) wood. D) uranium. E) solar.

B   General   13. Which of the following is the most dangerous to the earth's environment? A) damming rivers. B) overpopulation. C) tornadoes. D) household pets. E) nuclear power plants.

A   Pollution   14. Most of the lead in our air is caused by: A) cars. B) industrial plants. C) airplanes. D) burning refuse. E) cigarettes.

A   Recycling   15. Precycling means that: A) people buy things that can be used again. B) more people should ride bicycles. C) small children should wear the clothes of their older brothers or sisters. D) items should be tested before we buy them. E) environmental changes are always taking place.

D   Animals   16. Animals alive today are most likely to become extinct because: A) natural selection kills weaker animals. B) where they live is getting too warm. C) they are unable to reproduce because of pollution. D) the habitat where they live is destroyed. E) their food supply is destroyed by acid rain.

A   Energy   17. Coal and petroleum are examples of: A) fossil fuels. B) renewable sources of energy. C) energy sources that are

plentiful. D) alternative sources of
energy. E) recycled resources.

E General 18. Environmental problems are a threat
to; A) mostly people in small countries.
B) only people who live in cities. C)
only wild animals and endangered
species. D) mostly tropical plants and
animals. E) all living things in the
world.

B Pollution 19. Which of the following does not do
much to reduce the pollution by auto-
mobiles: A) properly tuned engine. B)
high octane gas. C) low lead gas. D)
smog control devices. E) propane
engines.

A Recycling 20. The main problem with landfills is
that they: A) take up too much space. B)
are ugly to look at and smell bad. C)
attract rats and other pests. D) prevent
farming of nearby land. E) do not
produce enough methane.

E Water 21. Building a dam on a river can be
harmful because it: A) makes the river
muddy. B) can no longer be used to make
electricity. C) increases level of
pollution on the water. D) causes the
river to flood. E) damages the river's
natural ecosystem.

D Water 22. Where is water under the ground found?
A) in landfills. B) in ponds. C) in low
pressure areas. D) in aquifers. E) in
rivers.

B Animals 23. Killing animals like wolves that eat
others: A) is necessary and should be
done. B) may increase the number of
other animals. C) does not affect other
animals in the area. D) may decrease the
number of other animals. E) will help
protect the environment.

A Energy 24. An example of a nonrenewable resource
is: A) petroleum. B) trees. C) ocean
water. D) sunlight. E) animals raised
for food.

A Pollution 25. Most air pollution in our big cities
comes from: A) cars. B) jet planes. C)
factories. D) big trucks. E) landfills.

A Recycling 26. An item which can not be recycled and
used again is: A) disposable diapers.
B) newspapers. C) aluminum cans. D)
motor oil. E) plastic bottles.

B Water 27. What is the main problem with the use
of aquifers for a water supply? A) They
recharge too quickly. B) They are
becoming used up. C) They contain

too much fresh water. D) They contain
too much salt water. E) It is hard to
get the water out.

D	Animals	28. A species that no longer exists is: A) protected. B) endangered. C) abundant. D) extinct. E) wild game.
C	Energy	29. Which uses the most energy in an average house in the United States? A) lights, B) TV. C) hot water heater, D) telephone. E) refrigerator.
B	General	30. Which of the following groups is most interested in environmental issues? A) Boy Scouts of America. B) The Sierra Club. C) Kiwanis. D) 4-H Club. E) The American Cancer Society.

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BY FRANK C. LEEMING, WILLIAM O. DWYER, and BRUCE A. BRACKEN

APPENDIX E
New Ecological Paradigm Scale (Dunlap et al. 2000)

Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you STRONGLY AGREE, MILDLY AGREE, are UNSURE, MILDLY DISAGREE or STRONGLY DISAGREE WITH IT.

STATEMENT	SA	MA	U	DM	SD
1. We are approaching the limit of the number of people the earth can support.					
2. Humans have the right to modify the natural environment to suit their needs.					
3. When humans interfere with nature, it often produce disastrous consequences.					
4. Human ingenuity will ensure that we do NOT make the earth unlivable.					
5. Humans are severely abusing the environment.					
6. The earth has plenty of natural resources if we just learn how to develop them.					
7. Plants and animals have as much right as humans to exist.					
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.					
9. Despite our special abilities humans are still subject to the laws of nature.					
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.					
11. The earth is like a spaceship with very limited room and resources.					
12. Humans were meant to rule over the rest of nature.					
13. The balance of nature is very delicate and easily upset.					
14. Humans will eventually learn enough about how nature works to be able to control it.					
15. If things continue on their present course, we will soon experience a major ecological catastrophe					

APPENDIX F
Policy documents regarding environmental issues in the South African military

01	First Edition EIP for Defence
02	Second Edition EIP for Defence
03	Guide to environmental compliance for officers commanding
04	Exercise Rhino – 2009: A soldier's pocket guide to Environmental Responsibility
05	Guidebook on Environmental Considerations during Military Operations
06	Environmental Guidelines on Field Sanitation during Military Training and Operations in the Department of Defence
07	Standardised environmental aspects for consideration during planning
08	Guidebook on Integrated Training area management
09	Internal policy on nature and environmental management
10	Procedural guidelines on prevention and control of erosion
11	Procedural guidelines on incorporating environmental considerations in the planning of peace support operations (including foreign countries)
12	Guidebook on the development and implementation of Environmental Education and Training in the Military
13	Guidebook on the conversion of military bases in SA
14	Guidebook on Environmental impact assessment in the Military
15	Integrated waste management in the Military

APPENDIX G
Evaluation panel for workshop on the Military Environmental Literacy questionnaire

PANEL OF EXPERTS WORKSHOP [MILITARY ENVIRONMENTAL LITERACY QUESTIONNAIRE]

Room 2028, Geology building, 5 May 2011

Name and surname	Appointment	Telephone number	e-mail address
JH. van der Maar	HOD Geography Stellenbosch Un	021 8083103	jhvdm@sun.ac.za
M. Laubscher	SO, Environ mgt RFIM Cape Town	0723597679	lappies.laubscher@gmail.com
R. Jeffery	SO₂ Envir mgt DOD	0828709160	rjeffery@absamail.co.za
A. Pretorius	Lecturer Mil Acad.	022 7023071	a.pret@ma2.sun.ac.za
Sanette Ferreira	Stellenbosch University	083-327-3530	slaf@sun.ac.za
Gerhard van Zyl	Lecturer FMS/SU (Military Academy)	0845045603	gerhard@ma2.sun.ac.za

APPENDIX H
Military Environmental Literacy questionnaire pretested by 15 students

Stellenbosch University
Department of Geography and Environmental Studies

MILITARY ENVIRONMENTAL LITERACY SURVEY
SOUTH AFRICAN ARMY

Dear respondent

I am Cdr Hennie Smit, a lecturer in the Department of Military Geography at the Faculty of Military Science of Stellenbosch University (Military Academy) in Saldanha. I am doing doctoral research in Geography and Environmental Studies at Stellenbosch University. The title of my dissertation is *"Military environmental literacy in the South African Army."*

The research aims to provide clear insights that may aid in training and management of staff and activities in the Army to enable it to meet its environmental management targets already committed to via various policy imperatives. Consent for the study was granted by the Army leadership.

As the Army use large areas of South Africa and is the custodian of these areas many would argue that it is important to be aware of the importance of sound environmental practices. This survey is designed to assess the environmental literacy (knowledge, attitudes and behaviour towards the **environment in the military**[29]) of South African Army soldiers. You and your answers will remain anonymous and the University guarantees the confidentiality of all information and its use for academic purposes only. Data on rank, years of service, gender, and branch type (Artillery, Armour, Logistics, Infantry,) etc. will only be used for the purpose of classification during statistical evaluation, and will under no circumstances be disclosed to any other party.

Your answers will mostly be combined with answers from many other soldiers to provide general indicators, so please be as honest and thorough as possible with your responses.

The results of the study are aimed at assisting our organisational decision-makers in drafting military policy on environmental interaction. As such, it may benefit you in your future professional career, and aid the army in carrying out its environmental obligations.

You are not obliged to participate in this study, but since every contribution adds greater validity to the outcome of this study, your dedicated cooperation in this regard will be sincerely appreciated.

When completed, please return the filled-in questionnaire to the person who administered the survey in your unit. Also hand in the completed consent form. The consent for is a form required by the University's Ethics committee and must be handed in separately so that it will not be possible to link the consent form to a specific questionnaire.

Thank you for your participation!

Hennie Smit

---

[29] Throughout this questionnaire the concept **"environment in the military"** refers holistically to encompass the bio-physical, socio-cultural and socio-economic environments in which the Army conduct its activities, whether these activities be training, daily activities, base management, disaster relief and support operations, peacemaking and peacekeeping, or war. Whenever any specific element encompassed by the definition is isolated for a question, it will be specified, i.e. cultural environment (like churches, grave sites, historical buildings, or archaeological and historic sites).

ATTITUDE TOWARDS THE ENVIRONMENT IN THE MILITARY

Please rate the following statements on how strongly you **AGREE** or **DISAGREE** with them. Remember, this information will remain anonymous so please be completely honest and answer all questions.

Use the following scale: a - strongly agree; b - agree; **c - neutral; d - disagree; e - strongly disagree** AND MARK EACH ANSWER WITH AN X IN THE CORRESPONDING BLOCK. For example:

1.   I like ice-cream.

   [a]   [b]   [c]   [d]   [e]

X

1.   During training, daily activities and base management, regardless of type, the environment in the military must be protected.

   [a]   [b]   [c]   [d]   [e]

2.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, the environment in the military must be protected.

   [a]   [b]   [c]   [d]   [e]

3.   During war the environment in the military must be protected.

   [a]   [b]   [c]   [d]   [e]

4.   During training, daily activities and base management, regardless of type, the protection of the cultural environment (like places of worship, grave sites, historical buildings, or archaeological and historic sites etc.) must be actively planned for.

   [a]   [b]   [c]   [d]   [e]

5.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, the protection of the cultural environment (like places of worship, grave sites, historical buildings, or archaeological and historic sites etc.) must be actively planned for.

   [a]   [b]   [c]   [d]   [e]

6.   During war, the protection of the cultural environment (like places of worship, grave sites, historical buildings, or archaeological and historic sites etc.) must be actively planned for.

   [a]   [b]   [c]   [d]   [e]

7.   I am a soldier and do not have to concern myself with the environment in the military.

   [a]   [b]   [c]   [d]   [e]

8.   All soldiers must receive continual environmental education and training.

   [a]   [b]   [c]   [d]   [e]

9.   When planning an operation, the environmental officer should be consulted about probable environmental impacts.

   [a]   [b]   [c]   [d]   [e]

10.   During training, daily activities and base management, regardless of type, wild animals must be protected.

   [a]   [b]   [c]   [d]   [e]

11.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, wild animals must be protected.

   [a]   [b]   [c]   [d]   [e]

12.   During war wild animals must be protected.

   [a]   [b]   [c]   [d]   [e]

13.   I am concerned about the amount of waste produced in the Army.

   [a]   [b]   [c]   [d]   [e]

14.   Environmental management plans is important for the effective functioning of a military
       unit.

       [a]   [b]   [c]   [d]   [e]

15.   It is appropriate that environmental laws are applicable to the military.

       [a]   [b]   [c]   [d]   [e]

16.   Anti - pollution measures must be part of the management plans of all units.

       [a]   [b]   [c]   [d]   [e]

17.   Recycling in the Army is not worth the trouble that it takes.

       [a]   [b]   [c]   [d]   [e]

18.   After a military operation the disturbed environment should be rehabilitated.

       [a]   [b]   [c]   [d]   [e]

19.   During all military operations it is important for soldiers to conserve water.

       [a]   [b]   [c]   [d]   [e]

20.   The South African military must become known as a "green" force.

       [a]   [b]   [c]   [d]   [e]

21.   I am concerned about soil erosion caused by military activities in the veld.

       [a]   [b]   [c]   [d]   [e]

BEHAVIOUR WITHIN THE ENVIRONMENT IN THE MILITARY

Please state the **EXTENT TO WHICH YOU CARRY OUT EACH OF THE FOLLOWING ACTIVITIES**.

Remember, this information will remain anonymous so please be completely honest and answer all

questions.

**Use the following scale: a - strongly agree; b - agree; c - neutral; d - disagree; e - strongly
disagree** AND MARK EACH ANSWER WITH AN X IN THE CORRESPONDING BLOCK. For example:

I always drink water with any meal I eat.

       [a]   [b]   [c]   [d]   [e]

22.   If there is an oil spill during an exercise I always follow the prescribed procedures to
       rectify the situation.

       [a]   [b]   [c]   [d]   [e]

23.   I turn off lights and appliances in my building when not in use.

       [a]   [b]   [c]   [d]   [e]

24.   During, training, daily activities and base management, regardless of type, I will
       dispose of wastewater by dumping it in a stream, vlei or other water body.

