Leaders in extreme and isolated environments: perceptions of South African Antarctic expeditioners

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Declaration

I, Daleen Koch, declare that the entire body of work contained in this research assignment is my own, original work; that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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Abstract

The South African National Antarctic Program appoints a station leader to lead a multidisciplinary team, comprising ten to thirty individuals, who spend twelve months or more at one of three remote research stations: Gough Island, Marion Island or SANAE. The extreme, isolated and confined environments encountered at Antarctic stations provide unique challenges to management and leadership.

The purpose of this study was to explore the perceptions that South African Antarctic expeditioners have concerning various aspects of leadership at the remote stations. The study explored whether the perceptions of men and differed, whether perceptions changed with more expedition experience, and whether the perceptions changed for teams that had experienced emergencies, evacuations, serious illness, death or constant and aggressive interpersonal conflict.

The analysis showed that an effective station leader maintains a personal bond with individuals, maintains a balance between active and passive regulation of the emotional well-being of team members, makes an effort to create and sustain a positive team climate, and maintains a moderate involvement when it comes to team members performing their professional duties. Gender, experience and events at the station influenced perceptions of the station leader's role in maintaining a personal bond, individual well-being, the team climate and intervention in professional duties.

The most important characteristics and competencies for a station leader to possess were trustworthiness, conflict management skills and good communication skills. Expeditioners prefer an extremely participative leadership approach. During emergencies, however, it is accepted that the station leader retains decision-making autonomy.

Approximately 40 per cent of the expeditioners had completed more than one expedition, and women represented approximately 16 per cent of a South African Antarctic team. Emergencies, evacuations, serious illness, death, or constant and aggressive interpersonal conflict are experienced by approximately 65 per cent of expeditioners.

The position of station leader is seen as an important one, which plays a decisive role in the success of an Antarctic station. The station leader affected individual adaptation and influenced the quality of the overwintering year, but did not affect the decision to overwinter again. Expeditioners, from the year 2000 to the most recent teams from 2015, indicated a decline in the appointment practices of station leaders at the South African National Antarctic Program, especially when it came to appointing station leaders based on their leadership qualities.

The findings in this research report were gathered from 180 returned expeditions, with an age profile between 25 and older than 61, who participated in the South African National Antarctic Program between 1961 and 2015. This research report is of value to the South African National Antarctic Program, to other National Antarctic Programs, and to space exploration missions, as well as to

organisations in distress, who find themselves in environments that are harsh and unforgiving, similar to the isolated and extreme environments at an Antarctic station.

Key words

Leadership

Antarctica

Extreme, isolated and confined environments

Antarctic stations

South African National Antarctic Program

Distressed organisations

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AAD	Australian Antarctic Division
ALSA	Antarctic Legacy of South Africa
ATS	Antarctic Treaty System
BAS	British Antarctic Survey
CSAGI	Comité Spécial de l'Année Geophysique Internationale
COMNAP	Council of Managers of National Antarctic Programs
DEA	Department of Environmental Affairs
DST	Department of Science and Technology
GISS	Gough Island Scientific Survey
ICSU	International Council of Scientific Unions
IGY	International Geosphysical Year
NRF	National Research Foundation
PEI	Prince Edward Islands
SAAC	South African Antarctic Club
SANAE	South African National Antartic Expedition
SANAP	South African National Antarctic Program
SANAE IV	Fourth South African National Antarctic Station, indicated with roman numerals
SCAR	Scientific Committee for Antarctic Research

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Antarctica is a continent with no endemic people and no commerce, dedicated to scientific research and observations through the governance of the Antarctic Treaty System (Jabour-Green & Nicols, 2003:78). Its harsh climate, limited infrastructure and inaccessibility, especially in winter, provides unique challenges in the management and leadership of Antarctic stations.

Antarctic stations typically are home to between four and twenty individuals spending the extreme polar winter in isolation. The station leader plays a crucial role in the management of day-to-day activities and dealing with conflict, emergencies and other team related decisions. The choice of team leader has a significant impact on the success of the expedition (Schmidt, Wood & Lugg, 2005:924). This study investigates perceptions of leadership, as well as the characteristics and approaches that team members perceive as being most required to be successful when leading an Antarctic team.

With three teams departing the South African shores annually for an overwinter expedition, this study can assist the South African National Antarctic Program (SANAP) in the appointment of station leaders. Other national Antarctic programs could perform similar studies using their own national expeditioners, or implement the results of this study as part of the leadership selection process.

Antarctic stations are analogous to space and undersea missions (Sarris & Kirby, 2007:706), where the station leaders have similar roles and responsibilities, and where the environment is extreme and isolated. This study may be beneficial to space agencies, in understanding the leadership needs of team members in space and undersea habitats, as well as in deciding on team composition and team leaders for mountaineering teams and adventure explorers.

The study is also an exploration into the mindset of South Africans when it comes to leaders and their expectations of them. Employees and leaders are changing as organisations are moving from the industrial age into the knowledge era, which calls for new approaches to leadership (Uhl-Bien, Marion & McKelvey, 2007). Distressed organisations find themselves in a situation or environment that is harsh and unforgiving (Onich, 2009:45), similar to that of teams overwintering in Antarctica. These changing landscapes may call for a different type of leader, and this study can provide guidance to understanding the needs of team members in stressful situations.

1.2 BACKGROUND

The Heroic Age of Antarctic exploration refers to an era close to the end of the nineteenth century, which ended with the safe return of expeditioners from the Imperial Trans-Antarctic Expedition in 1917. This early exploration of Antarctica was inspired by the desire for scientific exploration, as well

as by nationalism and individual fame (Palinkas & Seudfield, 2008:153). It was used as a tool to achieve national prestige and a fuel to flame geopolitical imagination (van der Watt & Swart, 2015:268). Roald Amundsen achieved the goals of both nationalism and fame, by claiming the South Pole for the Norwegian Crown and becoming the first explorer in history to reach the South Pole, on 14 December 1911 (Larson, 2011).

The expeditions of Captain Robert Falcon Scott, Sir Douglas Mawson and Sir Ernest Shackleton achieved all three goals. The researchers on their teams opened up the Antarctic continent for scientific exploration, and their scientific research endeavours deepened the understanding of the meteorological, biological and geophysical systems that govern Antarctica (Larson, 2011:129).

The expedition leaders in the Heroic Age are well known and their motivations for their expeditions were clear. Their team members, however, had their own motivations for signing up for expeditions to Antarctica. Some team members were scientists and inspired by research goals. Others were support personnel, such as communications operators and carpenters. A famous call for recruitment, supposedly from Sir Ernest Shackleton, give some insight into the type of person the earlier Antarctic expeditions wanted to attract (Allen, Moore & Grocott, 2009:1082).

> *Men wanted for hazardous journey. Small wages. Bitter cold. Long months of complete darkness. Constant danger. Safe return doubtful. Honour and recognition in case of success.*

Interest in Antarctica revived during the Second World War. Inspired by fears of an Argentine and German collaboration, the British started a permanent settlement in Antarctica, during the austral summer of 1943-1944 (Dudeney & Walton, 2012:342). Under the flag of scientific research, Chile, Australia, France, Russia and the United States soon followed suit, also opting for permanent Antarctic stations. The consequence of the permanent stations in Antarctica was the new type of explorer and expeditioner, the overwinterer, and a new type of team, the overwintering team.

Many Antarctic stations maintain a year round presence, with employees on duty through the polar winter. Most Antarctic program representatives, tourists and other visitors can gain access to the Antarctic continent from October to February. During this time, the permanent research stations receive their supplies of food, fuel and amenities and, more importantly, the overwintering team is relieved after their winter duty period, by a replacement team.

Depending on the national program, overwintering expedition members could spend between eight and fourteen months away from home, having social contact with only nine other individuals, as is the case with the South African National Antarctic Program at the Antarctic Station, SANAE IV (ALSA, 2015). The team members are isolated from their family, social and other support networks (Sarris & Kirby, 2007:706), and spend months together with individuals they did not choose themselves. Furthermore, the team members live in an extreme environment, where sometimes weeks can go by without anyone being able to go outside, due to inclement weather.

Another consequence of the extreme weather and limited light during the polar winter is that there is little or no chance for an evacuation or the replacement of a team member during winter. Should an evacuation or replacement be possible, it would be at great cost for the national Antarctic Program, in terms of logistics and loss in training investment (Sarris & Kirby, 2007:706-707). Team selection, compatibility and team leadership play a prominent role in the team situation for Antarctic overwintering.

South Africa was one of the original signatories to the Antarctic Treaty in 1959, and has maintained a presence in Antarctica ever since. The Department of Environmental Affairs (DEA) manages three remote stations, SANAE IV, Marion Island and Gough Island, as well as the national polar research vessel, the *SA Agulhas II*, on behalf of SANAP. South African nationals have been overwintering in Antarctica since 1959 (ALSA, 2015).

Every year, the DEA trains and selects three teams for each of the South African remote stations. The extreme and isolated environment in which these expeditioners will find themselves for the next twelve to fourteen months can lead to various psychological and physiological conditions (Sarris & Kirby, 2007:707).

Each team has an appointed station leader or team leader, usually chosen by the national program selectors and not democratically selected by the team. Research has shown that the choice of the station leader has a significant impact on the team members, especially in terms of the quality of life and the success of the expedition (Schmidt, Wood & Lugg, 2005:924).

Since Amundsen first discovered the South Pole, the type of expedition has changed significantly after the advent of permanent stations, but the responsibility of leaders in Antarctica remains similar. Station leaders are responsible for the welfare of the station community, conflict management, performance assessments, achieving the goals of the national Antarctic program and, most importantly, making sure that team members return home safely (AAD, 2013).

The station leader is dependent on the team members to each achieve the goals of their position. The expectations and needs of the team members in terms of leadership can play a deciding role in the success of the expedition and, ultimately, the achievement of the goals of the Antarctic program.

1.3 PROBLEM STATEMENT

Station leaders at Antarctic stations are not democratically selected, but chosen by the national Antarctic program prior to departure to Antarctica. The station leader is the highest authority on the remote station and serves as representative of the national government. In extreme situations, the leader may be called upon to act as a Deputy Coroner or function as a Special Constable (AAD, 2013), and it is understandable that a national Antarctic program carries a responsibility to appoint the candidate most suitable for this role.

The autocratic appointment of station leaders can influence the effectiveness of the station leader's responsibilities; especially if any disconnect exists between the leadership role from the perspective of the national Antarctic program and from that of the team members. Understanding the leadership needs of the Antarctic team member can assist Antarctic programs in the selection of station leaders.

Perceptions of needs will differ among team members. Female team members may have a different perspective to that of the male team members. Teams that have experienced emergencies may have a more holistic view of leadership needs, compared to overwintering teams that have completed a comparatively uneventful tour of duty. The same holds true for teams that experienced regular conflict or tension. Some team members complete more than one overwintering expedition. Multi-expedition team members can provide a different perspective than individuals who have overwintered only once.

In SANAP, the perceptions of overwintering teams on Marion Island and Gough Island can differ from those of teams that spend the winter at SANAE IV base. Although Marion Island and Gough Island qualify as extreme and isolated environments, the islands do not have the temperature extremes nor the extended polar winter experienced at SANAE IV.

Irrespective of the different settings and situations experienced by teams, team members, whether they have completed one or multiple expeditions, can provide valuable insight into the leadership qualities that are valued from the perspectives of both a team leader and a team member perspective.

With the problem statement as backdrop, this study aims to answer the question of what the requirements for leadership are of Antarctic station leaders, specifically from a team member's perspective.

1.4 RESEARCH OBJECTIVE AND AIMS

The research objective is to examine the perceptions of leadership roles, abilities, styles and influences of Antarctic expeditioners who operate in isolated and extreme environments. The research specifically focused on the perceptions of expeditioners who had spent at least one uninterrupted overwintering expedition at SANAE IV, Marion Island or Gough Island stations, as part of SANAP.

The study aims to provide insight on the perceptions of male and female expeditioners and the differences in perception of leadership needs based on gender. It further aims to find out if leadership perceptions change, by comparing the perceptions of team members who had been on only one expedition, against those of a multi-expedition team member. Lastly, the study compares the leadership needs of teams that had experienced situations beyond the norm, such as evacuations, serious illness, death or constant interpersonal conflict.

Through this research, SANAP, as well as other national Antarctic programs, can gain insight into the needs and perceptions of team members, which could assist in the appointment of station leaders equipped to serve the needs of both the national program and the team members. Organisations in distress may also benefit from the study, as the needs of their employees may be similar to those of the overwintering personnel.

1.5 RESEARCH DESIGN

Leadership at Antarctic stations is a relatively unexplored area in leadership research, but it is not a nascent topic. Due to the isolation, confinement and extreme environmental conditions, Antarctica has also been used as an analogue for space studies. From the perspective of leadership, as well as physiological and psychological well-being.

This research study explored the state of the understanding of leadership in Antarctica and other extreme environments. A quantitative methodology was employed, where existing research was used to compile a questionnaire specifically aimed to test the perceptions of South African Antarctic expeditioners.

The sample used in this study was returned overwintering expeditioners who had participated in the South African National Antarctic Program. These individuals were required to have spent at least twelve months away from home at one or more of the three South African Antarctic or Sub-Antarctic stations. The study targeted participants through the Antarctic Legacy of South Africa project, which maintains a large database of returned expeditioners, as well as members of the South African Antarctic Club.

With South Africans having been involved in overwintering activities since 1948 (Cooper & Headland, 1991:79), with the participation of women as overwintering expeditioners since 1987 (Cooper & Headland, 1991:86), these participants could provide a wide spectrum of age, gender and experiential perceptions.

1.6 CHAPTER OUTLINE

Chapter 1 has been an introduction to the study.

Chapter 2 provides a literature review, investigating SANAP, the concept and challenges of overwintering in the Antarctic, past leadership during the Heroic Age, and leadership in other extreme environments, as well as at Antarctic stations. Team selection, station leader appointments and the influences of gender, multiple expeditions and emergencies and extreme events are investigated. Chapter 2 concludes with modern leadership theories, leadership needs for distressed organisations and specific leadership competencies.

Chapter 3 outlines the research methodology employed in the study, such as the population and sample sizes and the questionnaire design. The data collection and data analysis methods are also discussed.

Chapter 4 presents the findings and discusses these findings in relation to previous research.

Chapter 5 gives a summary of the findings, a conclusion, as well as the limitations of this study. Some recommendations are made for future research.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

Understanding the setting in which this research project has taken place is paramount to the success of the report. This chapter aims to explore life in Antarctica and introduces the station team. It will explore the continent, its history and Antarctic governance policies. It will investigate the models of the ideal Antarctic station team member, as well as the physical and psychological challenges that the leader and the team experience during their tenure. This exploration into the background of Antarctic life aims to create a better understanding of the factors that influences the perceptions of the expeditioners.

The chapter will move towards a focus on leadership in extreme and isolated environments, which will include Antarctic stations and also lessons from space exploration. The characteristics of leaders during the Heroic Age will be explored, and the different leaders, their successes and failures, juxtaposed. An investigation into the differences in the appointment of Antarctic station leaders by various national programs aims to shed light on the approach followed by SANAP.

The literature review aims to establish a basis of the current knowledge regarding the characteristics required of leaders in extreme and isolated environments, with a focus on the leadership qualities required to deal with emergencies, interpersonal conflict and life threatening situations.

2.2 ABOUT ANTARCTICA

2.2.1 Background and importance

The Unknown South Land, or *Terra Australis Incognita*, fascinated explorers and adventurers long before the discovery of the South Pole in 1911. Seafaring explorers such as Ferdinand Magellan, Sir Frances Drake, and Captain James Cook had led the early ventures south, in search of the fabled southern continent (Turney, 2012).

No one inhabits Antarctica and under international law is it ‘land belonging to no-one’ or *terra nullius* (Sidiropoulos & Wheeler, 2016:12). Its geographic location makes Antarctica one of the most remote and isolated outposts on Earth. A journey of 4000 km is required to get from Cape Town to SANAE IV, and distances of 2 900 km to Gough Island and 2 300 km to Marion Island (Department of Transport, 1974). However, the isolation in Antarctica stretches beyond only the distance to the nearest major port.

Over the winter months, Antarctica is home to only a thousand scientists and support personnel, spread all over the continent (Williams, 2000:16). The sparsely populated continent with its limited infrastructure poses a challenge, especially for medical evacuations. For various periods during the year, the darkness of the polar winter and the harsh weather prevent any travel, between either the

different Antarctic stations or the country of origin (Palinkas, 2003). It is easier to evacuate someone from the International Space Station than from an Antarctic station during winter (Grant, 2004:357).

Antarctica, similar in climate to Mars, is a frozen desert that supports few life forms, which makes human habitation of Antarctica, at most, superficial (Grant, 2004:357). The variable dark-light cycles, high altitude, low humidity and the extreme cold makes it a physically stressful environment for human habitation (Orasanu & Lieberman, 2011:10). Grant (2004:357) captured the essence of living and working in Antarctica:

> *It is simply the remoteness, the hostility and the unforgiving nature of the environment in which man struggles to survive, let alone work.*

The continent's remoteness, location and isolation form part of the allure for a range of scientific disciplines, such as marine biology, astronomy, upper atmosphere physics, geology, seismology, meteorology, psychology and many more (Palinkas & Suedfeld, 2008:154). The Southern Ocean that encircles the Antarctic continent is resource-rich for fisheries and plays a crucial part in climate regulation and the uptake of carbon dioxide (Kennicutt II & Chown, 2014). A depth of four kilometres of ice contains the secrets of the Earth's climate history over the last million years, and it continues to have a profound effect on the present ocean systems and climate (BAS, 2015).

Antarctica is becoming more accessible to visitors (Jabour & Murray, 2004), but still remains isolated compared to other continents. Its remote location and climate makes it an attractive destination for scientists and explorers but, at the same time, the extreme and hostile climate makes it a challenge to live and work in. All these factors could contribute to the challenge of managing and preserving the continent.

2.2.2 Governance of Antarctica

The International Geophysical Year (IGY) was a watershed event that changed the international landscape of science, collaboration and governance in Antarctica. During 1957 and 1958, twelve nations collaborated in a united, planned program that saw 62 major scientific observation posts established and operated in and around Antarctica (National Research Council, 1961:v).

The success of IGY led to events that have affected Antarctic governance to the present day: the establishment of the Scientific (previously Special) Committee for Antarctic Research (SCAR) and the negotiation of the Antarctic Treaty.

The International Council of Scientific Unions (ICSU), through the Comité Spécial de l'Année Geophysique Internationale (CSAGI), a special IGY sub-committee, recommended a permanent organisation that could initiate, promote and coordinate scientific research in the Southern Ocean and in Antarctica. The result was SCAR, established on 3 February 1958, to govern Antarctic science and research (Department of Transport, 1974:14; National Research Council, 1961:vi).

The Antarctic Treaty was as much a result of the IGY as it was a product of the Cold War (van der Watt, 2012:126). The United States, on 2 May 1958, proposed to their IGY counterparts to join a treaty that aimed to preserve Antarctica and ensure its use for scientific research only. The Antarctic Treaty was negotiated and signed on 1 December 1959 (Shusterich, 1984:805).

To be included in the negotiations and recognised as a consultative party, a country had to have a research station in Antarctica that was staffed year-round. The United States saw South Africa as an ally to the West during the Cold War. South Africa was included as an original signatory and consultative party in the Treaty in 1959, although it was still negotiating for a permanent Antarctic station at that time (Sidiropoulos & Wheeler, 2016:29).

Subsequently, the Antarctic Treaty incorporated other agreements, conventions and protocols, which are now collectively known as the Antarctic Treaty System (ATS) (Sidiropoulos & Wheeler, 2016:16). The treaty still leaves claimant states with the right to assert their own national interests on the continent, as long as these do not conflict with the Antarctic Treaty or its subsidiary agreements (Sidiropoulos & Wheeler, 2016:20).

Where SCAR focuses on international scientific research and the ATS regulates relations and conduct amongst countries involved in Antarctica, a third international body focuses primarily on National Antarctic Programs. National programs have the responsibility of managing the support of scientific research and logistics for their respective countries. The Council of Managers of National Antarctic Programs (COMNAP) strives to develop and promote best practice in managing Antarctic science support (COMNAP, 2008:1).

Antarctica, as *terra nullius,* is a challenging continent to manage within the international political environment. Governance of scientific research, international relations and national programs is complex and multifaceted. Each overwintering station, especially the overwintering station leader, carries the responsibility of achieving the aims of their national program (AAD, 2013) during the austral winter, and the national program carries the responsibility to adhere to the Antarctic Treaty System (COMNAP, 2008:1).

2.2.3 South Africa and Antarctica

Even though the first South African National Expedition set foot in Antarctica only in 1960, its initial involvement started because of its proximity to the Southern Ocean. Between 1901 and 1913, southbound explorers of the Heroic Age, such as Erich von Drygalski, Captain Robert Falcon Scott and Sir Ernest Shackleton, used the harbours of Simons Town and Table Bay for repairs, shore leave and provisioning (Cooper & Headland, 1991:81). However, it was meteorology and an economic relationship with whaling that led to the formal involvement of South Africa in Antarctica.

Van der Watt and Swart (2015) explored the first proposals for South African expeditions to the Antarctic. Prof Ernest James Goddard tabled the first proposal for a South African national expedition in 1919 (Plugg, sine anno) and canvassed for support by stating the goal of ‘international recognition’

for the science community of the then fledgling Union of South African (van der Watt & Swart, 2015:275). Six years later, in 1925, General Jan Smuts called for an improved and connected meteorological network, bringing together nations by using Antarctic station data for its practical and scientific value (van der Watt & Swart, 2015:269).

A second proposal from Ernest Mills Joyce, in 1930, focused on the potential economic gains a South African expedition could bring to the Union of South African. However, South Africa's position in the British Commonwealth and its economic relationship with Norwegian whaling activities complicated matters to such an extent that the South African government did not consider the proposal any further (van der Watt & Swart, 2015).

National strategy, security, and imperial manoeuvring by the British eventually led to South Africa's active participation and presence in the Sub-Antarctic and the Antarctic. The strategic location of the Prince Edward Islands (PEI), which comprise Prince Edward and Marion islands, led to their annexation from the Imperial crown, through Operation SNOEKTOWN, on 29 December 1947 (Cooper & Headland, 1999:79). The first meteorological team arrived on the shores of Marion Island in February 1948, and the first weather observations started on 20 March of the same year. South Africa started to achieve General Jan Smuts' dream of a meteorological network in the Antarctic, 23 years later.

In 1942, during the Second World War, South Africa, together with the British Royal Navy, installed a weather station on the volcanic Sub-Antarctic island of Tristan da Cunha (Van der Watt & Swart, 2015:272), which was abandoned after a volcanic eruption in 1961 (Cooper & Headland, 1991). Gough Island, a close neighbour of Tristan da Cunha, hosted the Commonwealth inspired Gough Island Scientific Survey (GISS) in 1955 and 1956. After its strategic value for forecasting was realised through the efforts of the GISS, the South African Weather Bureau used the GISS infrastructure to establish an IGY meteorological station on Gough Island in 1956 (van der Watt, 2012).

South Africa was now established in the Sub-Antarctic, but more was needed to achieve the dreams of Goddard, Smuts and Joyce. South Africa pledged to protect and preserve the southern continent, by becoming one of the twelve founding signatories to the Antarctic Treaty in 1959 (ALSA, 2015). That same year saw the first South African National Antarctic Expedition (SANAE 1) departing South Africa for Antarctica on 3 December 1959, to settle in the abandoned Norwegian overwintering base in Dronning Maud Land (ALSA, 2015).

During these nascent years of South African Antarctic science and overwintering, the first team performed surface, upper air and geomagnetic observations, with field work for glaciological, geological and bird observations (Cooper & Headland, 1991:82). South Africa constructed four successive Antarctic stations from 1962 onward. Presently, research in meteorology, environmental sciences, physics and geology is studied at SANAE IV, located at 71°40' S 2°50' W, in the Norwegian claim territory of Dronning Maud Land (ALSA, 2015).

South Africa currently operates three permanent Antarctic and Sub-Antarctic stations: Marion Island, Gough Island and SANAE IV. These stations are managed through SANAP. The South African Department of Science and Technology (DST) manages the SANAP scientific research functions through their research agency, the National Research Foundation (NRF). The Department of Environmental Affairs (DEA) carries the responsibility for SANAP logistics and infrastructure (SANAP, 2016a).

With three stations staffed year round to provide meteorological and other scientific research data to the South African and international science community, South Africa has achieved General Jan Smuts' vision of unification of nations through a presence in Antarctica.

2.3 AN EXTREME ENVIRONMENT

2.3.1 Understanding extreme environments

In most research pertaining to Antarctica, the continent is described in terms of the extremes of temperature, wind speeds, danger and altitude (Steel, Suedfeld, Peri & Palinkas, 1997). When studying the history of polar exploration, Palinkas and Suedfeld (2007:153) observed recollections of hardship, self-sacrifice, suffering, illness and death. Manzey and Lorenz (1998, cited in Orasanu & Lieberman, 2011:4) define extreme environments as 'settings that possess extraordinary physical, psychological and interpersonal demands that require significant human adaptation for survival and performance'.

Orasanu and Lieberman (2011) grouped extreme environments into three dimensions: extremes that are ambient, social and task-related. The ambient extremes refer mostly to inhospitable areas such as high altitudes, the polar regions, deserts, subsea and outer space, which are devoid of life-sustaining elements. Social extremes refer to a hazardous social environment, which is not inhospitable to life, but can be dangerous. This can include the necessity of crisis management or peacekeeping operations. Lastly, task extremes refer to tasks that are inherently dangerous or risky due to the undertaking of extreme activities, such as extreme sports.

Present day expeditions and visits to the Antarctic continent have become much safer, where teams reside in permanent, heated buildings and experience less exposure to the cold environment (Leon, Sandal & Larsen, 2011:354). Most Antarctic stations have research laboratories, power generation facilities, workshops and living quarters housed in modern buildings; enabling expedition members to survive, sometimes in extreme comfort (Norris, 2010). Some stations have libraries, gymnasiums and even greenhouses, and living conditions have been described by some as luxurious (Rothblum, 1990:253), when compared to those of the Heroic Age.

It may be safer and more comfortable, but it remains impossible to sustain human life in Antarctica without complex logistics and a reliance on technology for survival. The continent remains inhospitable, with limited resources to sustain human life and extreme cold beyond that which humans evolved to endure. Leon *et al*. (2011:355) discussed how ambient extremes, specifically the

severe cold, affects both motor and cognitive performance. Exposure to cold could lead to a decrease in dexterity and muscle strength, and increased urination, dehydration and the chance of developing frostbite and hypothermia. Cognitive effects include a longer response time and a decrease in efficiency and accuracy. The combination of motor and cognitive impairments can ultimately lead to impaired judgement.

High altitude mountaineering provided examples of impaired judgment due to ambient extremes. Orasanu and Lieberman (2011:11) described how even experienced mountaineers, affected by sleep deprivation and lack of oxygen, made a push for the summit despite existing injuries, exhaustion and deteriorating weather. The authors studied naturalistic decision-making in extreme environments, and presented various case studies and examples where ambient extremes impaired judgement and led to increased risk-taking and, in some cases, resulted in death.

Schmidt *et al*. (2004:681) described danger, isolation and confinement as primary characteristics of extreme environments. When these stressors were experienced in extreme environment settings, they could influence decision-making (Orasanu & Lieberman, 2011:3), as well as the perceptions of team members about a wide range of concepts, such as team climate (Schmidt *et al*., 2004:681). Suedfeld (2010:644) emphasised the importance of interpersonal relationships between the team members in these settings.

Teams in extreme environments, such as the polar regions, can consist out of different types of groups. A polar trek or traverse team could have two to four expeditioners, where an overwintering team can range from 250 to as few as ten people (Leon *et al.*, 2011:354). Leon *et al*. emphasised the high interdependence on each other, as each team member has been chosen to fulfil a specific role. This interdependence requires a positive group climate that facilitates adaptation. Consensus amongst team members, on who holds the decision-making authority, is critical to prevent conflict on the ice.

2.3.2 Leading in extreme environments

Leadership in extreme contexts is a unique field of research and, according to Hannah, Uhl-Bien, Avolio and Cavarretta (2009), one of the least researched topics in the field of study of leadership. Different extreme environments, such as space, trauma and crisis response teams, and high altitude settings could provide insight into the leadership needs in situations outside the norm.

Maynard and Kennedy (2016) evaluated various reports of and papers from space applications. In a simulated Mars habitat, shared leadership has been found advantageous to team adaptation. An analysis of astronauts' journals on the International Space Stations have revealed that a team leader who possessed a certain level of hardiness made the team more resilient, and enabled the leader to deal with hypersensitivity and prevent small issues from escalating.

Suedfeld (2010:644) studied the requirements for leadership in the space environment. These leaders enjoyed a sense of mastery and accomplishment and exhibited self-control. From a teaming perspective, these leaders valued team harmony, stability and team members' welfare.

Klein, Ziegert, Knight and Xiao (2006) investigated leadership in extreme action teams. These teams, such as teams in an emergency trauma centre, are teams that are highly skilled and called together to perform urgent, unpredictable and interdependent tasks. The team composition changes during deployment and junior members form a part of the team in a training capacity. These teams require leaders that are flexible in the face of changing conditions.

Klein *et al*. further found that the most effective extreme action teams maintained the team hierarchy, but leadership was shared during the task, where the leader delegated his position to another team member. This gave emergent leaders an opportunity to experience the challenges of leadership in-situ, and allowed the established leader to recuperate. Hannah *et al*. (2009) had similar findings on shared leadership during extreme events. An ongoing extreme event, such as an emergency response to a hurricane, could lead to leadership fatigue and decreased performance if the responsibilities of leadership were not shared. In both these studies, shared leadership allowed leaders to recover and new leaders to emerge.

Small team polar expeditions, as might be found during traverses of Antarctica and Greenland, spend shorter periods in extreme environments but, during the expedition, continuously face harsh and cold conditions. These teams, according to Leon (1991), use dog sleds or man-haul their supplies, fuel and tents, and perform heavy physical labour whilst exposed to extreme cold. Leon (1991:731) found that team members of a 56-day North Pole expedition felt that group leadership played a major role, and they made an effort to maintain group harmony. The leaders enabled team members to provide input and opinions, and gave them the opportunity vent anger and frustration when needed.

It is important to note that Hannah *et al*. (2009) found that there is no one-size-fits-all approach to leadership in the different types of extreme context. Space, polar expeditions and extreme action teams had a common thread, with leaders who were hardy, flexible, open to input and sensitive to team well-being. Another thread was the sharing of leadership to allow leader recovery and the emergence of new leaders.

2.4 UNDERSTANDING OVERWINTERING

2.4.1 Antarctic adaptation, behaviour norms and expectations

The effects of isolation and confinement on a station's winter personnel has been a topic of investigation since the first teams started overwintering in a formal, science supported setting. Living and working in Antarctica requires adaptation to this unique environment. Nelson (1962) identified three criteria for adaptation: emotional response, work performance and an ability to adjust socially to other station members.

The latter criterion, social adaptation on a small station, was found to be the most intense. Hullin and Connery (1959, cited in Nelson, 1962) found that it did not matter whether a team member were outgoing or withdrawn, as long as they did not annoy, irritate or cause dissension among the team members. Subsequent research identified that introverted, yet socially adept, individuals exhibited better performance and adaptation (Palinkas & Suedfeld, 2008:160). The ideal characteristics for long polar expeditions, identified by this research, were:

- Aged older than 30 years;
- Emotionally stable;
- Few symptoms of depression;
- Low neuroticism;
- Introverted but socially adept;
- Satisifed with social support;
- Not greatly extraverted or assertive;
- No great need for social interaction;
- Low demands for social support;
- Sensitive to the needs of others;
- A desire for optimistic friends;
- High tolerence for little mental stimulation;
- Does not become bored easily;
- High tolerance for lack of achievement; and
- Low need for order.

Four other characteristics, from research by Glogower (1987, cited in Steel *et al*., 1997) identified tolerance, flexibility, acceptance of authority and a sense of humour as important traits necessary to adapt to Antarctic station life.

Research by Stuster (2000:55) found that individuals who are patient, likeable, exercise emotional control and possess technical competence in their area of expertise were likely to adapt successfully. They also require self-confidence, but without arrogance, have a sense of humour and a willingness to subordinate their own self-interest to that of the group. Lastly, they require a degree of tolerance and social resourcefulness.

Antarctic expeditions require three levels of adaptation: emotional response, work performance and the ability to adjust socially. There are many known characteristics and traits that an individual may have which would ease their adaptation to polar living. Should a national program select individuals for overwintering who match these desired traits, it is possible that these team members would better adapt to station life and ease the burden on the station leader.

However, individual personality traits and characteristics are not a determinant in the prediction of individual behaviour and responses on polar expeditions (Palinkas & Seudfeld, 2009:160).

Irrespective of team selection criteria, Antarctic stations require a station leader who can deal with the problems that arise from the process of adaptation.

2.4.2 Stressors and influences for Antarctic expeditioners

Additional stressors, introduced by the unique Antarctic environment, influence adaptation to Antarctic station life. Lilburne (2005) identified internal and external stressors that contribute to the challenges team members face on the station. Internally, station life could become monotonous and expeditioners could feel frustrated with the limited recreational options, little emotional and physical gratification and the social environment. External stressors included conflict with a distant authority, such as the national program, supply shortages and the inability to deal with problems and challenges at home.

The stressors experienced in extreme environments affected decision-making as well as cognitive processes (Orasanu & Lieberman, 2011:3). Palinkas (2003:354) grouped the stressors experienced by Antarctic overwintering team members into three broad categories: isolation, confinement and the extreme physical environment.

The physical isolation of the Antarctic continent also results in a psychological isolation. Communication with family and social support networks are limited (Orasanu & Lieberman, 2011) and the separation results in varying degrees of emotional deprivation (Palinkas, 2003). Contact with family and friends could induce stress, especially if it reveals problems that the overwinterer cannot deal with remotely, such as the passing or alienating of a loved one (Palinkas *et al*., 2004:645).

The isolation stressor could potentially affect the emotional well-being of the overwinterer and, in turn, their adaptation to life at the station. Station leaders are tasked, amongst other things, with the well-being of their team (AAD, 2013). In order for station leaders to be able to address the emotional well-being of a team member, it would be advantageous if they were aware of the personal circumstances of the team members and able to understand and empathise with the individual.

Station personnel are sometimes confined to the station for extended periods, due to weather, extreme cold, and safety policies. Palinkas (2003) confirmed the reasons for the confinement, and discussed the way in which this confinement could cause conflict and stressors because of the lack of division between personal, social and professional spheres. Living and working spaces are located in close proximity, which exposes personnel to the constant interaction between the same group of people (Palinkas, 2003:354).

This confinement could lead to increased social conflict amongst team members, between the team and the station leader, as well as between the different cliques and subgroups that inevitably form (Johnson *et al*., 2003:90). The greatest source of stress in Antarctica was found to be interpersonal conflicts between members of the team (Sarris, 2007:886). Confinement for prolonged periods could lead to minor social tensions turning into major conflict events.

On the Antarctic station, it is not always an option to remove oneself from tension or conflict situations (Palinkas *et al*., 2004:640). This leads to what Stuster (2000:53) aptly described as a type of cumulative stress, which results from the unrelenting proximity of other team members. These situations may call for a station leader with well-developed conflict resolution skills, and a measure of creativity, to address and relieve the issues that results from the forced confinement.

Palinkas and Suedfeld (2009) discussed the extreme physical environment faced by expeditioners, where hazards such as crevasses, blizzards and slippery ice could result in accidents, injury and death. Cold temperatures, high altitudes and up to six months of darkness, exposed overwinterers to the possibility of frostbite, hypothermia, hormonal changes and suppression of the immune system. These extreme conditions could lead to accidents, emergencies, poor health and inability to perform station duties. A station leader must be equipped to deal with emergency response and risk management, and balance the demands of the station with the physical well-being of the people.

Physiological and psychological disturbances in polar personnel were observed and recorded as early as the Heroic Age. Frederick Cook painted a sad picture of the Belgica expedition from 1898 to 1899 (Palinkas & Seudfeld, 2008:153):

> *The curtain of blackness which has fallen over the outer world of icy desolation has descended upon the inner world of our souls. …men are sitting about sad and dejected, lost in dreams of melancholy from which, now and then, one arouses with an empty attempt at enthusiasm.*

Nelson (1962:4) identified insomnia, headaches, irritability and mild depression in overwintering personnel, which increased with the onset of winter. Named 'Winter-over syndrome' ten years later by Strange and Youngman (1971, cited in Palinkas *et al*., 2004:641), the symptoms also included sadness, difficulty in concentrating and memory impairment.