       [a]   [b]   [c]   [d]   [e]

25.   During disaster relief and support operations, peacemaking and peacekeeping, regardless
       of type, I will dispose of wastewater by dumping it in a stream, vlei or other water
       body.

           [a]   [b]   [c]   [d]   [e]

26.   During war I will dispose of wastewater by dumping it in a stream, vlei or other water
       body.

[a]   [b]   [c]   [d]   [e]

27.   During training, daily activities and base management , regardless of type, I do not take the cultural environment (places of worship, grave sites, historical buildings, or archaeological and historic sites) into consideration when doing planning.

28.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, I do not take the cultural environment (places of worship, grave sites, historical buildings, or archaeological and historic sites) into consideration when doing planning.

[a]   [b]   [c]   [d]   [e]

29.   During war I do not take the cultural environment (places of worship, grave sites, historical buildings, or archaeological and historic sites) into consideration when doing planning.

[a]   [b]   [c]   [d]   [e]

 30.   During training, daily activities and base management, regardless of type, I leave litter in the veld or in the base.

[a]   [b]   [c]   [d]   [e]

31.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, I leave litter in the veld.

[a]   [b]   [c]   [d]   [e]

32.   During war I leave litter in the veld.

[a]   [b]   [c]   [d]   [e]

33.   When constructing a temporary base in the veld, I adhere to all prescribed regulations regarding the environment in the military.

[a]   [b]   [c]   [d]   [e]

34.   During training, daily activities and base management, regardless of type, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological and historic sites).

[a]   [b]   [c]   [d]   [e]

35.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, I respect the cultural environment (places of worship, grave sites, and historical buildings, archaeological and historic sites).

[a]   [b]   [c]   [d]   [e]

36.   During war I respect the cultural environment (places of worship, grave sites, and historical buildings, archaeological and historic sites).

[a]   [b]   [c]   [d]   [e]

37.   During training, daily activities and base management, regardless of type, I do not destroy natural vegetation.

[a]   [b]   [c]   [d]   [e]

38.   During disaster relief and support operations, peacemaking and peacekeeping, regardless of type, I do not destroy natural vegetation.

[a]   [b]   [c]   [d]   [e]

39.   During war I do not destroy natural vegetation.

[a]   [b]   [c]   [d]   [e]

40.   At my work, I try to recycle as much as possible.

[a]   [b]   [c]   [d]   [e]

41.   When conducting exercises, I take the shortest possible route, irrespective of any environmental damage caused.

[a]   [b]   [c]   [d]   [e]

42.   After using a foxhole, I fill it in and repair the damage to the environment.

[a]   [b]   [c]   [d]   [e]

| KNOWLEDGE ABOUT THE ENVIRONMENT IN THE MILITARY |

Please mark the **CORRECT ANSWER** to each of the following questions. Remember, this information will

remain anonymous so please be completely honest and answer all questions.

 Mark your answer WITH AN X IN THE CORRESPONDING BLOCK. For example:

My favourite food is?

[a]   Biltong
[b]   Pancakes
Xc]   Oranges
[d]   Meat
[e]   Pizza

43.   Which of the following South African legal instruments is the most important for dealing
        specifically with the military environment?

        [a]   the National Environmental Management Act (NEMA)
        [b]   the second edition Environmental Implementation Plan for Defence
        [c]   the Defence Environment Act
        [d]   the Military Environmental Policy
        [e]   I do not know

44.   What international convention prohibits the employment of methods or means of warfare
        which are intended, or may be expected, to cause widespread, long-term, damage to the
        natural environment?

        [a]   the Denmark Convention
        [b]   the Geneva Convention
        [c]   the Durban Convention
        [d]   the Paris Convention
        [e]   I do not know

45.   ITAM is the acronym for:

        [a]   Integrated Training Action Masterplan
        [b]   Integrated Training Area Masterplan
        [c]   Integrated Training Area Management
        [d]   Integrated Training Area Manual
        [e]   I do not know

46.   MIEM is the acronym for:

        [a]   Military Integrated Environmental Management
        [b]   Military Integrated Engagement Manual
        [c]   Military Integrated Engagement Masterplan
        [d]   Military Integrated Environmental Mission
        [e]   I do not know

47.   During times of war the DOD is compelled to respect the environmental rights of:

        [a]   its own members
        [b]   all residents of South Africa
        [c]   all residents of South Africa and allied countries
        [d]   all people, including those of enemy nations
        [e]   I do not know

48.   All military units must have an official environmental plan.

        [a]   true
        [b]   false
        [c]   I do not know

49.   Members of the DOD are subject to national environmental law.

        [a]   True
        [b]   False
        [c]   I do not know

50.   Field toilets must be placed at least 300 meters from food operations to:

        [a]   enhance the visual effect of the base area
        [b]   limit the spread of disease through feeding insects
        [c]   discourage the unnecessary use of the toilets
        [d]   make it easier to dismantle the toilets
        [e]   I do not know

51.   No field toilet, waste disposal site, grey water drainage site, etc. may be located
        closer than ………… meters from wetlands, marshes, rivers, dams, fountains or any other open
        water sources.

        [a]   500
        [b]   200
        [c]   100
        [d]   20
        [e]   I do not know

52.   Hazardous materials (Hazmat) must be stored:

        [a]   in small containers
        [b]   together with non-toxic materials
        [c]   separately, in secondary containment areas
        [d]   in plastic containers
        [e]   I do not know

53.   The best way to handle rubbish and refuse is to

        [a]   burn it
        [b]   bury it
        [c]   remove it by means of a unit refuse system
        [d]   leave it to be removed at a later date
        [e]   I do not know

54.   Fuel storage and re-bunkering sites must be sited to:

        [a]   avoid contamination of food and water sources
        [b]   avoid unnecessary noise and dust pollution
        [c]   avoid unnecessary disturbance of soil and natural vegetation
        [d]   do all of the abovementioned
        [e]   I do not know

55.   After use, radio and vehicle batteries must be disposed of:

        [a]   in the normal waste removal system
        [b]   by burning
        [c]   by burial
        [d]   by returning to the issuing unit
        [e]   I do not know

56.   Recycling of waste products entails:

        [a]   disposal according to regulations
        [b]   improper disposal
        [c]   reuse after they had been cleaned and remanufactured
        [d]   storage for later disposal
        [e]   I do not know

57.   The mass movement of troops or equipment during an exercise must be:

        [a]   as spread out as possible to avoid detection
        [b]   limited to existing tracks to avoid disturbance of the environment
        [c]   in small groups to facilitate rapid movement
        [d]   limited to main roads to ensure rapid movement
        [e]   I do not know

58.   During training, daily activities and base management, regardless of type, it is
        necessary to avoid damage to the cultural environment (places of worship, grave sites,
        and historical buildings, archaeological and historic sites).

        [a]   true
        [b]   false
        [c]   I do not know

59.   During disaster relief and support operations, peacemaking and peacekeeping, regardless
        of type, it is necessary to avoid damage to the cultural environment (places of worship,
        grave sites, and historical buildings, archaeological and historic sites).

        [a]   true

[b]   false
[c]   I do not know

60.   During war it is necessary to avoid damage to the cultural environment (places of
        worship, grave sites, and historical buildings, archaeological and historic sites).

        [a]   true
        [b]   false
        [c]   I do not know

61.   During a shooting exercise it is allowed to use trees and shrubs as targets

        [a]   because it presents a clear and easily identifiable target
        [b]   because its destruction may ensure effective training
        [c]   because it can later be used for firewood
        [d]   this is a false statement
        [e]   I do not know

62.   Unexploded ammunition must be marked and reported after a training exercise because it:

        [a]   may inhibit further training
        [b]   may be dangerous to wildlife
        [c]   may pollute soil and water resources
        [d]   all of the above
        [e]   I do not know

OPEN ENDED QUESTIONS

Please answer each of the following questions by **MARKING** the **YES** or **NO** questions with an **X** in the
corresponding block. Fill in the answers to the other questions in the space provided.

Remember, this information will remain anonymous so please be completely honest and answer all

questions.

63.   Do you **agree** with the following statement? "It is important for the South African Army to
        protect the military environment under its care."

        [a]   Yes, I agree
        [b]   No, I do not agree

64.   Please indicate why you answered yes or no to the statement in question 63 above. You may
        provide more than one reason.

        _____

        _____

        _____

        _____

65.   Do you consider yourself as being environmentally conscious; in other words, do you care
        about the environment in the military that you work in?

        [a]   Yes, I do
        [b]   No, I do not

66.   Please indicate why you answered yes or no to the question in question 65 above.
        You may provide more than one reason.

        _____

        _____

        _____

        _____

67.   Do you think that good environmental practices in the military can help improve mission
        success?

        [a]   Yes, I do
        [b]   No, I do not

68.   Please indicate why you answered yes or no to the question in question 67 above. You may provide more than one reason.

_____

_____

_____

_____

69.   In your work environment, do you try to minimise your impact on the environment?

[a]   Yes, I do
[b]   No, I do not

70.   Please indicate why you answered yes or no to the question in question 69 above. You may provide more than one reason.

_____

_____

_____

_____

71.   Do you think that the Army provided you with adequate environmental education and training to take care of the environment in the military while you execute your tasks?

[a]   Yes, I do
[b]   No, I do not

72.   Please indicate why you answered yes or no to the question in question 71 above. You may provide more than one reason.

_____

_____

_____

_____

73.   Do you have a need to learn more about the environment in the military in which you operate?

[a]   Yes, I do
[b]   No, I do not

74.   Please indicate why you answered yes or no to the question in question 73 above. You may provide more than one reason.

_____

_____

_____

_____

BIOGRAPHICAL AND SERVICE HISTORY INFORMATION

Please fill in your biographical and service history information in the spaces provided for it. Remember, this information will remain anonymous so please be completely honest and answer all questions.

75.	**Service branch**
	Mark ONE option only

[1] Armour   [2] Artillery   [3] Logistics   [4] Infantry

[5] Other: please specify.   _____

76. **Unit**
Please fill in your present unit in the space below

77. **Rank level**
Please fill in your rank in the space below

78. **Time in employment of DOD** (in years to nearest completed year)

79. **Post and responsibility**

80. **Please indicate any environmental responsibility you held at any time during your employment in the DOD, and the years** [to the nearest full year] **that you served in that capacity**

81. **Age in years**

82. **Gender**

[1] Male   [2] Female

83. **Marital status**

[1] Married   [2] Unmarried   [3] Divorced   [4] Widow/widower

84. **What is your mother tongue** (language spoken from birth)?
Mark ONE option only.

[1] Xitsonga   [2] Tsivenda   [3] siSwati   [4] Setswana

[5] Sesotho sa Leboa [6] Sesotho   [7] isiZulu   [8] isiXhosa

[9] isiNdebele   [10] English   [11] Afrikaans

[12] Other: please specify. _____

85. **Highest level of education completed**

[1] None   [2] Primary school   [3] Secondary school

[5] Undergraduate   [6] Post Graduate

86. **Were you enrolled for a course or courses in Geography during your academic career?**

[1] No   [2] Up to grade 10   [3] Up to Grade 12   [4] Post graduate

87. **Major academic discipline (main subject/s) of highest qualification**

88. **Functional courses completed/enrolled for and year of completion/envisaged completion**

89. **Environmental courses completed/enrolled for and year of completion/envisaged completion**

90. **Other courses completed/enrolled for and year of completion/envisaged completion**

91. **Have you ever been deployed?**

[1] Yes

[2] No

92. **If you answered yes to the question in 91 above, please indicate date(s), type(s) and place(s) of deployment.**

Stellenbosch University
Department of Geography and Environmental Studies

MILITARY ENVIRONMENTAL LITERACY SURVEY
SOUTH AFRICAN ARMY

By signing below, you agree that you have been sufficiently informed of the purpose of this study and any risks and benefits associated with it.

I have read and I understand the agreement above, and I participate with consent.

Signature of participant:

Place: _____

Date:

APPENDIX I
The pilot questionnaire

Stellenbosch University
MILITARY ENVIRONMENTAL LITERACY SURVEY
SOUTH AFRICAN ARMY

> Paste number here

1. Make your marks only within the boundaries of the boxes,   2. Use a **dark pencil** or **black/blue pen**.
   Example: ☒

ATTITUDE TOWARDS THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
*This section asks questions about your attitude towards the environment in which the military operates, in other words, what you **feel or think** about the statements in questions 1-22 below.*

Please rate the following statements on how strongly you AGREE or DISAGREE with them. Remember, this information will remain **anonymous**, so please answer ALL questions and be completely honest.	Agree strongly	Agree	Neutral	Disagree	Disagree strongly
Example: If you **agree** with the following statement: *I like ice- cream.*	☐	☒	☐	☐	☐
1. During any form of training, routine daily activities or base management the environment in which the military operates must be protected.	☐	☐	☐	☐	☐
2. During any form of disaster relief, peace operation, or support operation the environment in which the military operates must be protected.	☐	☐	☐	☐	☐
3. During any form of armed conflict the environment in which the military operates must be protected.	☐	☐	☐	☐	☐
4. Prior to any form of training, routine daily activities or base management the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
5. Prior to any form of disaster relief, peace operation or support operation the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
6. Prior to any form of armed conflict the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
7. I am a soldier and do not have to concern myself with the environment in which the military operates.	☐	☐	☐	☐	☐
8. All soldiers must receive continual environmental education and training.	☐	☐	☐	☐	☐
9. When planning an operation, the military environmental officer should be consulted about probable environmental impacts or potential damage to the environment in which the military will operate.	☐	☐	☐	☐	☐
10. During any form of training, routine daily activities or base management, animals must not be harmed.	☐	☐	☐	☐	☐
11. During any form of disaster relief, peace operation, or support operation animals must not be harmed.	☐	☐	☐	☐	☐
12. During any form of armed conflict animals must not be harmed.	☐	☐	☐	☐	☐
13. I am concerned about the amount of waste produced in the South African Army.	☐	☐	☐	☐	☐
14. Environmental management plans are important for the effective functioning of a South African Army unit.	☐	☐	☐	☐	☐
15. It is appropriate for the military to also be subjected to national and international / general environmental laws.	☐	☐	☐	☐	☐
16. Anti-pollution measures must be part of the management plan of all South African Army units.	☐	☐	☐	☐	☐

17.	Recycling in the South African Army is a waste of time and resources.	☐	☐	☐	☐	☐
18.	After any military operation the damage done to the environment in which the military operated should be rehabilitated.	☐	☐	☐	☐	☐
19.	During any military operation it is important for soldiers to conserve water.	☐	☐	☐	☐	☐
20.	I am concerned about soil erosion caused by military activities.	☐	☐	☐	☐	☐
21.	The South African Army must become known as a "green" force, in other words an environmentally responsible force.	☐	☐	☐	☐	☐
22.	During any kind of military operation, the religions, customs and languages of the local inhabitants of the area where the operation will take place must be respected.	☐	☐	☐	☐	☐

BEHAVIOUR WITHIN THE ENVIRONMENT IN WHICH THE MILITARY OPERATES

*This section(questions 23 – 44 below) asks questions about your behaviour in the environment in which the military operates, in other words, what do you **do** while executing your task.*

Please state the EXTENT TO WHICH YOU CARRY OUT EACH OF THE FOLLOWING ACTIVITIES. Please rate the following statements on how strongly you AGREE or DISAGREE with them. Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest. **Example**: If you **agree strongly** with the following statement: *I always drink water with any meal I eat*	Agree strongly	Agree	Neutral	Disagree	Disagree strongly
	☒	☐	☐	☐	☐
23. If there were an oil spill during an exercise I would follow the prescribed corrective procedures.	☐	☐	☐	☐	☐
24. I turn off lights and electric appliances in my building when they are no longer in use.	☐	☐	☐	☐	☐
25. During any form of training, routine daily activities or base management, I will dispose of waste water by dumping it in a stream, vlei or other water body.	☐	☐	☐	☐	☐
26. During any form of disaster relief, support operation or peace operation, I will dispose of waste water by dumping it in a stream, vlei or other water body.	☐	☐	☐	☐	☐
27. During any form of armed conflict I will dispose of waste water by dumping it in a stream, vlei or other water body.	☐	☐	☐	☐	☐
28. During the planning of any form of training, routine daily activity or base management, I take the cultural environment (places of worship, grave sites, historical buildings, or archaeological sites, historical sites, etc.) into consideration.	☐	☐	☐	☐	☐
29. During the planning of any form of disaster relief, support operation or peace operation, I take the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) into consideration.	☐	☐	☐	☐	☐
30. During the planning of any form of armed conflict I take the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historic sites, etc.) into consideration.	☐	☐	☐	☐	☐
31. During any form of training, routine daily activity or base management I leave litter behind in the veld or the base.	☐	☐	☐	☐	☐
32. During any form of disaster relief, support operation or peace operation I leave litter behind in the veld or base.	☐	☐	☐	☐	☐
33. During any form of armed conflict I leave litter behind in the veld or base.	☐	☐	☐	☐	☐
34. When constructing a temporary base in the veld, I adhere to all prescribed military regulations regarding the environment in which the military operates.	☐	☐	☐	☐	☐
35. During any form of training, routine daily activity or base management, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐
36. During any form of disaster relief, support operation or peace operation, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐

		[a]	[b]	[c]	[d]	[e]
37.	During any form of armed conflict, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐
38.	During any form of training, routine daily activity or base management, I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
39.	During any form of disaster relief, support operation, or peace operation I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
40.	During any form of armed conflict I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
41.	At my place of work, I try to recycle as much as possible.	☐	☐	☐	☐	☐
42.	When conducting military exercises, I take the shortest possible route, irrespective of any environmental damage caused.	☐	☐	☐	☐	☐
43.	After digging and using a temporary defensive position, I cover it up and repair the damage to the environment.	☐	☐	☐	☐	☐
44.	During any kind of military operation, I respect the religion, customs and language of the local inhabitants.	☐	☐	☐	☐	☐

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KNOWLEDGE ABOUT THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
*This section (questions 45 – 65) asks questions about what you **know** about the environment in which you operates and how to execute your task in it.*

		[a]	[b]	[c]	[d]	[e]
	Please mark the CORRECT ANSWER to each of the following questions. **Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest.** **Example**: If your answer of choice is **"pancakes"**:	☐	☒	☐	☐	☐
45.	Which of the following South African legal instruments is the most important for dealing specifically with the environment in which the military operates? [a] the National Environmental Management Act (NEMA) [b] the second edition Environmental Implementation Plan for Defence [c] the Defence Environment Act [d] the Military Environmental Policy [e] I do not know	☐	☐	☐	☐	☐
46.	Which international convention prohibits the employment of methods or means of warfare which are intended, or may be expected, to cause widespread, long-term damage to the natural environment? [a] the Denmark Convention [b] the Geneva Convention [c] the Durban Convention [d] the Paris Convention [e] I do not know	☐	☐	☐	☐	☐
47.	ITAM is the acronym for: [a] Integrated Training Action Master Plan [b] Integrated Training Area Master Plan [c] Integrated Training Area Management [d] Integrated Training Area Manual [e] I do not know	☐	☐	☐	☐	☐
48.	MIEM is the acronym for: [a] Military Integrated Environmental Management [b] Military Integrated Engagement Manual [c] Military Integrated Engagement Master Plan [d] Military Integrated Environmental Mission [e] I do not know	☐	☐	☐	☐	☐
49.	During times of armed conflict, the Department of Defence (DOD) is compelled to respect the environmental rights of: [a] only DOD members [b] only the residents of South Africa [c] only the residents of South Africa and allied countries [d] all people, including those of enemy nations [e] I do not know	☐	☐	☐	☐	☐

50.	All South African Army units must have an official environmental plan. [a] True [b] False [c] I do not know	☐	☐	☐		
51.	Members of the South African Army are excluded from National Environmental Law. [a] True [b] False [c] I do not know	☐	☐	☐		
52.	Field toilets must be placed at least 300 meters from food operations to: [a] enhance the visual effect of the base area [b] limit the spread of disease through feeding insects [c] discourage the unnecessary use of the toilets [d] make it easier to dismantle the toilets [e] I do not know	☐	☐	☐	☐	☐

KNOWLEDGE ABOUT THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
*This section (questions 45 – 65) asks questions about what you **know** about the environment in which you operates and how to execute your task in it.*

		[a]	[b]	[c]	[d]	[e]
	Please mark the CORRECT ANSWER to each of the following questions. **Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest.** **Example**: If your answer of choice is **"<u>pancakes</u>":**	☐	☒	☐	☐	☐
53.	No field toilet, waste disposal site, grey water drainage site, or any other waste disposal site may be located closer than ………… meters from wetlands, marshes, rivers, dams, fountains or any other open water sources. [a] 500 [b] 200 [c] 100 [d] 20 [e] I do not know	☐	☐	☐	☐	☐
54.	Hazardous materials (Hazmat) must be stored: [a] in small sealed containers [b] together with non-toxic materials [c] separately, in secondary containment areas [d] in sealed plastic containers [e] I do not know	☐	☐	☐	☐	☐
55.	The best way to handle any kind of rubbish and refuse is to: [a] burn it [b] bury it [c] remove it by means of a unit refuse system [d] leave it to be removed at a later date [e] I do not know	☐	☐	☐	☐	☐
56.	Fuel storage and re-bunkering sites must be situated to: [a] avoid contamination of food and water sources [b] avoid unnecessary noise and dust pollution [c] avoid unnecessary disturbance of soil and natural vegetation [d] do all of the abovementioned [e] I do not know	☐	☐	☐	☐	☐
57.	After use, radio and vehicle batteries must be disposed of: [a] in the normal waste removal system [b] by burning [c] by burial [d] by returning them to the issuing unit [e] I do not know	☐	☐	☐	☐	☐
58.	Recycling of waste products means: [a] disposal of waste products according to regulations [b] improper disposal of waste products [c] reuse of waste products after they had been cleaned and remanufactured [d] storage of waste products for later disposal	☐	☐	☐	☐	☐

	[e] I do not know					
59.	The mass movement of troops or equipment during an exercise must be: [a] as spread out as possible to avoid detection [b] limited to existing tracks to avoid disturbance of the environment [c] through division of the group in smaller groups to facilitate rapid movement [d] limited to main roads to ensure rapid movement [e] I do not know	☐	☐	☐	☐	☐

■

Paste number here

KNOWLEDGE ABOUT THE ENVIRONMENT IN WHICH THE MILITARY OPERATES					
*This section (questions 45 – 65) asks questions about what you **know** about the environment in which you operates and how to execute your task in it.*					

	Please mark the CORRECT ANSWER to each of the following questions. **Remember, this information will remain anonymous, so please answer** **ALL questions and be completely honest.** **Example**: If your answer of choice is **"pancakes"**:	**[a]** ☐	**[b]** ☒	**[c]** ☐	**[d]** ☐	**[e]** ☐
60.	During any form of training, routine daily activities or base management it is necessary to avoid damage to the cultural environment (places of worship, grave sites, and historical buildings, archaeological sites, historical sites). [a] true [b] false [c] I do not know	☐	☐	☐		
61.	During any form of disaster relief, support operation or peace operation it is necessary to avoid damage to the cultural environment (places of worship, grave sites, and historical buildings, archaeological sites, historical sites, etc). [a] true [b] false [c] I do not know	☐	☐	☐		
62.	During any form of armed conflict, it is necessary to avoid damage to the cultural environment (places of worship, grave sites, and historical buildings, archaeological sites, historical sites, etc.). [a] true [b] false [c] I do not know	☐	☐	☐		
63.	During a shooting exercise, soldiers are allowed to use trees and shrubs as targets: [a] because it presents a clear and easily identifiable target [b] because its destruction may ensure effective training [c] because it can later be used for firewood [d] soldiers are not allowed to use trees and shrubs as targets [e] I do not know	☐	☐	☐	☐	☐
64.	Unexploded ammunition must be marked and reported after a training exercise because it: [a] may inhibit further training [b] may be dangerous to wildlife [c] may pollute soil and water resources [d] all of the above [e] I do not know	☐	☐	☐	☐	☐
65.	Prior to any kind of military operation, I am informed of the religion, customs and language of the local inhabitants where the operation will take place: [a] true [b] false	☐	☐	☐		

[c] I do not know	

<table>
<tr><td colspan="2" align="center">OPEN ENDED QUESTIONS</td></tr>
<tr><td colspan="2">Please answer each of the following questions by MARKING the YES or NO questions with an X across the answer of your choice. Write the answers to the explanatory part of every question in the space provided in the boxes on the right of each question.

Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest.</td></tr>
<tr><td>66.</td><td>Do you **agree** with the following statement?
"It is important for the South African Army to protect the environment in which it operates."

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or <u>no</u> to question 66 above. You may provide more than one reason.</td></tr>
<tr><td>67.</td><td>Do you consider yourself as being generally environmentally conscious?

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or no <u>to</u> question 67 above. You may provide more than one reason.</td></tr>
<tr><td>68.</td><td>Do you think that good environmental practices in the South African Army can help improve mission success?

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or <u>no</u> to question 68 above. You may provide more than one reason.</td></tr>
<tr><td>69.</td><td>In your work environment, do you try to minimise your negative impact on the environment?

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or <u>no</u> to question 69 above. You may provide more than one reason.</td></tr>
<tr><td>70.</td><td>Do you think that the South African Army provided you with environmental education and training which is adequate to take care of the environment in which the military operates while you execute your tasks?