Two other recognised syndromes were experienced by a subset of Antarctic station team members: Polar T3 syndrome and subsyndromal seasonal affective disorder (Palinkas & Seudfeld, 2009:157). To prevent psychological distress and performance issues, some station leaders included many leisure activities throughout the polar winter (Palinkas & Seudfeld, 2009:159).

In the presence of syndromes and adaptation challenges, expeditioners also experienced positive and salutogenic effects during their Antarctic employment. Norris (2010) reported individual growth experiences, such as self-efficacy, increased self-reliance and cooperation. External influencers include experiencing the unique and beautiful Antarctic landscapes and team camaraderie fostered by joint survival in a dangerous environment. Palinkas (1992:652) found that the changes in the behaviour of individuals appeared to have led to long-term health benefits in Antarctic expeditioners.

Table 2.1 summarises the main stressors that Antarctic team members are exposed to during their tenure, the resulting issues and the requirements for a station leader resulting from these issues.

Table 2.1: Stressors, impacts and Antarctic station leader requirements

Stressor	Impact or issue	Qualities necessary in a station leader
Isolation	Stress Decline in emotional well-being	Good with personal relationships
		Ability to relate to others
		Empathy
Confinement	Conflict	Conflict resolution abilities
		Creativity in easing problems of confinement
		Organiser of leisure activities
Extreme environment	Danger and emergencies Poor health and inability to perform duties	Emergency response and risk management
		Balancing station demands and physical well-being of the team

Source: Summary by author based on literature reviewed.

Antarctic station leaders are responsible for the well-being of the station team, and need to be aware of the stressors and mediating techniques to improve Antarctic station life. The stressors could affect the well-being of the Antarctic overwintering individual, and could have adverse effects on the team and team climate.

2.4.3 Balancing gender, leadership and the Antarctic

During the Heroic Age, expeditions to Antarctica consisted solely out of men. From a literature review perspective, most models of the ideal polar personality were based on a narrow sample of men from a few national programs (Steel *et al*., 1997). With more women now becoming involved in Antarctic overwintering, these models may change, and insight into the female perspectives on overwintering and leadership could contribute to the literature.

The first national program to select two women to overwinter in the Antarctic was that of the United States, in 1974 (Aston, 2005), almost 15 years after IGY and the start of Antarctic overwintering organised by national programs. Sarris and Kirby (2005:162) reported that men still formed the great majority of overwintering personnel, with a ratio of one woman to eight men.

Bowers *et al.* (2000, cited in Schmidt *et al*., 2005:924) found that gender heterogeneous groups delivered slightly higher performance levels, but this was measured in a traditional work environment, and these findings could differ in the Antarctic setting. Historically, successful and remarkable expeditions have been either homogenous, such as the all-male team of Scott, or chosen specifically for compatibility, as in the case of Amundsen (Stuster, 2000:54).

Steel *et al*. (1997) found that the personalities of men and women who are interested and suitable for polar work are similar, which could imply similar needs regarding leadership. However, in terms of interpersonal expressiveness, women were found to differ significantly from men at Antarctic stations (Leon & Sandal, 2003:260). It seems that the different genders could provide different perceptions when evaluating Antarctic station leaders.

Rogelberg and Rumery (1996, cited in Schmidt *et al.*, 2004) found that the presence of women in teams reduced men's competitiveness. Bishop (2004:C17) reported that the presence of both genders normalised the group behaviour, and there is growing evidence that shows that a balanced mix of men and women leads to better long term performance, as is required for Antarctic expeditions.

National culture and the maturity of an Antarctic national program could play a role in gender-based experiences at Antarctic stations. The first Australian woman spent a year at Macquarie Island in 1977, and the first female station leaders served at Mawson and Macquarie Island as early as 1989 (Riffenburgh, 2007:1095). Eleven years later, in 2000, the French sent their first two women to overwinter at Dumont d'Urville (Rosnet *et al*., 2004).

Schmidt *et al*. (2004:685) found no evidence to suggest that gender influenced team member perceptions of team climate at Australian Antarctic stations. This differed dramatically from a study at Dumont d'Urville, where seduction behaviour occurred during the second winter the women shared with men, which led to rivalry, frustration and sexual harassment. The isolation and confinement were found to amplify and enhance the usual gender related problems, and added additional stressors to the overwintering team (Rosnet *et al*., 2004).

From a South African perspective, women overwintered for the first time on Marion Island from 1986 to 1987 (Cooper & Headland, 1991:86), and the first woman to spend a year in Antarctica did so as late as 1997 (SANAP, 2016d). The literature revealed very little about South African women in Antarctica, their perceptions or their leadership needs.

Men seems to fit better into the Antarctic station life than women do (Sarris, 2007:887), but this could be skewed, considering that women form only about twelve per cent of the Antarctic community. Sarris and Kirby (2007:719) also found that gender perceptions differ, specifically when it comes to Antarctic station culture. Men described Antarctic stations as friendly, open and participatory, whereas women found them to be rule- and hierarchy-orientated and not participatory. Sarris (2006:369) suggested a change in Antarctic station culture, aimed to improve the cultural fit for women expeditioners, who required increased job satisfaction, clearer roles and less conflict in their roles. This could point to the gender specific leadership needs of women at Antarctic stations.

General differences between men and women may imply different leadership styles. Bishop (2004) found that, when generalised, men leaned more towards an efficient and task-orientated approach, where women focused on interpersonal concerns about well-being. The genders also differed when considering communication styles, response to crowding, need for privacy and need for affiliation.

Eagly and Johnson (1990) reacted critically towards the stereotypical approach that women lead with an interpersonal-orientated style and men with a task-orientated style. Their view had support in the literature, which showed little evidence of these distinct styles when evaluating gender-based leadership styles in an organisational setting. Their own research, however, revealed some evidence

of gender-specific leadership styles. Women portrayed a more democratic or participatory style, while men leaned more towards directive and autocratic approach.

Women are becoming more prominent at Antarctic stations but are still vastly under-represented. The female presence could introduce additional stressors to the Antarctic station environment, but also normalise the station life. Gender difference could imply different leadership requirements, though little evidence of this was found in the literature about extreme and isolated environments. Gender diverse groups in the Antarctic can work, but this may depend on nationality, the maturity of the Antarctic program and the ages of the team members.

2.4.4 Returning expeditioners

Irrespective of the psychological and physiological stressors experienced by Antarctic station personnel, it is not uncommon for individuals to overwinter more than once (Taylor, 1969, cited in Rothblum, 1990).

The salutogenetic effects that some overwintering personnel experienced during their tour of duty could serve as a motivator to return to the extreme and isolated conditions (Leon *et al*., 2011:356). Leon *et al.* also discussed that the personal growth, sense of accomplishment and transformation of values an Antarctic overwinterer experienced during their year could influence their decision to return.

The successful completion of previous Antarctic expeditions does influence the perceptions individuals may have (Schmidt *et al*. 2005:925), which can affect their decision to overwinter again. Wood *et al*. (2000:87) reported that 25 per cent of Australian overwinterers return to complete two or more tours of duty. The literature, however, revealed little about returning expeditioners, their motivators and their requirements regarding leadership.

2.4.5 Crisis and emergency management in Antarctica

The adaptation to Antarctic station life could be affected by long periods of conflict, trauma, emergencies or even death. The station leader must be able to deal with these situations and to maintain individual and team well-being.

Prolonged conflict and tension, or acute stress, have been found to have a cumulative effect on an individual's ability to cope with a further stress events (Orasanu & Lieberman, 2011:10). The authors reviewed the acute stress experienced by submarine crewmembers, and found that this affected their ability to cope with crisis events.

Palinkas (1992:651) reported that acute exposure to stress, similar to what could be experienced at an Antarctic station with prolonged tension and conflict, increased the risk of contracting a disease or illness. Under extended and extreme stress, follower performance was affected by their leader's ability to instil trust, to keep them focused on the task or goal, and the way the leader responded to followers' concerns and expectations (Hannah *et al.*, 2009). This could imply that to improve team

performance in a stressful situation, such as an emergency in Antarctica, a station leader must be both trustworthy and open to input from the team.

Drawing analogues from space theory, Kanas *et al*. (2009) discussed a phenomenon called displacement, which occurs when astronauts experience high levels of interpersonal conflict, anxiety and negative emotions, with no outlet. Used as a coping mechanism, displacement prevented open conflict in a confined team environment, but resulted in blocked emotions, poor team cohesion and territorial behaviour. The isolation of Antarctic stations makes team members particularly vulnerable for conflict (Rothblum, 1990), making this a risk factor for team members and a focus area for station leaders.

When considering the extreme environment in which the Antarctic station team operates, it is highly likely that extreme events can occur. Hannah *et al*. (2009) defined an extreme event as "a discrete episode that may result in an extensive and intolerable magnitude of physical, psychological or material consequences to organisation members".

An example of an extreme event in Antarctica occurred at Rothera station in 2003, when a leopard seal dragged an overwintering member underwater during a scuba dive (Muir, Barnes & Reid, 2006). Members of her team manged to recover her to administer emergency first aid. She was pronounced dead on the station. Another extreme event saw three members of a British field party killed in October 1965, during a survey of the Heimefrontfjella mountain range in East Antarctica. Their tractor dropped into a crevasse and the recovery of the tractor and the bodies failed (Spaeth, 2009).

Overwintering teams are dependent on their Antarctic station for life sustaining services. Auerbach (2011) discussed a fire at Vostok station in 1982, where one team member died and many were injured. The team was without heating and power for eight months during the Antarctic winter. In 2014, Halley Research station encountered a major technical issue, which resulted in losing all electrical and heating systems in the middle of winter (BAS, 2014). Some power and heating was restored, but the station was not able to return to normal operation.

Trauma events, such as death of a team member, and emergencies, such as loss of life-sustaining services, would require effective leadership to deal with the crisis at hand and its effects on the team from a physical, emotional and cognitive perspective. During catastrophic events, Sorokin (1943, cited in Hannah *et al.*, 2009) found that team members distorted the way they processed information and made decisions because they were overly aroused and emotional. A station leader who is grounded, calm under stress and not overly emotional, could lead and guide team members under these circumstances.

Vroom and Jago (1988, cited in Klein *et al*., 2006:602) advised that when time is of the essence, as in life and death situations, autocratic leadership was more beneficial. Bass (2008, cited in Hannah *et al.*, 2009) confirmed that followers reacted positively to leaders who provided rapid and authoritative responses in threatening situations, even if the decisions made by the leader were poor.

A dominating and aggressive leader who reacted quickly could override the debilitating effects that followers experienced during emergencies, when they became vulnerable, immobilised and overwhelmed.

Poor decisions and an authoritative approach affected the ability of the team to provide input into life threatening situations, as happened during the 1996 Mount Everest climbing tragedy (Kayes, 2004; Hannah *et al*., 2009). Authoritative leadership inhibited team performance, prevented any input from other experienced guides, and the drive to achieve the goal ultimately led to the death of various climbers.

Hannah *et al.* (2009) also mentioned that leaders who were less intimidating, accepted input from followers, explained their decisions and communicated regularly, also remained effective in extreme contexts. With two conflicting leadership approaches in extreme events and situations, it is not clear whether an authoritative or more participatory approach would best suit Antarctic station leaders when confronted with an extreme situation.

Extreme events are a reality that Antarctic expeditioners face, and the station leader must be equipped to deal with emergencies and acute stress in the Antarctic station environment. Leaders who are trustworthy, grounded, calm under stress and not overly emotional could be beneficial in emergencies. It remains unclear whether it is preferable that these leaders should be authoritative or more participatory in their approach.

2.5 THE CONTEXT OF LEADERSHIP IN ANTARCTICA

2.5.1 A history of Antarctic leadership

The history of leadership in Antarctica started with the early explorers, who commanded ships with crews that braved the Southern Ocean and explored the then-unknown Antarctic continent. These expeditions differed dramatically from modern day Antarctic overwintering. The expedition leader appointed his own personnel, was intimately involved in almost all the aspects of expedition planning and execution and, most importantly, had decision-making autonomy (Godwin, 1987:3).

Modern station leaders contribute little to the planning and preparation of expeditions, and decision-making autonomy is influenced by the supervision of the national program (Godwin, 1987:3). It may still be of value to look at leadership characteristics historically found in Antarctica and the Arctic, by evaluating well-known explorers such as Dr Fridtjof Nansen, Roald Amundsen, Captain Robert Falcon Scott and Finn Ronne.

Nansen was an innovative Norwegian explorer known for his feats at the North Pole, where he designed and built a custom polar vessel, the Fram, to prove the theory of polar ice drift from 1893 to 1896 (Suedfeld, 2000:643). Stuster (2000) discussed the many characteristics that distinguished Nansen from other polar explorers of his time, which contributed to the ultimate success of the expedition.

Nansen believed it was ‘the man that matters’ and that the physical and psychological well-being of those under his command could mean the difference between success and failure. Nansen paid attention to every detail of the expedition, devised contingency plans, and he designed and tested custom equipment for the voyage.

Most of all, his leadership style differed from that of his peers of the nineteenth century. He had an egalitarian approach, compared to the autocratic and military style of leaders of the time (Stuster, 2000:52). Through his approach, he fostered group solidarity and ultimately achieved the goals of his expedition. Suedfeld (2010:643) described Nansen as the ideal leader for exploratory missions, and held his example as an ideal type to lead missions to Mars.

Following in the footsteps of Nansen was another famous Norwegian, Roald Amundsen. Bown (2012:327) described how Amundsen’s comrades praised him for his leadership qualities. They appreciated his warmth, sense of humour and generosity. This same leader, however, was also described as a hard taskmaster and sometimes sharp in the way he spoke to his team. His men complained in the privacy of their own diaries that he was abrasive and brusque under stress.

For his South Pole expedition, he surrounded himself with men of skills. His small team of experts required a strong, in-touch and self-confident leadership style (Fisher, 2011). Amundsen’s job was to lead his team to victory and bring them back alive (Brown, 2012:327). Despite the stress and constant life-and-death decisions that he was forced to make on a regular basis, he was still perceptive of the feelings and emotions of his comrades, and shared credit for the expedition’s success with his team (Bown, 2012:328).

Despite the way Amundsen treated his team when he was under stress, many signed on for more than one expedition with him. This apparent contradiction is significant. It is possible that Amundsen’s strong leadership and caring nature overshadowed his shortcomings. It is also possible that the maturity of his team, and their dependence on and trust in his skills and expertise, allowed his team members to more easily deal with his harsh words. This may point to the importance of trust in Antarctic leadership and also emphasises the significance of the inclusion of multi-expedition team members and the maturity of the team.

Scott’s expedition to reach the South Pole differed from that of Amundsen, as he led a large expedition that was multi-faceted, and contained elements of both exploration and ambitious science projects (Larson, 2011). From Suedfeld (2010), he received a lot of posthumous criticism, and was described as conventional, a poor organiser, dull, inflexible in his approach and steeped in military hierarchy. His poor planning and refusal to change decisions ultimately lead to the death of himself and his entire polar party.

Huntford (2012) described how Scott was unable to understand and connect with those around him, even more so with the men who did not share his background. He struggled with conflict resolution and had to resort to military authority to enforce his leadership. He kept officers and scientists apart

from the seamen, enforcing cliques in his team. According to Huntford, Scott was self-centred and antagonised his team members.

Cavell (2010) found that as a young officer, he had great personal charm. His naval colleagues and expedition team members described him as bold and courageous, a firm decision maker and one who had the nerves to get things done. It seemed that his good characteristics were contradicted by his moodiness, depression, highly-strung nature and inability to keep his emotions in check.

Scott failed to achieve the principal objective of his expedition, to reach the South Pole and return alive. However, his team of scientists made significant contributions to Antarctic science (Larson, 2011) and helped to open the Antarctic continent to scientific research. Scott remains a significant Antarctic leader and his failure at one element of the expedition should not overshadow the achievements he and his team made in terms of science and logistics of Antarctic operations.

However, while his hierarchical and inflexible leadership approach may have been appropriate for the naval element of the expedition, and might work in larger teams, it seems to have failed on the Antarctic continent and with the smaller team he led to the South Pole. One could deduct from this that the leadership approach required for successful Antarctic expeditions might be influenced by another element, namely the size of the team.

Suedfeld (2010) also discussed the failure in leadership from Finn Ronne, a Norwegian born U.S. military polar explorer who worked with Admiral Byrd and managed the Ellsworth station during IGY. He shared characteristics with Nansen and Amundsen, as he was considered an excellent organiser and a hard worker. However, his military leadership style was characterised by mistrust, punishment and was generally authoritarian. This led to conflict with the civilian scientists, who responded with disobedience, rudeness and ridicule.

The evaluation of four leaders in extreme environments is too small a sample from which to draw conclusions about the type of leader that has been found successful in past Arctic and Antarctic expeditions, but this has provided a perspective on the characteristics and other elements required for successful Antarctic leadership. Individual leadership characteristics, the leadership approach and teaming elements could potentially play a role in Antarctic expeditions. Elements such as trust, team maturity, and number of team members could affect the successful outcome of the expedition. The environmental context can also play a role, such as that a military approach is not always successful when dealing with civilian scientists, nor enforcing naval discipline on a continental Antarctic station.

Nansen’s ability to foster team solidarity, and both Nansen and Amundsen’s focus on the well-being of their teams seemed to influence the successful outcomes of their expeditions. In contrast, the military, inflexible and hierarchical approach followed by Scott and Ronne affected their expedition’s goals and, in the case of Ronne, caused outright rebellion.

There are clear differences in the four leaders discussed. Leaders who focused on individual and team well-being seemed more successful than leaders who placed hierarchy and goal achievement first. Leaders in Antarctica, however, are tasked with both these outcomes, which highlights the challenges to leadership in Antarctica.

2.5.2 The role and challenges of the Antarctic station leader

The Antarctic station leader's effectiveness could have a notable effect on both the quality of life of the expedition team, as well the achievement of the goals of the expedition (Schmidt *et al*., 2005:924). The station leader has a responsibility towards achieving the goals of the national program (Godwin, 1987:3), and needs to ensure that Antarctic Treaty requirements, policies and procedures are adhered to and administrated effectively (AAD, 2016).

A station leader at an Australian Antarctic station assumes responsibility for all aspects of safety, as well as the physical and emotional well-being of station personnel. They need to coordinate and manage expedition personnel during deployment, which includes performance management and shared station duties (AAD, 2016).

The station leader is the highest authority on the remote station and serves as the representative of the national government. The responsibilities can include the management of aviation, boating, construction and field activities (AAD, 2016). If needed, the leader may be called to act as a Deputy Coroner or function as a Special Constable (AAD, 2013).

Complex reporting structures between the team members, their professional supervisors, the station leader and authorities at the national program headquarters complicate the authority of the station leader, and affect the position, as well as the followers' perceptions (Godwin, 1987:9). The station leader could potentially lose authority if the national program or professional supervisors override station decisions.

Godwin (1987) found that when the station leader has no other function except fulfilling the duties of a station leader, it could lead to challenges in producing tangible achievements. Without a formal trade or profession to practice at the station, such as a mechanic repairing vehicles, station leaders could experience low levels of achievement and satisfaction. They are responsible for mostly intangible elements of station life, such as conflict resolution, team morale and motivation. The station leader remains an individual, as well as a leader, and negative personal experiences can potentially affect their ability to lead.

Kanas and Ritsher (2005:933) discussed two leadership roles that are defined in the literature, task and supportive. The task, or instrumental, role focuses on the work or operational needs, whereas the supportive, or expressive, role addresses emotional needs and the group morale. For the Antarctic station leader, the task leader role forms a prominent part of the job at the start of an expedition, whilst team members are adjusting to the new environment. Kanas and Ritsher then

describe a transition to where the supportive role becomes more prominent, with the station leader more focused on the emotional well-being of the team.

Johnson *et al.* (2003) observed that station leaders should keep up team morale by dealing with various issues before they could negatively affect team members, such as addressing abusive individuals and managing the overindulgence of alcohol. Shared station duties and program goals must be achieved without overworking and tiring out the team. At the same time, the station leader must be able to maintain relationships through work and social engagements, without losing authority.

A major challenge faced by station leaders is that their exposure to the same psychological and physiological stressors as the rest of the team, besides the pressure resulting from leadership (Suedfeld, 2010:643) and the intangible aspects of their role.

It is clear that the assumption of these different roles at different times by the Antarctic station leader requires a unique individual who is acutely aware of the situation in which they find themselves, and fosters a high situational awareness. They must be able to switch between the task and supportive roles when needed. The supportive role may require a close and personal relationship with team members, to better assess well-being and team morale.

The personal relationships required to gauge team well-being could be affected by the perception of an individual Antarctic team member. Any discord between the perceptions of individual team members and reality, regarding the Antarctic station leader's approach and characteristics, could potentially have a negative effect on the station leader's ability to influence team members.

2.5.3 Leadership theory in Antarctica

Leadership style affects adaptation to Antarctic station life. Stuster (1996, cited in Suedfeld, 2010:642) went as far as saying that good leadership means more to mission success than good habitability. Schmidt *et al.* (2004:685) confirmed that effective leadership was found to impact team climate. This section will investigate leadership theory, approaches, and their application to small groups in Antarctic stations.

Leonov and Lebedev (1975, cited in Johnson, Boster & Palinkas, 2003) found that the weak leadership of some polar expeditions, has been associated with the catastrophic failure of those expeditions. The leader of an expedition in an extreme environment can have a notable impact on the quality, and ultimate success, of the expedition (Schmidt *et al.*, 2005:924).

The Antarctic team is multi-disciplinary and comprises individuals who are specialists in their field (Wood, Hysong, Lugg & Harm, 2000:89). Reuveni and Vashdi (2015) reported that diverse backgrounds and different paradigms could cause disagreement and tension in multidisciplinary teams, leading to communication breakdowns and decreased performance. A transformational leadership approach has been found to moderate the differences in multidisciplinary teams, and it may be suitable for Antarctic station leaders.

Nelson (1962:10) studied a station with twenty personnel and found that a democratic leadership style led to greater social compatibility and efficiency. In contrast, a larger group of forty team members also achieved efficiency and compatibility, although with an autocratic leadership style. This resonates with the different leadership approaches by Amundsen and Scott, where Amundsen's smaller team might have required a different style than Scott's larger team. This confirms that team size could play a role in the leadership approach.

Godwin (1987:12) argued that, in the unique Antarctic station setting, there is no specific leadership style that can be chosen and applied to the suite of decisions a station leader is faced with during the leadership tenure. He did find, however, that some styles are better suited to the environment. A consultative and participative approach to leadership was found to be more effective than an authoritative and directive approach.

The participative style suggested by Godwin gives team members an opportunity to provide input into decisions, which can foster greater commitment. This is of special importance in small teams, such as those at Antarctic stations, where the limited personnel numbers requires better use of each of the team members (Godwin, 1987:12).

Suedfeld (2010:644) evaluated leaders of past polar expeditions, and found that those who were good planners and flexible enough to change their decisions fared better. They were open to consult with team members, but retained the final authority. This emphasises the common thread of a more participatory approach at Antarctic stations, which involves consensus from the team, although the final authority remains with the station leader.

According to Palinkas (cited in Johnson *et al*., 2003), effective Antarctic station leaders should ideally have had previous leadership experience. They must communicate expedition goals, remain flexible, and it is important to interact with team members at the station. Interaction with team members is particularly challenging for station leaders, as they must be able to maintain relationships through work and social engagements, without losing their authority.

Leon *et al.* (2011:357) concurred that station leaders must be clear about everyone's roles and responsibilities. They must be open to the opinions and advice of team members, again leaning towards a participative approach. The theme of station leaders and their responsibility towards individual and team well-being surfaced again. Leon *et al*. found that station leaders should sensitise themselves to the needs of team and team member.

Wood, Schmidt, Lugg, Ayton, Phillips and Schepanek (2005) studied isolated Antarctic groups over a period of ten years. This longitudinal study found that effective leadership correlated positively to team climate and station cohesion. This study showed that highly regarded leaders fixed problems, united the team, solicited feedback and rewarded good behaviour.

Lovegrove (2013) identified the categories and characteristics that successful station managers must have to lead a team in an extreme and confined environment, classifying them by the ability to relate to others, emotions and self-attitude, and their style of thinking.

Table 2.2: Categories and characteristics of Antarctic station leaders

Relating to others	Emotions and self-attitude	Style of thinking
Trust	Self-awareness, stability and self-control	Openness to change
Communication	Low anxiety or neuroticism	Grounded and consistent approach
Reserved warmth	Optimism and humour	
Reduced sensitivity	Integrity and leading by example	

Source: Lovegrove, 2013.

Two important classes of leadership play a role in the Antarctic, the formal and the emergent leader. Huntford (2012) emphasised the difference between a formal leader, such as one appointed by a distant authority, and the psychological leader, who emerges through natural selection by team members. The Antarctic station leader represents formal leadership, but it cannot be taken for granted that the leader will naturally transcend to the position of psychological leader in the team.

It is clear that leadership plays an important role in the Antarctic station team and climate. External elements, such as professional diversity, emergent leadership, and team size, could influence the leadership approach. There are models available of the ideal station leader, and the literature provided many individual and behavioural characteristics that ideal leaders in Antarctica might possess.

From the perspective of the team member, the station leader's personal and behavioural characteristics, as well as their approach to leadership and leadership style, affected the quality of the expedition. Knowing which characteristics and approaches team members find important in station leaders, could assist national Antarctic programs when selecting station leaders.

2.5.4 Antarctic team composition and selection

Antarctic team selection takes place annually for most Antarctic programs. The British Antarctic Survey (BAS) selects and recruits annually, between March and August, and staff are deployed, by air or by sea, between September and November (Grant *et al.*, 2007:793). Overwintering staff could spend between twelve and fifteen continuous months at their respective stations (Sarris & Kirby, 2005). This relatively short period from appointment to return is all the time that station leaders have to get to know the team, form personal relationships, and establish a rapport with those around them in order to deal with the personal and environmental challenges that come with overwintering.

The team composition at SANAE IV station, as with most Antarctic stations, has a support and science component. The support team consists of a doctor, two diesel mechanics, a mechanical

engineer, an electrical engineer, and an electronic engineer. The smaller science contingent comprises a meteorologist and two to three electronic engineers to maintain physical science, mainly space physics, programs (SANAP, 2016b). Each Antarctic station also has a station leader. Some national programs include the leader role as an additional responsibility for an existing team member (SANAP, 2016c), whereas other programs appoint an individual solely for this function (AAD, 2013).

On the Sub-Antarctic island of Marion, a larger research programme is undertaken, which includes oceanography, biology, meteorology, and geology studies by wintering personnel (SANAP, 2016b). The multidisciplinary nature of the teams sees scientists, professionals and tradespeople of various ages working and living together at an isolated station, which could introduce conflict and issues associated with diverse and multidisciplinary teams.

During the Heroic Age of exploration, medical support was optional. Roald Amundsen wrote in his diary ‘we had no physician, and we didn’t need one’ (Bown, 2012:152). All the members of his expedition returned alive. With the onset of formal overwintering stations, medical support changed. The medical doctor now forms an important part of the Antarctic station team (Grant, 2004:358).

The conditions of the Antarctic winter pose unique challenges to the overwinterer. Grant *et al*. (2007:793) stressed the importance of selecting suitable personnel to face the conditions of the Antarctic winter: danger, monotony, remoteness, isolation, confinement, and the enforced togetherness. Not all people react in the same way to prolonged periods of isolation and confinement. Some never adapt to the trying conditions at an Antarctic station, whereas others display a strong ability to cope, and even thrive, in these environments (Rivolier, Bachelard & Cazes, 1991:291).

National Antarctic programs employ different strategies when selecting personnel, which sometimes involves rigorous selection procedures (Steel *et al.*, 1997). Sarris and Kirby (2005:162) found that poor selection decisions could lead to social and economic cost implications to the individual, the team and the national program.

By including psychiatric evaluations and psychological testing, national programs can select out high-risk individuals who will not be suitable team members for overwintering (Grant *et al.*, 2007:793). Select-in policies rely on certain traits and characteristics that have been found favourable for Antarctic overwintering (Grant *et al.*, 2007:793). This approach could have a positive effect on the quality of station life and improve work performance (Palinkas & Seudfeld, 2009:160). Ultimately, selecting the right people for overwintering eases the burden of the station leader, who must deal with the adaptation problems and conflict caused by poor selections.

The Australian Antarctic Division (AAD) uses both select out and select in practices when appointing overwintering personnel (Harris, 2014:26). The AAD evaluates four critical factors to ensure effective performance in Antarctica (Comcare, 2013:14), by reviewing a person’s ability to perform the task, medical fitness, mental stability and resilience.

A study by Gunderson and Nelson in Stuster (2000:55) also found that effective performance at United States Antarctic stations was highly correlated with certain behavioural traits. Three categories have been used for the screening of Antarctic personnel at U.S. Antarctic stations over the past three decades:

i) Emotional stability, characterised as ‘calm’ and ‘even tempered’;
ii) Task performance, characterised as ‘industrious’ and ‘hard-working’; and
iii) Social compatibility, characterised as ‘friendly’ and ‘popular’.

BAS prefers to exclude psychological selection procedures and rely on the professional judgement of in-house staff with experience in Antarctica. Team selections are based on interviews, a basic assessment of mental state and operational criteria (Grant *et al*., 2007:793). The literature revealed little about the selection procedure and criteria used by SANAP.

Antarctic teams are multidisciplinary by nature. Some national programs do a thorough screening of individuals before appointment, which usually includes medical, psychological and social elements. There is a high cost associated with getting the selection wrong, both to the team in the Antarctic and the Antarctic program.

2.5.5 Antarctic station leader selection

The approaches used to screen and appoint the station leader differs among the national programs. At BAS managed stations Halley, Rothera, Bird Island and King Edward Point (Grant *et al., 2007:*795), station leaders are appointed on invitation from management. BAS rely on individuals who have experience and a proven record in Antarctica (Lovegrove, 2015). BAS stations refer to the station leader as the ‘base commander’, purportedly to maintain and support good discipline (Harris *et al*., 2010).

AAD performs a multi-level process, which includes rigorous interviews and testing for station leaders, and places a heavy focus on candidates displaying values like integrity, respect and empathy. The selection process, described by Robertson (2013), starts with a comprehensive application form, followed by a telephonic interview. Shortlisted candidates need to undergo medical screening, followed by a security check, since the role requires a candidate who is qualified to operate on a Highly Protected/Confidential level in service of the Australian Federal Government.

The Minnesota Multiphasic Personality Inventory test is used by AAD, to screen the mental health of candidates. The last stage of the process occurs in a selection centre, where candidates spend a week with observers, running through various scenarios, both indoors and outdoors. Candidates are tested on a wide range of experience, including waste management, environmental protection, risk assessments and search and rescue operations. Individual skills, such as negotiation, public speaking, problem solving and reactions when confronted with ambiguity, are also tested.

At SANAP, the station leader, referred to as the team leader, is chosen from the members of the expedition team. The leadership duties are seen as being additional to the team leader's station role. SANAP requires a team leader candidate to have at least a bachelor's degree and prior knowledge of administration and staff control (SANAP, 2016c).

National programs have different concerns when it comes to appointing Antarctic station leaders. Program such as AAD and BAS place a strong focus on prior experience and candidate suitability. SANAP place less focus on leadership and more on the administrative aspects of the position. AAD prefers a well-rounded individual with very specific experience in disciplines such as waste, fire and crisis management.

2.5.6 Concluding on key issues and competencies for Antarctic station leaders

From the study of the overwinterer and the challenges that station leaders experience during their tenure, various leadership competencies have been identified. The theory on leadership in Antarctica has also revealed a multitude of competencies that leaders could possess to better fulfil their roles at Antarctic stations.

These competencies have been divided into three classes, individual competencies, behavioural competencies and experience. The experiential competencies come with the specific professional experience that the station leader brings from his or her professional background. The table below summarises the major categories.

Table 2.3: Summary of leadership competencies for Antarctic station leaders

Individual	**Behavioural (towards others)**	**Experiential**
Able to relate to others	Sensitive to the needs of others	Emergency response
Communication	Empathy	Good planner and organiser
Flexibility, open to change	Fosters personal relationships	Previous leadership experience
Emotionally intelligent	Negotiation	Clear about goals, roles and responsibilities
Creative problem solving	Comfortable with diversity	Waste management
Comfortable with ambiguity	Unites the team, fosters solidarity	Risk management
Mental stability	Trustworthy	Environmental protection and conservation
Resilience	Open to input from others	Search and rescue
Calm under stress	Comfortable social interaction	
Not overly sensitivity	Conflict management	
Optimistic	Respect	
Situational awareness	Maintains discipline	
Self-awareness	Shared leadership, delegation	
Self-control		

Source: Summary by author based on literature reviewed.

Various themes emerged from the examination of leadership at Antarctic stations. One prominent theme was the balancing act required by station leaders, when they are responsible for the emotional well-being of the team whilst managing the goals of the expedition and station duties.

Leaders must also strike a balance between retaining authority and maintaining discipline, while fostering a personal relationship with team members and interacting with them socially. The social distance between the leader and the follower influences the effectiveness of the station leader. According to Hannah *et al.* (2009:907), older research had indicated that maintaining a social distance allowed leaders to be more effective. Conversely, social closeness was associated with trust and better cohesion, which ultimately led to a strong sense of belonging, reduced stress, and fostered willingness to sacrifice more for the sake of the organisational goal in teams.

Station leaders are exposed to the same psychological and physiological challenges caused by the Antarctic station environment, as the team is, but they must remain objective in order to deal with discipline and team problems, and look after the well-being of each team member.

The station leader's style or approach is affected by various environmental factors, such as the size of the team, the measure of diversity and the maturity of the team. The leadership approach would potentially also be affected by gender, as well as the situation in which the team found themselves in, such as an emergency.

The next section looks into some of the theoretical aspects of leadership, such as the competencies of an effective leader, different leadership styles and their relevance to an Antarctic station leader. It will also investigate distressed organisations, the impact on employees and the type of leadership that is needed when organisations experience distress.

2.6 THEORETICAL PERSPECTIVE ON LEADERSHIP

2.6.1 An effective leader

Leadership involves persuading a group of individuals to willingly pursue a common goal, by setting aside their individual goals and concerns (Hogan *et al.*, 1994:493). Effective leaders are faced with complex environments, and one must be able to think and operate multi-dimensionally and exhibit significant emotional and behavioural attributes to cope with them (Jogunola, 2013:20). This correlates with the emotional intelligence aspects of leadership identified by Lovegrove (2013), who described the emotions and self-attitude aspects of station leaders.

Because traditional leadership involves the persuasion and influence of team members, it is important to understand how this is applied. Argyris (1957, cited in Hersey *et al.*, 1979) found a direct relationship between the maturity level of individuals or groups and the kind of power bases that can used to influence their compliance. Coercive, connection, information, legitimate, referent and reward power have been found to be potential means of inducing compliance and influencing the behaviour of others (Hersey *et al.*, 1979).

The maturity of the team is not the only maturity that matters. Avery (2004, cited in Joseph, 2008:11) found that leaders who possessed a high level of emotional maturity were able to maintain cooperative relationships with those around them. This was supported by Rosete and Ciarroachi (2005, cited in Joseph, 2008:11), who found that leadership effectiveness correlated with emotional intelligence.

Emotional intelligence in leaders is characterised by high levels of self-awareness, self-management, self-motivation, empathy and social skills (Luthans, 2002:67), which enable leaders to recognise and regulate emotions in themselves and those around them. Emotionally intelligent Antarctic station leaders could be better equipped to foster and maintain relationships with team members.

A leader is deemed effective if the team tasks and team maintenance are completed, that is, if the goals of the team's purpose are achieved (Burke, Stagl, Klein, Goodwin, Salas & Halpin, 2006:289). Hogan *et al*. (1994:495) suggested another evaluation of leadership effectiveness by using the perception of the team members. Subordinates felt that effective leaders were measured in their integrity, where trustworthiness emerged as the single most important characteristic. Vanhove *et al*. (2014:77) did find that evaluations by subordinates of their leader's performance, specifically in small and dependent communities, could be harmful to both individual and group performance, interpersonal relationships and trust.