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or <u>no</u> to question 70 above. You may provide more than one reason.</td></tr>
<tr><td>71.</td><td>Do you have a need to learn more about the environment in which the South African Army operates?

YES ☐   **NO** ☐

Please indicate why you answered <u>yes</u> or <u>no</u> to question 71 above. You may provide more than one reason.</td></tr>
</table>

Paste number here

BIOGRAPHICAL AND SERVICE HISTORY INFORMATION

Please fill in your biographical and service history information in the spaces provided for it in the boxes on the right of each question.

Remember, this information will remain <u>anonymous</u>, so please answer **ALL** questions and be completely honest.

72.	**Your service formation**: Please mark <u>one</u> option only with an X across the answer of your choice.	Air Defence Artillery ☐ Armour ☐ Artillery ☐ Engineer ☐ Infantry ☐ Intelligence ☐ ☐ Support ☐ Signal Other: ☐ Please specify:
73.	**Unit**: Please write down your current unit in the space provided.	
74.	**Rank level**: Please write down your rank in the space provided.	
75.	**Time in employment of the Department of Defence**: Please write down in years to the nearest completed year.	
76.	**Current post and responsibility**: Please write down your current post and responsibility in the space provided.	
77.	**Environmental experience**: Please write down any environmental position or environmental responsibility you held at any time during your employment in the Department of Defence, and the years [to the nearest full year] that you served in that capacity.	
78.	**Age**: Please write down years to nearest full year.	
79.	**Gender**: Please mark <u>one</u> option only with an X across the answer of your choice.	Male ☐ Female ☐
80.	**Marital status**: Please mark <u>one</u> option only with an X across the answer of your choice.	Married ☐ Unmarried ☐ Divorced ☐ Widow/Widower ☐
81.	**Mother tongue** (language spoken at home from birth): Please mark <u>one</u> option only with an X across the answer of your choice.	Xitsonga ☐ Tsivenda ☐ Setswana ☐ Sesotho se Leboa ☐ Sesotho ☐ isiZulu ☐ isiNdebele ☐ English ☐ Afrikaans ☐ SiSwati ☐ isiXhosa ☐ Other: ☐ Please specify:
82.	**Highest level of education <u>completed</u>**: Please mark <u>one</u> option only with an X across the answer of your choice.	Secondary School ☐ Post-School diploma ☐ First University degree ☐ Post Graduate qualification ☐
83.	**Highest level of Geography education <u>completed</u>**: Please mark <u>one</u> option only with an X across the answer of your choice.	None ☐ Grade 10 ☐ Grade 12 ☐ Post-School diploma ☐ First University degree ☐ Post Graduate qualification ☐

		BIOGRAPHICAL AND SERVICE HISTORY INFORMATION
	Please fill in your biographical and service history information in the spaces provided for it in the boxes on the right of each question. Remember, this information will remain <u>anonymous</u>, so please answer **ALL** questions and be completely honest.	

84.	**Main academic subject/s of your highest qualification:** Please write down the main academic subject/s of your highest academic qualification.	
85.	**Functional courses completed/enrolled for, and year of completion OR foreseen completion:** Please write down the course/s you completed and the date/s of completion, OR the course/s you are enrolled for and the estimated date/s of completion.	
86.	**Environmental courses completed/enrolled for, year of completion OR foreseen completion:** Please write down the course/s you completed and the date/s of completion, OR the course/s you are enrolled for and the estimated date/s of completion.	
87.	**Have you ever been deployed?** Please mark <u>one</u> option only with an X across the answer of your choice.	**YES** ☐ **NO** ☐
88.	If you answered **YES** to the question in 87 above, please indicate <u>date/s,</u> <u>type/s</u> and <u>place/s</u> of deployment.	

THANK YOU FOR PARTICIPATING IN THIS RESEARCH PROJECT

APPENDIX J
Stellenbosch University ethics committee application

ETHICS COMMITTEE APPLICATION FORM

UNIVERSITY OF STELLENBOSCH

SUBCOMMITTEE A

Application to the University of Stellenbosch SUBCOMMITTEE A for clearance of new/revised research projects

This application must be typed or written in capitals
Name: Prof/Dr/Mr/Ms: Cdr H.A.P. Smit
Position/Professional Status: Lecturer and Chair of department of Military Geography, Faculty of Military Science, Military Academy.
Affiliation: Research Programme/Organisation:

DPhil candidate, Department of Geology, Geography and Environmental Studies, Stellenbosch University (Main Campus)
Supervisor: Professor J.H van der Merwe

Telephone and extention no.	**Code:**	022 no. 7023110
Fax:	**Code:**	022 no. 7023060

   Email address: hennies@ma2.sun.ac.za

Title of research project: (*Do not use abbreviations*)

MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY

Where will the research be carried out?

Within the units of the South African Army
All the following sections must be completed (Please tick all relevant boxes where applicable)

   1. **FUNDING OF THE RESEARCH: How will the research be funded?**

By researcher with organisational support from the South African Department of Defence.

   2. **PURPOSE OF THE RESEARCH:**

To develop a research instrument (questionnaire) and then to test the military environmental literacy of members of the South African Army

   3. **AIMS AND OBJECTIVES OF THE RESEARCH:** *(Please list objectives)*

The research aims to evaluate existing instruments for measuring environmental literacy, identify context specific indicators of military environmental literacy in the South African Army, develop and apply a standardized instrument (questionnaire) to measure MEL and to analyse and interpret the results for operational and policy relevance.

In order to achieve this aim, the following objectives are pursued:

Objective 1. Analyse and evaluate existing instruments to determine their suitability to be used in a South African Army context (literature survey).
Objective 2. Identify and formulate indicators of military environmental literacy in the South African Army context (policy document survey; military interviews).
Objective 3. Develop the measuring instrument (questionnaire) (draft development and scrutiny, pilot testing).
Objective 4. Apply the instrument to a sample of members of South African Army units (military survey).
Objective 5. Analyse and interpret the questionnaire data and formulate management policy recommendations.
   4. **SUMMARY OF THE RESEARCH** *(give a brief outline of the research plan – not more than 200 words)*

The study will commence by analysing and evaluating existing instruments to determine their suitability to be used in a South African Army context.

The next step will be to mine the existing literature for variables to include in the questionnaire. This data will be expanded by conducting interviews with role-players within the DOD, and especially the Army, involved in Environmental management.

The draft questionnaire will then be developed. The draft questionnaire will be scrutinised by the identified experts within the military environmental services and geography peers to assess the integrity of the instrument. The information gleaned from this process will be used to refine the instrument to be subjected to an iterative process of pilot testing. After each pilot test, the results will be analysed by the Centre for Statistical Consultation at Stellenbosch University and the questionnaire adapted accordingly, until stabilised.

A representative sample of the South African Army will then be surveyed, using the standardized questionnaire, and the results analysed, using the descriptive and correlational statistical methods normally employed.

The results of the study will then be used to inform military environmental management policy and education in the South African Army and other armies in developing countries.

5. NATURE AND REQUIREMENTS OF THE RESEARCH

5.1 How should the research be characterised *(Please tick ALL appropriate boxes)*

5.1.1 Personal and social information collected directly from participants/subjects   X
5.1.2 Participants/subjects to undergo physical examination
5.1.3 Participants/subjects to undergo psychometric testing
5.1.4 Identifiable information to be collected about people from available records
5.1.5 Anonymous information to be collected from available records   X
5.1.6 Literature, documents or archival material to be collected on individuals/groups   X

5.2 Participant/Subject Information Sheet attached? (*for written and verbal consent*)

YES	
NO	X

5.3 Informed Consent form attached? *(for written consent)*

YES	
NO	X

5.3.1 If informed consent is not necessary, please state why:

Subject Information Sheet and Informed Consent sheet, which will contain information for the participants, is not available yet and will be submitted shortly.

NB: If a questionnaire, interview schedule or observation schedule/framework for ethnographic study will be used in the research, it must be attached. The application cannot be considered if these documents are not included.

5.4 Will you be using any of the above mentioned measurement instruments in the research?

YES	X
NO	

The questionnaire will be designed as part of the study (phase 1) and be applied to selected members of the South African Army during phase 2. The questionnaire will be submitted for approval as soon as it has been developed, and prior to the commencement of phase 2.

6 PARTICIPANTS/SUBJECTS IN THE STUDY

6.1 If humans are being studied, state where they are selected:

From members of the South African Army.

6.2 Please mark the appropriate boxes:

Participants/subjects will:	YES	NO
be asked to volunteer		X
be selected	X	

6.2.1 State how the participants/subjects will be selected, and/or who will be asked to volunteer:

Participants will be selected randomly and asked to fill in the questionnaire. If they do not wish to fill in the questionnaire, another participant will be selected randomly. All questionnaires will be filled in anonymously and the results will be analysed in such a way that it will be impossible to identify participants.

6.7 Will participation or non-participation disadvantage the participants/subjects in any way?

YES	
NO	X

6.7.1 If yes, explain in what way:

No, however, some participants may fear being disadvantaged if they refuse to participate. To counter this, the researcher and/or his research assistants will be on hand to explain the process and the anonymity of the questionnaire and to assure the subjects that participation is voluntary and that they will not be disadvantaged in any way for not participating.

6.8 Will the research benefit the participants/subjects in any direct way?

YES	
NO	X

6.8.1 If yes, please explain in what way:

However, the research will benefit the SANDF and the people of South African to the extent that it will draw attention to Environmental literacy in the armed forces and help to improve military environmental education.

7. PROCEDURES

7.1 Mark research procedure(s) that will be used:

Literature	X
Documentary	X
Personal records	
Interviews	X
Survey	X
Participant observation	
Other (please specify) _____ _____	

7.2 How will the data be stored?

Even though anonymous, the data will be stored securely in the office of the researcher.

7.3 If an interview form/schedule; questionnaire or observation schedule/framework will be used, is it attached?

YES	
NO	X

One of the objectives of the research is to develop a questionnaire. As soon as the questionnaire is developed, and before it is used, it will be tabled at the Ethics committee for approval.

7.4 Risks of the procedure(s): Participants/subjects will/may suffer:

No risk	X
Discomfort	X
Pain	
Possible complications	
Persecution	
Stigmatisation	
Negative labeling	
Other (please specify) _____ _____	

7.4.1 If you have checked any of the above except "no risk", please provide details:

Some participants may experience discomfort, should they wish not to participate, of if they fear that their identity will be disclosed. To counter this, the researcher and/or his research assistants will be on hand to explain the process and the anonymity of the questionnaire and to assure the subjects that participation is voluntary and that they will not be disadvantaged in any way for not participating.

8. RESEARCH PERIOD

(a) **When will the research commence**: July 2009

(b) Over what approximate time period will the research be conducted:

Project should be concluded by the end of 2012.

9. GENERAL

9.1 Has permission of relevant authority/ies been obtained?

YES	
NO	X

9.1.1 If yes, state name/s of authority/ies:

Informal consent has been secured. The process of obtaining formal consent from the South African Department of Defence has already commenced, but it is a rather lengthy process. The moment consent is secured; the necessary documentation will be made available to the Ethics committee.

9.2 Confidentiality: How will confidentiality be maintained to ensure that participants/subjects/patients/controls are not identifiable to persons not involved in the research?

All questionnaires will be filled in anonymously. All analyses will be done in such a way that it will be impossible to identify participants.

9.3 Results: To whom will results be made available, and how will the findings be reported to the research participants?

Results will be published in academic journals and in the form of a thesis. The results will also be made available to the Department of Defence. The findings will be made available to any participant that asks to be informed about it.

9.4 There will be financial costs to:

participant/subject	
organisation	
Other (please specify) Researcher _____	X

9.4.1 Explain any box marked YES:
All costs incurred will be for the account of the researcher.

9.5 Research proposal/protocol attached:

YES	X
NO	

9.6 Any other information which may be of value to the Committee should be provided here:

NONE

Date: 26/05/2009   **Applicant`s signature**

Who will supervise the project?

Name: Professor J.H van der Merwe

Programme/Organisation/Department: Department of Geology, Geography and Environmental Studies, Stellenbosch University (Main Campus).

Date: **Signature:**_____

Director/Head/Research Coordinator of Department/Institute in which study is conducted:

Name: **Date:**   **Signature:**_____

APPENDIX K
Stellenbosch University Ethics committee preliminary approval

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot • your knowledge partner

30 September 2009

Tel.: 021 - 808-2687
Enquiries: Sidney Engelbrecht
Email: sidney@sun.ac.za

Reference No. 199/2009

Cdr HAP Smit
Department of Geology, Geography and Environmental Studies
University of Stellenbosch
SALDANHA
7602

Cdr HAP Smit

APPLICATION FOR ETHICAL CLEARANCE

With regards to your application, I would like to inform you that the project, *Military environment literacy in the South African Army (Phase I)* has been approved on condition that:

1. The researcher/s remain within the procedures and protocols indicated in the proposal;
2. The researcher/s stay within the boundaries of applicable national legislation, institutional guidelines, and applicable standards of scientific rigor that are followed within this field of study and that
3. Any substantive changes to this research project should be brought to the attention of the Ethics Committee with a view to obtain ethical clearance for it.
4. The researcher submits an application for ethical clearance before the commencement of Phase II of the research project.

We wish you success with your research activities.

Best regards

Mrs. Maléne Fouché
Manager: Research Support

Afdeling Navorsingsontwikkeling • Division of Research Development
Privaat Sak/Private Bag XI • 7602 Stellenbosch • Suid-Afrika/South Africa
Tel +27 21 808 9111 • Faks/Fax: +27 21 808 4537

APPENDIX L
Stellenbosch University Ethics committee final ethical approval

Approval Notice

17-Nov-2011
SMIT, Hendrik Adolf

Protocol #: HS199/2009A

Title: **Military environmental literacy in the South African Army**

Dear Cdr Hendrik SMIT,

The **Application** received on **21-Sep-2011**, was reviewed by Research Ethics Committee:
Human Research (Humanities) via Committee Review procedures on **29-Sep-2011** and has been
approved.

Please note the following information about your approved research protocol:

 Protocol Approval Period: **17-Nov-2011** -**16-Nov-2012**

Present Committee Members:
Hattingh, Johannes JP ; Thesnaar, Christoffel CH; Theron, Carl CC; Somhlaba, Ncebazakhe NZ;
Viviers, Suzette S; Engelbrecht, Sidney SF; Van Zyl, Gerhard Mkhonto; Fouche, Magdalena
MG; Van Wyk, Berte B; Beukes, Winston WA

Standard provisions

1. The researcher will remain within the procedures and protocols indicated in the proposal,
particularly in terms of any undertakings made in terms of the confidentiality of the information
gathered.

2. The research will again be submitted for ethical clearance if there is any substantial departure
from the existing proposal.

3. The researcher will remain within the parameters of any applicable national legislation,
organisational guidelines and scientific standards relevant to the specific field of research.
4. The researcher will consider and implement the foregoing suggestions to lower the ethical risk
associated with the research.

You may commence with your research with strict adherence to the abovementioned provisions and stipulations.

Please remember to use your **protocol number** (**HS199/2009A**) on any documents or correspondence with the REC concerning your research protocol.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:

Please note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required.
The Committee will then consider the continuation of the project for a further year (if necessary).
Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) number REC-050411-032.

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

We wish you the best as you conduct your research.
If you have any questions or need further help, please contact the REC office at 0218089183.

Included Documents:
Application Form
Letter of Consent
Questionnaire
Research Approval 2009
Letter of Permission
Admin Review

Sincerely,

Sidney Engelbrecht
REC Coordinator

Research Ethics Committee: Human Research (Humanities)

APPENDIX M
Initial Defence Intelligence permission to conduct the study

08/10 2009 15:15 FAX 0123263246   DCIM   002

RESTRICTED

DI/SDCI/DCIOC/R/202/3/7

Telephone: (012) 315-0216
Fax: (012) 326-3246
Enquiries: Brig Gen A.C. Smit

Defence Intelligence
Private Bag X367
Pretoria
0001
October 2009

AUTHORITY TO CONDUCT A SURVEY ON MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY: 77515633PF CDR H.A.P. SMIT

1.   Your facsimile MA/R/520/3/4 dd 29 Sept 09 regarding "A Survey on Military Environmental Literacy in the South African Army" refers.

2.   Authority is hereby granted from a security perspective for the conduct of the survey on Military Environmental Literacy in the South African Army.

3.   On completion of the research, the final product must first be submitted to DI (SDCI) for scrutiny and authority for release before distribution to any organisation or individual outside the Department of Defence.

4.   For your attention.

(MAJ GEN T. MATLAKENG)
ACTING CHIEF OF DEFENCE INTELLIGENCE: MAJ GEN

WM/WM

DISTR

For Action

Commandant Military Academy   (Attention: Cdr H.A.P. Smit)

Internal

DI/SDCI/DCIOC/R/202/3/7

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APPENDIX N

Final Defence Intelligence authority to conduct the survey

RESTRICTED

DI/SDCI/DCIC/R/521/3

Telephone:	(012) 315-0216
Fax:	(012) 326-3246
Enquiries:	Brig Gen E.L. Pule

Defence Intelligence
Private Bag X367
Pretoria
0001
29 August 2012

AUTHORITY TO UTILISE QUESTIONNAIRES FOR RESEARCH ON MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY

1.   Your electronic mail received on 28 Aug 2012 as well as letter DI/SDCI/DCIOC/R/202/3/7 dd 08 Oct 2009 refers.

2.   Authority is hereby granted from a security perspective to Cdr H.A.P. Smit to utilise the questionnaires as presented to Defence Intelligence (DI), Sub-Division Counter Intelligence (SDCI).

3.   On completion of the research, the final product must be submitted to DI (SDCI) for scrutiny and authority for release before distribution to any organisation or individual outside the Department of Defence (DOD).

4.   For your attention.

(BRIG GEN T.M. MXAKATO)
CHIEF OF DEFENCE INTELLIGENCE: LT GEN

DISTR

For Action

Commandant Military Academy   (Attention: Cdr H.A.P. Smit)

Internal

DI/SDCI/DCIC/R/521/3

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APPENDIX O
Permission from the Chief of Joint Training to conduct the study

RESTRICTED

Telephone: (012) 355-6579
Facsimile: (012) 355-6602
Enquiries: Col G.S. Kok

TRG COMD/R/103/10
TRG COMD/R/202/3/7

Department of Defence
(Training Command)
Private Bag X161
Pretoria
0001
08   September 2010

PERMISSION TO CONDUCT A SURVEY AS PART OF A STUDY ON MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY: 77515633PF CDR H.A.P. SMIT

1.   MA/R/520/3/4 dated 29 September 2009 and 6 November 2009 and DI/SDCI/DCIOC/202/3/7 dated 18 October 2009 refer.

2.   Authority is hereby granted to 77515633PF Cdr H.A.P. Smit to conduct a study on environmental literacy in the South African Army as part of his doctoral studies at the Stellenbosch University.

3.   Security clearance for the study was granted *vide* DI/SDCI/DCIOC/202/3/7 dated 18 October 2009.

(M. MABUZA)
GENERAL OFFICER COMMANDING TRAINING COMMAND: MAJ GEN
GSK/GSK   (AUTH DOCTORAL STUDIES_SMIT_070910)

DISTR

For Action

Commandant
☞   Military Academy   (Attention: Brig Gen L. Yam)
                                      (Attention: Cdr H.A.P. Smit)

Internal

File: TRG COMD/R/103/10
          Daily File

M1
Refer to Cdr H.A.P. Smit
for Continuation
Brig C
04/10/10

MILITARY ACADEMY
RECEIVED
0 4 OCT 2010
SALDANHA
MILITARY ACADEMY

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APPENDIX P

Permission from the Chief of the South African Army to conduct the study

RESTRICTED

Telephone: 012 355 2874
Facsimile: 012 355 2586
Enquiries: Col C.B. Hepburn

Department of Defence
SA Army
(Directorate Army Strategic Direction)
Private Bag X981
Pretoria
0001
// October 2011

DECISION BRIEF: AUTHORITY FOR THE CONDUCTING OF RESEARCH PROJECT BY CDR H.A.P. SMIT LECTURER DEPARTMENT OF MILITARY GEOGRAPHY MILITARY ACADEMY ON MILITARY ENVIRONMENTAL LITERACY IN THE SA ARMY

Appendix A: Research Proposal
           B: Security Clearance

BACKGROUND

1.   Permission for Cdr H.A.P. Smit to conduct the research project was granted by his higher command, GOC Training Command, and security clearance obtained from DI. TRG COMD/R/103/10 TRG COMD/R/202/3/7 dated 08 Sep 10 and DI/SDCI/DCIOC/R/202/3/7 dated 08 Oct 09 refer.

2.   This request was submitted to DASD (LT/ELT section), as the nodal point for coordinating research projects within the SA Army by other Arms of Service and external agencies and to ensure that such research is conducted in full compliance with DI/R/202/1/P Defence Intelligence (DI) Security Instruction 01/2011: Procedures to be Followed to Conduct Research in Department of Defence dated 12 Jul 11.

3.   Cdr H.A.P. Smit is a lecturer in the Department of Military Geography at the Faculty of Military Science of Stellenbosch University (Military Academy), and has been granted approval to conduct doctoral research under the supervision of Professor J.H. van der Merwe, Department of Geology, Geography and Environmental Studies, also of Stellenbosch University. The title of his dissertation is *"Military environmental literacy in the South African Army."* Cdr Smit approached Col C.B. Hepburn as FSAAS project officer with a request for assistance in providing access to various SA Army Regular units and headquarters for the purposes of conducting a survey by means of a questionnaire.

4.   The motivation for the research project is that the South African Army uses and controls large terrains all over South Africa. To use and maintain this land in

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an environmentally sustainable and responsible way is an organisational imperative. The DOD has a long history of endeavouring to do so, as the first instruction to formulate guidelines for environmental management in the then SADF was issued as early as 1977. The National Environmental Management Act No 107 of 1998 (NEMA) obligates all scheduled organs of state with functions that affect the environment, including the DOD, to develop an Environmental Implementation Plan (EIP). In 2001 the EIP for Defence was formulated and became part of South African subordinate Law after publication in the Government Gazette. Since then the DOD designed an Environmental Management System (EMS) for Defence, and has been unsuccessfully trying to implement it.

5.　　The DOD is thus externally mandated by the Constitution, and more specifically NEMA, and internally committed through the EIP, to effective environmental management. However, without an implemented EMS the guiding EIP principle for Environmental management, ie …*"land under military control is considered a National Asset… entrusted to the department by the nation and should therefore be used and managed wisely for as long as it is required for military purposes",* remains difficult if not impossible to implement. One of the key reasons for this situation is a perceived lack of management knowledge concerning the existing level of environmental literacy among members and employees of the DOD.

6.　　To effectively execute the mandate, the DOD will need to accurately gauge the environmental literacy of its members as prerequisite for further training to meet management demands – the essential problem confronting this research. This study therefore aims to develop a tailor-made, standardised instrument to measure military environmental literacy in the SA Army, and then to use this instrument to determine the level of military environmental literacy (attitude, knowledge and behaviour relating to the military environment) in the SA Army, as the major component within the SANDF responsible for most of the environmental impact. The results of the survey will indicate the level of environmental literacy in the SA Army, differentiated according to Army subgroups (armour corps, infantry, artillery etc.) demographics and rank level. This will enable the SA Army to develop focused environmental curricula targeted at functional groups, a resource which is currently lacking.

AIM

7.　　The aim of this document is to obtain authority for Cdr H.A.P. Smit to conduct surveys at identified SA Army units and headquarters under the supervision of DASD (LT/ELT section).

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FINANCIAL IMPLICATION

8.   There are no direct financial implications for the SA Army to execute and approve the surveys. Cdr Smit is on strength with the Military Academy which will furnish him with all the necessary financial support and S&T. There may be ad hoc requirements for Col C.B. Hepburn or his *secundus* to occasionally draw S&T and for travel to coordinate the various unit visits. This is, however, funded as a LT/ELT general research objective in the DASD 2010/11 Business Plan under Series 1006283680, Item code 151214 (transport: air passengers interior) and Series 1006283700, Item code 151210 (transport: vehicle hire). Any financial authority for expenditure in this regard will be requested by means of an SA Army Headquarters instruction.

RECOMMENDATION

9.   Dir Army SD recommends that you approve the research project and that Cdr H.A.P. Smit be granted access to various SA Army Regular units and headquarters for the purposes of conducting a survey on military environmental literacy in the SA Army, under the supervision of DASD (LT/ELT section). DI/R/202/1/P DI Instruction 01/2001 dated 12 Jul 11 will be fully adhered to.

(E.F. DROST)
DIRECTOR ARMY STRATEGIC DIRECTION: BRIG GEN

Approved/Not approved

(V.R. MASONDO)
CHIEF OF THE SOUTH AFRICAN ARMY: LT GEN
13 / 10 / **2011**

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APPENDIX Q
South African Army headquarters instruction 071/12 (Rudman 2012)

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SA ARMY HQ/DASD/R/518/3/8

Telephone:	012 3552589
Facsimile:	012 3552586
Enquiries:	Col C.B. Hepburn
	Lt D.N. Pfotenhauer

Department of Defence
SA Army Headquarters
Private Bag X981
Pretoria
0001
20 April 2012

SA ARMY HEADQUARTERS INSTRUCTION 071 /12: RESEARCH PROJECT ON MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY

Appendix A: Authority to conduct a survey on Military Environmental Literacy in the South African Army: 77515633PF: Cdr H.A.P. Smit (DI/SDCI/DCIOC/R/202/3/7)

B: List of Formations and Units selected by Cdr H.A.P. Smit for the conducting of the survey.