Since the station leader is part of the Antarctic station community in a work and a social position, performance evaluation by team members during their tenure may have adverse effects on the team. A study that measures the perceptions of team members about their leaders, after the successful completion of an expedition, may prevent these issues.

Perceptions about leadership should not always be taken at face value, because of the difference between the actual characteristics of effective leaders and leader-like characteristics. Hogan *et al.* (1994:497) found that characteristics that were perceived as leader-like included intelligence, aggressiveness, honesty, determination, sociability, verbal skills, understanding, and industriousness, but that possessing these characteristics did not imply effective leadership. A formal study of effective leaders by Bray and Howard (1983, cited in Hogan *et al.,* 1994:498) found that ambition, readiness for decision-making, resistance to stress, a high tolerance for uncertainty, conscientiousness and intellect serve as predictors of advancement.

The effectiveness of a leader can be measured, from the perspective of the team members, by gauging their ability to influence others to attain a common goal. However, characteristics that team members feel to be leader-like do not always translate to effective leadership. The perceptions of South African Antarctic expeditioners might also include leader-like characteristics that may not be effective at Antarctic stations.

The maturity of the team could determine the approach the station leader must follow to influence the team members effectively. With a personal relationship with team members and a high level of emotional intelligence, this would be easier to achieve. The perceptions of team members regarding what a station leader should look and act like could potentially influence the leader's ability to influence them.

2.6.2 Styles matter

2.6.2.1 Situational leadership

Situational leadership calls for a leader to match the leadership style applicable to the specific task, or to the nature of their subordinates (Klein *et al.*, 2006). Both Byrt (1978) and Adair (1968), cited in Godwin (1987), stressed the importance of leadership effectiveness based on the situation in which the leader finds him or herself.

At an Antarctic station, it is possible that different approaches could be required at different times during both the task role and the supportive role that Antarctic station leaders need to take on. Godwin found the situational leadership model to be the most effective in small groups, which may make it relevant to South African Antarctic stations.

Age, gender and professional diversity in Antarctic teams may also call for a leadership approach tailored for a specific individual or situation. Hersey (1979) discussed four approaches that could be employed in situational leadership: telling, selling, participating, and delegating.

Telling, or authoritative leadership, is directive and was found appropriate for low maturity groups and individuals that needed supervision. Selling is also directive, but suited to groups who were willing, but not yet able, to take responsibility. Moving along the continuum, moderately to high maturity groups worked better with a participative style of leadership. Highly mature groups responded best to a delegating approach.

2.6.2.2 Authoritative leadership

With an authoritative leadership style, followers have limited participation in decision-making (Jogunola, 2013:18). This style is characterised by behaviour that sees the leader making decisions in isolation, without consulting team members (Burke *et al*., 2000). Kiazad, Restubog, Zagenczyk, Kiewitz and Tang (2010) found that authoritative leaders are characterised by a need for control, structure and rules. They can reward followers for compliance, but these leaders also assert dominance through threats and intimidation.

This style is autocratic and has been found to lead to a high level of dissatisfaction in groups (De Beer, 2009:12). This approach could introduce conflict in an already sensitive environment at an Antarctic station. However, there are conditions in which an authoritative style could be effective, especially when there is time pressure or when input from team members will not change the final decision (De Beer, 2009).

A station leader may need to make confidential decisions that cannot be decided democratically, or make decisions under pressure during emergencies. It seems that this approach could have its uses in certain situations, but not as the everyday approach.

2.6.2.3 Participative leadership

The participative, or democratic, leader acts as a facilitator, where team members are involved in identifying goals, procedures or outcomes together (Jogunola, 2013:18). A station leader could employ this approach when decisions or problem solving are needed that will affect the whole team at the Antarctic station.

Despite the participation of team members, the leader maintains the ultimate decision-making responsibility. The difference is that the group feels more committed, because they have been part of the decision-making process (De Beer, 2009:10). This approach is not always practical when time is of the essence, or when a range of different opinions could result in conflict.

2.6.2.4 Transformational leadership

Transformational leaders use charisma, inspiration, intellectual stimulation and individual needs to motivate followers in the pursuit to achieve the organisational goals (Joseph, 2008). They are enablers, who empower their followers (Coetzee, 2008), and increase follower commitment, loyalty and individual contribution (Joseph, 2008).

Antarctic overwinterers are contract working professionals and usually experts in their individual professions. Transformational leadership does not offer them a lot in terms of the fulfilment of their professional duties. However, it may be possible to use transformational leadership to inspire the team members when it comes to performing their shared station duties.

Kerney and Gebert (2009) found that a high level of transformational leadership was more effective in diverse teams, such as the multidisciplinary overwintering team. For the modern work environment, Lim and Ployhard (2004, cited in Reuveni & Vashdi, 2015) found this style effective to help employees to deal with quickly changing conditions, the continuous pressure to innovate, and general uncertainty, which is not similar to the conditions overwinterers face.

2.6.2.5 Authentic leadership

The trustworthiness of an Antarctic station leader was found to be an important personal characteristic. Trustworthiness is closely aligned with authentic leadership, as this leadership style instils trust in followers that leads to better work engagement (Hsieh & Wang, 2015).

Gardner, Cogliser, Davis and Dickens (2011) describe how authentic leadership is based on values and is oriented towards building interpersonal relationships with followers. These leaders accept responsibility for their own actions, outcomes and mistakes, and do not manipulate their followers, but lead from the heart.

The trust and relationship themes resonate strongly with what is required from an Antarctic station leader. The lack of boundaries between the social and work environments does not allow the leaders to act differently in these contexts, and authentic leaders whose moral values permeate their actions can fulfil this role.

2.6.3 Leading the distressed

Leadership studies at Antarctic stations could provide interesting insights into the traditional business environment. Organisations can find themselves in a distressed state. Onich (2009) described the environment in which a distressed organisation finds itself as 'harsh, unforgiving and ambiguous', which is similar to the isolated, confined and extreme environment in which Antarctic stations operate.

Leadership seems to take the centre stage, as lack of leadership capacity was found to be a major cause of organisational illness (Puplampu, 2005:256). According to Kanter (2003), leadership is also the most important element to enable a distressed organisation to do a turnaround.

Distressed organisations usually experience some form of financial distress (Kanter, 2003), or when their public image conflicts with the internal narrative, such as in the case of a declining business, a stagnant organisational climate or internal strife (Brenton, 1998). Once an organisation enters the spiral of decline, the distress it experiences has adverse effects on the workplace dynamics. Kanter (2003) described how employees and managers at distressed organisations found themselves in a culture of secrecy, finger pointing and isolation, which led to avoidance and turf protection. This resulted in passivity and feelings of helplessness in employees.

Organisational responses to distress, usually inspired by cost cutting, could include replacing employees, downsizing staff, restructuring and eliminating entire divisions (Brenton, 1998:232). When the relationship or trust between an employee and an organisation was violated, the employee felt disappointed and distressed (Morrison & Roberson, 1997:231).

Brett (1980, cited in Allen, Freeman, Russel, Reizenstein & Rentz, 2001:147) viewed the transitions an employee experienced when organisations downsized as a stressful life event. Sverke, Hellgren and Näswall (2002) reported that job insecurity, during times of distress, affected employee well-being, which resulted in various types of strain, and had a strong psychological impact.

Employees at these organisations need leadership to take them through the turbulent times and sustain good leadership in the long term (Slatter, Lovett & Barlow, 2011). Kanter (2003) suggested that an organisation in decline could be reversed through leadership that created a culture of open communication channels, respect, collaboration and initiative. BBC turnaround CEO Greg Dyke was known for his personal warmth, truthfulness, clear articulation of goals and open dialogue. He made a connection with staff and made time to hear them out (Kanter, 2003).

Slatter *et al*. (2011) described the ideal leadership approach when dealing with distressed organisations. It requires a leader who is absolutely decisive, and autocratic only for short periods to

implement decisions for survival. They have the ability to motivate and energise teams to achieve their best under the current pressure, by being articulate and convincing, to gather support for the turnaround. They are aware of their own shortcomings, but need to be excellent communicators.

Employees at distressed organisations share some similarities with team members at Antarctic stations. They are subjected to stressors and uncertainties that affect their well-being. Distressed organisations require unique leaders to achieve organisational goals under harsh conditions and deal with the stressors that employees experience under these extreme circumstances. Some of the characteristics that have been used to describe turnaround leaders were similar to descriptions of Antarctic station leaders. Perceptions of Antarctic team members regarding the requirements for leadership may be similar to the perceptions of employees in distressed organisations.

2.7 THEORETICAL PERSPECTIVES ON PERSONAL CHARACTERISTICS

2.7.1 Emotional intelligence

Antarctic station leaders need to interact on a personal level with their team, whilst exposed to internal and external stressors. Emotionally intelligent leaders were found to make great leaders, as this ability enabled them to use their emotions intelligently, both to manage themselves and when working with others (Boyatzis, Goleman & Rhee, 1999; Goleman, 2004).

There are five clusters of emotional intelligence, namely self-awareness, self-regulation, motivation, empathy and social skill. These clusters were grouped and the associated competencies are listed below (Boyatzis, Goleman & Rhee, 1999).

i) Self-awareness, which includes emotional awareness, accurate self-assessment and self-confidence;
ii) Self-regulation, which includes self-control, trustworthiness, conscientiousness, adaptability and innovation;
iii) Motivation, which includes achievement drive, commitment, initiative and optimism;
iv) Empathy, which includes understanding others, developing others, service orientation, leveraging diversity and political awareness;
v) Social Skills, which includes influence, communication, conflict management, leadership, acting as a change catalyst, building bonds, collaboration and cooperation, as well as team capabilities.

These emotional intelligence competencies captured many of the competencies that the literature had identified for an ideal Antarctic station leader, such as trustworthiness, communication, conflict management and understanding others. These competencies are not unique to Antarctic station leaders, but are also applicable in traditional business settings.

2.7.2 Resilience

An Antarctic station leader is exposed to multiple environmental stressors whilst dealing with the responsibility of leadership. Leadership research, in both space and the Antarctic, identified resilience as a personal characteristic that can help to deal with the challenges.

Siebert (2012) described resilience as the ability to bounce back from disruption and overwhelming situations. The isolated, confined and extreme environment at an Antarctic station, coupled with personal or adaptation problems, could be seen as a potentially overwhelming situation for an overwinterer, where they are removed from their normal support network. A resilient person deals with major difficulties by allowing themselves to feel the grief, anger and confusion of the situation in which they find themselves. They deal with these emotions and bounce back to emerge stronger than before (Stoltz, 2003).

Stoltz also described how resilient leaders reacted when they were faced with adversity. These leaders took immediate and decisive action. In some cases, this meant that they had to be flexible and change decisions and beliefs they had previously held. This correlates with the idea that an Antarctic station leader must be flexible, but at the same time decisive in the manner in which they approach problems.

Arond-Thomas (2004) feels that the foundation of resilience is emotional competence, which highlights the importance of emotional intelligence for Antarctic station leaders. Emotional resilience was included as one of the seven elements that contribute to emotional intelligence by Dulewicz and Higgs (1999). They defined emotional resilience as a person's ability to react consistently when exposed to pressure or stress.

A resilient Antarctic station leader could deal with their own problems, as well as the problems and challenges caused by the team environment at an Antarctic station. This competency could help them to remain calm under pressure and deal with the psychological problems that might surface at the station.

2.7.3 Conflict management

Conflict management has been identified in the literature as an important competency for an Antarctic station leader. Conflict could occur within and between individuals and groups, because of disagreements, differences and incompatibility (Rahim, 1982). As conflict could potentially affect the emotional well-being of team members and team harmony, station leaders could intervene through either conflict resolution or conflict management.

Conflict resolution results in the conflict being reduced or eliminated, whereas conflict management aims to reduce conflict when there is too much of it. Conflict management can also serve to induce conflict, if conflict is needed to solve problems or increase team effectiveness (Rahim, 1982:82).

Styles and approaches that a station leader could employ to resolve conflict could be linked to the task and supportive roles the station leader needs to fulfil. Blake and Mouton (cited in Morrison, 2008) placed conflict management in two dimensions, production and concern for people. Production could represent the task role, and concern for people relates to the supportive role of the leader. A grid adapted for Antarctic station leaders is shown in Figure 2.1.

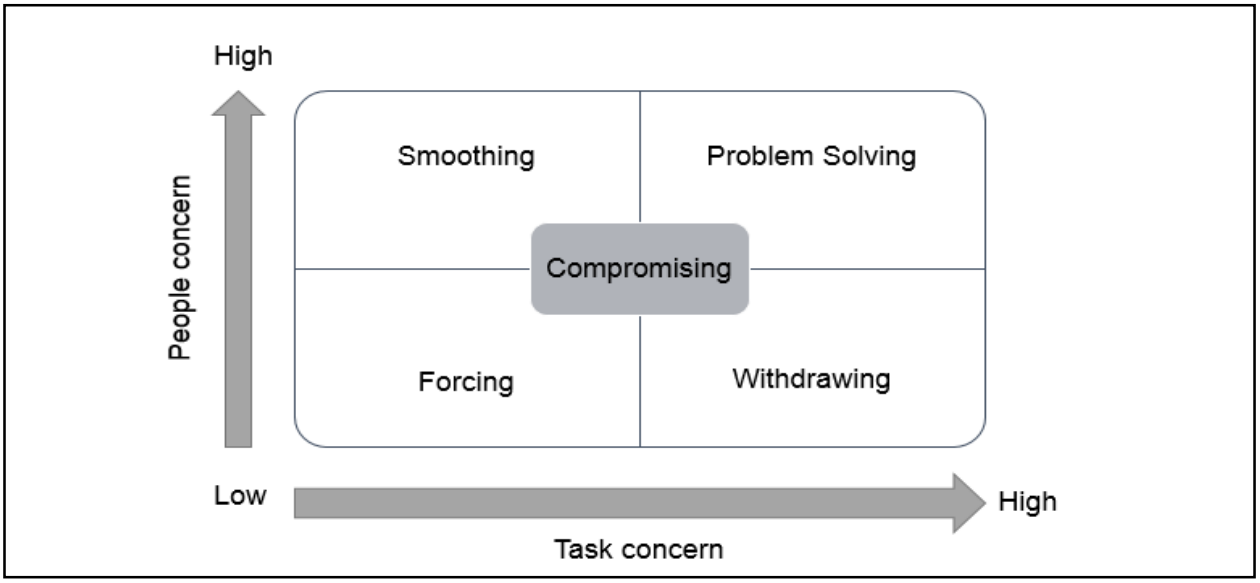

Figure 2.1: Conflict management dimensions

Source: Morrison, 2008.

Depending on the situation, the station leader must be able to choose an approach to best suit the conflict at hand. If both the task and the team's well-being is at stake, a problem solving approach is necessary.

Kohlrieser (2007) identified various approaches that could aid an Antarctic station leader in dealing with conflict at the station. The leader must establish a bond with the conflicting parties and be able to separate the person from the issue. The leader must open a conversation about the issue to be able to start negotiation. Thirdly, by being clear about what the issue is, without being hostile, the leader can start dealing with the conflict.

The leader must attempt to get to the root cause of the conflict and each party's perception of what caused the conflict. Understanding the different viewpoints of the parties involved will help everyone to reach a mutually beneficial resolution. It seems that the conflict management skills required for Antarctic station leaders is complemented by the negotiation skill that was also identified as a competency.

2.8 SUMMARY

This chapter has set the scene for South Africa's presence in the Antarctic. It introduced the concept of extreme environments, team composition and the leadership requirements needed to deal with

the psychological and physiological effects of overwintering on team members. Characteristics such as emotional intelligence, resilience, decisiveness, flexibility, trustworthiness and hardiness, amongst others, were identified as leadership characteristics that were ideal for Antarctic station leaders.

An exploration of the characters of historic Antarctic leaders revealed various different competencies that Antarctic station leaders may possess. Many experiential competencies were also identified, such as conflict management, waste management, search and rescue, emergency response and risk management capabilities.

The literature did not reveal much about the station leader appointments by SANAP, but it did provide insight into the selection procedures of other national programs, such as AAD and BAS. It also explored the state of knowledge of gender perceptions in the Antarctic, the impact of extreme events, as well as what the motivations were for overwinterers to complete more than one expedition.

Five leadership styles were identified, namely the authoritative, participative, situational, transformational and authentic style, and the practicality of each at an Antarctic station. The link between leadership at Antarctic stations and the requirements for leadership at organisations that are in distress was discussed.

The literature provided substantial coverage of the role and impact of the station leader, especially when it comes to personal relationships, personal well-being and team climate. Station leaders were tasked with attaining the outcomes of the expedition and the achievement of station goals, through managing the way the team members performed their professional duties.

The literature review provided valuable insight that was used to develop a questionnaire aimed at testing the perceptions of South African Antarctic expeditioners.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research explored the perceptions on leadership of South African Antarctic expeditioners in extreme and isolated environments. The previous chapter investigated the current state of knowledge concerning the environment faced by overwintering expeditioners, the selection of teams and leaders, and provided insight into various leadership styles and characteristics in extreme and isolated environments.

This chapter describes the research study population and sampling size. It will discuss the questionnaire design, the data collection and the data analysis methods that the study employed.

The research method was based on the collection and analysis of primary data. The study made used of a standardised questionnaire as a survey instrument. A customised questionnaire was developed, which used findings from the literature. Ideas gleaned from existing schools of thought from previous research were collated in order to draft a list of desirable characteristics of station leaders in Antarctica, and other topics of interest, such as the style of leadership, the appointment of leaders, and their influence on the team, were selected.

3.2 THE POPULATION AND SAMPLE

Participants in the study were 180 returned expeditioners, who had participated in the South African National Antarctic program over a period of 54 years, between 1961 and 2015. The participants were required to have spent at least twelve uninterrupted months at Gough Island, Marion Island or the SANAE base in Antarctica.

The participants comprised scientists, engineers, doctors and personnel who were specialists in various trades. Each team had a station leader who had been appointed prior to the expedition. In terms of gender distribution, 15.6 per cent of the participants were women and 84.4 per cent were men.

In total, 206 respondents registered, from whom a number of either complete or incomplete responses were received. Nine respondents indicated they had not completed a full tour of duty of twelve months at one of the stations, and these entries were removed from the dataset. A further 17 incomplete surveys were also removed from the dataset, leaving the remaining 180 as the sample for the study.

Participation in the study was voluntary, and each participant received a letter of informed consent, as described in Appendix A, prior to the start of the questionnaire. The study was approved by the Ethics Committee of the University of Stellenbosch before data collection commenced.

3.3 THE QUESTIONNAIRE DESIGN

3.3.1 Research methodology

3.3.1.1 Research instrument selection

According to Saunders, Lewis and Thornhill (2009), the choice of the type of questionnaire to use is dependent on the characteristics of the respondents, the need to attract a specific person or group, the likely response rate, the sample size and type of questions that could facilitate answering the research question.

This research targeted a very specific population, the SANAP overwintering community, who had the right attributes necessary to provide feedback on leadership in extreme and isolated environments. Two organisations could provide access to this specific group of respondents: the South African Antarctic Club and the Antarctic Legacy of South Africa, which both keep a contact database of members that includes contain telephonic as well as electronic mail contact details.

Various social media groups exist on websites such as Facebook, where expeditioners from Gough Island, Marion Island and SANAE share their overwintering experiences on station-specific pages (Facebook, 2016a), or through the Friends of Antarctic Legacy of South Africa page (Facebook, 2016b). The SANAP overwintering community were found to be active online users, where even the earlier teams, such as SANAE 20, who overwintered in 1979, had a dedicated Facebook group (Facebook, 2016c).

The time needed to complete an internet-based questionnaire is the shortest time calculated when mapping the number of respondents expected to the time constraints introduced by the postal delivery and collection option, and telephonic or structured interviews (Saunders *et al*., 2009). Due to its speed and efficiency and the accessibility of respondents through internet based means, a self-administered, internet based questionnaire was chosen as the research instrument.

3.3.1.2 Sample size

In order to extrapolate the findings of a research study to the general population, the required number of responses, or the sample size, must adequately represent the population in question in order to generalise the findings. The choice of sample size is governed by the level of confidence in the results that is required, the permissible margin of error and the type of analysis that is planned (Saunders *et al.*, 2009).

South Africa presently operates three remote stations, and the number of team members at each of the three stations could vary each year. In 2015, the SANAE team comprised ten members, Marion Island had twenty and the Gough Island team had nine team members (ALSA, 2015). The total team member count for the year was 39.

From the onset of overwintering, up to 2010, approximately 675 team members were selected for overwintering at SANAE, 847 at Marion Island and 398 at Gough Island (SAAC, 2010). If the average

team count for 2015 were used for the period from 2011 to 2015, it would give a total population of 2115. This, however, accounts for the number of team member positions filled each year, but does not consider individuals who have completed multiple expeditions, or expeditioners who are deceased. A total population of approximately 2000 was assumed.

To be able to compare groups, and various categories in them such as gender, experience and the occurrence of emergencies and other events, a sample size of at least 30 respondents is required to adequately represent a normal distribution of any population (Saunders *et al.*, 2009).

The confidence level indicates the level of certainty that the sample size reflects the profile of the population that is the subject of research. The error margin indicates the measure of accuracy with which the response could be generalised to the population. This means that if 60 per cent of the respondents held a certain opinion of the station leader, and the error margin was 5 per cent, that 55 to 65 per cent of the population would probably have the same opinion.

For a population of approximately 2000, the sample size should be at least 322 to reach a confidence level of 95 per cent, with an error margin of 5 per cent (Saunders *et al.*, 2009). An increased error margin of 7 per cent allows for a smaller sample size of 179. If the confidence level is reduced to 90 per cent and the error margin is raised to 5.8 per cent, the actual sample size of 179, which was used, is required.

3.3.1.3 Data requirements and question design

The research was descriptive in nature, and the contents of the questionnaire were based on findings from the literature study. The purpose of the research was to collect the perceptions of leadership of South African Antarctic expeditioners in isolated and extreme environments. With very little research having been done in this field in South Africa, secondary data was not considered and the research methodology decided upon was primary data collection.

Dilmann (2007, cited in Saunders *et al.*, 2009:368) described three types of data variables that should be considered when designing a questionnaire, which are opinion, behaviour and attribute data. Attribute variables, which describe respondent characteristics, were included in the questionnaire design.

The type of attributes collected in this study included age and gender. The respondents were also described according to their level and type of experience in extreme environments. This included where and when they had overwintered, how many expeditions they had completed, whether they had been appointed in a leadership position and whether they had experienced trauma, emergencies or conflict.

Opinion variables allow the respondents to describe how they feel about something, based on their experiences (Saunders *et al*., 2009). To test respondent's perceptions of leadership, opinion variables were chosen as the variable type for the majority of responses in the questionnaire design.

Closed-ended questions are quick and easy for the respondent to answer, with a finite number of answers or responses to choose from. This also allows the researcher to compare responses between respondents (Saunders *et al*., 2009). Six types of closed-ended questions can be included in a survey, namely list, category, ranking, rating, quantity and matrix type questions. Open-ended questions allow for a free response from participants in their own words (Kothari, 2004), instead of limiting them to a finite choice. These questions can be used to complement the closed-ended questions, and provide a more comprehensive picture of the respondent's feelings.

The questionnaire design included predominantly closed-ended questions, with two open-ended questions to facilitate opinionated feedback to the researcher.

3.3.1.4 Pilot testing

Saunders *et al*. (2009) suggests a pilot study to establish the face validity of a questionnaire and ensure that respondents understand the questions. Pilot testing of the questionnaire was done with a small subset of the population. The pilot testing provided valuable feedback and questions were adapted, according to recommendations from participants in the pilot study.

3.3.2 Personal information design

Participants were requested to provide personal information through a short personal information section. This section started with a qualifying question, to test whether the participant had spent twelve months or more at one of the South African Antarctic stations and thus qualified for participation in the survey. This was achieved through a list type question, to which respondents could choose only either yes or no.

Demographic information collected included answers to gender and age-category type questions. Further personal information requested was specific to the details of participants' overwintering background, such as the stations at which they had overwintered and the year during which the overwintering expeditions took place. The form was a combination of category and list style questions.

The other individual level measures that were included in the questionnaire design were:

i) Expedition leader status;
ii) Prior experience through more than one overwintering expedition; and
iii) Respondents who indicated that they had experienced emergencies, trauma or prolonged conflict and tension during their overwintering tour of duty.

3.3.4 Leadership question design

3.3.4.1 The role of and approaches for an effective station leader

The literature provided many examples of what the station leader is responsible for, where the main themes were the task and supportive roles of the station leader. From a task, or instrumental,

perspective the leader needs to coordinate shared station duties, make sure that specific job-related tasks are performed, and manage performance (AAD, 2013).

The station leader also needs to look after the emotional and physical well-being of individuals (AAD, 2013) and take responsibility for the team cohesion and team climate (Wood *et al,* 2005). The literature provided contradictory findings, where Hannah *et al.* (2009:907) found that maintaining a social distance allowed some leaders to be more effective, but also found that social closeness was associated with trust and better cohesion.

Four themes were found to be prominent when considering what makes an effective station leader:

- The effectiveness of personal relationships with team members;
- Leadership intervention with regard to emotional well-being;
- The station leader's role in team climate; and
- Station leader intervention in professional duties.

These four themes were tested through using a semantic differential rating scale. Saunders *et al.* (2009) described this scale type, where polar opposites can be used to test respondents' opinions, and which could be used to test underlying attitudes.

3.3.4.2 Station leader characteristics and competencies

Various competencies and characteristics were identified as important for station leaders to possess in extreme and isolated environments. The competencies were identified from research performed at mainly Australian, British and American Antarctic stations. The section aimed to test which characteristics emerged as the most important for station leaders to possess in the South African context, where diversity forms a prominent element of the work environment. Competing competencies were also included, such as the task-relationship balance, authoritative elements and participative elements.

Thirteen leadership characteristics and competencies were identified, and were included in a ranking matrix, which requested participants to rank them from highest to lowest importance. According to Saunders *et al.* (2009), a ranking matrix would allow the researcher to discover the relative importance of something to the respondent, especially when all the characteristics and competencies were deemed important according to the literature.

An open-ended question was also included, which allowed respondents to provide their view on other characteristics and competencies that were not included. The aim was to identify additional elements relevant to leadership at Antarctic stations.

3.3.4.3 Leadership styles

This section has explored the leadership styles that South African Antarctic expeditioners may prefer. A list type question was included to test preference for one of the four main styles discussed in the literature, namely authoritative, participative, democratic and delegatory leadership styles.

A further eight statements were included that used five-point Likert-scale measurements to test whether respondents preferred participative or authoritative approaches at the remote stations. The Likert style rating scale tests how strongly a respondent agrees or disagrees with a statement (Saunders *et al.*, 2009) and uses agreement as a measurement.

The statements were derived from the findings in the literature and adapted to suit the remote station environment. Questions 16, 18, 20 and 22 (see Appendix B) represented an authoritative leadership style and tested the following:

- Whether the respondent was comfortable with a station leader who made decisions in isolation;
- How the respondent felt about a station leader who showed a need for control by approving all the station decisions;
- Whether the respondent agreed with a station leader who rewarded team members for compliance and asserted authority through punishment; and
- How the respondent reacted to a station leader who monitored their professional duties.

Questions 17, 19, 21 and 23 (see Appendix B) represented a participative leadership style and tested the following:

- Whether the respondent was comfortable with a station leader who allowed the team to discuss problems together;
- Whether the respondent preferred a station leader who valued his or her input;
- How the respondent felt about joint decision-making where the station leader acted as a facilitator; and
- Whether the respondent was more committed to decisions if the station leader allowed the individual voices and opinions to emerge.

The authoritative and participative categories were represented by four questions each, and a Likert scale rating, from one to five, offered opinion input options. The results of each style category were summed together. This means that if a respondent indicated that they strongly agreed with each of the four authoritative behaviour questions, a rating value of five was allocated per question and the respondent received a total score of 20 for authoritative leadership style preference. Table 3.1 shows the allocated rating value for each of the Likert scale categories.

Table 3.1: Likert scale and allocated rating values

Likert scale	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Allocated rating value	1	2	3	4	5

A possible permutation for a single response to the authoritative style questions is shown in Table 3.2. This respondent would receive a value of 14 for authoritative style preference.

Table 3.2: Example response for the authoritative category

Question	16	18	20	22	Total
Likert result	Neither agree nor disagree	Disagree	Agree	Strongly agree	14
Allocated rating value	3	2	4	5	

The highest result indicated the preferred station leader, thus if a respondent received a total of 14 for authoritative category and 18 for the participative category, the respondent was coded as preferring a participative station leader.

The results were also analysed by looking at the participative and authoritative responses separately, especially to distinguish between border scenarios where the participative and authoritative categories were close together. Both categories were grouped into five new classifications, shown in Table 3.3. This secondary classification was based on the authoritative or participative coding value total allocated to the primary category.

Table 3.3: Results of classification of leadership style

New classification code	**Classification descriptor**	**Category total results**
1	Not at all	1, 2, 3, 4.
2	Slightly	5, 6, 7, 8.
3	Somewhat	9, 10, 11, 12.
4	Moderately	13, 14, 15, 16.
5	Extremely	17, 18, 19, 20.

If a respondent received a total of 14 for the authoritative category, they were classified as preferring a moderately authoritative station leader. Similarly, if the responded summed to 18 for the participative category, they were classified as preferring an extremely participative station leader.

For an authoritative leadership style, the new classification was used to compare gender, experience and the impact of events on the responses. The last question served as a confirmation of the control variable for those who had experienced emergencies or trauma, by testing whether the station leader should retain decision-making autonomy under extreme events.

3.3.4.4 Position of station leader and its effect on the team

This section of the questionnaire tested perceptions on the position and appointment of the station leader. Factors such as the importance of the role and the impact the station leader had on team members' adaptation, the quality of the tour of duty and the decision to overwinter again were tested, using five-point Likert-scale measurements.

The section concluded with two questions that addressed the autocratic appointment of the station leader. Respondents were asked to indicate whether they would like to be involved in the appointment of the station leader, and to provide their opinion of the emphasis on leadership qualities when SANAP appoints the station leaders.

3.3.4.5 Antarctic station leaders and the traditional business environment

The last section was an open-ended question, which allowed participants to provide feedback on their perceived differences between the requirements for leadership at an Antarctic station, compared with those in the traditional business environment in South Africa.

3.4 DATA COLLECTION

The self-administered questionnaire, which may be seen in Appendix B, was made available to participants via an online survey platform, SurveyMonkey. An online link was distributed to participants, with the assistance of the South African Antarctic Club and the Antarctic Legacy of South Africa.

Members were made aware of the study by means of a press release on the Antarctic Legacy of South Africa website. During the 2016 Midwinter function, hosted by the South African Antarctic Club, the club secretary introduced the study to the members of the Antarctic community who attended the function.

Participants' responses were submitted through the online survey platform. Responses remained anonymous and no names, email address or IP addresses were recorded in the respondents' dataset. The survey was open for sixteen days, it opened on 13 August 2016 and closed on 28 August 2016.

3.5 DATA ANALYSIS

3.5.1 Pre-analysis filter and analysis software

After the survey had closed, the dataset was reviewed and all incomplete responses were removed. The first question served as a qualifier, and respondents who had not spent 12 months or more at a remote South African Antarctic station were disqualified, and removed from the dataset.

SurveyMonkey provided a basic statistical analysis of some of the questions. A more in-depth analysis was performed by exporting the data from the online survey platform and importing it into Microsoft Excel. Descriptive statistics were processed using the Data Analysis tool pack.

3.5.2 Data analysis techniques

Table 3.4 describes the data analysis approaches used in the research.

Table 3.4: Data analysis approaches

Question number	Question purpose	Coding and analysis techniques
2	Age demographic.	Bar chart to show age distribution. The data was categorised using with the following codes: 1 – Below 25 2 – 25 to 30 3 – 31 to 40 4 – 41 to 50 5 – 51 to 60 6 – 61 and older
3	Gender demographic.	Pie chart to show gender distribution. Male: Coded as 1 Female: Coded as 2 Not indicated: 3
4	Experience representation.	Bar chart to show number of expeditions One: Coded as 0 More than one: Coded as 1
5	Station representation.	Bar chart showing station representation. An additional pie chart was added to show the percentage of who had visited more than one station.
6	Temporal distribution of overwintering.	Categorised into decades and represented as a bar chart. Respondents were recoded according to categories from 1960-1969, 1970-1979, 1980-1989, 1990-1999, 2000-2009 and 2010-2015.
7	Appointment as station leader categorisation.	Bar chart. Leader: Coded as 0 Team member: Coded as 1
8	Test for situations beyond the norm, such as emergencies, evacuations, trauma or continuous and aggressive interpersonal conflict.	Pie chart Emergencies experienced: Coded as 0 Uneventful year: Coded as 1
9, 10, 11, 12	Test for an effective station leader in terms of personal interaction, personal well-being, team climate and involvement in professional duties.	Bart chart showing overall responses. Categorised responses for: -Gender -Single vs. multi-expeditions -Eventful vs. uneventful year
13	Test for the most important leadership characteristics and competencies.	Weighted average plotted on a bar chart. Categorised top three responses for: -Gender -Single vs. multi-expeditions -Eventful vs. uneventful year
15	Test for leadership styles using list selection.	Pie chart showing preferences. -No response coded as 0

		-Authoritative coded as 1 -Participative coded as 2 -Democratic coded as 3 -Shared / delegatory coded as 4
16, 17, 18, 19, 20, 21, 22, 23	Test for participative and authoritative styles using Likert scale, and determine the differences between: -Gender; -Single vs. multi-expeditions; and -Eventful vs. uneventful year.	The responses of each category were summed, with an upper limited of 20 per category. The highest scoring category indicated the respondent's preferred leadership style.
24	Test for leadership autonomy during emergencies.	Bar chart
25, 26, 27, 28, 29, 30	Test for perceptions of: -Importance of the position; -Impact on team members; and -Station leader appointment.	-Bar chart -Selected comparison for single vs. multi-expeditions, leader and team member views.
31	Comparison between a leader in an isolated, confined and extreme environment and one in the traditional business environment in South Africa.	Coded for themes.

3.6 SUMMARY

In this chapter, the questionnaire design was discussed. It has provided an overview of the population, the sample size and the approaches to the questionnaire design that the researcher employed. How the different sections and questions related to the findings in the literature review was also discussed.

The chapter further showed the data analysis techniques employed and the different coding schemes for the various variables.

CHAPTER 4
FINDINGS

4.1 INTRODUCTION

The objective of the study was to investigate the perceptions of leadership at South African Antarctic stations. The study intended to explore the following perceptions:

- Do men's perceptions of leadership differ from those of women;
- Do perceptions of leadership change when comparing those of team members who have been on only one expedition with those of a multi-expedition team member; and
- Whether there is a change in the perception of the requirements for leadership in teams that have experienced situations beyond the norm, such as emergencies, evacuations, serious illness, death or constant and aggressive interpersonal conflict.

In this chapter, the findings of the study will be discussed, starting with an overview of the participants' attributes, through their demographics and their Antarctic experience. This chapter will further discuss the characteristics and competencies of good leaders, the preferred leadership style amongst South African Antarctic expeditioners, and general perceptions of position of the station leader. The chapter will end with a discussion on the differences between an Antarctic station leader and a leader in a traditional business in South Africa.

4.2 MAIN FINDINGS

4.2.1 The profile of the respondents

4.2.1.1 Age and gender profiles

The online survey returned 180 completed questionnaires. With a population of around 2000, this resulted in a margin of error of 6.97 per cent, giving a confidence level of 95 per cent. The age distribution of the respondents is show in Figure 4.1. Only one participant was below 25 years of age, and 15.6 per cent of the respondents were between 25 and 30.

The age category of 31 to 40 had the highest representation, with 26.7 per cent of the respondents. The second most highly represented age category was of respondents aged between 51 and 60, which represented 23.3 per cent of the respondents.

The respondents were well distributed between the age categories, which prevented a bias towards the perceptions of a specific generation.