BACKGROUND

1. Cdr H.A.P. Smit is authorised to conduct the research project entitled, Military Environmental Literacy in the South African Army. This research will be conducted in full compliance with DI/R/202/1/P Defence Intelligence (DI) Security Instruction 01/2011: Procedures to be followed to Conduct Research in Department of Defence dated 12 Jul 11. Cdr Smit was granted permission by C SA Army on decision brief dd 11 Oct 11.

2. Cdr Smit is a lecturer in the Department of Military Geography at the Faculty of Military Science of Stellenbosch University (Military Academy), and has been granted approval to conduct doctoral research under the supervision of Professor J.H. van der Merwe, Department of Geology, Geography and Environmental Studies, also of Stellenbosch University. The title of his dissertation is "*Military environmental literacy in the South African Army.*"

3. The South African Army uses and controls large terrains of land all over South Africa. The National Environmental Management Act No 107 of 1998 (NEMA) obligates all scheduled organs of state with functions that affect the environment, including the DOD, to develop an Environmental Implementation Plan (EIP). In 2001 the EIP for Defence was formulated and became part of South African subordinate Law after publication in the Government Gazette. Since then the DOD designed an Environmental Management System (EMS) for Defence.

4. Central to Cdr Smit's research is the conducting of survey's to establish a general perception of environmental literacy within the various formations of the SA Army. Twenty five units have therefore been randomly selected from the South African Army. These units will now be contacted to arrange a visit by Cdr Smit and/or his research assistants, to the unit.

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AIM

5.   The aim of this instruction is to initiate the following:

  a.   Instruct the relevant GOC's of the Formations to comply with the specific requirements of Cdr Smit for the conducting of the survey.

  b.   To grant approval for the execution of the specific steps to be taken by the Formations in order to provide Cdr Smit with the data that he requires.

EXECUTION

6.   General Outline. The following steps are required to be put in place before Cdr H.A.P. Smit visits each unit.

  a.   Phase 1: Preparation.

    i.   Rank breakdown from Lt Col to troop of each Fmn identified in Appendix B to be given to Cdr Smit. This is necessary for Cmdr Smit to select members according to the specific stipulations of the survey.

    ii.   Complete name list of each unit identified in Appendix B to be given to Cdr Smit.

    iii.   Selection of between 30 and 70 members from each unit in the selected Fmn's for the survey by Cdr Smit.

    iv.   Name list of identified members sent back to each Fmn and unit by Cdr Smit in order for the unit OC to brief the members on the expectations of Cmdr Smit and the process that Cmdr Smit will follow

  b.   Phase 2: Unit visits for the conducting of survey by Cdr H.A.P. Smit.

    i.   A suitable venue, preferably a venue capable of accommodating 70 members, to be identified by unit OC.

    ii.   Sample group of members to fill in questionnaire under supervision of CDR Smit or his appointed research assistant.

    iii.   Individual unit OC to arrange for selected members to be present at the predetermined venue (in consultation with Cdr Smit) for Cdr Smit to begin survey.

    iii.   Projected time of survey per member is estimated at 45 mins. The survey will be conducted with the entire group in one sitting. Therefore the projected time for the completion of the survey will be approximately 1 hour.

c.   Phase 3: Finalized product. Cdr Smit to coordinate between DI and the Faculty of Military Science of Stellenbosch University (Military Academy) with the publishing and dissemination of his research findings.

COORDINATING INSTRUCTIONS

7.   Cdr Smit and his designated research assistant will be conducting the interviews at the various units (reflected in Appendix 3). Suitable venues for the conducting of sampling and interviews without undue disturbance will be arranged between Cdr Smit and the individual unit OC.

ADMIN AND LOG

8.   Timings. As per Cdr Smit's timetable, the timings will be negotiated between himself and the various unit commanders once Cdr Smit has received the data he requires.

9.   Schedule. The interviews will be conducted over a period to be determined in consultation with Cdr Smit and the various unit commanders of the selected units.

10.   Dress. Unless otherwise stated in future communication between Cdr Smit and the unit OC, dress no. 3 (Office Dress) will be adhered to.

11.   Venue. To be arranged between Cdr Smit and individual unit OC.

COMMAND AND SIGNALS

11.   Contact Details. The contact details of the lead researcher, Cdr H.A.P. Smit, coordinating officer, Col Hepburn and his secundi, Lt Pfotenhauer are as follows:

a.   Cdr H.A.P. Smit (Lead Researcher)

   i.   Telephone no: 022 702 3110

   ii.   Facsimile: 022 702 3060

   iii.   Email: Hennies@ma2.sun.ac.za

b.   Col C.B. Hepburn (Coordination)

   i.   Telephone: 012 355 2874

   ii.   Facsimile: 012 355 2586

   iii.   Mobile: 082 729 0798

   iv.   Email: clyde.hepburn@gmail.com

334

c.   Lt D.N. Pfotenhauer (Coordination secundi)

    i.   Telephone: 012 3552584

    ii.   Facsimile: 012 3552586

    iii. Mobile: 0721043176

    iv.   Email: davidpfotenhauer1@gmail.com

12.   Cdr Smit is the lead researcher for this project. Col Hepburn will coordinate the planned survey visits with assistance from his secundi Lt Pfotenhauer. Overall command remains vested in D Army SD, Brig Gen E.F. Drost.

(MAJ GEN L. RUDMAN)
CHIEF OF THE SOUTH AFRICAN ARMY: LT GEN

Enclosure: SA Army HQ Decision Brief/C SA Army/SA Army Future Strategy dd 11 Oct 11

DISTR

For Action

SA Army Inf Fmn	(Attn: Maj Gen I. Yam)
SA Army Supp Fmn	(Attn: Maj Gen S. Marumo)
SA Army Arty Fmn	(Attn: Brig Gen H.G. Holtshauzen)
SA Army ADA Fmn	(Attn: Col H.J. Baird)
SA Army Armour Fmn	(Attn: Brig Gen B.C. Gildenhuys)
SA Army Engr Fmn	(Attn: Brig Gen A.M.Z. Msi)
SA Army Trg Fmn	(Attn: Brig Gen A. Fredericks)
SA Army Int Fmn	(Attn: Brig Gen N. Yengeni)
SA Army Sigs Fmn	(Attn: Brig Gen L.L. Eggers)
Research Coordinator FSAAS	(Attn: Lt D.N. Pfotenhauer)

For Info

Director Army Strategic Direction	(Attn: Brig Gen E.F. Drost)
SSO LT/ELT DSAD	(Attn: Col H.P. Grobler)
Commandant SA Military Academy	(Attn: Cdr H.A.P. Smit)

APPENDIX R

The final questionnaire

Stellenbosch University
Department of Geography and Environmental Studies

MILITARY ENVIRONMENTAL LITERACY SURVEY
SOUTH AFRICAN ARMY

Dear respondent

I am Cdr Hennie Smit, a lecturer in the Department of Military Geography at the Faculty of Military Science of Stellenbosch University (Military Academy) in Saldanha. I am doing doctoral research in **Geography and Environmental Studies** at Stellenbosch University. The title of my dissertation is *"Military environmental literacy in the South African Army."*

The summarised results of the research aim to provide clear insights that will inform the training and management of staff and activities in the Army to enable it to meet the environmental management objectives in context of its various policy imperatives. Permission for the study to be conducted was granted by SA Army leadership. However, your consent as SA Army member and potential participant is hereby sought.

Because the SANDF, and in context of this study, the SA Army in particular inhabit and utilise vast areas of South Africa's physical space, and are the custodians of these spaces, it can be argued that it is essential for the SA Army to be informed of the importance of sound environmental practices. This survey is designed to assess the environmental literacy (knowledge, attitudes and behaviour towards the **environment in which the military operates**[30]) of South African Army soldiers.

Should you consent, <u>both you and your answers will remain anonymous, and the researcher and Stellenbosch University guarantee that information provided by you will be treated as confidential at all times and that results for academic and management purposes will only be made available in summary format.</u> Data on rank, years of service, gender, and formation (Artillery, Armour, Infantry, etc.) will only be used for the purpose of classification during statistical evaluation, and will under no circumstances be disclosed to any other party but the researcher.

Your answers will mostly be combined with answers from many other soldiers to provide general indicators, so please be as honest and thorough as possible with your responses.

---

[30] Throughout this questionnaire the concept "environment in which the military operates" refers holistically to encompass the bio-physical, socio-cultural and socio-economic environments in which the Army conduct its activities, whether these activities are training, routine daily activities, base management, disaster relief and support operations, peacemaking and peacekeeping, or any form of armed conflict. Whenever any specific element encompassed by the definition is isolated for a question, it will be specified, i.e. the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).

The results of the study are aimed at assisting our organisational decision-makers in drafting military policy on environmental interaction. As such, it may benefit you in your future professional career, and aid the army in carrying out its environmental obligations.

You are not obliged to participate in this study, but since every contribution adds greater validity to the outcome of this study, your dedicated cooperation in this regard will be sincerely appreciated.

When completed, please return the filled-in questionnaire to the person who administered the survey in your unit. Also hand in the completed consent form. The consent form is a form required by the University's Ethics committee and must be handed in <u>separately</u> so that it will not be possible to link the consent form to a specific questionnaire.

Thank you for your participation!

Hennie Smit
Stellenbosch University

**MILITARY ENVIRONMENTAL LITERACY SURVEY
SOUTH AFRICAN ARMY**

1. Make your marks only within the boundaries of the boxes, Example: ☒

2. Use a **dark pencil** or **black/blue pen**.

SECTION 1:

ATTITUDE TOWARDS THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
*This section asks questions about your attitude towards the environment in which the military operates, in other words, what you **feel or think** about the statements in questions 1-15 below.*

Please rate the following statements on how strongly you AGREE or DISAGREE with them. Remember, this information will remain **anonymous**, so please answer ALL questions and be completely honest.	Agree strongly	Agree	Neutral	Disagree	Disagree strongly
Example: If you **agree** with the following statement: *I like ice-cream.*	☐	☒	☐	☐	☐
1. During any form of military operation the environment in which the military operates must be protected.	☐	☐	☐	☐	☐
2. Prior to any form of training, routine daily activities or base management the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
3. Prior to any form of disaster relief, peace operation or support operation the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
4. Prior to any form of armed conflict the protection of the cultural environment (like places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.) must be planned for actively.	☐	☐	☐	☐	☐
5. When planning an operation, the military environmental officer should be consulted about probable environmental impacts or potential damage to the environment in which the military will operate.	☐	☐	☐	☐	☐
6. During any form of military operation animals must not be harmed.	☐	☐	☐	☐	☐
7. I am concerned about the amount of waste produced in the South African Army.	☐	☐	☐	☐	☐
8. Environmental management plans are important for the effective functioning of a South African Army unit.	☐	☐	☐	☐	☐
9. It is appropriate for the military to also be subjected to national and international / general environmental laws.	☐	☐	☐	☐	☐
10. Anti-pollution measures must be part of the management plan of all South African Army units.	☐	☐	☐	☐	☐
11. Recycling in the South African Army is a waste of time and resources.	☐	☐	☐	☐	☐
12. After any military operation the damage done to the environment in which the military operated should be rehabilitated.	☐	☐	☐	☐	☐
13. I am concerned about soil erosion caused by military activities.	☐	☐	☐	☐	☐

| 14. | The South African Army must become known as a "green" force, in other words an environmentally responsible force. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15. | During any kind of military operation, the religions, customs and languages of the local inhabitants of the area where the operation will take place must be respected. | ☐ | ☐ | ☐ | ☐ | ☐ |

SECTION 2:

BEHAVIOUR WITHIN THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
This section (questions 16-28 below) asks questions about your behaviour in the environment in which the military operates, in other words, what do you __do__ while executing your task.