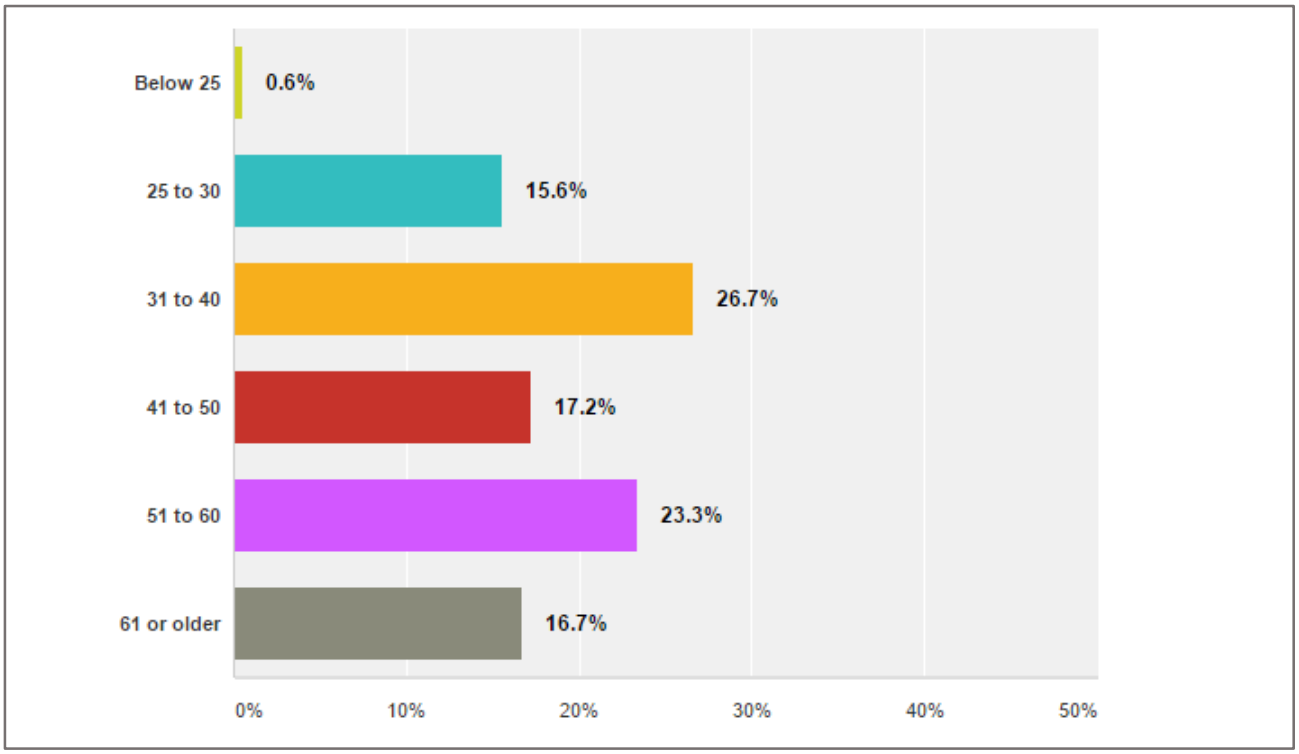

Figure 4.1: Age distribution

The gender distribution showed a strong male representation. This can be explained by the fact that the first woman overwintered on Marion Island only from 1986 to 1987 (Cooper & Headland, 1991:86) and the first woman was appointed to an Antarctic team in 1997 (SANAP, 2016d).

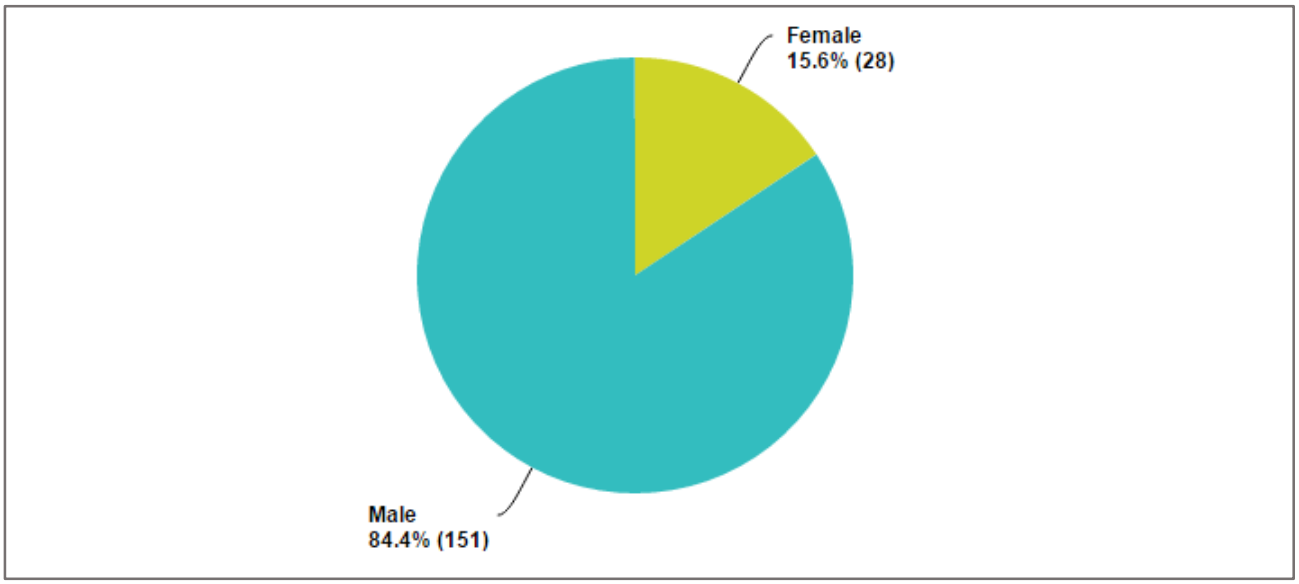

Figure 4.2: Gender distribution

Sarris and Kirby (2005:162) found that there was a ratio of one woman to eight men in Antarctic overwintering teams. The South African responses shows a ratio of one woman to approximately five men. With female representation as low as 15.6 per cent, there will be a strong male bias in the

respondent data. The research investigated the potential difference in perception of leadership between men and women in extreme environments. To prevent the male bias, responses will distinguish between male and female participants in selected sections.

4.2.1.2 Antarctic experience profiles

This section discusses the Antarctic experience profile of the respondents. Figure 4.3 provides insight into the experience of the participants, and was used to test the role of experience in perceptions of leadership, especially between the respondents who had completed only one expedition, and those who had been members of more than one.

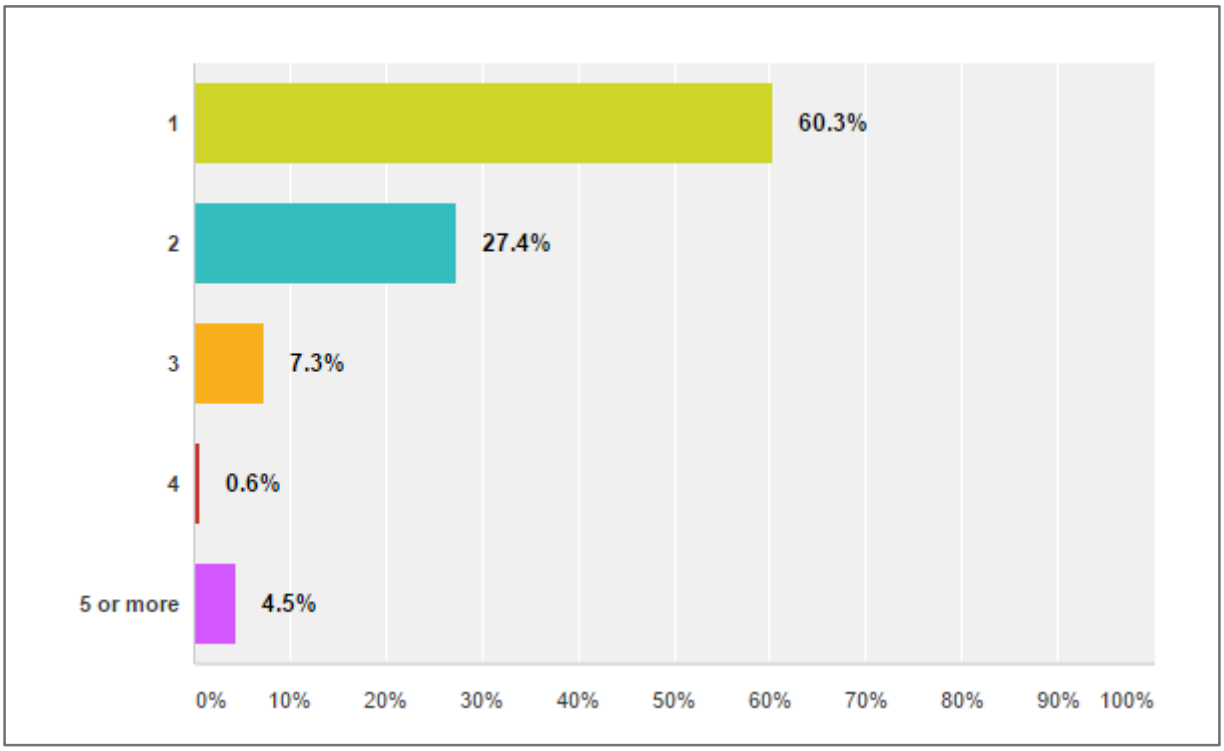

Figure 4.3: Experience profiles of respondents

The majority of the respondents had completed a single expedition, and thus served under only one station leader. Overwinterers who had completed more than one expedition represented 39.7 per cent of the respondents. More than one expedition meant that they had had experience under more than one station leader, which may provide a more holistic view.

Figure 4.4 provides an overview of the stations where the participants overwintered. Marion Island and Gough Island do not experience the polar winter as severely as the SANAE teams do, and many overwinterers at the island-based stations have a large field component as part of their professional duties.

The smaller teams of Gough Island represented 22.2 per cent of the respondents. Marion Island, with 50.6 per cent, and SANAE, with 52.2 per cent, represented the majority of the participants. Due

to the responses from overwinterers who had completed more than one expedition at more than one station, the respondent results exceeded 100 per cent.

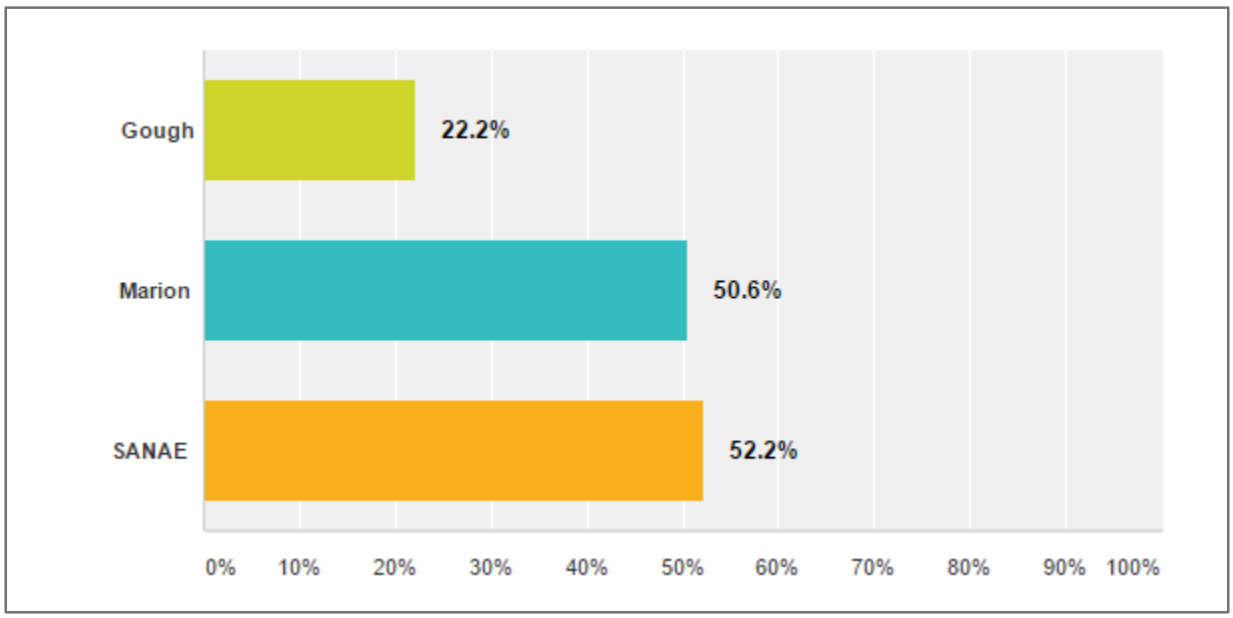

Figure 4.4: Remote station representation

Of the responses received, 39.7 per cent indicated that they had completed more than one expedition. It was of interest to see how many of them had visited more than one station. This is depicted in Figure 4.5.

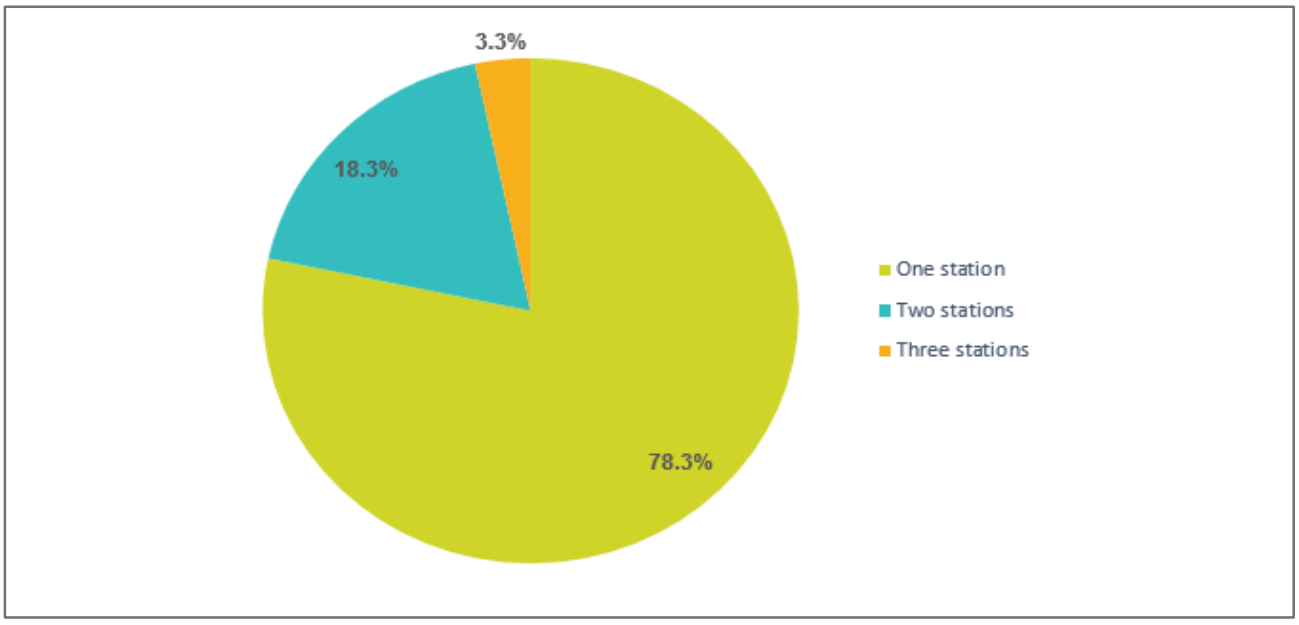

Figure 4.5: Number of stations at which respondents had overwintered

The respondents represented 54 years of overwintering, ranging from 1961 to 2015. Figure 4.6 shows that the respondents had a wide range of overwintering experience.

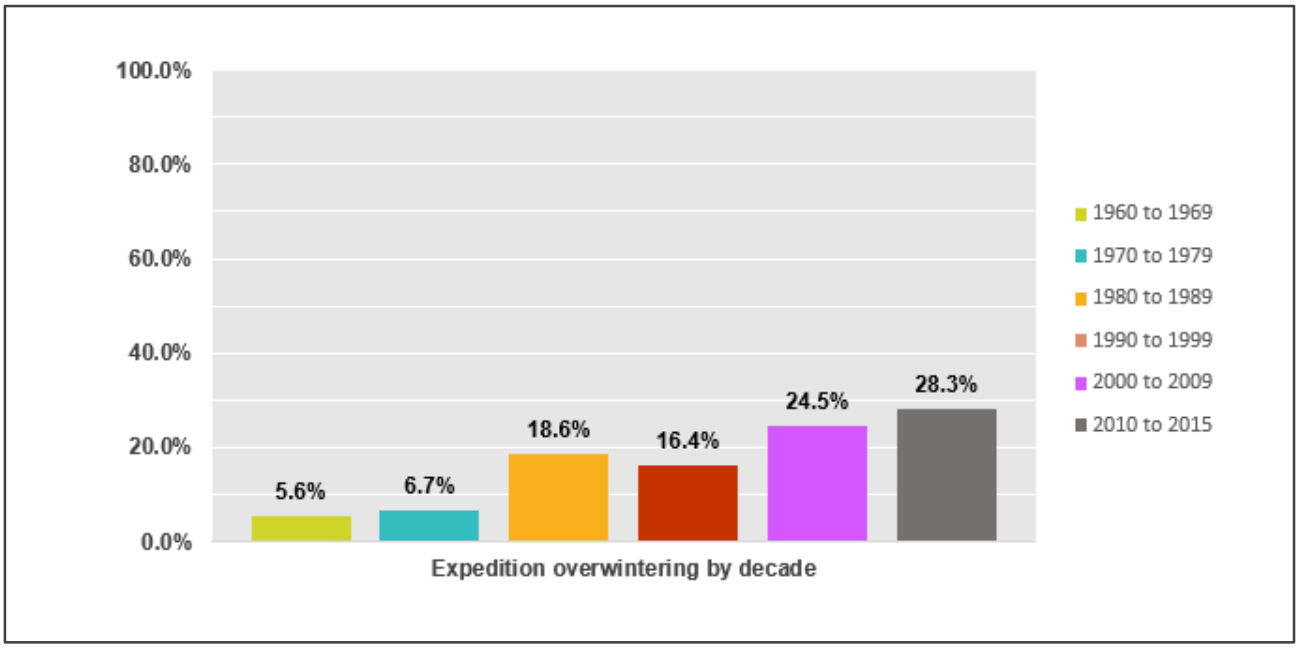

Figure 4.6: Distribution by years for overwintering

Only 5.6 per cent and 6.7 per cent of the respondents overwintered between 1960-69 and 1970-79. Similar responses were received for the period from 1980-89 and 1990-99. Expeditioners that overwintered from 2000 to 2009 represented the second largest group, with 24.5 per cent of the responses.

The strongest representation was found in the shorter period between 2010 and 2015, which represented 28.3 per cent of the responses. This distribution none the less allowed an accurate reflection of the perceptions of leadership throughout the duration of the South African National Antarctic Program, and gave a good indication of the changes and the present management practices at the remote stations, as well as the station leader appointment practices of SANAP.

In terms of station leader distribution, as shown in Figure 4.7, 19.4 per cent of the respondents indicated that they had been appointed as station leader of their expedition, and 80.5 per cent were appointed as team members. This allowed two different perspectives on the results that tested the importance of the position and team member input into the station leader's appointment.

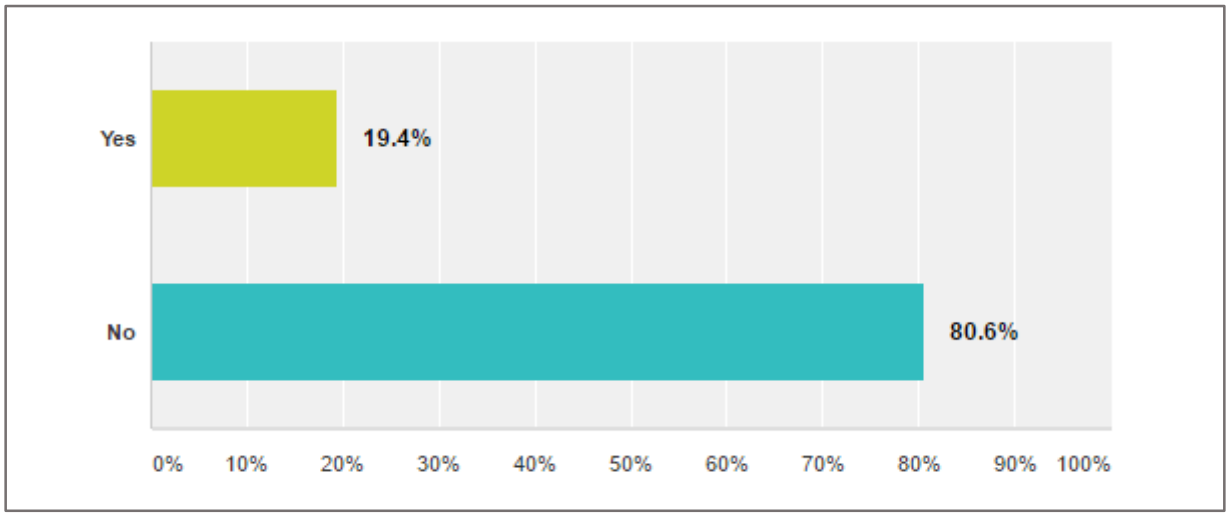

Figure 4.7: Station leader appointments

It was of interest to see that as many as 65 per cent of the respondents indicated that they, or their team, had experienced emergencies, evacuations, trauma or continuous and aggressive interpersonal conflict during their overwintering tour of duty. In this report, this will be referred to as an eventful year.

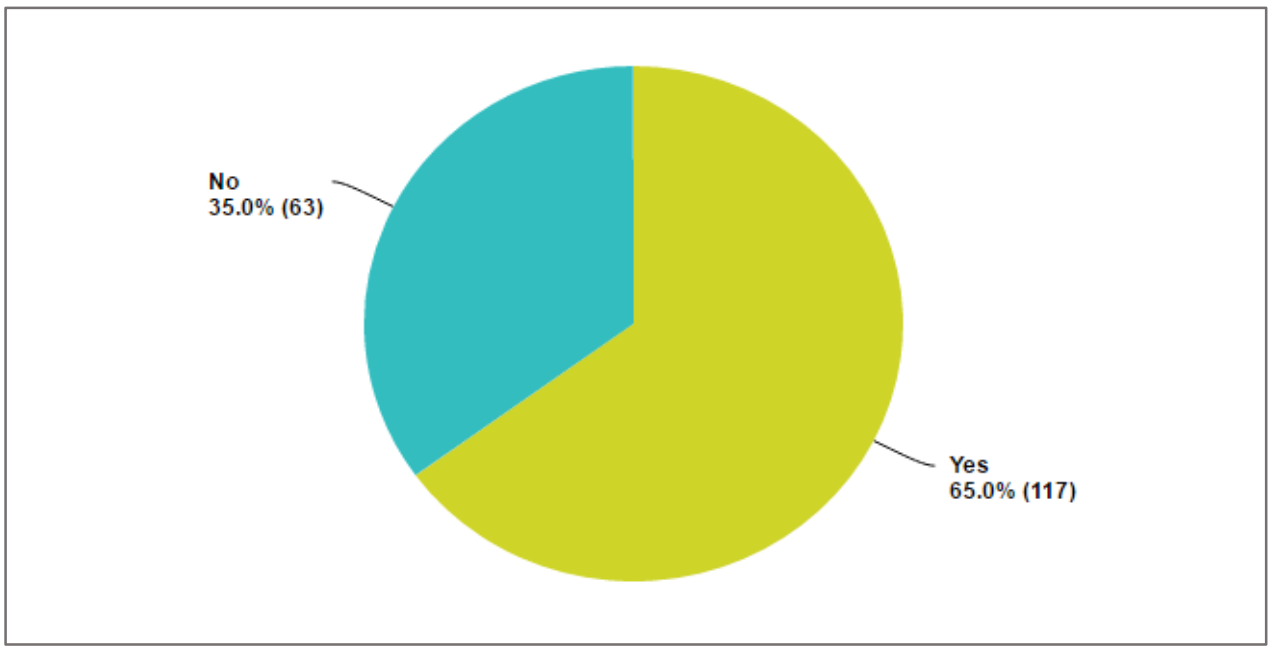

Figure 4.8: Eventful vs. uneventful overwintering

In terms of an uneventful year, 35.0 per cent of respondents had indicated that they did not experience events such as emergencies, evacuations, trauma, death or continuous and aggressive interpersonal conflict.

4.2.2 The role of and approaches for an effective station leader

4.2.2.1 Personal relationships

An Antarctic station leader can either form and maintain a strong personal relationship with the team members to build trust and cohesion, or keep as distance between themselves and the team members (Hannah *et al.*, 2009). Table 4.1 shows the test for personal relationships between the station leader and the team, as well as the semantic differential rating scale extremes.

Table 4.1: Test for personal interaction with team members

Question 9	In terms of personal interaction with team members, indicate on the scale of 1 to 5 what type of station leader is more effective.			
Semantic differential scale				
Keeps a distance as far as personal relationships with team members are concerned.			Maintains a strong personal bond with team members.	
1	2	3	4	5

South African Antarctic expeditioners favour a station leader who maintains a personal bond with team members, as can be seen in Figure 4.9. Of the respondents, 40.2 per cent agreed and 30.2 per cent strongly agreed that the station leader must maintain a strong personal bond with team members. A quarter of the respondents, 25.7 per cent, felt that a balance could be struck between a social distance and a close personal bond between the station leader and team members.

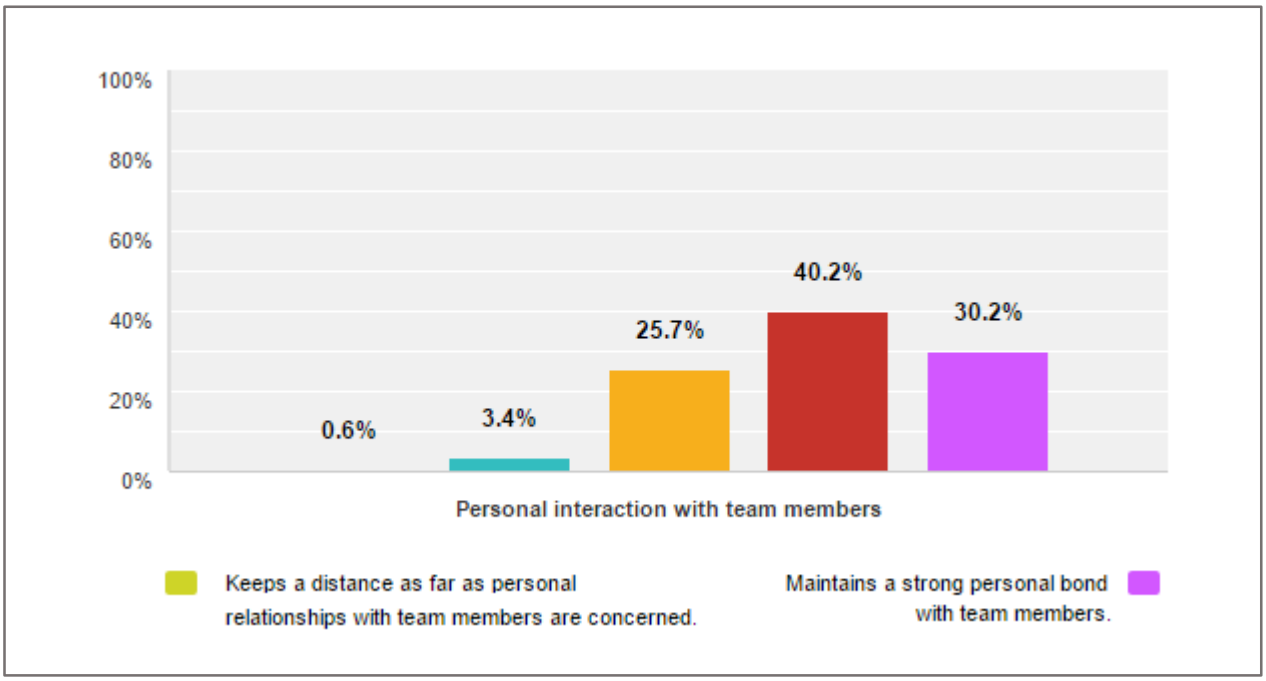

Figure 4.9: Personal interaction with team members

When a gender comparison was performed, none of the female participants disagreed or strongly disagreed that a station leader should keep a distance as far as personal relationships with the team members are concerned. These results are shown in Figure 4.10.

Of these women, 41.4 per cent preferred a balance between a social distance and a close personal bond with the station leader. The majority of female respondents, 44.8 per cent agreed on a strong personal bond. The male distribution of opinions was similar to the overall opinion.

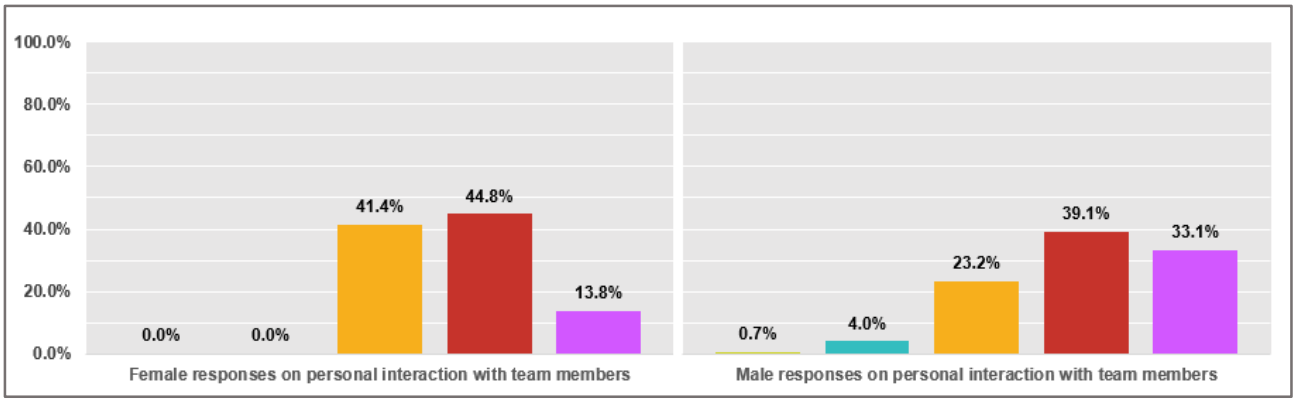

Figure 4.10: Gender comparison on personal interaction

When multi-expedition and single expedition overwinterers were analysed, the results showed that those overwinterers with more expedition experience mostly agreed that the station leader must maintain a strong personal bond with team members. Team members with experience of a single expedition, however, scored much higher at the furthest end of the scale, where 34.5 per cent wanted a strong personal bond to be maintained with the station leader.

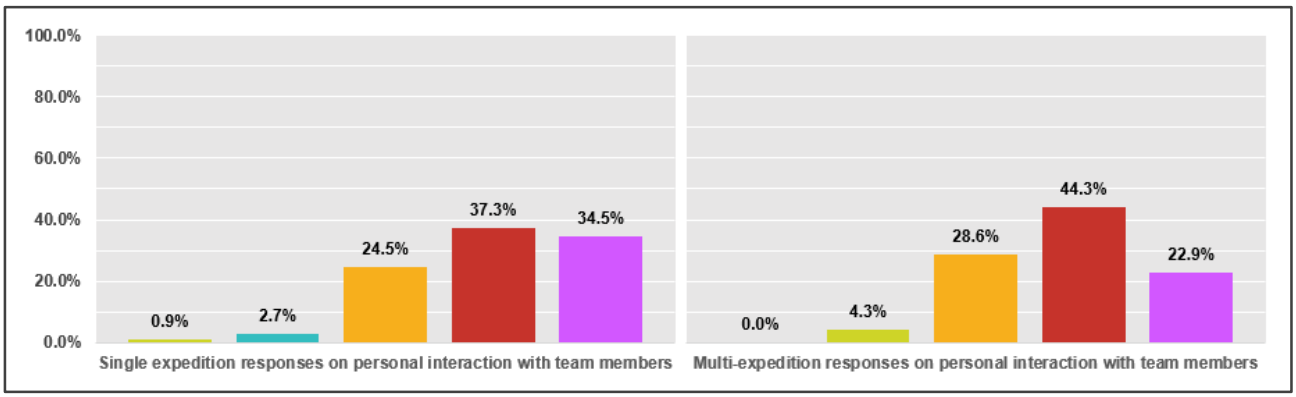

Figure 4.11: Expedition experience comparison on personal interaction

Fewer of the more experienced overwinterers felt that a distance was needed between the team members and the station leader, where 4.3 per cent disagreed, compared to 2.7 per cent of the single expedition respondents. None of the more experienced expeditioners felt that a large social distance was necessary.

Expeditions that had experienced emergencies, evacuations, trauma or continuous and aggressive interpersonal conflict placed a higher emphasis on the role of the station leader in maintaining a strong personal bond with team members, with 45.7 per cent in favour and 30.2 per cent strongly in favour of a personal bond with their station leader.

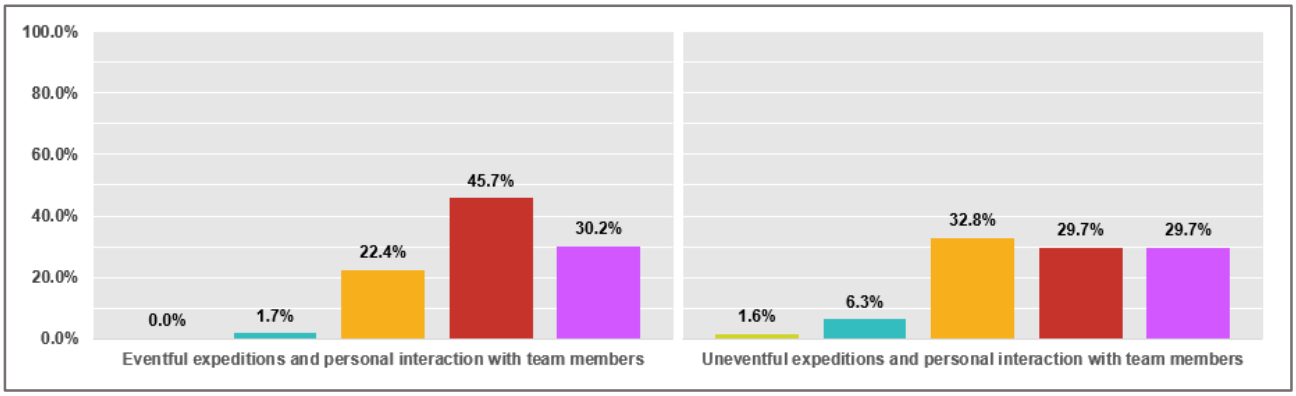

Figure 4.12: Impact of emergencies on personal interaction with the station leader

The uneventful expeditions did not react as strongly as the eventful expeditions, but also preferred a station leader who maintained a stronger personal bond, as opposed to a social distance, with team members.

4.2.2.2 Personal well-being

Station leaders are tasked, amongst other things, with the well-being of their team (AAD, 2013). Table 4.2 shows the test for personal well-being and the semantic differential rating scale extremes to indicate the level of involvement from the station leader.

Table 4.2: Test for personal well-being of team members

Question 10	In terms of the personal well-being of team members, indicate on the scale of 1 to 5 what type of station leader is more effective.			
Semantic differential scale				
Allows team members to regulate their own emotional well-being.			Actively monitors and influences the well-being of team members.	
1	2	3	4	5

In terms of personal well-being, the majority of participants felt that the station leader should take the middle ground when it came to looking after the personal well-being of team members.

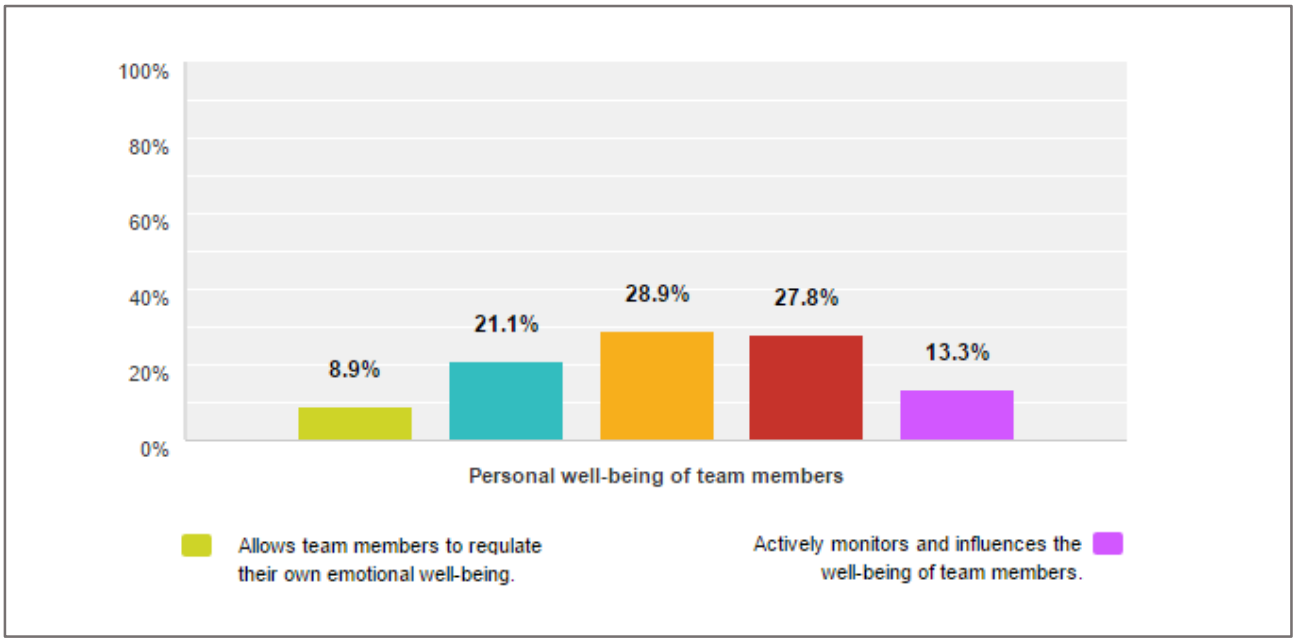

Figure 4.13: Leadership and personal well-being of team members

A gender comparison revealed that women placed a slightly higher emphasis on the active involvement of the station leader on personal and emotional well-being of team members, where the majority of men balanced in the middle.

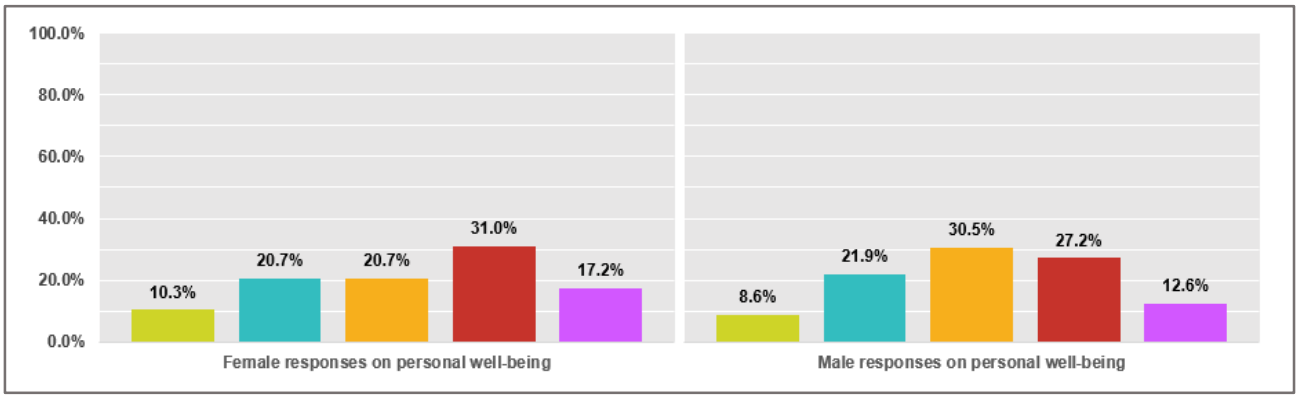

Figure 4.14: Gender comparison on personal well-being

The experience profile of the respondents is shown in shown in Figure 4.15. When it comes to expeditioners regulating their own emotional well-being, single expedition respondents felt more strongly about it than overwinterers with more experience did.

These groups also differed significantly when it came to the station leader's active involvement in the well-being of team members, where 21.4 per cent of the experienced group felt more strongly in favour of this, compared to the 8.2 per cent of the single expedition overwinterers.

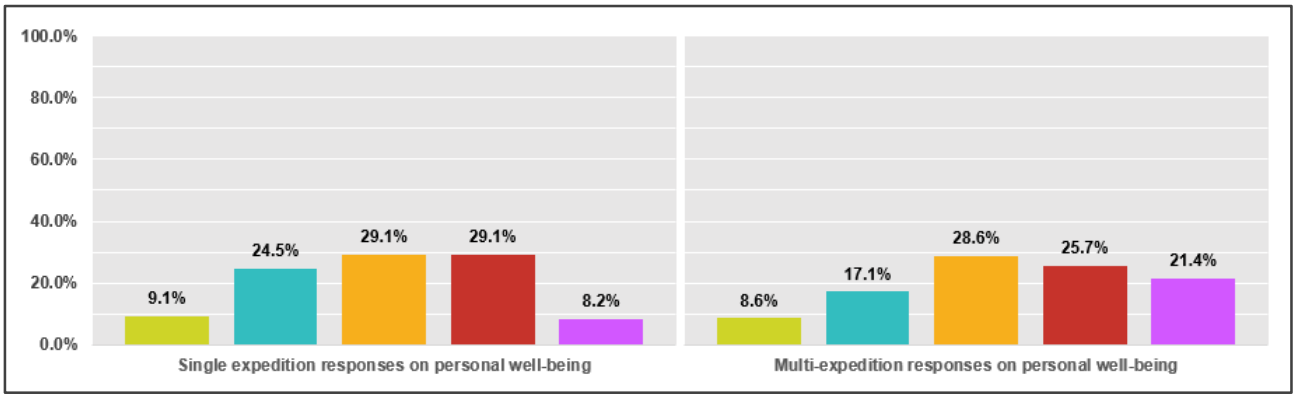

Figure 4.15: Expedition experience comparison on personal well-being

When the impact of emergencies was included in the evaluation of the station leader's involvement in personal well-being, the respondents who had experienced an eventful year indicated a slightly higher preference for a station leader who actively monitored and influenced the well-being of team members.

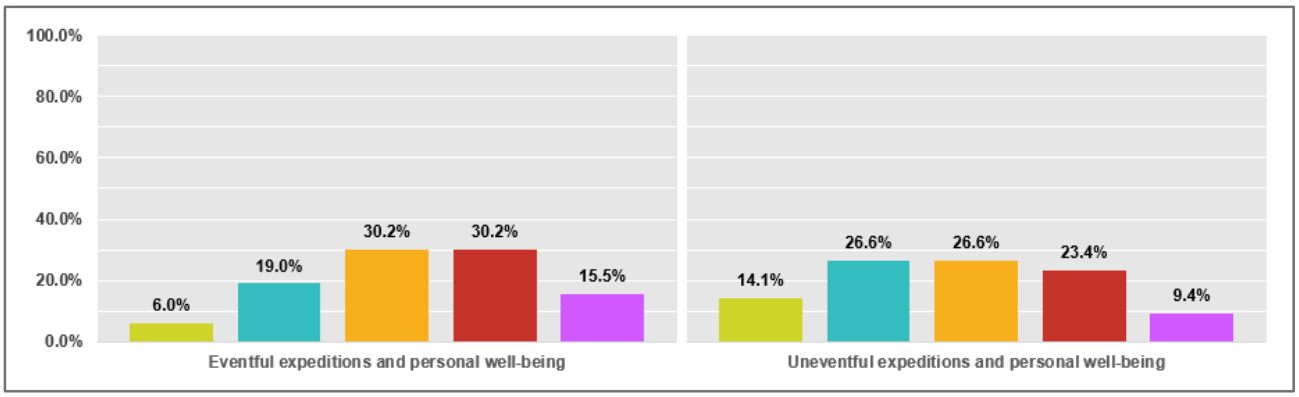

Figure 4:16: Impact of emergencies on personal well-being

Groups that had had an uneventful year had a slightly higher preference for the team members regulating their own emotional well-being.

4.2.2.3 Team climate

The team climate at the station can affect the quality of the overwintering year, and effective leadership correlated positively with team climate and station cohesion (Wood *et al*., 2005). Table 4.3 shows the test for team climate, and the semantic differential rating scale extremes to indicate the extent of the involvement of the station leader.

Table 4.3: Test for the station leader's responsibility for team climate

Question 11	In terms of the team climate at the station, indicate on the scale from 1 to 5 what type of team leader is more effective.			
Semantic differential scale				
Allows the team climate to form independently without actively influencing it.			Makes an effort to create and sustain a positive team climate.	
1	2	3	4	5

The South African Antarctic respondents indicated that a station leader who made an effort to create and sustain a positive team climate was more effective, and 34.1 per cent preferred and 27.9 per cent strongly preferred this choice. A smaller percentage of respondents, 5.6 per cent, strongly preferred that the team climate form independently, without the station leader actively influencing it.

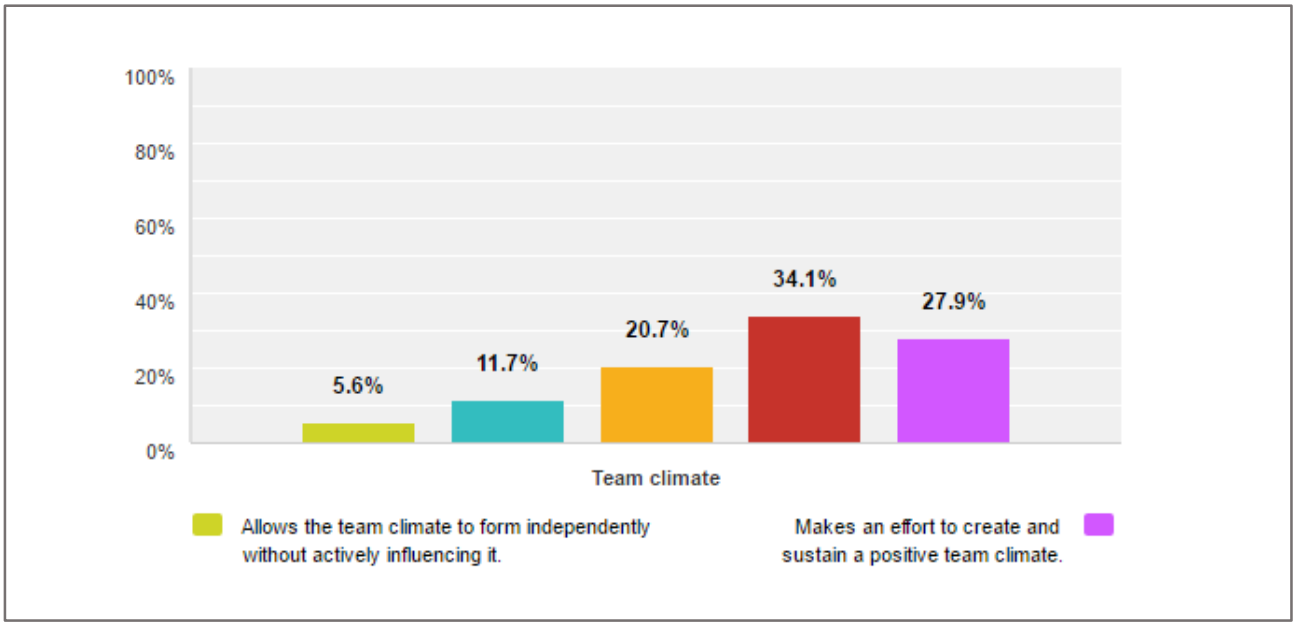

Figure 4.17: Leadership and team climate

The gender comparison in response the station leader's role in team climate is shown in Figure 4.18. The female distribution differed slightly from the male distribution, where more women indicated that the climate should form independently. A station leader who actively influences team climate was still predominantly preferred by both genders.

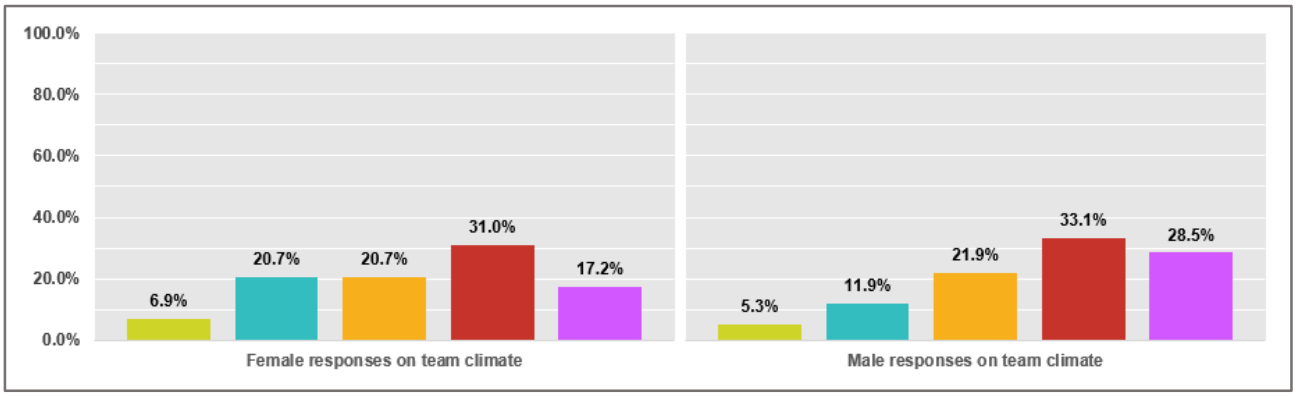

Figure 4.18: Gender comparison on team climate

The more experienced expeditioners had a stronger preference for a station leader who makes an effort to create and sustain a positive team climate, where 30.0 per cent preferred and 34.3 per cent strongly preferred this in an effective station leader.

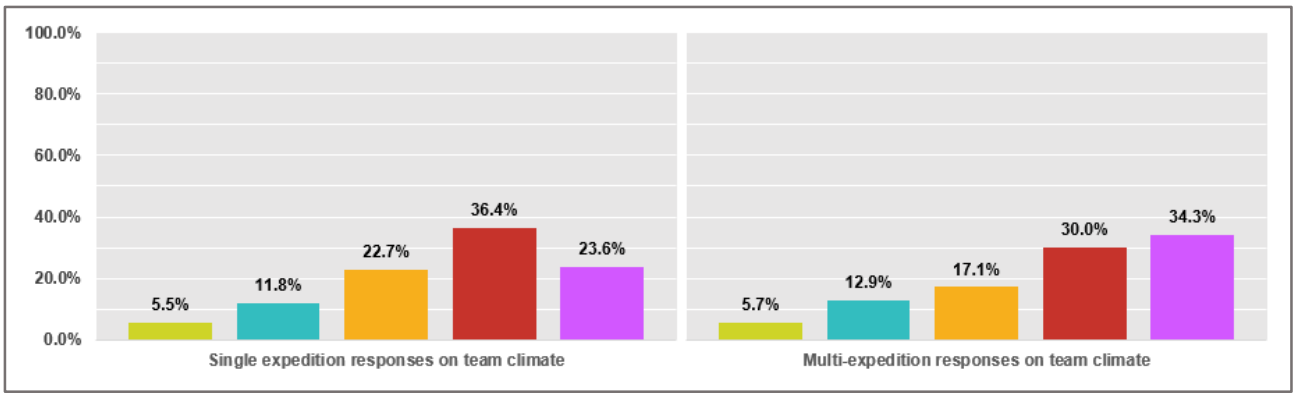

Figure 4.19: Experience comparison on team climate

Emergencies strongly influenced perceptions. The comparison between the views of team members in an eventful and an uneventful year is shown in Figure 4.20. Teams that experienced an eventful year indicated that a station leader who actively created and sustained a positive team climate was much more effective.

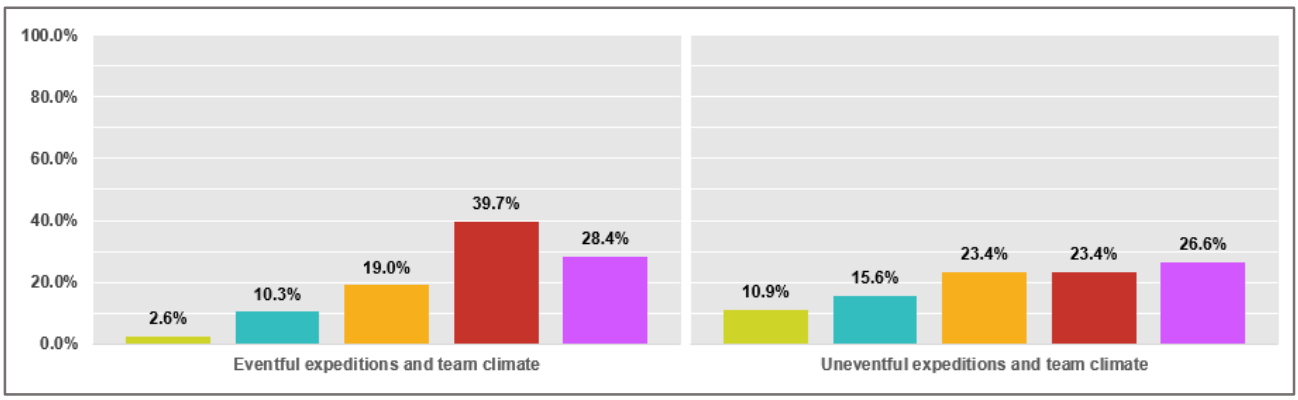

Figure 4.20: Impact of emergencies on team climate

The responses from team members on uneventful expeditions were more evenly distributed, but still showed a slightly higher preference for a station leader who had made an effort to create and sustain a positive team climate. This group also had the highest incidence of respondents, 10.9 per cent, who preferred the team climate to form independently without interference from the station leader.

4.2.2.4 Professional duties intervention

The station leader has a responsibility to achieve the goals of the national program (Godwin, 1987:3), and needs to ensure that Antarctic Treaty requirements, policies and procedures are adhered to and administrated effectively (AAD, 2016).

The station leader's responsibility in achieving the outcomes of the Antarctic program is influenced by the way in which the team performs their professional duties. Table 4.4 shows the test for the extent of the station leader's influence when it comes to team members performing their professional duties at the station.

Table 4.4: Test for the station leader's influence on professional duties

Question 12	As far as the professional duties of team members are concerned, indicate on the scale of 1 to 5 what type of station leader is more effective.			
Semantic differential scale				
Maintains a low involvement and acts mostly in response to team members' requests for support.			Maintains a strong involvement and strongly influences team achievement and expedition outcomes.	
1	2	3	4	5

Figure 4.21 shows that South African Antarctic expeditioners had an even distribution of responses on what the station leaders' influence should be in this regard, with a slight increase where 29.1 per cent preferred and 16.2 per cent strongly preferred a station leader who maintained a strong involvement in their professional duties and strongly influenced team achievement.

Of the respondents, 18.4 per cent preferred and 19.0 per cent strongly preferred that the role of the station leader in professional duties of team members should be limited to only situations where they requested an intervention from the station leader.

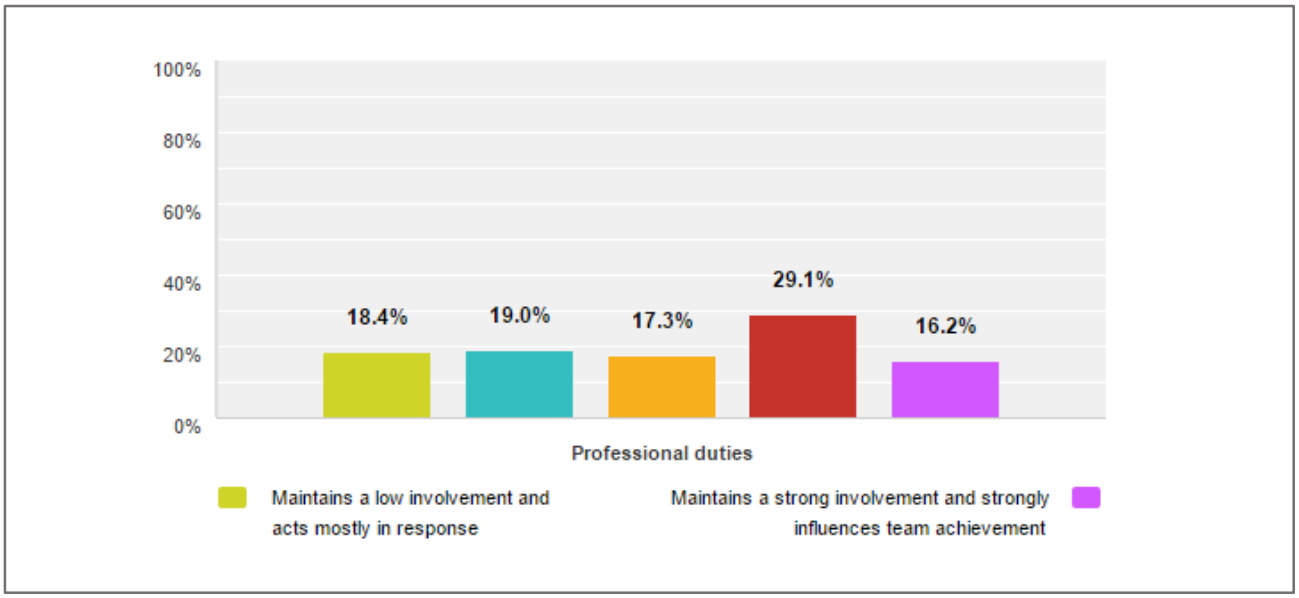

Figure 4.21: Station leader intervention in professional duties

The gender comparison in Figure 4.22 showed that female respondents did not strongly prefer a station leader who maintained a strong involvement in the professional duties, and were more evenly distributed across the different options. Male respondents showed a preference for a strong involvement.

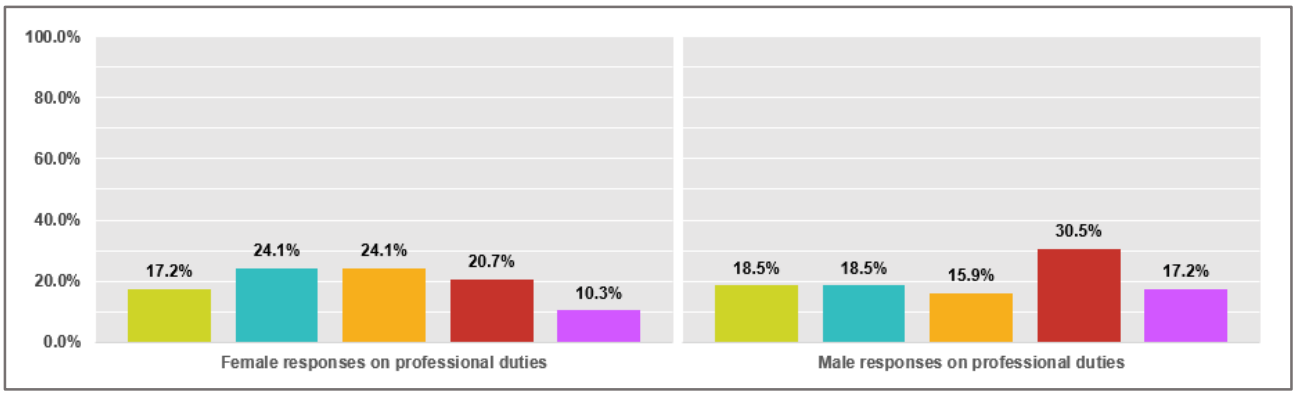

Figure 4.22: Gender comparison on professional duties

Overwinterers who had completed a single expedition had a different profile compared to that of the more experienced overwinterers, where the responses of the former group were more evenly distributed. From Figure 4.23, it can be seen that the more experienced expeditioners indicated that an effective station leader maintained a strong involvement and strongly influenced team achievement.

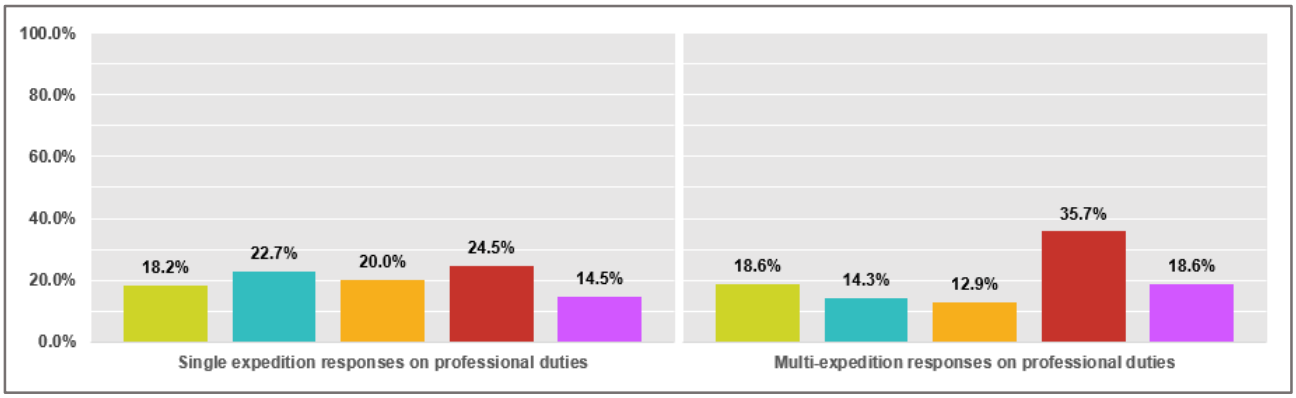

Figure 4.23: Experience comparison on professional duties

Expeditioners who had an uneventful year strongly preferred a station leader who maintained a low involvement in professional duties, where 28.1 per cent strongly preferred to involve the station leader in their professional duties only when they requested it.

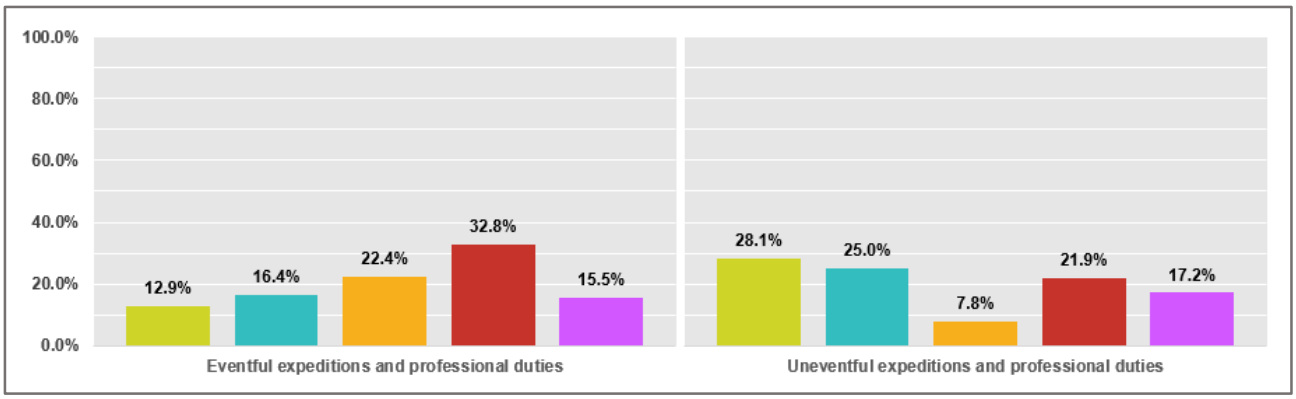

Figure 4.24: Impact of events on professional duties

The impact of emergencies, evacuations and constant and aggressive interpersonal conflict can be seen on the respondent's distribution for an eventful year where, in this group, 32.8 per cent preferred and 15.5 per cent strongly preferred a station leader who maintained a stronger involvement.

4.2.3 Station leader characteristics and competencies

4.2.3.1 Ranked characteristics and competencies

Thirteen leadership characteristics and competencies were identified from the literature. Respondents were asked to rate them from the most important to the least important. The characteristics and competencies, as well as the ranking responses from South African Antarctic expeditioners, are shown in Figure 4.25.

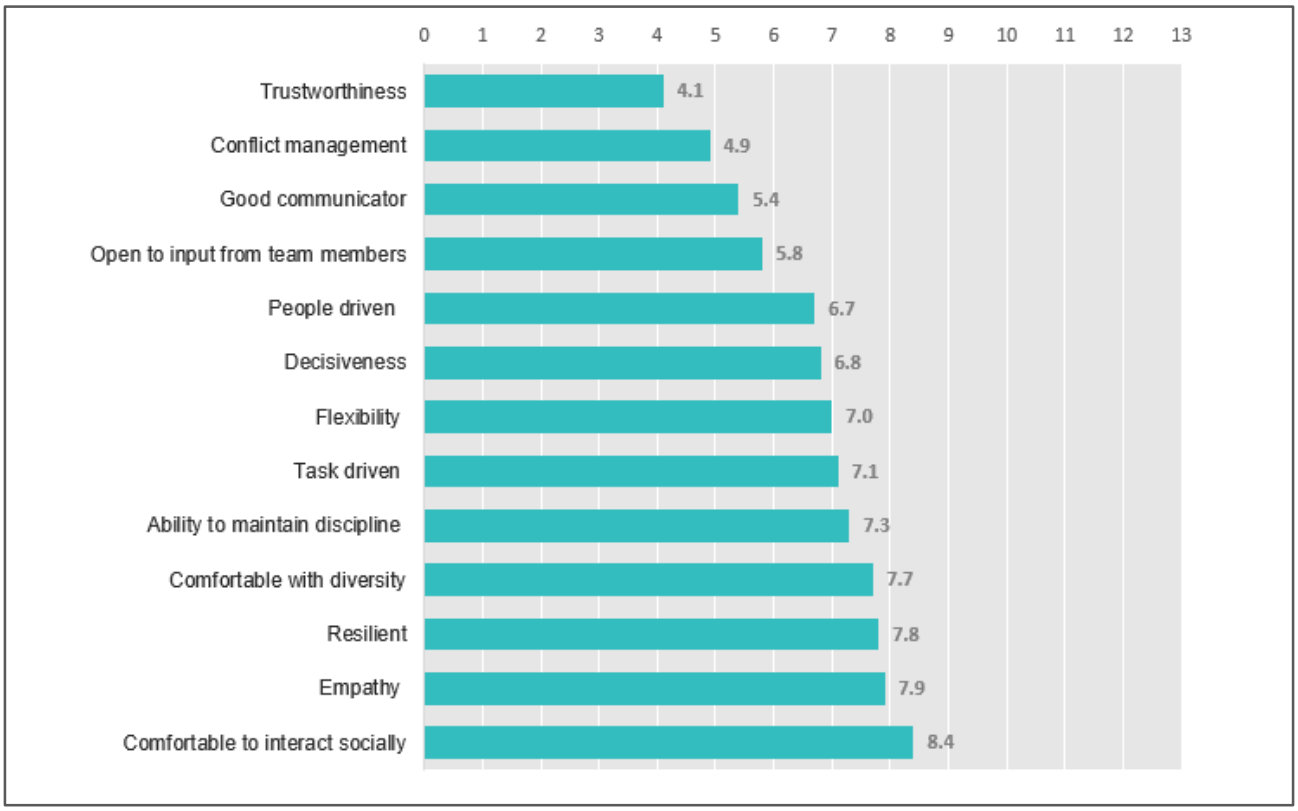

Figure 4.25: Station leader characteristics and competency rating

The trustworthiness of station leader received the ranking of most important, with conflict management in second place. The ability to communicate was ranked third most important, and being open to input from the team was ranked fourth. The high ranking of input from the team could give an indication of the leadership style preference, where a participative station leader would place a higher emphasis on team member's opinion in decisions than an authoritative station leader.

A station leader who was people-driven, cared about the well-being of team members and was sensitive to individual needs, outranked a leader that was task-driven. The more authoritative competencies, such as maintaining discipline and decisiveness, ranked fifth and ninth respectively.

It was of interest to see that decisiveness in a station leader was found more important than flexibility. Being comfortable with diversity ranked only tenth in the desirable characteristics of a leader, and this in the culturally diverse South African teams. This may be influenced by the perceptions of all-male, all-white Antarctic teams of the past. Resilience, empathy and being comfortable to interact with socially were considered as the least important abilities for a station leader.

The leadership abilities were also analysed by gender, expedition experience and the impact of emergencies. The leadership abilities responses showed no significant differences between the genders. Figure 4.26 shows the comparison, where no rating differed from another by more than two intervals.

Female respondents indicated that conflict management was the most important ability, followed by trustworthiness and being open to input from team members. Male respondents preferred trustworthiness, followed by conflict management and being a good communicator. Both groups did not find being comfortable to interact with socially with a station leader as an important competency.

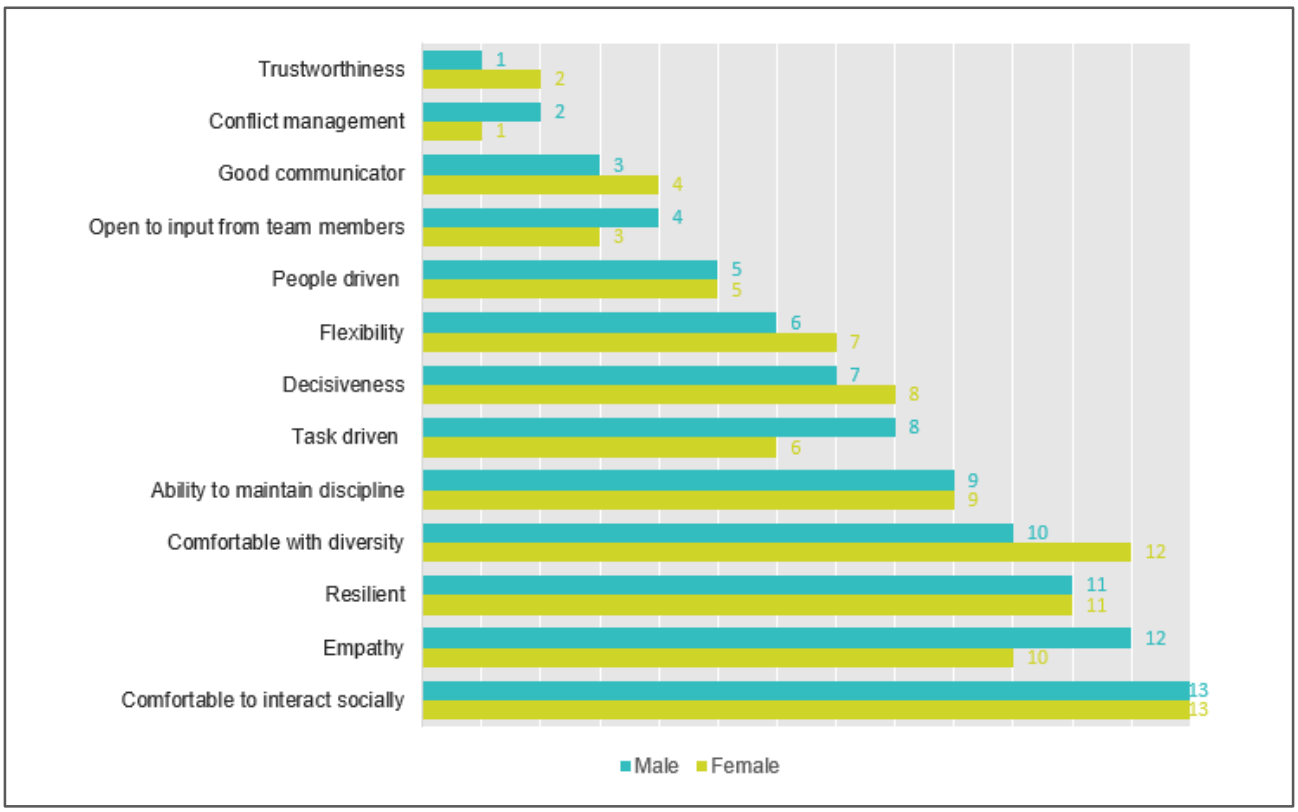

Figure 4.26: Gender comparison of leadership characteristics and competencies

Women felt that being task-driven was more important than flexibility or decisiveness in a station leader, where men preferred flexibility and decisiveness above a task-driven station leader. Men rated a station leader's comfort with diversity higher than women did. Female overwinterers, however, felt that empathy was more important than men did, although both groups gave the same ranking to a more people-driven station leader.

A comparison between overwinterers who had completed a single expedition and more experienced overwinterers, showed a different profile, as depicted in Figure 4.27. Both groups ranked trustworthiness first and conflict management second. Single expedition respondents ranked openness to the input of team members third, where more experienced expeditioners preferred their station leader to be a good communicator.

These two groups ranked a people-driven station leader similarly, but more experienced expeditioners preferred a task-driven station leader to a people-driven leader. Expeditioners with experience of only one expedition preferred a flexible leader to a decisive one.

Another major difference between the groups was the ranking of empathy. Multi-expedition overwinterers ranked it as the least important competency, but those who had completed a single expedition ranked empathy ninth. Multi-expedition respondents felt that the ability to maintain discipline was more important than did respondents who had completed only one expedition.