Please state the EXTENT TO WHICH YOU CARRY OUT EACH OF THE FOLLOWING ACTIVITIES. Please rate the following statements on how strongly you AGREE or DISAGREE with them. Remember, this information will remain __anonymous__, so please answer ALL questions and be completely honest. **Example**: If you __agree strongly__ with the following statement: *I always drink water with any meal I eat*	Agree strongly	Agree	Neutral	Disagree	Disagree strongly
	☒	☐	☐	☐	☐
16. If there were an oil spill during an exercise I would follow the prescribed corrective procedures.	☐	☐	☐	☐	☐
17. I turn off lights and electric appliances in my building when they are no longer in use.	☐	☐	☐	☐	☐
18. During any form of military operation I leave litter behind in the veld or base.	☐	☐	☐	☐	☐
19. When constructing a temporary base in the veld, I adhere to all prescribed military regulations regarding the environment in which the military operates.	☐	☐	☐	☐	☐
20. During any form of training, routine daily activity or base management, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐
21. During any form of disaster relief, support operation or peace operation, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐
22. During any form of military operation, I respect the cultural environment (places of worship, grave sites, historical buildings, archaeological sites, historical sites, etc.).	☐	☐	☐	☐	☐
23. During any form of training, routine daily activity or base management, I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
24. During any form of disaster relief, support operation, or peace operation I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
25. During any form of military operation, I do not destroy natural vegetation willingly and knowingly.	☐	☐	☐	☐	☐
26. At my place of work, I try to recycle as much as possible.	☐	☐	☐	☐	☐
27. When conducting military exercises, I take the shortest possible route, irrespective of any environmental damage caused.	☐	☐	☐	☐	☐
28. During any kind of military operation, I respect the religion, customs and language of the local inhabitants.	☐	☐	☐	☐	☐

SECTION 3:

KNOWLEDGE ABOUT THE ENVIRONMENT IN WHICH THE MILITARY OPERATES
This section (questions 29-42) asks questions about what you __know__ about the environment in which you operates and how to execute your task in it.

		[a]	[b]	[c]	[d]	[e]
Please mark the CORRECT ANSWER to each of the following questions. Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest. **Example**: If your answer of choice is **"pancakes"**:		☐	☒	☐	☐	☐
29.	Which international convention prohibits the employment of methods or means of warfare which are intended, or may be expected, to cause widespread, long-term damage to the natural environment? [a] the Denmark Convention [b] the Geneva Convention [c] the Durban Convention [d] the Paris Convention [e] I do not know	☐	☐	☐	☐	☐
30.	ITAM is the acronym for: [a] Integrated Training Action Master Plan [b] Integrated Training Area Master Plan [c] Integrated Training Area Management [d] Integrated Training Area Manual [e] I do not know	☐	☐	☐	☐	☐
31.	MIEM is the acronym for: [a] Military Integrated Environmental Management [b] Military Integrated Engagement Manual [c] Military Integrated Engagement Master Plan [d] Military Integrated Environmental Mission [e] I do not know	☐	☐	☐	☐	☐
32.	During times of armed conflict, the Department of Defence (DOD) is compelled to respect the environmental rights of: [a] only DOD members [b] only the residents of South Africa [c] only the residents of South Africa and allied countries [d] all people, including those of enemy nations [e] I do not know	☐	☐	☐	☐	☐
33.	Members of the South African Army are excluded from National Environmental Law. [a] True [b] False [c] I do not know	☐	☐	☐		
34.	Hazardous materials (Hazmat) must be stored: [a] in small sealed containers [b] together with non-toxic materials [c] separately, in secondary containment areas [d] in sealed plastic containers [e] I do not know	☐	☐	☐	☐	☐
35.	The best way to handle any kind of rubbish and refuse is to: [a] burn it [b] bury it [c] remove it by means of a unit refuse system [d] leave it to be removed at a later date [e] I do not know	☐	☐	☐	☐	☐

Please mark the CORRECT ANSWER to each of the following questions. Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest. <u>Example</u>: If your answer of choice is **"pancakes"**:	[a] ☐	[b] ☒	[c] ☐	[d] ☐	[e] ☐
36. Fuel storage and re-bunkering sites must be situated to: [a] avoid contamination of food and water sources [b] avoid unnecessary noise and dust pollution [c] avoid unnecessary disturbance of soil and natural vegetation [d] do all of the abovementioned [e] I do not know	☐	☐	☐	☐	☐
37. After use, radio and vehicle batteries must be disposed of: [a] in the normal waste removal system [b] by burning [c] by burial [d] by returning them to the issuing unit [e] I do not know	☐	☐	☐	☐	☐
38. Recycling of waste products means: [a] disposal of waste products according to regulations [b] improper disposal of waste products [c] reuse of waste products after they had been cleaned and remanufactured [d] storage of waste products for later disposal [e] I do not know	☐	☐	☐	☐	☐
39. The mass movement of troops or equipment during an exercise must be: [a] as spread out as possible to avoid detection [b] limited to existing tracks to avoid disturbance of the environment [c] through division of the group in smaller groups to facilitate rapid movement [d] limited to main roads to ensure rapid movement [e] I do not know	☐	☐	☐	☐	☐
40. During any form of military operation, it is necessary to avoid damage to the cultural environment (places of worship, grave sites, and historical buildings, archaeological sites, historical sites, etc.). [a] true [b] false [c] I do not know	☐	☐	☐		
41. During a shooting exercise, soldiers are allowed to use trees and shrubs as targets: [a] because it presents a clear and easily identifiable target [b] because its destruction may ensure effective training [c] because it can later be used for firewood [d] soldiers are <u>not</u> allowed to use trees and shrubs as targets [e] I do not know	☐	☐	☐	☐	☐
42. Unexploded ammunition must be marked and reported after a training exercise because it: [a] may inhibit further training [b] may be dangerous to wildlife [c] may pollute soil and water resources [d] all of the above [e] I do not know	☐	☐	☐	☐	☐

SECTION 4:   **OPEN ENDED QUESTIONS**

Please answer each of the following questions (questions 43-48) **by MARKING the YES or NO questions with an X across the answer of your choice. Write the answers to the explanatory part of every question in the space provided in the boxes on the right of each question.**

Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest.

43.	Do you **agree** with the following statement? "It is important for the South African Army to protect the environment in which it operates." **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or <u>no</u> to question 43 above. You may provide more than one reason.	
44.	Do you consider yourself as being generally environmentally conscious? **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or no <u>to</u> question 44 above. You may provide more than one reason.	
45.	Do you think that good environmental practices in the South African Army can help improve mission success? **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or <u>no</u> to question 45 above. You may provide more than one reason.	
46.	In your work environment, do you try to inimize your negative impact on the environment? **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or <u>no</u> to question 46 above. You may provide more than one reason.	
47.	Do you think that the South African Army provided you with environmental education and training which is adequate to take care of the environment in which the military operates while you execute your tasks? **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or <u>no</u> to question 47 above. You may provide more than one reason.	
48.	Do you have a need to learn more about the environment in which the South African Army operates? **YES** ☐ **NO** ☐ Please indicate why you answered <u>yes</u> or <u>no</u> to question 48 above. You may provide more than one reason.	

SECTION 5:	BIOGRAPHICAL AND SERVICE HISTORY INFORMATION

Please fill in your biographical and service history information in the spaces provided for it in the boxes to the right of each question.
(questions 49-64)

Remember, this information will remain <u>anonymous</u>, so please answer ALL questions and be completely honest.

49.	**Your service formation:** Please mark <u>one</u> option only with an X across the answer of your choice.	Air Defence Artillery ☐ Armour ☐ Artillery ☐ Engineer ☐ Infantry ☐ Intelligence ☐ Signal ☐ Support ☐

		Other: ☐ Please specify:
50.	**Unit:** Please write down your current unit in the space provided.	
51.	**Rank level:** Please write down your rank in the space provided.	
52.	**Time in employment of the Department of Defence:** Please write down in years to the nearest completed year.	
53.	**Current post and responsibility:** Please write down your current post and responsibility in the space provided.	
54.	**Environmental experience:** Please write down any environmental position or environmental responsibility you held at any time during your employment in the Department of Defence, and the years [to the nearest full year] that you served in that capacity.	
55.	**Age:** Please write down years to nearest full year.	
56.	**Gender:** Please mark <u>one</u> option only with an X across the answer of your choice.	Male ☐ Female ☐
57.	**Marital status:** Please mark <u>one</u> option only with an X across the answer of your choice.	Married ☐ Unmarried ☐ Divorced ☐ Widow/Widower ☐

58.	**Mother tongue** (language spoken at home from birth): Please mark <u>one</u> option only with an X across the answer of your choice.	Xitsonga ☐		Tsivenda ☐		Setswana ☐
		Sesotho se Leboa ☐		Sesotho ☐		isiZulu ☐
		isiNdebele ☐		English ☐		Afrikaans ☐
		SiSwati ☐		isiXhosa ☐		
		Other: ☐ Please specify:				

59.	**Highest level of education <u>completed</u>:** Please mark <u>one</u> option only with an X across the answer of your choice.	Secondary School ☐	Post-School diploma ☐	First University degree ☐
			Post Graduate qualification ☐	

60.	**Highest level of Geography education <u>completed</u>:** Please mark <u>one</u> option only with an X across the answer of your choice.	None ☐	Grade 10 ☐	Grade 12 ☐
		Post-School diploma ☐	First University degree ☐	Post Graduate qualification ☐

61.	**Main academic subject/s of your highest qualification:** Please write down the main academic subject/s of your highest academic qualification.	

62.	**Environmental courses completed/enrolled for, year of completion OR foreseen completion:** Please write down the course/s you completed and the date/s of completion, OR the course/s you are enrolled for and the estimated date/s of completion.	
63.	**Have you ever been deployed?** Please mark <u>one</u> option only with an X across the answer of your choice.	**YES** ☐ **NO** ☐
64.	If you answered **YES** to the question in 63 above, please indicate <u>date/s,</u> <u>type/s</u> and <u>place/s</u> of deployment.	

CONSENT TO PARTICIPATE IN RESEARCH

MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY

You are requested to participate in a research study conducted by Commander H.A.P. Smit, from the Department of Military Geography, Faculty of Military Science, Military Academy, at Stellenbosch University. The results of this study will contribute towards a doctoral degree in Geography and Environmental Studies at Stellenbosch University. You were selected as a possible participant in this study because you are a South African Army soldier who operates within the military environment, the focus of this study.

1.   PURPOSE OF THE STUDY

This survey is designed to assess the **military environmental literacy** (knowledge, attitudes and behaviour towards the environment in which the military operates) of South African Army soldiers.

2.   PROCEDURES & POTENTIAL RISKS AND DISCOMFORTS

If you volunteer to participate in this study, we would ask you to complete a once-off questionnaire that should take ± 30 minutes to complete. There are no potential risks or discomforts foreseen.

3.   POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY & PAYMENT FOR
        PARTICIPATION

The results of the study are aimed at assisting our organisational decision-makers in drafting military policy on environmental interaction and training. As such, it may benefit you in your future professional career, and aid the SA Army in carrying out its environmental obligations. Unfortunately no payment can be given for participation.

4.   CONFIDENTIALITY, PARTICIPATION AND WITHDRAWAL

No information that is obtained in connection with this study and that can be associated with you will be disclosed. Confidentiality will be maintained by means of the making available of results [for academic and management purposes] only in summary format. Data on rank, years of service, gender, and formation (Artillery, Armour, Infantry,) etc. will only be used for the purpose of classification during statistical evaluation, and will under no circumstances be disclosed to any other party but the researcher. Data will be secured by keeping completed questionnaires locked up, and password protecting the computerised data.

If permission to publish the findings can be obtained from the Army, only summarised data and findings will be published.

You can choose whether to participate in this study or not. Should you volunteer to participate in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so, although no such circumstances are anticipated.

5.   IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact either myself at Albatrossingel 20, Vredenburg, 7380, telephone 0842057174, or e-mail hennies@ma2.sun.ac.za, or Professor Hannes van der Merwe, Department of Geography and Environmental Studies, Private Bag X1, Matieland, 7602, telephone 021 808 3218, or e-mail catherine@sun.ac.za. If a research assistant handled the survey, his/her details are:

Name and Surname of research assistant:

6.   RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development, Stellenbosch University.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by the investigator, mentioned under point five above, in English, the language of communication and instruction in the South African Army. I am in command of this language. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to participate in this study.

_____
Name of Subject/Participant

_____   _____
Signature of Subject/Participant   Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to the participant. He/she was encouraged and given ample time to ask me any questions. This conversation was conducted in English and no translator was used.