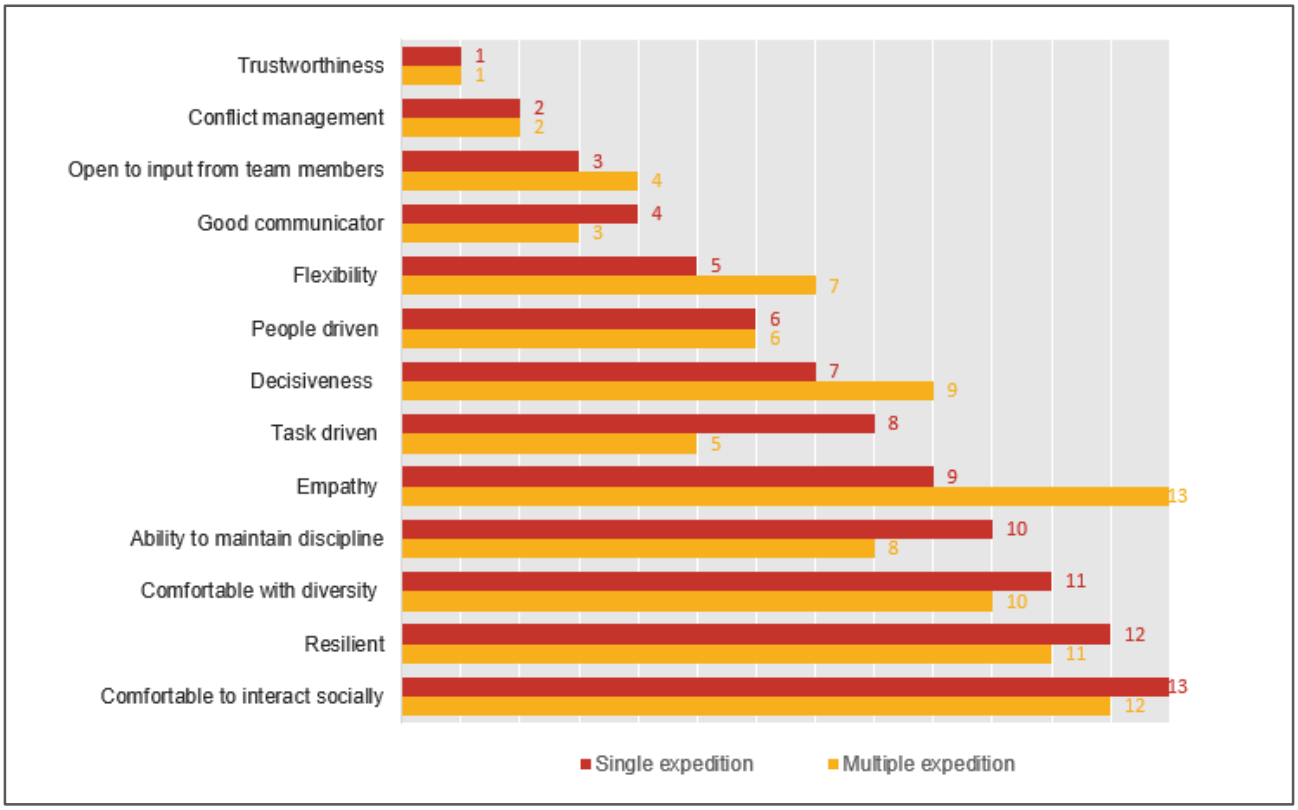

Figure 4:27: Experience comparison of leadership characteristics and competencies

Figure 4.28 shows the comparison between respondents who had had an eventful year and those that had not. Hannah *et al.* (2009) found that under extended and extreme stress, follower's performance was affected by their leader's ability to instil trust, to keep them focused on the task or goal, and the way the leader responded to follower's concerns and expectations. This was confirmed by the results, where trust, conflict management, and being a good communicator were ranked in the first three positions by those respondents who had experienced an eventful year.

The respondents who had had an eventful year ranked the ability to maintain discipline seventh, compared to members of uneventful expeditions, who ranked it tenth. The ability to maintain discipline was perceived as less important for station leaders, when the team members had not experienced constant or aggressive interpersonal conflict, probably because the station leader did not need to exhibit this competency in a situation without conflict or tension.

Empathy was ranked tenth by eventful expeditioners, compared to thirteenth and last by respondents who had experienced an uneventful tour of duty. For those expeditions that had experienced trauma,

emergencies or conflict, the requirement for an empathic station leader could be seen as more important, based on their personal experience of trauma and conflict.

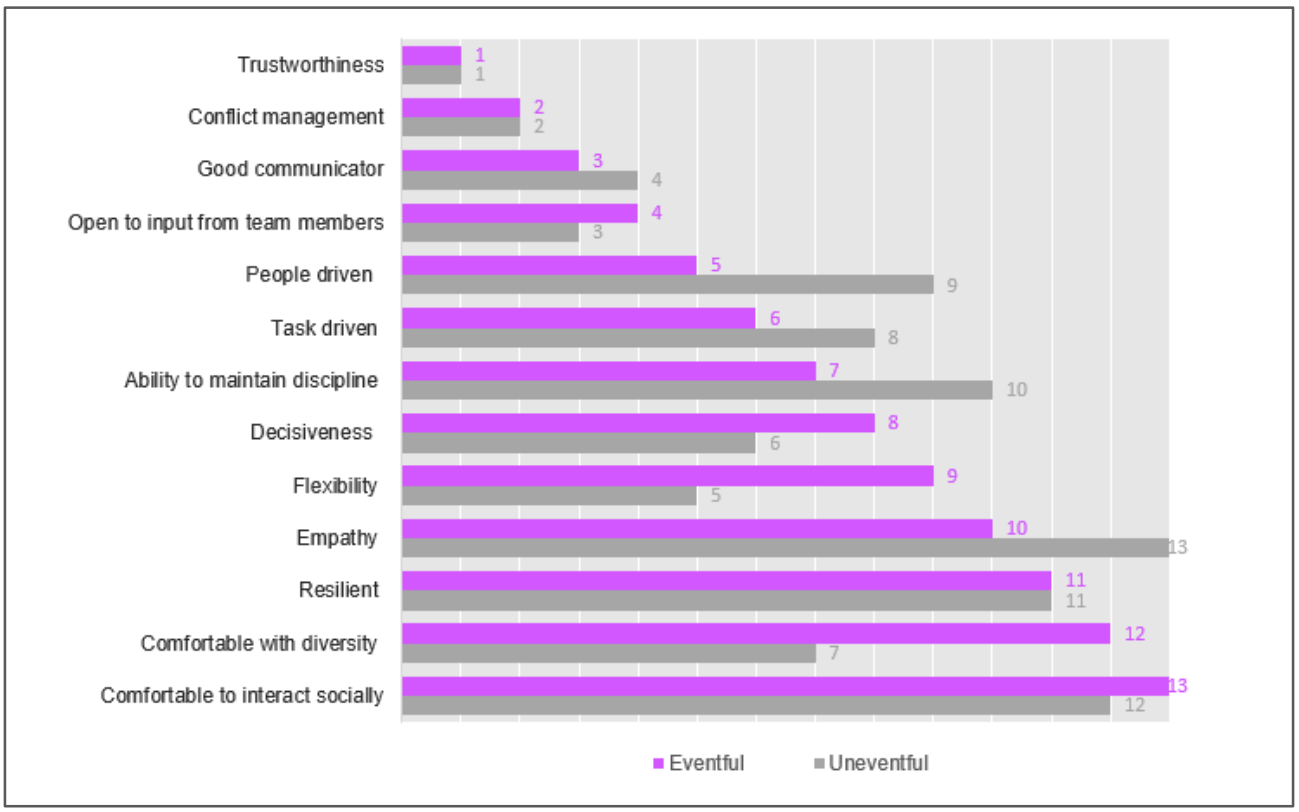

Figure 4.28: Event comparison of leadership capabilities and competencies

Overwinterers who had had an uneventful year preferred a station leader who was more flexible, decisive and comfortable with diversity. These respondents ranked ‘task-driven’ as the eighth most important characteristic of a station leader, and ‘people-driven’ ninth, while their counterparts who experienced an eventful year ranked ‘people-driven’ fifth and ‘task-driven’ sixth, in the list of desirable characteristics and competencies of a station leader.

Respondents who had experienced an uneventful year ranked ‘being comfortable with diversity’ in seventh place, the highest of all the different groups. In the absence of emergencies, evacuations, serious illness, death or constant and aggressive interpersonal conflict, the conflict that might arise from diversity in a multicultural team could become more prominent, and a station leader who was comfortable with a diverse team, would become more important.

4.2.3.2 Additional characteristics and competencies

Respondents were given the opportunity to provide input into additional desirable characteristics and competencies through an open-ended question. The results of the open-ended question are tabled in Appendix C, with a summary in Table 4.5.

Many of the responses pointed towards personal characteristics, such as sobriety, integrity, honesty and fairness. Some respondents preferred this position to be filled by a natural leader, as opposed to a selected position.

Table 4.5: Additional leadership competencies for Antarctic station leaders

Individual	Behavioural towards others	Experiential
Integrity	Lead by example	Emergency response experience
Honesty	Non-racist	Knowledge about environment
Trustworthy, open, transparent	Perceptive, sensitive to needs	Science program knowledge
Positive outlook, optimistic	Fairness	Ability to interact with SANAP management
Sobriety	Respectful	Conflict management skills
Confidence	Availability	Maintain balance in task- and supportive roles
Responsible	Patience	Leadership experience
Physical health and fitness	Friendliness	
Gravitas	Sense of humour	
Psychologically stable	Ability to maintain discipline	
High morals	Communication	
Intelligence		
Calm demeanour		

4.2.4 Leadership style

4.2.4.1 General leadership style

Respondents were presented with four statements representing different leadership styles, namely authoritative, participative, democratic and shared, and asked to choose the one they preferred. The results are shown in Figure 4.29.

The first statement represented authoritative leadership, and the respondent who chose this style preferred a station leader who told them what to do, and they were happy to comply with the decisions taken by the station. Only one respondent preferred this leadership approach.

A democratic leadership style was preferred by 19.8 per cent of the respondents, where the station leader allowed them to vote, before decisions that affected them and the team, were taken. A shared leadership style, where the station leader delegated decision-making authority to other experienced team members and shared the leadership responsibilities, was preferred by 33.9 per cent of the respondents.

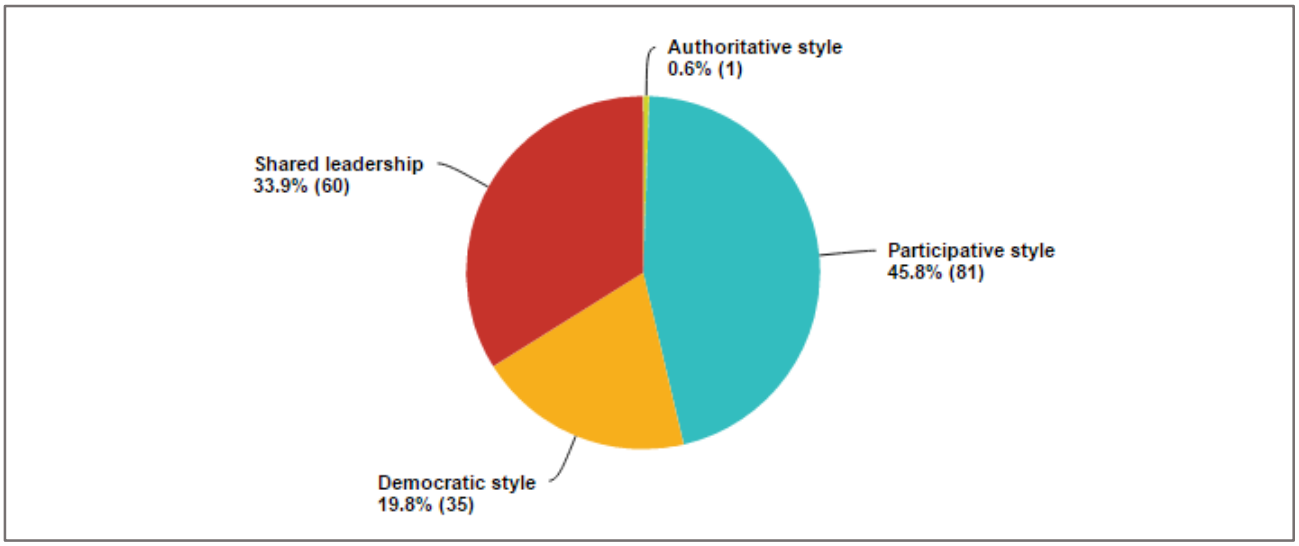

Figure 4.29: General leadership style preferences

A majority (45.8 per cent) of the respondents preferred a participative leadership style, where the station leader consulted with the individual as part of the decision process on matters that affected the team, but the station leader retained final decision-making authority.

4.2.4.2 Authoritative and participative leadership styles

A participative or authoritative preference analysis were performed, using the method described in Chapter 3.3.4.3 for the responses to Question 16 to 23. The results from the analysis showed an overwhelming positive response to a participative style, as depicted in Figure 4.30. When the preferred style was determined from the results of the survey, 96.6 per cent of the respondents had indicated a preference for a participative station leader. Only six of the respondents, 3.4 per cent, revealed a preference for an authoritative station leader.

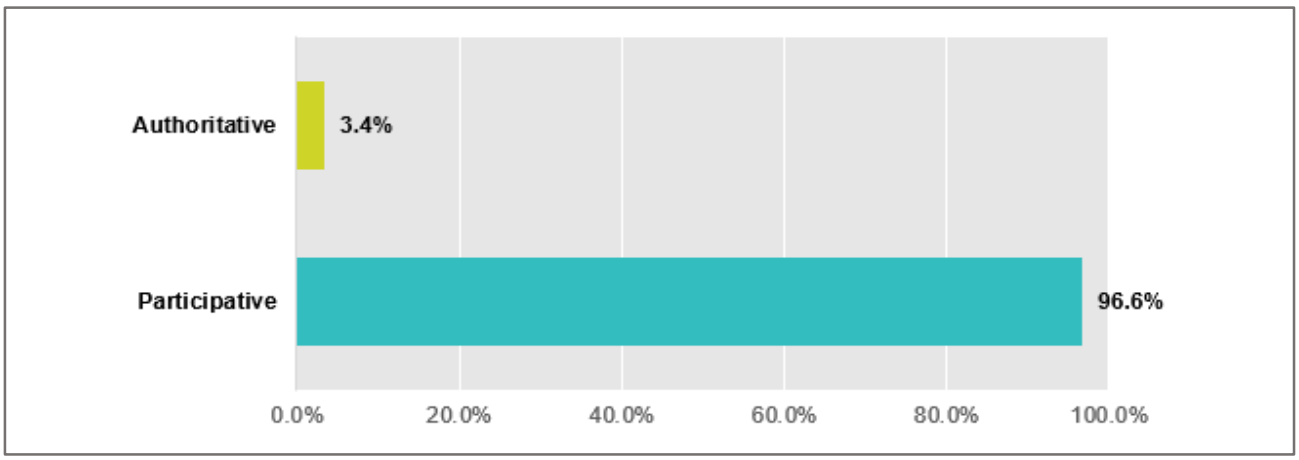

Figure 4.30: Specific leadership style preference

An in-depth analysis was also performed for both the participative and authoritative responses. The participative and authoritative leadership style responses were each divided into a new five new

classifications, shown in Figure 4.31 and Figure 4.32, using the analysis methods described in Chapter 3.3.4.3. This method reclassified the responses into five new classes, which indicated whether the responded were not at all, slightly, somewhat, moderately or extremely oriented towards that style.

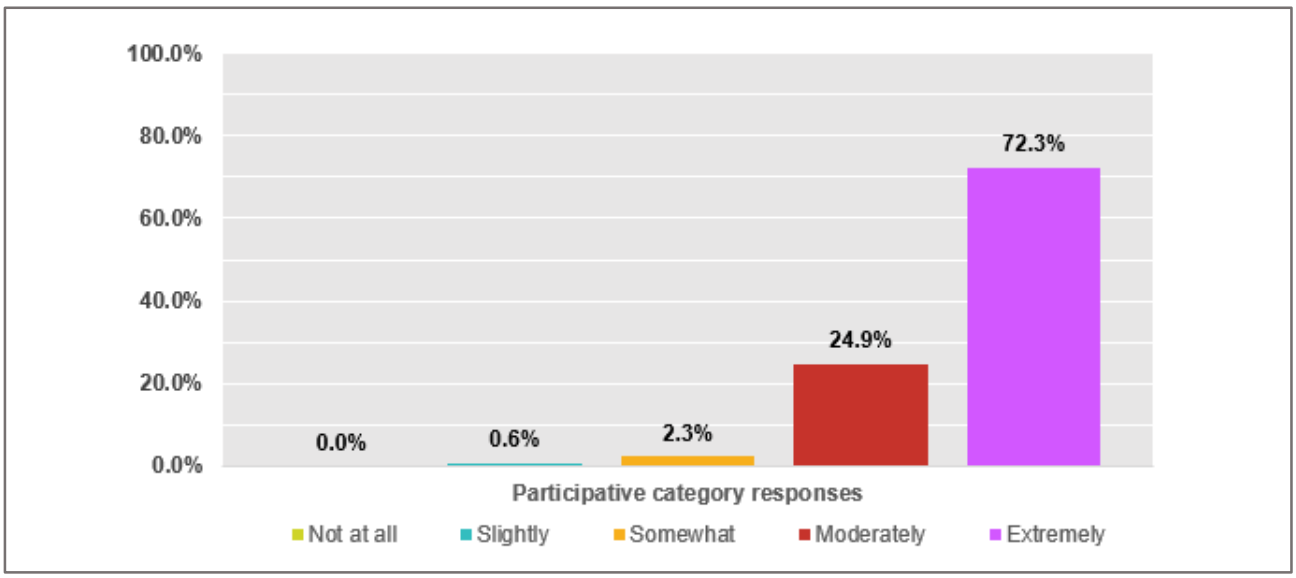

Figure 4.31: Classified participative responses

The results of the participative evaluation confirmed that South African Antarctic expeditioners were extremely oriented towards a participative style, where 72.3 per cent of respondents fell into the extremely participative, and 24.9 per cent into the moderately participative, classification.

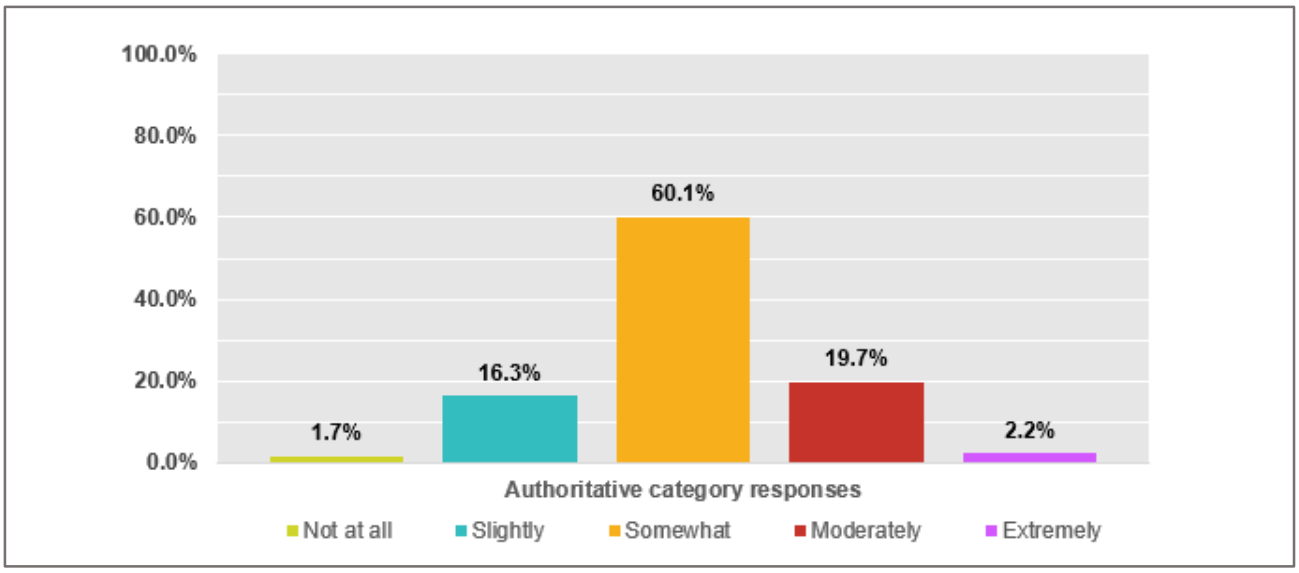

Figure 4.32: Classified authoritative responses

An analysis of the authoritative category revealed a more interesting result. The results centred at 60.1 per cent, which showed that South African Antarctic expeditioners could be classified as preferring a somewhat authoritative station leader.

The authoritative responses were further explored in terms of gender, expedition experience and the impact of an eventful year.

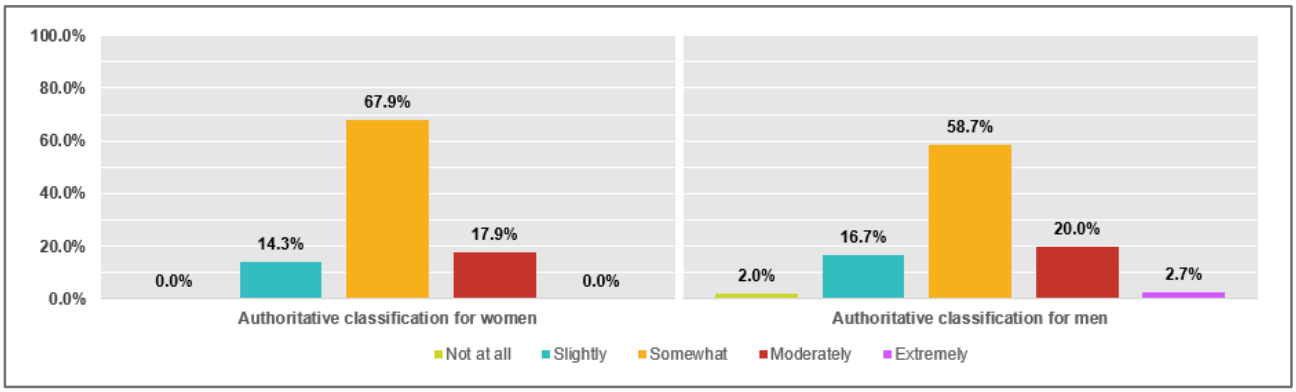

Figure 4.33: Gender comparison on authoritative responses

When comparing responses according to gender, 2.7 per cent of male respondents preferred an extremely authoritative station leader. The majority of women preferred a somewhat authoritative station leader, but more men than women preferred a moderately authoritative station leader.

Figure 4.34 shows the impact of an eventful year on the preferences for an authoritative leader. Bass (2008, cited in Hannah *et al.*, 2009) found that followers reacted positively to leaders who provided authoritative responses in threatening situations, where Hannah *et al.* (2009) found that leaders who were less intimidating, and accepted input from followers, explained their decisions and communicated regularly, remained effective in extreme contexts.

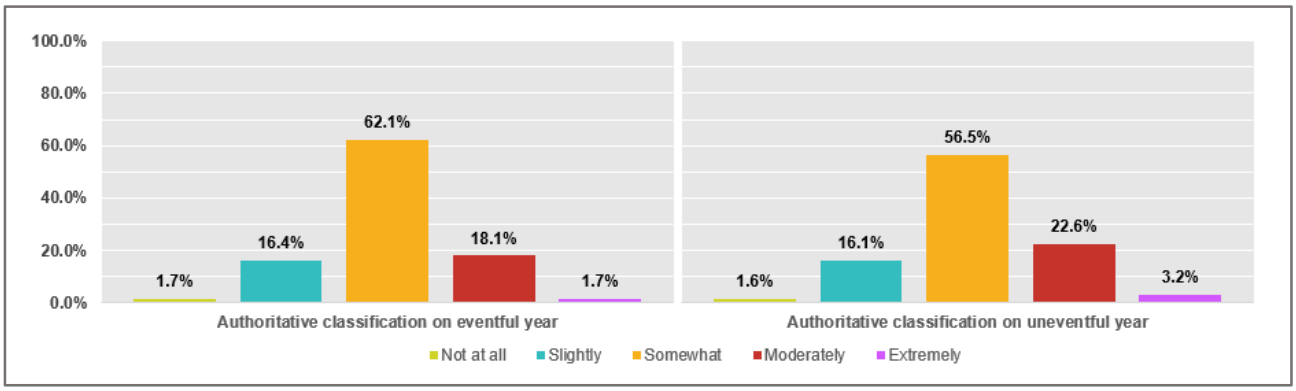

Figure 4.34: Impact of events on authoritative responses

Of the respondents who had experienced an eventful year, 62.1 per cent preferred a somewhat authoritative station leader, compared to 56.5 per cent of the respondents who had had an uneventful year. Of respondents who had had an uneventful year, 22.6 per cent preferred a moderately

authoritative station leader, compared to 18.1 per cent for the other group. It was not possible to determine with confidence whether a more authoritative or less authoritative station leader is preferred during emergencies or an eventful year.

Experience did not play a major role in the responses, as shown in Figure 4.35. Both single and multiple expedition respondents showed a similar profile to the overall authoritative responses.

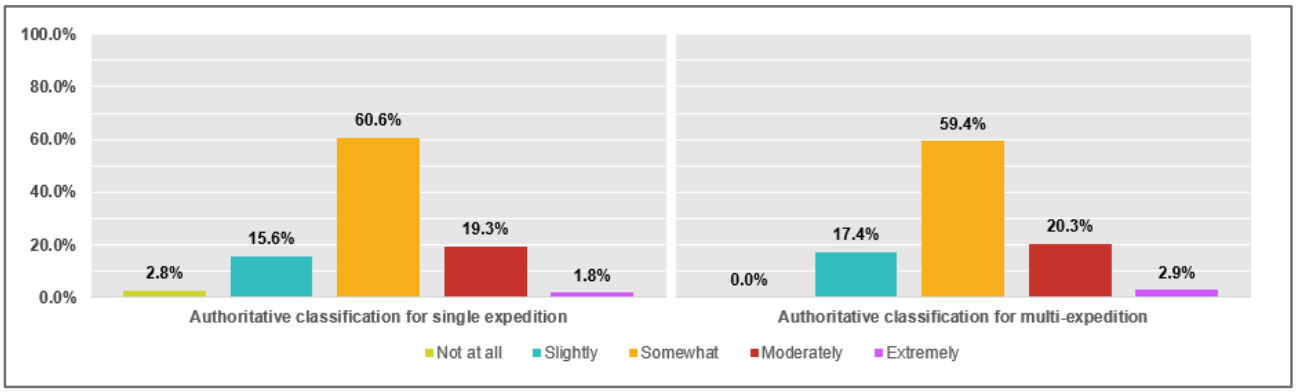

Figure 4.35: Experience comparison and authoritative responses

The highest preference for a moderately authoritative station leader came from overwinterers who had had an uneventful year, where 22.6 per cent indicated this choice. Of the three different groupings of gender, experience and events, there were no significant differences between the results, where the majority of all the groups indicated a preference for a somewhat authoritative station leader.

4.2.4.3 Leadership in emergencies

The majority of respondents, 65.0 per cent, indicated that they or their team had experienced emergencies, trauma or continuous and aggressive interpersonal conflict during their deployment. It was of interest to explore the role of the station leader in these situations, especially when it came to decision-making autonomy.

Figure 4.36 shows the results when the respondents were asked to indicate if the station leader should maintain decision-making autonomy during emergencies. The result were strongly skewed towards agreement, where 39.8 per cent agreed and 36.9 per cent strongly agreed.

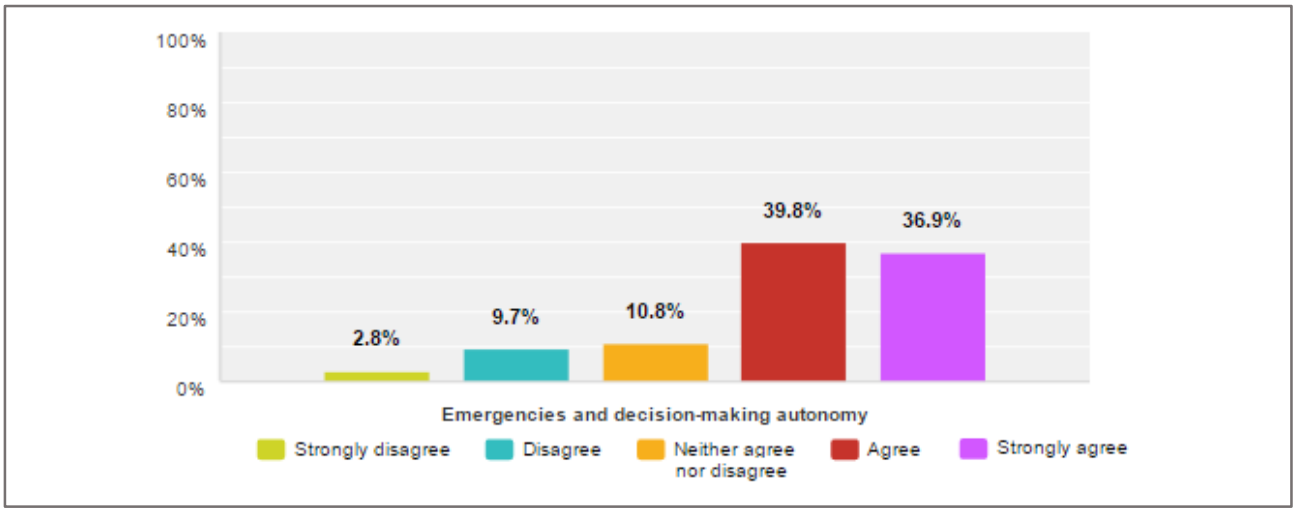

Figure 4.36: Emergencies and station leader autonomy

From a team member perspective, only 9.7 per cent disagreed and 2.8 per cent strongly disagreed that station leaders should retain decision-making autonomy during emergencies. Even though 62.1 per cent of the respondents who had experienced emergencies only preferred a somewhat authoritative station leader, the majority of participants agreed that, during emergencies, a station leader with decision-making autonomy is preferred at South African Antarctic stations.

4.2.5 The position of station leader and its effect on the team

4.2.5.1 Importance of the position

In terms of the importance of the position of station leader, Figure 4.37 shows that 46.0 per cent of the respondents agreed and 29.0 per cent strongly agreed that the station leader plays a decisive role in the success of a remote station. This is also reflected in Table 4.6, where the mean responses were 3.95.

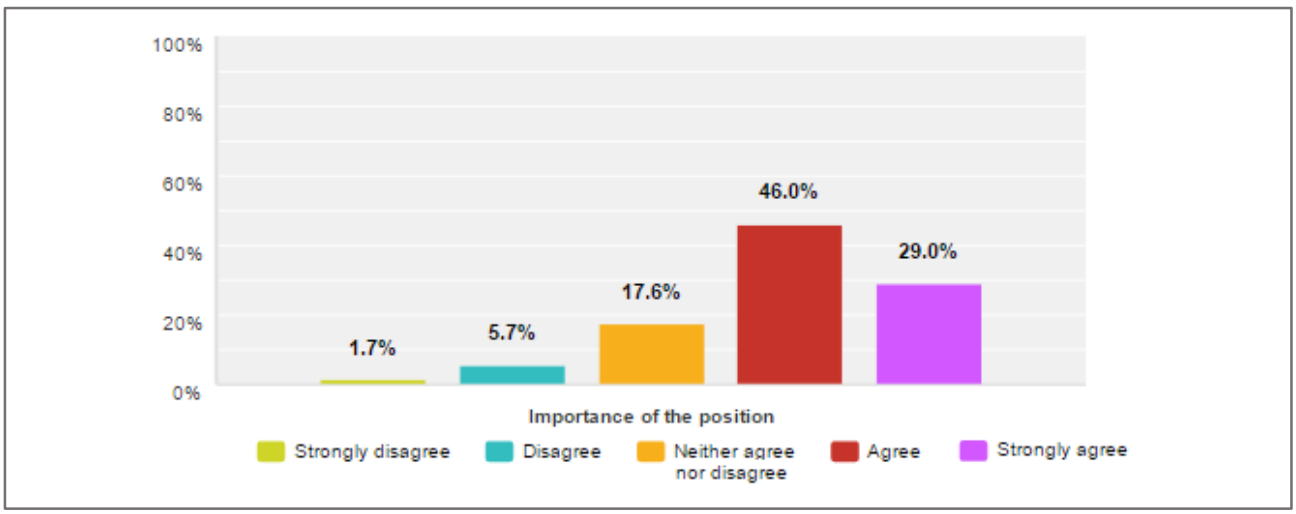

Figure 4.37: Importance of the position of station leader

Table 4.6: Descriptive statistics for the importance of the position of station leader

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	4.00	3.95	0.92

Of the respondents, 19.4 per cent indicated that they had been appointed as station leaders for their expedition, and the other 80.6 per cent comprised the team members. When the responses of these two groups to the question on the importance of the position of station leader, were compared, they yielded similar distributions, as shown in Figure 4.38. The leaders felt slightly more strongly about the importance of the position of the station leader.

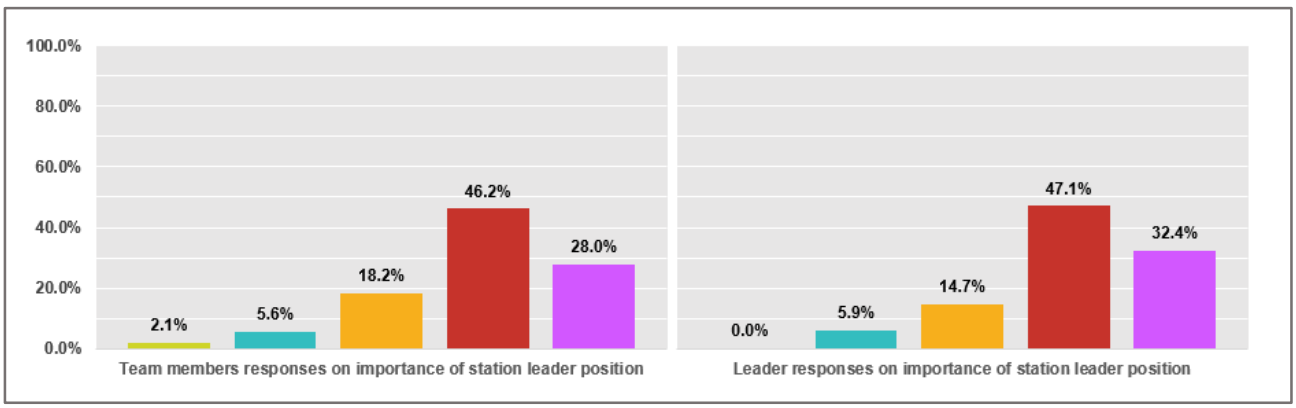

Figure 4.38: Comparison between the perceptions of leaders and team members on the importance of the position of station leader

It can be concluded that the position of the station leader is seen as an important one in the team, and plays a decisive role in the success of an Antarctic station.

4.2.5.2 Impact of the station leader on team members

The impact of the station leader on team members was tested, using a five point Likert scale, by the following three statements:

- The station leader affected my ability to adapt to life at the station;
- The station leader influenced the quality of my expedition year; and
- The station leader affected my decision to overwinter again.

The station leader is responsible for individual well-being, when this is affected by how well an individual adapts to the isolated, confined and extreme conditions at Antarctic stations (AAD, 2013). The results of the survey on station leader's role in adaptation are shown in Figure 4.39 and Table 4.7.

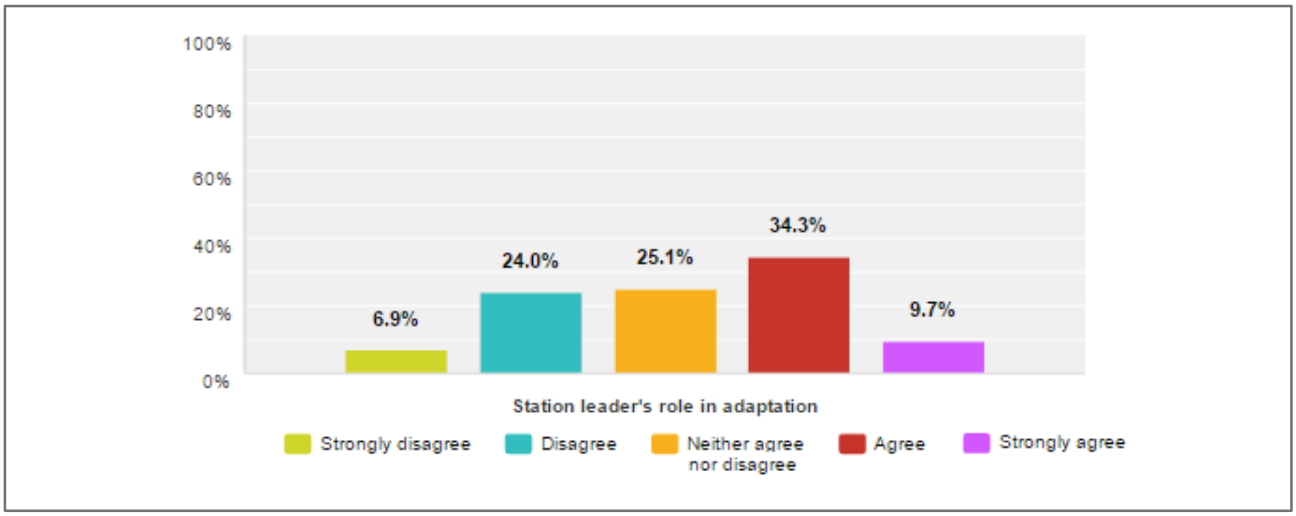

Figure 4.39: The station leader's role in adaptation

Table 4.7: Descriptive statistics for the station leader's role in adaptation

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	4.00	3.16	1.12

Of the responses, 34.3 per cent agreed, and 9.7 per cent strongly agreed, that the station leader had affected their ability to adapt to life at the station, but a quarter of the respondents, 25.1 per cent, neither agreed nor disagreed. Another quarter of the respondents, 24.0 per cent, disagreed that the station leader had affected their ability to adapt to life at the station, and 6.9 per cent strongly disagreed.

A comparison was made between respondents who had been on a single expedition and those who had been on multiple expeditions. The results, in Figure 4.40, show that the station leader played a greater role in the adaptation of people on their first expedition.

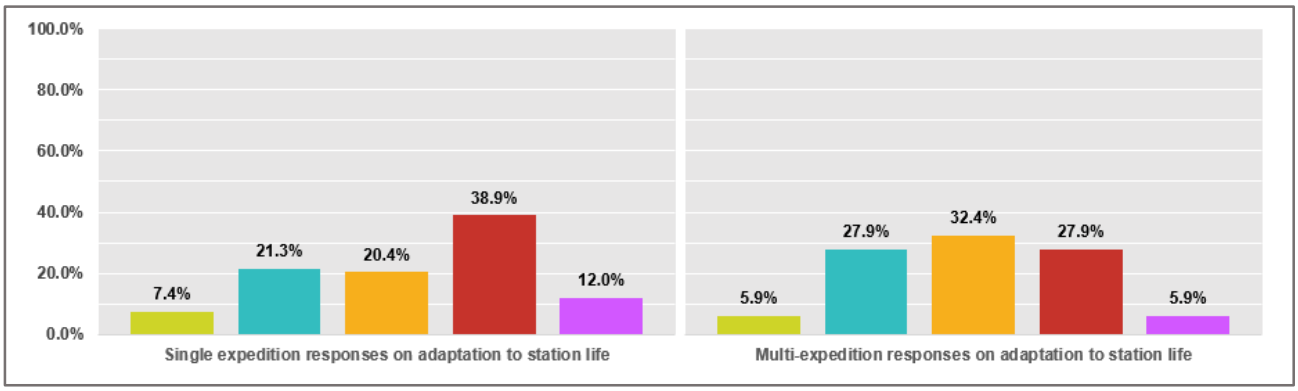

Figure 4.40: Experience comparison on adaptation

The results from the survey statement confirmed that the station leader affected adaptation to life at an Antarctic station, with a larger influence during the first expedition. However, one should be careful

not to conclude that the station leader helped individuals to adapt to station life, as that was not tested and cannot be inferred from the results.

Antarctic station leader's effectiveness can have a notable effect on the quality of life of the expedition team (Schmidt *et al*., 2005). From Figure 4.41 and Table 4.8, it can be seen that a large majority of the respondents, 45.7 per cent, agreed and 18.9 per cent strongly agreed, with a mean of 3.58, that the station leader had influenced the quality of the respondent's overwintering year. The respondents who disagreed, 18.9 per cent and strongly disagreed, 3.4 per cent, represented the population to a lesser extent.

It can be concluded that the station leader influenced the quality of the overwintering year. It cannot, however, be inferred that the station leader contributed to either a higher or a lower quality year, as this was not tested.

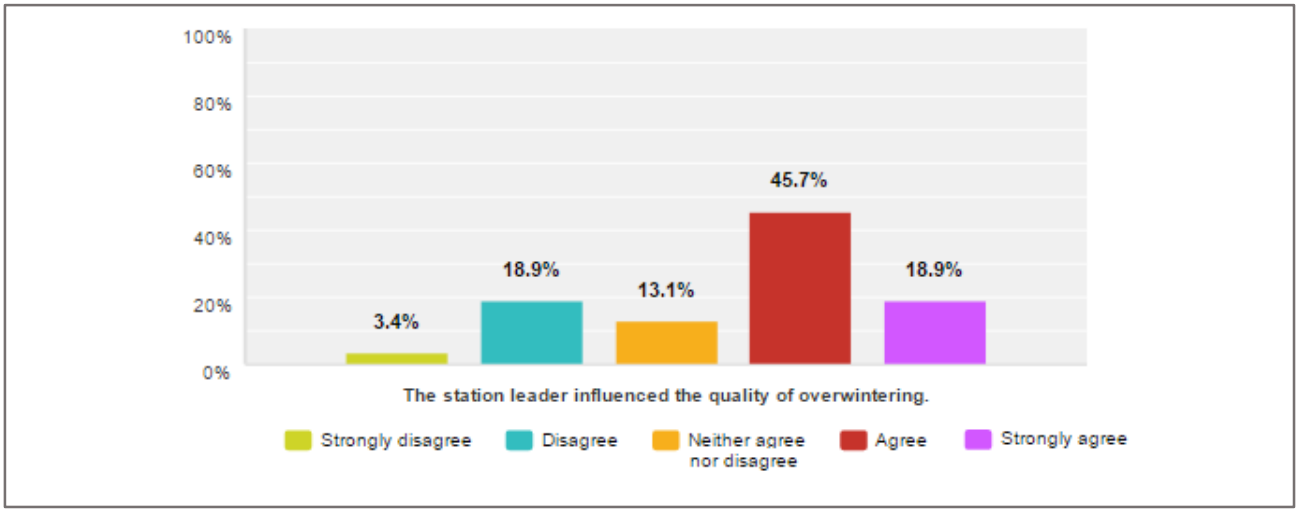

Figure 4.41: The station leader's influence on the quality of the expedition

Table 4.8: Descriptive statistics on the station leader's influence on quality of the expedition

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	4.00	3.58	1.10

Individuals who had completed more than one overwintering expedition represented 39.7 per cent of the respondents. Their motivations and reasons for going on multiple expeditions was not explored as part of this research. It was of interest to test whether the station leader had played a role in the decision to overwinter again, for both single expedition and multi-expedition respondents. The results are shown in Figure 4.42 and Table 4.9.

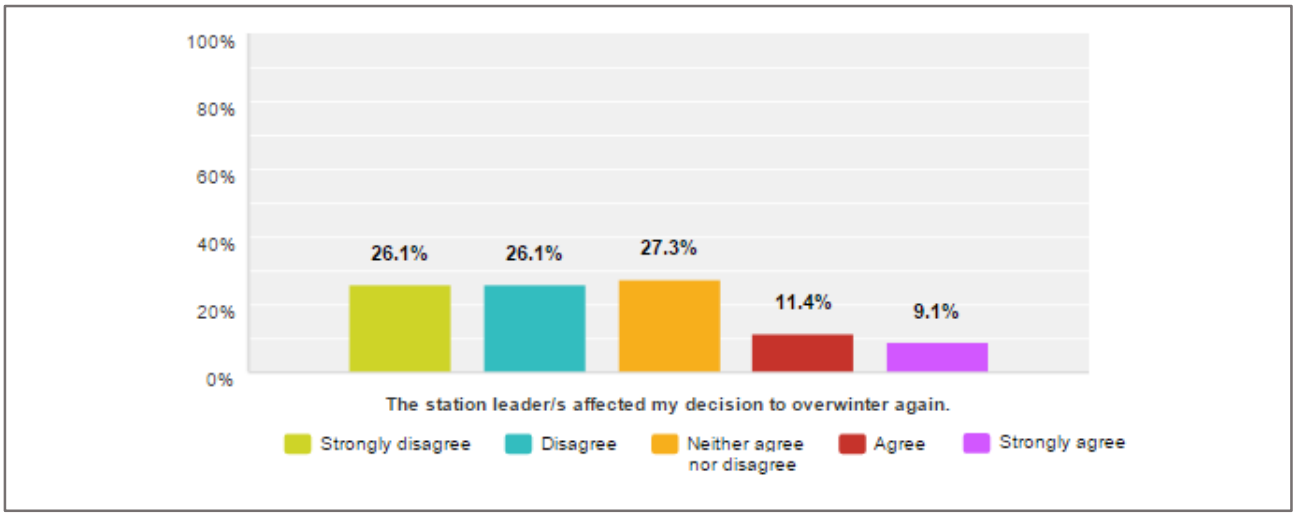

Figure 4.42: Station leader's role in the decision to overwinter again

Table 4.9: Descriptive statistics for the station leader's role in decision to overwinter again

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	4.00	2.46	1.29

The sample results shows a mean of 2.46, where 26.1 per cent strongly disagreed, and 26.1 per cent disagreed that the station leader had influenced their decision to complete another expedition. A comparison between team members of single expeditions and of multiple expeditions is shown in Figure 4.43.

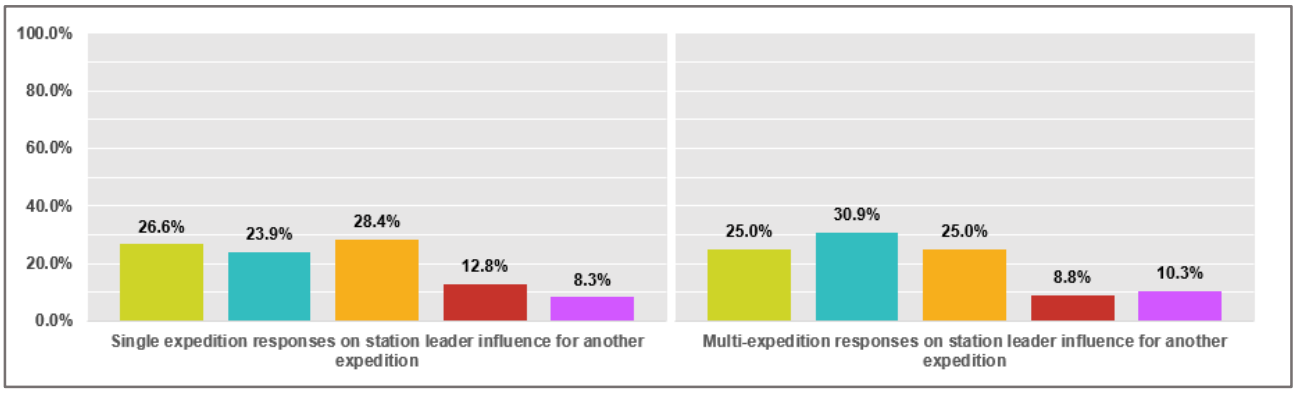

Figure 4.43: Experience comparison on the station leader influence for another expedition

When comparing the two groups, the more experienced expeditioners gave a slightly higher indication that the station leader did not influence their decision to apply for another expedition. The overall conclusion is that the station leader plays a lesser role in the decision to apply for another overwintering expedition.

4.2.5.3 Station leader appointment

The autocratic appointment of station leaders could potentially influence the effectiveness of the station leaders in fulfilling their duties, especially if the leader appointed differed from the psychological leader (Huntford, 2012). This section explores the autocratic appointment of the station leader, and also measured the opinions on how much emphasis is placed on leadership qualities when appointments are made for this position.

Figure 4.44 and Table 4.10 shows the results when respondents were asked if the team members should be allowed to have an input into their station leader's appointment. The responses show that 35.2 per cent of the respondents agreed and 21.6 per cent strongly agreed that the team should be allowed a measure of input into who was appointed as their station leader. A minority of 6.3 per cent strongly disagreed, and 15.3 per cent disagreed, that the team should have an input into the station leader's appointment.

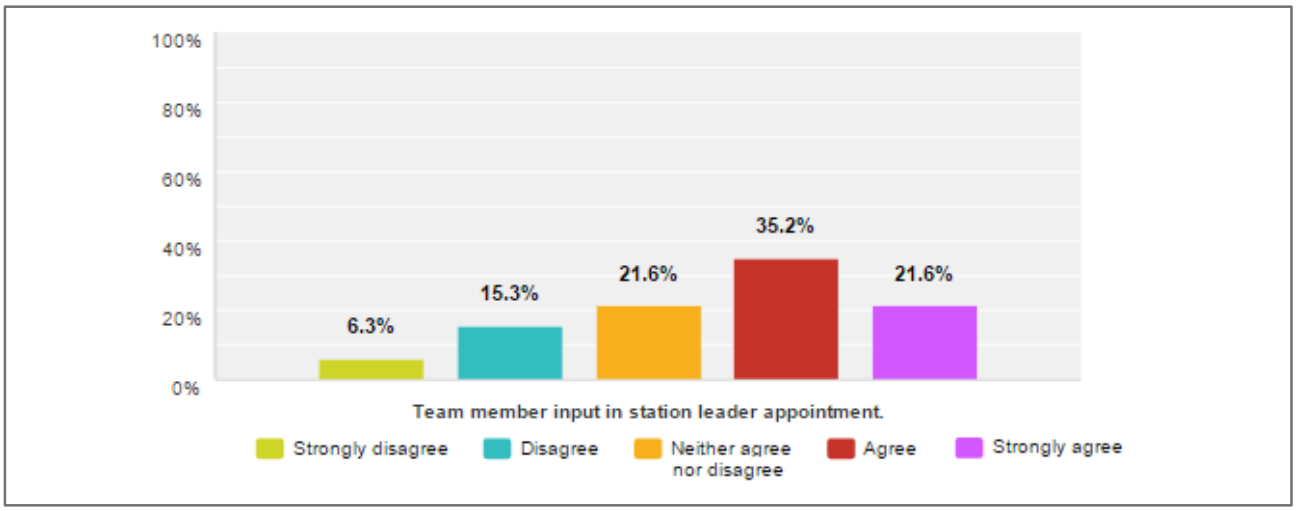

Figure 4.44: Team members' input into the station leader's appointment

Table 4.10: Descriptive statistics for team member input into the station leader's appointment

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	4.00	3.51	1.18

It can be concluded that South African Antarctic expeditioners would like a measure of input when it comes to the appointment of their station leader.

At a South African Antarctic station, the station leader duties are additional to the professional duties of the individual. The requirements for the position of station leader were that a candidate should have a bachelor's degree and have prior knowledge of administration and staff control (SANAP, 2016c).

Figure 4.45 and Table 4.11 show the respondent's data on whether SANAP placed a high emphasis on leadership qualities when appointing the station leader. Those who strongly disagreed with this statement represented 14.2 per cent of the respondents, and 17.6 per cent disagreed with the statement.

The majority of the respondents did not either agree or disagree with the statement, which was confirmed by 29.0 per cent of the respondents and a mean of 3.05. Based on the results, 31.8 per cent disagreed that SANAP places a high emphasis on leadership qualities for station leaders and 39.2 per cent felt that SANAP did place a high emphasis on leadership qualities.

It is not possible to reach a definitive conclusion about the perceptions of the Antarctic program's emphasis on leadership qualities at the appointment stage.

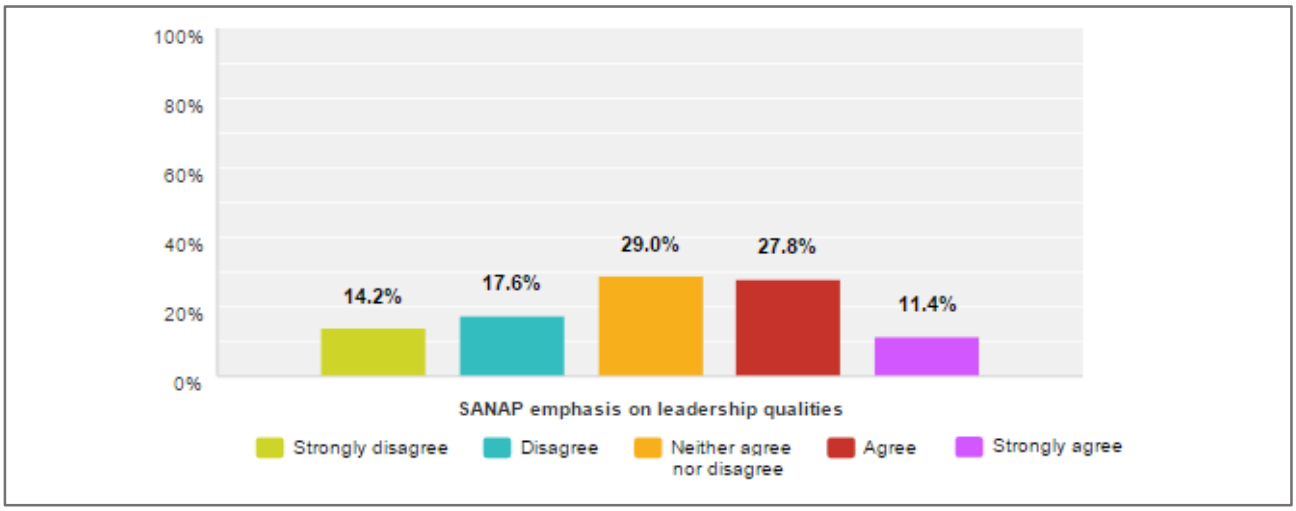

Figure 4.45: SANAP's emphasis on leadership qualities during appointment

Table 4.11: Descriptive statistics for SANAP's emphasis on leadership qualities

Minimum	Maximum	Median	Mean	Standard Deviation
1.00	5.00	3.00	3.05	1.27

The respondents were divided according to the year in which they completed their last overwintering expedition, to better gauge the changes in SANAP station leader appointment practices over the 54 years. The results are shown in Figure 4.46 and Table 4.12.

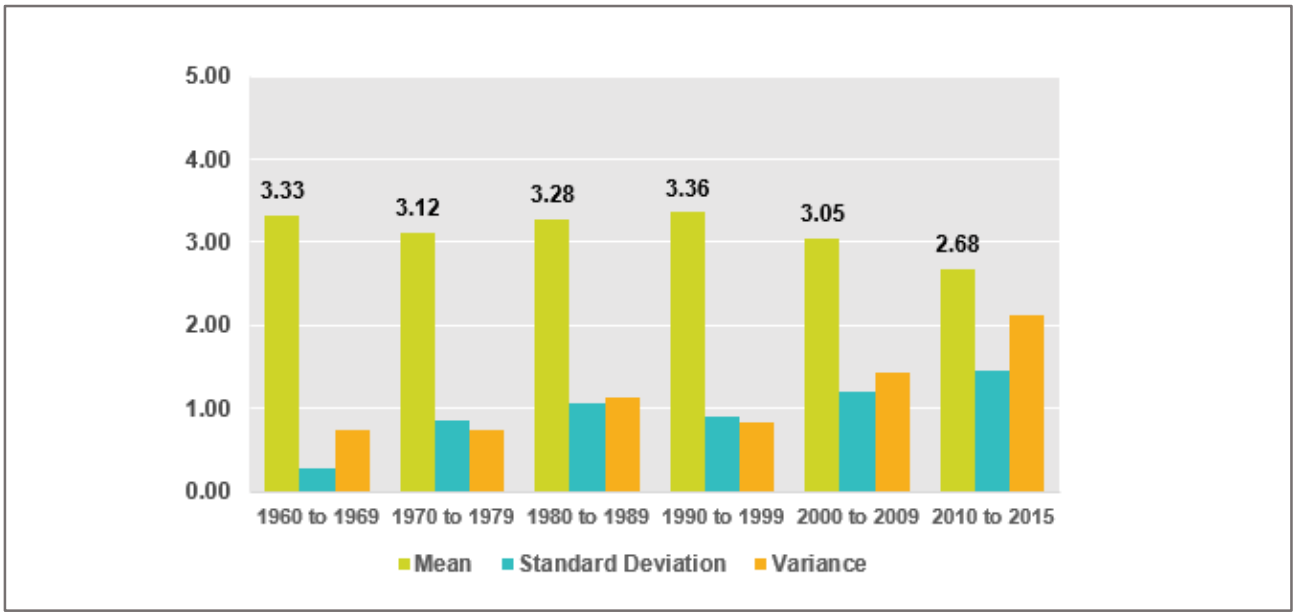

Figure 4.46: Decal distribution of means for SANAP's emphasis on leadership qualities

Table 4.12: Descriptive statistics for SANAP's emphasis on leadership qualities

Decade overwintered	Mean	Standard Deviation	Variance	Percentage of sample
1960 to 1969	3.33	0.29	0.75	5.6%
1970 to 1979	3.12	0.86	0.74	6.7%
1980 to 1989	3.28	1.07	1.14	18.6%
1990 to 1999	3.36	0.91	0.82	16.4%
2000 to 2009	3.05	1.20	1.44	24.5%
2010 to 2015	2.68	1.46	2.12	28.3%

Between 1960 and 1989, respondents had similar means of 3.33, 3.12 and 3.28 respectively, where 1 represented strong disagreement and 5 represented strong agreement on whether SANAP placed a high emphasis on leadership qualities when appointing station leaders.

The group that overwintered between 2000 and 2009 started showing more disagreement than agreement with SANAP's appointment practices when it came to leadership qualities, with a mean of 3.05. The respondents who overwintered between 2010 and 2015 showed the lowest mean of 2.68. This group, represented by 28.3 per cent of the respondents, also had the highest variance, 2.12, in perception, compared to the lowest variance of 0.74 for the period from 1970 to 1979.

It can be concluded that, although the sample was undecided about SANAP's emphasis on leadership qualities, the most recent overwintering personnel felt that SANAP did not place a high emphasis on leadership qualities when appointing station leaders, with the first decline showing in the period from 2000 to 2009, and a more drastic decline from 2010 to 2015.

4.2.6 Unique qualities for the Antarctic leader

Question 31 provided the respondents with an opportunity to provide feedback on the unique leadership qualities required when comparing a leader in an isolated, confined and extreme environment to that of one in the traditional business environment in South Africa. From the ninety responses, 42 different themes were identified, which are shown in Appendix D. The recurring themes are summarised in Table 4.13.

Table 4.13: Recurring themes for unique Antarctic leadership qualities

Recurring theme	Frequency	Recurring theme	Frequency
Active involvement / knowledge / interest in science, conservation & outdoor.	3	More endurance, perseverance and resilience required.	2
Task – supportive balance.	3	Availability 24/7 – always on call.	2
Respect professional capacity of team member.	4	More adaptable than back in South Africa.	6
Remain calm under stress in isolated and extreme conditions.	5	Psychology knowledge.	3
Balancing professional duties with shared team duties.	2	Better balance between personal and professional opinions.	4
Ability to deal with non-performance through alternate means, other than firing individuals.	3	Better at dealing with diversity.	3
Skilled at situational leadership.	2	Able to deal with the lack of boundary between work and social environments.	6
More skills to deal with interpersonal conflict.	3	Lead by example.	5
Social intelligence.	3	More involved in day-to-day activities.	3
More flexible.	2	Emotional intelligence.	2
More emergency and survival competencies.	2		

The respondents felt strongly that these leaders must be able to deal with the lack of any boundary between the professional and social environment of the station. In traditional business, leaders go home after a workday to recuperate, but Antarctic station leaders are always on call and must be available at any time.

Another consequence of the lack of boundaries between work and social life is that these leaders therefore need to better balance their personal and professional opinions. It was suggested that an Antarctic station leader requires a higher than average emotional and social intelligence, which can assist them to deal with this lack of boundaries.

Leaders form part of the life at the station, and are required to lead by example, especially when it comes to performing shared station duties. This differs from company managers in South Africa,

who can delegate tasks and coordinate activities. Station leaders also require the ability to balance their team's professional duties with the shared team duties.

Being more visible and more involved in the day-to-day activities of scientists and field workers emerged as a prominent theme. Respondents felt that station leaders required an active involvement, knowledge and interest in science, conservation and the outdoors as part of the position. Team members was appointed as a specialist or professional on their team, and respondents felt that the leader needed to respect the team's professional experience, knowledge and opinions more at an Antarctic station than what would be required back in South Africa.

The task role and supportive role of the station leader became more prominent at an Antarctic station than in the traditional business environment, where the station leader is tasked with team and individual well-being, as well as the expedition's outcomes. Station leaders need to support team members during the year, but their own support network is limited.

Other qualities that were found important for station leaders to possess were the ability to remain calm under stress, flexibility, endurance, perseverance, resilience and some knowledge of psychology. More emergency and survival competencies were required for Antarctic station leaders, which are competencies usually required only in specialised industries in South Africa.

Respondents thought that Antarctic station leaders should be able to deal better with any issues arising from cultural and race diversity, as these issues are amplified in the confined environment of the station. They also require more skills to deal with interpersonal conflict. When it comes to team members who are not performing their professional duties adequately, it is not always possible to remove and replace these members. This implied that station leaders should be better equipped to deal with non-performers and any other disciplinary problems, thus leveraging personal relationships, psychology and conflict mediation techniques.

4.3 SUMMARY

This chapter provided the perceptions of team members regarding the role of the station leader, specifically concerning personal relationships, personal well-being, team climate, and intervention in professional duties. South African Antarctic expeditioners felt that the three most important characteristics and competencies required for a station leader were trustworthiness, conflict management and the ability to communicate.

The overall leadership style that expeditioners preferred were an extremely participative style. The results also showed that a somewhat authoritative style is also acceptable to most team members, with no conclusion about the preferred style for coping with emergencies.

Regarding the position of station leader, both leaders and team members agreed that the station leader played a decisive role; that station leader affected the ability of team members to adapt to life

at the station, and that the station leader influenced the quality of the expedition. The station leader, however, did not play a major role in the decision of expeditioners to overwinter again.

The majority of expeditioners wanted to provide a measure of input into the appointment of the station leader. The results also showed that, since 2000, there has been less emphasis by SANAP on leadership qualities when appointing station leaders, with a sharper decline from 2010 to 2015.

CHAPTER 5
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In this last chapter, a summary of the findings of the study is presented, together with a comparison of these findings with those reported in the main body of the literature. The role and approaches of an effective station leader at an Antarctic station will be discussed, as well as characteristics and competencies these leaders should possess.

This chapter will also provide a summary on the findings on suggested leadership styles for Antarctic station leaders, as well as findings around the position of station leader and its impact on the Antarctic station team.

The chapter will further discuss the implications of the findings for the South African and international Antarctic community, and extend some of the conclusions to a comparison with the traditional business community. The chapter will conclude with the limitations of the study, recommendations and suggestions for future research on the topic of leadership in extreme environments.

5.2 SUMMARY OF MAIN FINDINGS

5.2.1 Respondent profiles

The respondents comprised 180 returned South African Antarctic expeditioners, who had overwintered between 1961 and 2015. A wide age distribution saw respondents aged from below 25 up to the age category of 61 or older. The South African Antarctic expeditioners were represented in a ratio of one woman to approximately five men, which is an improvement on the one woman to eight men that represents the rest of the world in the Antarctic community (Sarris & Kirby, 2007).

On average, about 40 per cent of South African Antarctic expeditioners had completed more than one expedition, compared to Australia where 25 per cent of Australians return for another Antarctic winter (Wood *et al*., 2000). The SANAE teams had the greatest representation in the survey, with expeditioners that overwintered on Marion Island second and those from Gough Island third.

When spending a year at a remote station, an expeditioner has a 65 per cent probability of experiencing an emergency, evacuation, trauma, death, or continuous and aggressive interpersonal conflict, which emphasises the fact that a station leader should be skilled enough to be able to handle emergencies and conflict effectively.

5.2.2 The role of and approaches for an effective station leader

5.2.2.1 Personal relationships

South African Antarctic expeditioners find that a station leader who maintains a personal bond with team members, as opposed to social distance, is more effective. Women prefer a balance between

a strong personal bond and a social distance, where men are more keen on a strong personal bond with their station leaders. The social distance between the team and the station leader becomes less when expeditioners are more experienced in overwintering, and when the team experiences emergencies, evacuations, trauma or continuous and aggressive interpersonal conflict, there is a greater need for a strong personal bond with the station leader.

5.2.2.2 Personal well-being

An effective station leader at a South African Antarctic station maintains a balance between allowing team members to regulate their own emotional well-being and actively monitoring and influencing the personal well-being of team members. More experienced overwinterers prefer a station leader who is more involved in their personal and emotional well-being.

Women prefer a station leader who is slightly more involved in the matter of personal well-being than the men do. This confirmed the findings of Leon and Sandal (2003), who found women to differ significantly from men when it came to interpersonal expressiveness at Antarctic stations. When an expedition is uneventful, the team members have a greater preference to regulate their own emotional well-being than do team members that experienced eventful expeditions.

5.2.2.3 Team climate

A station leader needs to make an effort to create and sustain a positive team climate. Team members on an eventful expedition with emergencies, trauma and conflict occurring, prefer a station leader who actively influences the team climate. Both men and women prefers a station leader who actively influence the team climate, which confirms the findings of Schmidt *et al*. (2004:685), who also found no evidence to suggest that gender influenced team members' perceptions of team climate at Australian Antarctic stations. More experienced overwinterers had a slightly higher preference for the station leader's involvement in team climate.

5.2.2.4 Professional duties

Station leaders should maintain a moderate involvement when it comes to the team members and the fulfilment of their professional duties. Women prefer to be left alone in the fulfilment of their duties, except when they request the station leader's involvement, whereas the majority of men appreciate a stronger involvement from the station leader.

Expeditioners with more experience, as well as expeditioners who had experienced an eventful year, preferred a stronger involvement from the station leader in their professional duties.

5.2.3 Station leader characteristics and competencies

The three most prominent characteristics and competencies expected of a station leader are trustworthiness, conflict management skills and the ability to communicate. In the absence of emergencies, evacuations, serious illness, death or constant and aggressive interpersonal conflict,

the conflict that might arise from diversity in a multicultural team could become more prominent, and having a station leader, who is comfortable with a diverse team, becomes more important.

Many of the competencies that South African Antarctic expeditioners found important are difficult to gauge at the interview stage, and may only emerge and seen to be present or absent during the course of the year, which makes employing station leaders based on these competencies more challenging.

A station leader who is people-driven, who cares about the well-being of team members and is sensitive to individual needs is more effective than a leader who is task-driven. South African Antarctic expeditioners prefer a station leader who maintains an active involvement and interest in the core business of SANAP, namely science, research and conservation.

5.2.4 Leadership styles

The predominant leadership style that South African Antarctic expeditioners prefer is an extremely participative style, as well as a somewhat authoritative approach. A dissemination of authoritative style preference did not reveal any significant differences in terms of gender, experience or the occurrence of events.

It is also undecided whether a more authoritative or less authoritative station leader is preferred during emergencies. However, when emergencies do occur at South African Antarctic stations, the station leader should retain decision-making autonomy.

5.2.5 The position of station leader and its effect on the team

5.2.5.1 Importance of the position

The study confirmed that both team members and leaders recognise that the station leader is seen as an important position in the team and as playing a decisive role in the success of an expedition overwintering at an Antarctic station.

5.2.5.2 Impact of the station leader on team members

The station leader affects the team members' adaptation to life at South African Antarctic stations, having a greater influence during the first expedition and less influence on individuals who had completed more than one expedition. A station leader also influences the quality of the overwintering year, but does not play a prominent role in the decision of a team member to go on another overwintering expedition.

5.2.5.3 Station leader appointment

South African Antarctic expeditioners would like to give input into the appointment of their station leader. The autocratic appointment of station leaders, however, had not resulted in an overwhelmingly negative response to this practice.

From 2000, to the most recent teams from 2015, it seems that there has been a decline in the practices of SANAP when appointing station leaders, particularly regarding the level of importance they allocate to leadership qualities. The most recent group of overwintering respondents, those from 2010 to 2015, showed the strongest response to SANAP's lack of emphasis on the leadership qualities of station leaders.

5.3 IMPLICATIONS

5.3.1 The Antarctic community

5.3.1.1 South African National Antarctic Program

This study revealed the mind-set and perceptions of the South African Antarctic expedition community. The majority of expeditioners viewed the station leader as fulfilling more than just an administrative or task based role, and perceived the role to extent to a supportive capacity. This included responsibilities for individual well-being and team climate.

These perceptions showed that a need exists for improved appointment practices, station leader training, and better on-station guidelines for station leaders. The station leader also lacks a support network, which can be hindrance to them finding higher-order solutions for problems.

There is a high probability that the station leader will need to deal with an emergency, an evacuation, a trauma event, or continuous and aggressive interpersonal conflict during the expedition year. The skills required to cope with these should be in place at appointment or, if necessary, form part of the pre-departure training.

The autocratic appointment of station leaders is somewhat concerning to team members, and the majority of South African Antarctic expeditioners would prefer the opportunity to provide input into the appointment of the leader of their own expedition.

5.3.1.2 Other Antarctic programs

This study confirmed many of the findings from the literature about the station leader's role as being both a task-orientated and a supportive leader. It also confirmed the impact and importance of the station leader in a small community.

The results concerning the team members' preferred leadership style is a new contribution to the field of Antarctic leadership. Other Antarctic programs could use these results and appoint station leaders who exhibit a style that is more participative than an authoritative for remote deployments.

5.3.2 Traditional business environments and organisations in distress

The type of station leader who is effective in Antarctica has many similarities to, and differences from a leader in a traditional business environment. The requirement for similar competencies, such as emotional and social intelligence, arose.

Organisations in distress may require a different type of leadership approach than they would under normal circumstances. If the extreme environment analogy may be used for distressed organisations, it would be advised that a more participative leader would be better suited to deal with the challenges that arise from the stressful and unforgiving environment in which a distressed organisation and its employees find themselves. However, just as in Antarctica, during some types of emergency, it is better for the leaders to retain decision-making autonomy.

A leader who is trustworthy, skilled at conflict management and who possesses advanced communication skills would be a good person to have at the helm whilst the organisation is in distress.

5.4 LIMITATIONS

The total number of responses to the study from females was 28. This limits the study in terms of the results obtained from the perceptions of women, versus those of men. Instead of definitive findings, the gender-related perceptions may be seen as guidelines.

The all-male, all-white teams of the past do not reflect the current team composition. South African teams that now overwinter together in the isolated, confined and extreme environment are more diverse in terms of gender, race, and culture. Diversity-related challenges, and the effectiveness of the station leader to deal with them, have emerged from the open-ended responses.

5.4 RECOMMENDATIONS

When considering the great impact that the station leader has on the quality of the overwintering year, and the ability of the overwinterer to adapt to life at the station, it is advised that SANAP implement a more rigorous procedure for the appointment of station leaders, which includes an analysis of their preferred leadership style. This could enable SANAP to better gauge individual competence, behaviour and experience.

The current requirements for the position requirements, such as a candidate who should have a bachelor’s degree and possess prior knowledge of administration and staff control (SANAP, 2016c), should be reviewed and adapted to include previous leadership or management experience, knowledge of or interest in science and conservation, and specific leadership abilities.

It is also suggested that SANAP appoint the station leader earlier, to allow for better psychological screening, as well as training them in conflict management, diversity, the current science projects, and emergency response.

SANAP needs to provide the station leader with a large support network outside the station, which may include an advisory board comprising experienced station leaders and representatives from the Department of Environmental Affairs.

The findings in this research report could also be used by SANAP to provide their station leaders with improved operating guidelines as part of the role. This includes operating practices in terms of availability, sobriety, methods to improve team climate, guides on the leader's intervention in the professional duties of team members and dealing with non-performance.