_____   _____
Signature of Investigator   Date

APPENDIX S
Example of a list of possible respondents from a unit

(Unit name and date omitted on purpose to protect confidentiality)

RANK	INITIALS	SURNAME	CORPS	GENDER	RACE
LT COL	JP	BESTER	SAAC	M	WHITE
LT COL	ZJ	DLADLU	OSC	M	AFRICAN
MAJ	AS	BOTIPE	PSC	M	AFRICAN
MAJ	DH	FOURIE	MUS	M	AFRICAN
MAJ	AE	KRITZINGER	PERS	F	WHITE
CAPT	S	SOLOMONS	TSC	M	COLOURED
CAPT	P	VAN WYK	OSC	F	COLOURED
LT	SA	MABASO	SAIC	F	AFRICAN
LT	M.E.	MAHULA	PSC	F	AFRICAN
LT	M.F.	MAKHETHA	TSC	M	AFRICAN
2LT	M.B.	GUMEDE	OSC	M	AFRICAN
WO1	L.	ABRAHAMS	TSC	M	COLOURED
WO2	J	IMMELMAN	OSC	F	WHITE
WO2	AA	JOUBERT	SAEC	M	WHITE
S SGT	BF	JACOBS	SAEC	M	WHITE
S SGT	TR	KHUZWAYO	TSC	M	AFRICAN
SGT	I.	ERASMUS	OSC	F	WHITE
SGT	W	FRANSMAN	OSC	M	COLOURED
SGT	WA	GERBER	PSC	M	WHITE
CPL	PS	MONENYANE	SAIC	M	AFRICAN
CPL	TS	MONNAPULE	TSC	M	AFRICAN
CPL	DT	MONNYE	SAIC	M	AFRICAN
CPL	B	MPELA	PERS	F	AFRICAN
L CPL	MS	TSHONA	CAT	M	AFRICAN
L CPL	K.G.	TSIANE	TSC	M	AFRICAN
L CPL	SR	VUKAPI	SAIC	M	AFRICAN
L CPL	E.R	WILLIAMS	TSC	M	COLOURED
LCPL	Z.P.S.	XULU	TSC	M	AFRICAN
L CPL	M.G.	ZAPHEZA	TSC	M	AFRICAN
L CPL	F.J.	ZONDO	OSC	M	AFRICAN
RFN	F.M.	NDIMANDE	SAIC	M	AFRICAN
RFN	LZ	RADIKGOMO	SAIC	M	AFRICAN
RFN	M.D.	RADIKGOMO	SAIC	F	AFRICAN
RFN	ME	RAKOTSOANE	SAIC	M	AFRICAN
RFN	M.S.	RAMMUTLA	SAIC	M	AFRICAN
RFN	E	SEBONYANE	SAIC	M	AFRICAN
RFN	LJ	SEBONYANE	SAIC	M	AFRICAN
RFN	ME	SEGALO	SAIC	M	AFRICAN
RFN	FI	SEROBENYANE	SAIC	M	AFRICAN
RFN	NA	SETLOGELO	SAIC	M	AFRICAN
RFN	LJ	SHINE	SAIC	M	AFRICAN
RFN	W	SINTU	SAIC	M	AFRICAN
RFN	S.S.	SITHEMBU	SAIC	M	AFRICAN
RFN	ZG	THEBE	SAIC	M	AFRICAN
RFN	V	THEMBU	SAIC	M	AFRICAN
RFN	J.S.	TSHABALALA	SAIC	M	AFRICAN
RFN	R.M.	WESSIE	SAIC	M	AFRICAN

APPENDIX T
Appointment letter for Research Assistants

Telephone: (022) 702-3110

Facsimile: 0862116894

Enquiries: Cdr H.A.P. Smit

Military Academy

Private Bag X2

Saldanha

7395

July 2012

To whom it may concern

APPOINTMENT AS RESEARCH ASSISTANT

I, the undersigned, 77515633 PF, Cdr H.A.P. Smit, hereby appoint …………………………………as my research assistant to assist me in conducting a survey of Military Environmental Literacy in the South African Army. He/she will act as my representative and will organise and execute the research at the designated unit/s on my behalf.

Signed on this 9th day of July 2012 at the Military Academy, Saldanha.

(H.A.P. SMIT)
CHAIR SCHOOL OF GEOSPATIAL STUDIES AND INFORMATION SYSTEMS: CDR

APPENDIX U
Letter to Commanding Officer of each unit

Telephone: (022) 702-3110

Facsimile: 0862116894

Enquiries: Cdr H.A.P. Smit

Military Academy

Private Bag X2

Saldanha

7395

 30 August 2012

The Officer Commanding

8 SAI Battalion

Lt Col Dyakopu

PERMISSION TO CONDUCT A SURVEY AS PART OF A DOCTORAL STUDY ON MILITARY ENVIRONMENTAL LITERACY IN THE SOUTH AFRICAN ARMY: 77515633PF CDR H.A.P. SMIT

BACKGROUND

Permission to conduct the research project entitled, Military Environmental Literacy in the South African Army, was granted by my higher command, i.e. GOC Training Command. Security Clearance was obtained from Defence Intelligence. TRG COMD/R/103/10 TRG COMD/R/202/3/7 dated 08 Sep 10 and DI/SDCI/DCIOC/R/202/3/7 dated 08 Oct 09 refers.

2.   The request was then submitted to C Army and permission was granted on decision brief dd 11 Oct 11. SA Army headquarters instruction 071/12: Research Project on Military Environmental Literacy in the South African Army dated 20 Apr 12 stipulates the conditions under which the survey at the various units will be conducted.

3.   The Department of Defence, the South African National Defence Force and the South African Army in particular will benefit directly from this study. Such a study has never before been undertaken in South Africa. The research results will supply valuable management information regarding the level of environmental literacy in the SA Army. The results of the study will be an important benchmarking tool that will help the Department of Defence to determine the effectiveness of its military environmental programmes. It will contribute towards enhancing these

programmes if and where required. The questionnaire developed for the study will serve as an effective instrument to do follow-up surveys to test the effect of any future military environmental programmes.

AIM

4.   The aim of this letter is to request permission to conduct the survey in your unit. Full particulars of the process can be found in the accompanying SA Army Headquarters Instruction, but in summary the research process will entail:

        a.   Either myself (the primary researcher) or my research assistant will request that a name list of the unit be faxed to me to enable me to draw a random sample of members from different rank groups from the unit.

        b.   The selected respondents will then be added to a list, and a time will be arranged to survey these members at their unit.

        c.   On the day of the survey, either myself or my research assistant will ask the identified members to fill in a questionnaire on military environmental literacy. For this we will need a suitable venue to conduct the survey in one session.

        d.   The expected duration of the whole exercise is 60 minutes. This entails briefing of the respondents, handing out of questionnaires, completion of questionnaires, and collecting the questionnaires. The impact on routine unit activities is thus very limited.

REQUEST

5.   It is hereby requested that you grant permission to conduct the survey.

6.   Thank you for your consideration of this matter.

Sincerely

(H.A.P. SMIT)

CHAIR SCHOOL OF GEOSPATIAL STUDIES AND INFORMATION SYSTEMS: CDR

Decision by Commanding Officer

....
....

(M DYAKOPU)

OFFICER COMMANDING 8 SAI: LT COL

APPENDIX V

Final instructions to research assistants

FINAL INSTRUCTIONS TO RESEARCH ASSISTANTS

Major

Please have a look at the instructions below and phone me on 0842057174 or on 022 7023110 if you have any questions. Thanks again for assisting me, I really appreciate it.

1.   Questionnaires must be filled in under exam conditions. The respondents must all be in one venue at the same time. They may not talk, discuss the questions, or help one another.

2.   Please write your name and surname in the space allocated for it at the back of the "Consent to Participate in Research" form, and sign it at the bottom. You can also ask the participants to write down your name and surname.

3.   Explain to the respondents that the "Consent to Participate in Research" form will only be used to verify that they had given their consent to participate, and that I had not filled in the questionnaires myself. It will not be used to disclose their names under any circumstance, and it cannot be used to identify their responses.

ASK RESPONDENTS TO SIGN THE FORM BEFORE COMPLETING THE QUESTIONNAIRE. THEN COLLECT THEM IMMEDIATELY, AND MAKE SURE TO COLLECT AND STORE THEM SEPARATELY FROM THE COMPLETED QUESTIONNAIRES. THIS IS REALLY IMPORTANT, IF THERE ARE 70 COMPLETED QUESTIONNAIRES, I NEED 70 CONSENT FORMS AS WELL.

4.   Ask the respondents to fill in all questions with either a black or blue pen or a pencil. Use the pens provided to help anyone who need a pen. Please collect the pens after the exercise so that they can be used again.

5.   Ask respondents that have got no experience of war fighting to still answer questions such as "During any form of armed conflict …" Ask respondents to try and imagine how they will behave under such conditions.

6.   If, for whatever reason, any of the selected respondents are not available on the day of the survey, the next person of the same rank level on the unit name list must be asked to take part in the survey.

7.   Distribute the lollipops together with the questionnaires. It is unfortunately their only compensation!

8.   Please inform me when you will be conducting the survey, so that I can make sure that I will be available on my cell phone to answer any questions. My cell phone number is 0842057174.

9.   Once you have collected all the questionnaires, please let me know so that I can arrange to get the completed questionnaires back to me.

THANK YOU ONCE AGAIN FOR HELPING ME WITH THIS IMPORTANT PART OF MY STUDY.

Regards

Hennie Smit

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APPENDIX W
Verification table

NUMBER	UNIT	DESCRIPTION OF DISCREPANCIES

APPENDIX X
Countries respondents deployed to

Angola
Botswana
Burundi
Central African Republic
Comoros
Democratic Republic of the Congo
Lesotho
Mozambique
Namibia
Reunion
South Sudan
Sudan
Swaziland
Tanzania
Zambia

APPENDIX Y
Random numbers used for unit selections using the "RAND" function in Microsoft Excel

SA Army Armour Formation

| 0.452282 | 0.740156 | 0.887162 | 0.925014 | 0.86796 | 0.078816 | 0.223742 | 0.61977 | 0.986347 |
| 0.885958 | 0.367141 | 0.989941 | 0.13711 | 0.45878 | 0.186505 | 0.116441 | 0.673754 | 0.878774 |

SA Army Artillery Formation

| 0.399439 | 0.090357 | 0.997915 | 0.920183 | 0.801342 | 0.865338 | 0.219867 | 0.699625 |
| 0.479749 | 0.530741 | 0.16649 | 0.71914 | 0.706033 | 0.284528 | 0.301157 | 0.218558 |

SA Army Engineer Formation

HQ, School of Engineering & Regiments

| 0.200758 | 0.721687 | 0.161477 | 0.873198 | 0.58407 | 0.3874 | 0.116093 | 0.138896 | 0.177842 |

Special Units

| 0.108979 | 0.559102 | 0.285641 | 0.593068 | 0.226409 | 0.992882 | 0.863552 | 0.638299 | 0.307038 |

SA Army Infantry Formation

HQ & Force Preparation

| 0.027311 | 0.022393 | 0.476829 | 0.029713 | 0.32432 | 0.217114 | 0.319858 | 0.673266 | 0.828327 |

Parachute

| 0.702733 | 0.960006 | 0.248614 | 0.156289 | 0.512654 | 0.481268 | 0.16596 | 0.704749 | 0.490621 |

Mechanised

| 0.767554 | 0.16372 | 0.630321 | 0.957656 | 0.680416 | 0.935719 | 0.229463 | 0.177948 | 0.446456 |

Motorised

| 0.376144 | 0.406795 | 0.128991 | 0.459511 | 0.441962 | 0.976333 | 0.398498 | 0.61004 | 0.39019 |

Conventional: North

| 0.556842 | 0.883114 | 0.001607 | 0.752544 | 0.236281 | 0.299625 | 0.431026 | 0.274985 | 0.692954 |

Conventional: South

| 0.894379 | 0.782704 | 0.308721 | 0.586859 | 0.182776 | 0.442087 | 0.837916 | 0.634021 | 0.036379 |

SA Signal Formation

0.3899	0.578133	0.897453	0.652093	0.728261	0.623757	0.419599	0.057531	0.29899

SA Support Formation

Support Bases

0.564007	0.733982	0.568588	0.679367	0.932622	0.002681	0.812849	0.343264	0.71946

TSC Capability

0.859051	0.780008	0.946848	0.496853	0.965855	0.344353	0.993947	0.005902	0.952791

OSC Capability

0.570752	0.278414	0.657556	0.685171	0.742449	0.587026	0.726469	0.244085	0.239291

SA Training Formation

0.793269	0.926792	0.096348	0.476779	0.861047	0.750914	0.740798	0.547666	0.248799

APPENDIX Z

Name list of selected participants

Rank	Names
Officers and Candidate officers	
LT COL	L Gallant(F)
	SD Dladla
MAJ	R Fourie
CAPT	K Mohapa
LT	K.A. Buffel(F)
2 LT	0
CO	0
Warrant Officers and Non Commissioned Officers	
Warrant Officer	AT Lanser
	F.K. Boekhouer
SSGT	LM Duma
	LB Makona
	AB Williams(F)
	JR Swart
	TE Tshabalala
SGT	H Booysen
	RJ Lehaba
	PS Manaka
	JT Sekoati
CPL	MB Buthelezi
	BO Masahu
	RD Muller
	LM Motlhabang(F)
LCPL	HS Swartz
	MJ Lekgare
	MM Tseka
PTE/RFM	RN Jacobs(F)
	HZ Ndlovu(F)
	M Phele
	E Poto
	TG Sauls
	PP Sonjica
	MB Thupa
	MJ Williams
	PM Zwane
	V Mamba
	TD Leshiba

TOTAL	34