The possibility of team member's input into their station leader appointment is not always practical. However, team feedback should be solicited, in the form of leadership reviews before the expedition departs to the remote station, during the expedition, and at the end of the overwintering tour of duty, to gain a better understanding of the effectiveness of improvements in appointment practices and station leader's performance.

5.5 FURTHER RESEARCH

Further research could be conducted in this field by investigating the difference in effectiveness between a station leader who is appointed solely in the leadership position, and that of a station leader who is seen as an additional professional member of the team.

Modern SANAP teams are more diverse culturally and in terms of gender. An investigation into the diversity challenges might provide SANAP and future station leaders with insight into potential conflicts and challenges that could arise in diverse teams in an isolated, confined and extreme environment.

With 65 per cent of expeditions experiencing an eventful year, it may be of interest to perform a more targeted study of leadership approaches during emergencies at Antarctic stations.

REFERENCES

Allen, S.H., Moore, J. & Grocott, M.P. 2009. Expedition medicine in the tropics: through heat and sleet. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **103**(11):1081-1084.

Allen, T.D., Freeman, D.M., Russel, J.E.A., Reizenstein, R.C. & Rentz, J.O. 2001. Survivor reactions to organizational downsizing: does time ease the pain? *Journal of Occupational and Organizational Psychology*, **74**, 145-164.

Antarctic Legacy of South Africa (ALSA). 2015. *SANAE IV* [Online]. Available: http://blogs.sun.ac.za/antarcticlegacy/about-2/sanae-iv/. Accessed: 16 March 2016.

Aston, F. 2005. Women of the white continent. *Geographical*, **77**(9):26-30.

Auerbach, P.S. 2011. *Wilderness medicine*. Sixth edition. Maryland Heights: Mosby.

Australian Antarctic Division (AAD). 2013. *Station Leader* [Online]. Hobart: Australian Antarctic Division. Available: http://www.antarctica.gov.au/living-and-working/experiences/station-leader. Accessed: 16 March 2016.

Australian Antarctic Division (AAD). 2016. *Station Leader: Casey, Davis, Mawson & Macquarie Island* [Online]. Hobart: Australian Antarctic Division. Available: http://www.antarctica.gov.au/__data/assets/pdf_file/0014/20903/FINAL-Station-Leader-2016.pdf. Accessed: 22 May 2016.

Bishop, S.L. 2004. Evaluating teams in extreme environments: from issues to answers. *Aviation, Space, and Environmental Medicine*, (Supplement), **75**(7):C14-C21.

Brenton, F. 1998. Towards a rhetoric of change: reconstructing image and narrative in distressed organizations. *Journal of Business and Technical Communication*, **12**(2):217-237.

British Antarctic Survey (BAS). 2014. Power down at British Antarctic Survey Halley Research Station – Statement [Press release]. Cambridge: British Antarctic Survey. 6 August.

British Antarctic Survey (BAS). 2015. *Why Antarctica Matters* [Online]. Cambridge: British Antarctic Survey. Available: https://www.bas.ac.uk/about/antarctica/why-antarctica-matters/ Accessed: 17 May 2016.

Bown, S.R. 2012. *The Last Viking: The Life of Roald Amundsen*. Boston: Da Capo.

Boyatzis, R.E., Goleman, D. & Rhee, K. 1998. Clustering competence in emotional intelligence: Insights from the Emotional Competence Inventory (ECI). Working Paper WP 99-6. Cleveland, Ohio: Department of Organizational Behaviour, Weatherhead School of Management, Case Western Reserve University.

Burke C.S., Stagl, K.C., Klein, C., Goodwin, G.F., Salas, E. & Halpin, S.M. 2006. What type of leadership behaviours are functional in teams? A meta-analysis. *The Leadership Quarterly*, **17**, 288-307.

Cavell, J. 2010. Manliness in the life and posthumous reputation of Robert Falcon Scott. *Canadian Journal of History*, **45**(3):537-564.

Coetzee, J. 2008. *Leadership behaviour for the successful strategic repositioning of Sanlam.* Research report presented in partial fulfilment of the requirements for the degree of Master of Business Administration, University of Stellenbosch, Cape Town. [Online] Available: http://scholar.sun.ac.za/handle/10019.1/5537. Accessed: 3 June 2016

Comcare. 2013. Comcare's guide to remote or isolated work [Online]. Canberra: Australian Government Comcare. Available: http://www.comcare.gov.au/__data/assets/pdf_file/0017/133361/Guide_to_remote_or_isolated_work_WHS1_PDF,_172_KB.pdf. Accessed: 19 May 2016.

COMNAP. 2008. *COMNAP Constitution 04 July 2008* [Online]. Available: https://www.comnap.aq/Shared%20Documents/comnap-constitution-adopted-04-july-2008.pdf. Accessed: 18 May 2016.

Cooper, J. & Headland, R.K. 1991. A history of South African involvement in Antarctica and at the Prince Edward Islands. *South African Journal of Antarctic Research*, **21**(2):77-91.

De Beer, C.M. 2009. *Leadership shifts required to be successful in the new economy.* Research report presented in partial fulfilment of the requirements for the degree of Master of Business Administration, University of Stellenbosch, Cape Town. [Online] Available: http://scholar.sun.ac.za/handle/10019.1/940. Accessed: 3 June 2016.

Department of Transport. 1974. *South African National Antarctic Expeditions.* Pretoria: Co-operative Press Ltd. Available: http://alp.lib.sun.ac.za/bitstream/handle/123456789/2633/sanae_williams_transport_1974.pdf?sequence=3&isAllowed=y. Accessed: 17 May 2016.

Dudeney, J.R. & Walton, D.W.H. 2012. From Scotia to 'Operation Tabarin': Developing British Policy for Antarctica. *Polar Record*, **48**, 342-360.

Dulewicz, V. & Higgs, M. 1999. Can emotional intelligence be measured and developed? *Leadership & Organization Development Journal*, **20**(5):242-253.

Eagly, A.H. & Johnson, B.T. 1990. Gender and leadership style: a meta-analysis. *Psychological Bulletin*, **108**(2):233-256.

Facebook. 2016a. *SANAE Friends* [Online]. Available: https://www.facebook.com/groups/SANAExpeditions/ Accessed: 10 September 2016.

Facebook. 2016b. *Friends of Antarctic Legacy of South Africa* [Online]. Available: https://www.facebook.com/groups/409942979164222/ Accessed: 10 September 2016.

Facebook. 2016c. *Sanae 20* [Online]. Available: https://www.facebook.com/groups/108741689198/ Accessed: 10 September 2016.

Fisher, B. 2012. *South to the Pole: Celebrating the success of Roald Amundsen* [Online]. Lausanne: International Institute for Management Development (IMD). Available: http://www.imd.org/research/challenges/TC001-12.cfm. Accessed: 18 May 2016.

Gardner, W.L., Cogliser, C.C., Davis, K.M. & Dickens, M.P. 2011. Authentic leadership: a review of the literature and research agenda. *The Leadership Quarterly*, **22**(6):1120-1145.

Godwin, J.R. 1987. Leadership at Antarctic Stations [Online]. Canberra: Australian Military Forces Psychological Research Unit. Available: http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA183893. Accessed: 20 May 2016.

Goleman, D. 2004. What makes a leader? Best of HBR 1998. *Harvard Business Review,* **1**, 1-11.

Grant, I.C. 2004. Telemedicine in the British Antarctic Survey. *International Journal of Circumpolar Health*, **63**(4):356-364.

Grant, I., Eriksen, H.R., Marquis, P., Orre, I.J., Palinkas, L.A., Suedfeld, P., Svensen, E. & Ursin, H. 2007. Psychological selection of Antarctic personnel: the “SOAP” instrument. *Aviation, Space, and Environmental Medicine*, **78**(8):793-800.

Hamel, G. & Prahalad, C.K. 1996. Competing on the new economy: managing out of bounds. *Strategic Management Journal*, **17**, 237-242.

Hannah, S.T., Uhl-Bien, M., Avolio, B.J. & Cavarretta, F.L. 2009. A framework for examining leadership in extreme contexts. *The Leadership Quarterly*, **20**, 897-919.

Harris, A., Marquis, P., Eriksen, H.R., Grant, I., Corbett, R., Lie, S.A. & Ursin, H. 2010. Diurnal rhythm in British Antarctic personnel [Online]. *Rural and remote health*, 10, 1351. Available: http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=1351. Accessed: 20 May 2016.

Harris, N. 2014. The Antarctic Selection [Online]. *Australian Antarctic Magazine*, **27**, 26-27. Available: http://search.informit.com.au/fullText;dn=902814539542510;res=IELHSS;action=addOrderItem. Accessed: 19 May 2016.

Hense, P.A. 2004. Ernest Shackleton provides some lessons in leadership. *Grand Rapids Business Journal*, **22**(33), 9 August:20

Hersey, P., Blanchard, K.H. & Natemeyer, W.E. 1979. Situational Leadership, Perception and the Impact of Power. *Group & Organization Studies*, **4**(4):418-428.

Hogan, R., Curphy, G.J & Hogan, J. 1994. What we know about leadership: Effectiveness and Personality. *American Psychologist*, **49**(6):493-504.

Hsieh, C. & Wang, D. 2015. Does supervisor-perceived authentic leadership influence employee work engagement through employee-perceived authentic leadership and employee trust? *The International Journal of Human Resource Management*, **26**(18):2329-2348.

Huntford, R. 2012. *Scott and Amundsen: the last place on Earth.* London: Hachette Digital

Jabour-Green, J. & Nicol, D. 2003. Bioprospecting in areas outside national jurisdiction: Antarctica and the Southern Ocean. *Melbourne Journal of International Law,* **4**, 76-111.

Jogunola, K. 2013. *The relationship between leadership style and company performance: A study of South African non-listed companies*. Research report presented in partial fulfilment of the requirements for the degree of Masters of Business Administration, University of Stellenbosch Business School, Cape Town. [Online] Available: http://scholar.sun.ac.za/handle/10019.1/97434. Accessed: 20 May 2016.

Johnson, J.C., Boster, J.S. & Palinkas, L.A. 2003. Social Roles and the evolution of networks in extreme and isolated environments. *Journal of Mathematical Sociology*, **27**, 89-121. doi: 10.1080/00222500305890.

Joseph, A. 2008. *The impact of leadership style on team performance and cohesiveness within a technical* environment. Research report presented in partial fulfilment of the requirements for the degree of Master of Business Administration, University of Stellenbosch, Cape Town. [Online] Available: http://scholar.sun.ac.za/handle/10019.1/5752. Accessed: 3 June 2016.

Kanas, N. & Ritsher, J. 2005. Leadership issues with multicultural crews on the international space station: lessons learned from Shuttle/Mir. *Acta Astonautica*, **56**, 932-936.

Kanas, N., Sandal, G., Boyd, J.E., Gushind, V.I., Manzey, D., North, R., Leon, G.R., Suedfeld, P., Bishop, S., Fiedler, E.R., Inoue, N., Johannes, B., Kealey, D.J., Kraft, N., Matsuzaki, I., Musson, D., Palinkas, L.A., Salnitskiy, V.P., Sipes, W., Stuster, J. & Wang, J. 2009. Psychology and culture during long-duration space missions. *Acta Astronautica*, **64**, 659-677.

Kanter, R.M. 2003. Leadership and the psychology of turnarounds. *Harvard Business Review*, **81**(6):58-67.

Kayes, D.C. 2004. The 1996 Mount Everest climbing disaster: the breakdown of learning in teams. *Human Relations*, **57**(10):1263-1284.

Kearney, E. & Gebert, D. 2009. Managing diversity and enhancing team outcomes: the promise of transformational leadership. *Journal of Applied Psychology*, **94**(1):77-89.

Kennicutt II, M.C & Chown, S.L. 2014. Six priorities for Antarctic Science. Comment in *Nature*, **512**, 23-25.

Kiazad, K., Restubog, S.L.D., Zagenczyk, T.J., Kiewitz, C. & Tang, R.L. 2010. In pursuit of power: the role authoritarian leadership in the relationship between supervisors' Machiavellianism and subordinates' perception of abusive supervisory behaviour. *Journal of Research in Personality,* **44**, 512-519.

Klein, K.J., Ziegert, J.C., Knight, A.P. & Xiao, Y. Dynamic delegation: shared, hierarchical, and deindividualized leadership in extreme action teams. *Administrative Science Quarterly*, **51**(4):590-621.

Kohlrieser, G. 2007. Six essential skills for managing conflict [Online]. Lausanne: International Institute for Management Development (IMD). Available: http://www.imd.org/research/publications/upload/PFM149_LR_Kohlrieser.pdf. Accessed: 7 July 2016.

Kothari. C.R. 2004. *Research Methodology: methods and techniques*. Second Revised Edition. New Delhi: New Age Publishers.

Larson, E.J. 2011. Poles apart: Scott, Amundsen and science. *Endeavour*, **35**, 129-136.

Leon, G.R. 1991. Individual and group process characteristics of polar expedition teams. *Environment and Behavior*, **23**(6):723-748. doi: 10.1177/0013916591236005

Leon, G.R. & Sandal, G.M. 2003. Women and coupes in isolated extreme environments: applications for long-duration missions. *Acta Astronautica*, **53**, 259-267.

Leon, G.R., Sandal, G.M. & Larsen, E. 2011. Human performance in polar environments. *Journal of Environmental Psychology*, **31**, 353-360.

Lilburne, L. 2005. *Shrinks on ice: a review of psychosocial research* [Online]. Graduate thesis for certificate in Antarctic Studies, University of Canterbury, Gateway Antarctica, Christchurch, New Zealand. Available: http://www.anta.canterbury.ac.nz/documents/GCAS_7/Lilburne_L_Lit.Review.pdf. Accessed: 21 May 2016.

Lovegrove, I. 2013. Leaders in Antarctica: Characteristics of an Antarctic station manager. In Giannantonio, C.M. & Hurley-Hanson, A.E. (eds.), *Extreme Leadership: Leaders, teams and situations outside the norm*. Cheltenham: Edward Elgar Publishing.

Luthans, F. 2002. Positive organizational behaviour: developing and managing psychological strengths. *The Academy of Management Executive*, **16**(10):57-75.

Maynard, M.T. & Kennedy, D.N. 2016. Team adaptation and resilience: what do we know and what can be applied to long-duration isolated, confined, and extreme contexts. NASA, Texas, United States. [Online] Available: http://ston.jsc.nasa.gov/collections/TRS/_techrep/TM-2016-218597.pdf. Accessed: 31 May 2016.

Morrel, M. & Capparell, S. 2001. *Shackleton's Way: Leadership lessons from the great Antarctic explorer*. New York: Penguin Publishing Group.

Morrison, E.W. & Robinson, S.L. 1997. When employees feel betrayed: a model of how psychological contract violation develops. *Academy of Management Review*, **22**(1):226-256.

Morrison, J. 2008. The relationship between emotional intelligence competencies and preferred conflict-handling styles. *Journal of Nursing Management*, **16**(8):974-983.

Muir, S.F., Barnes, D.K.A. & Reid, K. 2006. Interactions between humans and leopard seals. *Antarctic Science*, **18**(1):61-74. doi: 10.1017/S0954102006000058.

National Research Council (U.S.) Committee on Polar Research. 1961. Science in Antarctica: A Report, Parts 1-2. Washington: National Academies.

Nel, C. The new economy- a revolution of leadership. *Management Today*

Nelson, P.D. 1962. Human adaptation to Antarctic station life [Online]. San Diego: Navy Medical Neuropsychiatric Research Unit. Available: http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=AD0286493. Accessed: 18 May 2016.

Norris, K.A. 2010. *Breaking the Ice: Developing a model of expedioner and partner adaptation to Antarctic employment*. Thesis submitted in partial fulfilment for the degree of Doctor of Philosophy (Clinical Psychology), University of Tasmania, Tasmania, Australia. [Online] Available: http://eprints.utas.edu.au/10391/5/Whole_thesis.pdf. Accessed: 22 May 2016.

Onich, T.M. 2009. Leadership in the Distressed Organization. *Commercial Lending Review*, **24**(5):45-47.

Orasanu, J. & Lieberman, P. 2011. NDM Issues in Extreme Environments. In Mosier, K.L. & Fisher, U.M. (eds), *Informed by Knowledge: Expert Performance in Complex Situations*. New York: Psychology Press.

Palinkas, L.A. 1992 Going to extremes: the cultural context of stress, illness and coping in Antarctica. *Social Science & Medicine*, **35**(5):651-664.

Palinkas, L.A. 2003. The psychology of isolated and confined environments: Understanding human behaviour in Antarctica. *American Psychologist*, **58**(5):353-363.

Palinkas, L.A. & Suedfeld, P. 2008. Psychological effects of polar expeditions. *The Lancet*, **371**, 152-163.

Palinkas, L.A., Johnson, J.C. & Boster, J.S. 2004. Social support and depressed mood in isolated and confined environments. *Acta astronautica*, **54**(9):639-647.

Plugg, C. No Date. *Goddard, Professor Ernest James* [Online]. S2A3 Biographical Database of Southern African Science. Available: http://www.s2a3.org.za/bio/Biograph_final.php?serial=1073. Accessed: 15 May 2016.

Puplampu, B.B. 2005. Towards a framework for understanding the distressed organization: Insights from practitioner-based organizational interventions in an emerging economy. *Consulting Psychology Journal: Practice and Research*, **57**(4):246-258. doi: 10.1037/1065-9293.57.4.246.

Rahim, M.A. 1982. A strategy for managing conflict in complex organizations. *Human Relations,* **38**(1):81-89.

Reuveni, Y. & Vashdi, D.R. 2015. Innovation in multidisciplinary teams: the moderating role of transformational leadership in the relationship between professional heterogeneity and shared mental models. *European Journal of Work and Organizational Psychology*, 24(5), 678-692. doi: 10.1080/1359432X.2014.1001377.

Riffenburg, B. 2007. *Encyclopedia of the Antarctic, Volume 1*.New York: Routledge.

Rivolier, J., Bachelard, C. & Cazes, G. 1991. Crew Selection for an Antarctic-Based Space Simulator. In Harrison, A.A., Clearwater, Y.A. & McKay, C.P. (eds), *From Antarctica to Outer Space: Life in Isolation and Confinement*. New York: Springer New York.

Robertson, R. 2013. *Leading on the edge: Extraordinary stories and leadership insights from the world's most extreme workplace.* Camberwell: Wrightbooks.

Rosnet, E., Jurion, S., Cazes, G & Bachelard, C. 2004. Mixed-gender groups: coping strategies and factors of psychological adaptation in a polar environment. *Aviation, Space, and Environmental Medicine*, (Supplement) **75**(7):C10-C13.

Rothblum, E. 1990. Psychological factors in the Antarctic. *The Journal of Psychology*, **124**(3):253-273.

SANAP. 2016a. *About SANAP* [Online]. Available: http://www.sanap.ac.za/about_sanap/about_sanap.html. Accessed: 16 May 2016.

SANAP. 2016b. *Sanae - Antarctica* [Online]. Available: http://www.sanap.ac.za/sanap_sanae/sanap_sanae.html. Accessed: 18 May 2016.

SANAP. 2016c. *Jobs* [Online]. Available: http://www.sanap.ac.za/sanap_jobs/sanap_jobs.html#personnel. Accessed: 20 May 2016.

SANAP. 2016d. *Sanae Teams* [Online]. Available: http://www.sanap.ac.za/sanap_sanae/sanae_teams.html. Accessed: 2 July 2016.

Sarris, 2006. Personality, culture fit, and job outcomes on Australian Antarctic stations. *Environment and Behavior*, **38**(3):356-372.

Sarris, A. 2007. Antarctic culture: 50 Years of Antarctic Expeditions. *Aviation, Space, and Environmental Medicine*,**78**(9):886-892.

Sarris, A. & Kirby, N. 2007. Behavioral norms and expectations on Antarctic stations. *Environment and Behavior*, **39**, 706-723.

Saunders, M., Lewis, P. & Thornhill, A. 2009. *Research methods for business students*. Fifth Edition. Essex: Pearson Education Limited.

Schmidt, L.L., Wood, J. & Lugg, D.J. 2004. Team Climate at Antarctic Research Stations 1996-2000: Leadership matters. *Aviation, Space, and Environmental Medicine*, **75**(8):681-687.

Schmidt, L.L., Wood, J. & Lugg, D.J. 2005. Gender differences in leader and follower perceptions of social support in Antarctica. *Acta Astronautica*, **56**, 923-931.

Schreiber, C. & Carley, K.M. 2006. Leadership style as an enabler of organizational complex functioning. *Emergency: Complexity & Organization*. **8**(4):61-76.

Shusterich, K.M. 1984. The Antarctic Treaty System: history, substance, and speculation. *International Journal,* **39**(4):800-827.

Sidiropoulis, E. & Wheeler, T. 2016. *To the ends of the Earth: Antarctica, The Antarctic Treaty and South Africa*. South African Institute of International Affairs. Available: http://www.saiia.org.za/research-reports/1022-to-the-ends-of-the-earth-antarctica-the-antarctic-treaty-and-south-africa/file. Accessed: 17 May 2016.

Siebert, A. 2012. The complete summary: the resiliency advantage [Online]. Kennett Square: Soundview Executive Book Summaries. Available: http://www.summary.com/book-summaries/_/The-Resiliency-Advantage/. Accessed: 10 July 2016.

Slatter, S., Lovett, D. & Barlow, L. 2011. *Leading corporate turnaround: how leaders fix troubled companies.* Chichester: John Wiley & Sons.

South African Antarctic Club (SAAC). 2010. *Expedition Members* [Online]. Available: http://antarctic-club.org.za/members.html Accessed: 10 September 2016.

Spaeth, G. 2009. History of the geological research expeditions to the Heimefrontfjella (East Antarctica) and chronology of the geological mapping program. *Polarforschung*, **79**(1):3-10.

Steel, G.D., Suedfeld, P., Peri, A. & Palinkas L.A. 1997. People in high latitudes. *Environment and Behavior*, **29**(3):324-346.

Stoltz, P. 2003. Building resilience for uncertain times. *Leader to Leader*, **31**, 16-20.

Stuster, J.W. 2000. Bold endeavors: Behavioral lessons from polar and space exploration. *Gravitational and Space Biology Bulletin*, **13**(2):49-57.

Suedfeld, P. 2010. Historical space psychology: Early terrestrial explorations as Mars analogues. *Planetary and Space Science*, **58**, 639-645.

Sverke, M., Hellgren, J. & Näswall, K. 2002. No security: a meta-analysis and review of job insecurity and its consequences. *Journal of Occupational Health Psychology*, **7**(3):242-264.

Tapscott, D. 1997. Strategy in the new economy. *Strategy & Leadership*, **25**(6):8-14.

Turney, C. 2012. *1912: The year the world discovered Antarctica.* Berkeley: Counterpoint.

Uhl-Bien, M., Marion, R. & McKelvey, B. 2007. Complexity leadership theory: shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly*, **18**, 298-318.

Vanhove, A.J., Herian, M.N., Harms, P.D., Luthans, F. & DeSimone, J.A. 2015. Examining psychosocial well-being and performance in isolated, confined, and extreme environments Final Report. NASA, Texas, United States. [Online] Available: http://ston.jsc.nasa.gov/collections/TRS. Accessed: 21 May 2016.

Van der Watt, S.M.E. 2012. *Out in the Cold: Science and the Environment in South Africa's involvement in the sub-Antarctic and Antarctic in the Twentieth Century*. Published doctoral dissertation. Stellenbosch: Stellenbosch University [Online]. Available: http://scholar.sun.ac.za/handle/10019.1/20055. Accessed: 15 May 2016.

Van Der Watt, L. & Swart, S. 2015. Falling off the Map: South Africa, Antarctica and Empire, c. 1919 – 1959. *The Journal of Imperial and Commonwealth History*, **43**(2):267-291.

Visser, D.J. 2004. doi: http://scholar.sun.ac.za/handle/10019.1/49840

Williams, J. 2000. Antarctica: A land of Ice and Wind. *Weatherwise*, **53**(1):14-23.

Wood, J., Hysong, S.J., Lugg, D.J. & Harm, D.L. 2000. Is it really so bad? A Comparison of positive and negative experiences in Antarctic winter stations. *Environment and Behavior*, **32**(1):84-100.

Wood, J., Schmidt, L., Lugg, D.J., Ayton, J., Phillips, T. & Schepanek, M. 2005. Life, Survival, and Behavioural Health in Small Closed Communities: 10 Years of Studying Isolated Antarctic Groups. *Aviation, Space, and Environmental Medicine*, (Supplement), **76**(6):B89-B93.

APPENDIX A:
SURVEY PARTICIPATION LETTER

Dear participant,

I would like to invite you to complete a survey aimed at overwinterers from Gough, Marion and SANAE. You were selected as a possible participant in this study because you participated in an expedition to Gough Island, Marion Island or a SANAE base, which lasted more than 12 months.

The purpose of this survey is to explore the perceptions around leadership characteristics and approaches that South African Antarctic expeditioners perceive to be most successful when leading a team in this environment. Antarctic and Sub-Antarctic stations provide unique challenges to management and leadership, due to the harsh climate, limited infrastructure and isolation.

I am doing this study as part of obtaining an MBA degree from the University of Stellenbosch, where the title of my research assignment is ***Leaders in extreme and isolated environments: Perceptions from South African Antarctic Expeditioners.***

The research is supported by the Antarctic Legacy of South Africa and the South African Antarctic Club. The study aims to contribute to the body of knowledge around leadership at Antarctic Stations. The results can also be used by Antarctic programs when appointing station leaders.

Your participation is entirely voluntary and you are free to decline to participate.

This study has been approved by the University of Stellenbosch Business School Departmental Ethics Screening Committee, and will be conducted according to accepted and applicable national and international ethics guidelines and principles. The survey is anonymous and response data will only be analysed at aggregate level.

If you have any questions or concerns about this study, please feel free to contact me on daleen.koch@gmail.com or my supervisor, Dr. John Morrison, on John.Morrison@usb.ac.za.

If you are willing to participate and complete the electronic survey, please click here or copy the address below into your browser window. There are 31 questions and it should take around 15 minutes to complete. Kindly complete the survey by 28 August 2016.

https://www.surveymonkey.com/r/extremeleadership

Thanks in advance for your support.

Yours sincerely,

Daleen Koch

RIGHTS OF RESEARCH PARTICIPANTS: 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.

APPENDIX B:
QUESTIONNAIRE

Section A: Personal Information

1. Have you spent more than 12 months consecutively at South African Antarctic or Sub-Antarctic station part of the South African National Antarctic Program? (i.e. overwinter or complete expedition)

- Yes
- No

2. Your current age category

- Below 25
- 25 to 30
- 31 to 40
- 41 to 50
- 51 to 60
- 61 or older

3. Your gender

- Male
- Female

4. Number of expeditions for SANAP

- 1
- 2
- 3
- 4
- 5 or more

5. At which stations did you overwinter? (choose multiple where applicable)

- Gough
- Marion
- SANAE

6. What year(s) did you overwinter? For multiple expeditions choose all years.

For expeditions to SANAE, choose the year you spent the most time in Antarctica.

For expeditions to Marion and Gough, choose the year you departed for the station.

1957 or earlier	1972	1987	2002
1958	1973	1988	2003
1959	1974	1989	2004
1960	1975	1990	2005
1961	1976	1991	2006
1962	1977	1992	2007
1963	1978	1993	2008
1964	1979	1994	2009
1965	1980	1995	2010
1966	1981	1996	2011
1967	1982	1997	2012
1968	1983	1998	2013
1969	1984	1999	2014
1970	1985	2000	2015
1971	1986	2001	

7. Where you appointed as station or team leader during any of your expeditions?

- Yes
- No

For participants that only completed expeditions as station leaders: You may encounter questions that asks for a view from a team member perspective. Please answer these questions as if you were a team member under your own leadership.

8. Did you or your team experience any emergencies, evacuations, trauma or continuous and aggressive interpersonal conflict during your expedition?

- Yes
- No

Section B: Overwintering and leadership

9. In terms of personal interaction with team members, indicate on the scale of 1 to 5 what type of station leader is more effective.

Keeps a distance as far as personal relationships with team members are concerned.				Maintains a strong personal bond with team members.
1.	2.	3.	4.	5.
○	○	○	○	○

10. In terms of the personal well-being of team members, indicate on the scale of 1 to 5 what type of station leader is more effective.

Allows team members to regulate their own emotional well-being.				Actively monitors and influences the well-being of team members.
1.	2.	3.	4.	5.
○	○	○	○	○

11. In terms of the team climate at the station, indicate on the scale from 1 to 5 what type of team leader is more effective.

Allows the team climate to form independently without actively influencing it.				Makes an effort to create and sustain a positive team climate
1.	2.	3.	4.	5.
○	○	○	○	○

12. As far as the professional duties of team members are concerned, indicate on the scale of 1 to 5 what type of station leader is more effective.

Maintains a low involvement and acts mostly in response to team members' requests for support.				Maintains a strong involvement and strongly influences team achievement and expedition outcomes.
1.	2.	3.	4.	5.
○	○	○	○	○

13. Please rank the following characteristics and competencies for a station leader from most important (1) to least important (13).

Trustworthiness

Conflict management

Empathy

Flexibility

Open to input from team members

Task-driven – clear on goals and what needs to be achieved

People-driven – care about well-being of team members and sensitive to individual needs

Resilient

Comfortable to interact socially

Ability to maintain discipline

Decisiveness

Comfortable with diversity

Good communicator

14. Are there any other characteristics that you feel are important for a station leader at a remote research station?

15. With which of the following station leaders would you the <u>most comfortable</u> with (choose only one).

- I prefer that my station leader tells me what to do and I am happy to comply with decisions he / she takes.
- I prefer a station leader who consults with me as part of the decision process on matters that affects the team, but retains final decision-making authority.
- I am more comfortable if a station leader allows me to vote before decisions, that affects myself and the team, are taken.
- I am comfortable if the station leader delegates decision-making authority to other experienced team members and share the leadership responsibilities.

Indicate on the scale from 1 to 5 to what extent you agree with the following statements.

1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5. Strongly agree

16. I am comfortable if a station leader makes decisions without consulting me.

1	2	3	4	5	N/A
○	○	○	○	○	○

17. When there is a problem at the station, the station leader should get the team together to discuss the solution.

1	2	3	4	5	N/A
○	○	○	○	○	○

18. I am comfortable with a station leader who wants to approve all station decisions.

1	2	3	4	5	N/A
○	○	○	○	○	○

19. A station leader must be open to opinions from the team members.

1	2	3	4	5	N/A
○	○	○	○	○	○

20. A station leader must punish bad behaviour and reward good behaviour

1	2	3	4	5	N/A
○	○	○	○	○	○

21. I am more comfortable with decisions when everyone in the team were allowed to give their input as part of the decision-making process.

1	2	3	4	5	N/A
○	○	○	○	○	○

22. A station leader must monitor the work output from team members and make sure they perform their tasks adequately.

1	2	3	4	5	N/A
○	○	○	○	○	○

23. I feel more committed to a decision when I was allowed to give input.

1	2	3	4	5	N/A
○	○	○	○	○	○

24. During emergencies, the station leader must retain decision-making autonomy.

1	2	3	4	5	N/A
○	○	○	○	○	○

25. The station leader plays a decisive role in the success of a Sub-Antarctic or Antarctic station.

1	2	3	4	5	N/A
○	○	○	○	○	○

26. The station leader/s affected my ability to adapt to life at the station.

1	2	3	4	5	N/A
○	○	○	○	○	○

27. The station leader/s influenced the quality of my overwintering year.

1	2	3	4	5	N/A
○	○	○	○	○	○

28. The station leader/s affected my decision to overwinter again.

1	2	3	4	5	N/A
○	○	○	○	○	○

29. Team members should be allowed to give input in their station leader appointment.

1	2	3	4	5	N/A
○	○	○	○	○	○

30. My Antarctic Program places a high emphasis on leadership qualities when appointing the station leaders.

1	2	3	4	5	N/A
○	○	○	○	○	○

This question is optional.

31. Do you have any views on special leadership qualities that a station leader requires in the unique Antarctic and Sub-Antarctic environments, which are not so prominent in a traditional business environment back in South Africa?

The End.

Thanks for your participation!

APPENDIX C:

QUESTION 14 OPEN ENDED RESPONSES

The following open-ended responses were received in response to Question 14.

Table C.1: Open-ended response to leadership qualities

Number	Response Text	Emerging themes and trends
1	Lead by example, good listener.	Lead by example
2	Knowledge of team member's family back home.	
3	Integrity, high moral values.	Integrity
4	Honest and not pretending under all circumstances. Treat all team members equally irrespective of the colour of their skin. No one chooses the colour of his or her skin.	Honesty Non-racist
5	Cool headed emergency response. Does not micromanage.	Emergency response experience Empowerment Trust Delegate
6	Observant.	Perceptive Environmental awareness
7	Leadership training before expeditions.	
8	Integrity, honesty and fairness.	Integrity Honesty Fair
9	Both a broad and deep perspective, adaptiveness.	Flexible
10	Don't be overbearing.	
11	Definitely need to have a positive outlook on life. Our team leader became depressed half way through the year and the base tuned into a very dark place. Felt like it was the team leader's house and not the team's house. Couldn't do anything without worrying that you might get in trouble or might not be what the team leader wanted. He also made decisions that made the entire team unhappy but took his job as team leader far too seriously... He thought he was the boss of the team. Influenced our year in a big way.	Positive outlook
12	Sober habits.	Sobriety
13	To have confidence in his/her abilities.	Confidence
14	Consistency, fairness and accountability.	Fairness Consistency
15	Have and be respectful.	Respectful
16	Responsibility.	Responsible
17	Good health and fitness.	Physical health and fitness
18	Sober habits.	Sobriety
19	Gravitas	Gravitas

20	Sense of humour.	Sense of humour
21	He must be familiar with all the projects going on.	Science program knowledge
22	Being available at short notice to discuss any issues.	Availability 24/7 – always on call.
23	To understand and respect your own private time.	Sensitive to team member needs
24	Hard-working, good moral background, psychologically stable, emotionally strong and stable, generosity, independent.	Hard worker High morals Psychologically stable
25	Logical thinking pattern.	Intelligence
26	Presence.	
27	Honest, fair, well-balanced, integrity.	Fairness
28	Able to get support from Company for team, not afraid to tackle sensitive issues.	Ability to interact with SANAP management
29	Intelligence, scientific knowledge, moral ethics.	Science program knowledge
30	Set the base rules, integrity.	Lay down the rules Integrity
31	A good leader need to have stability.	Stability
32	Level-headed.	Level-headed
33	Fairness - What goes for one member should go for the next.	Fairness
34	Patience.	Patience
35	Diversity as no issue back in 1981 as all team members were white males.	
36	Ability to recognise skills and delegate with support.	Shared leadership Delegated leadership
37	Relaxed.	Calm demeanour
38	Open door policy.	
39	Lead with example.	Lead by example
40	Innovation.	
41	Friendly and less sensitive to racial issues.	Friendliness
42	Ethical, driven, committed.	Ethical
43	Righteous.	Righteous
44	Be of practical and creative mind with good sense of humour and to lead by example.	Sense of humour
45	Interest of team and team well-being above operational requirements.	Sensitive to team member needs
46	Not a fragile ego - handle antagonism from someone or a few without making it a team issue	Resilient
47	Motivated, optimistic, objective	Optimistic outlook
48	Confident in his own abilities	Confidence

49	Must be able to read the mood of the team and deal with any conflicts in a manner, which is not too autocratic or militaristic. Each situation must be dealt with in its own context and situation. Some basic conflict management training would be a plus.	Situational leadership approach Conflict management training
50	Ability to read people (and team dynamics), social and situational awareness, and accompanied by a subsequent genuine intuition for proactive intervention (without interfering) which may even entail masterfully doing the scary - nothing, in certain select situations which I suppose can be summarized as wisdom.	Emotional intelligence
51	Resourceful, can adapt to the conditions at hand, calm under pressure, prepared to do the "dirty Work" himself, realistic in his expectation of the goals.	Lead by example Calm under pressure
52	Ability to delegate - some of his/her responsibilities - form Team Leads	Shared leadership
53	Ability to work with the Team rather than Oversee see everything from a Superior Rank point of view. Difficult to achieve.	Participative leadership
54	The importance of positivity can not be stressed enough. Adaptability and to balance being people orientated with task orientated is also crucial (although people orientatedness should be preferred more often than not when looking in the long term). Mostly easy going, but must have the ability to put his/her foot down when necessary.	Positive outlook Adaptability Easy going Able to maintain discipline Maintain task-supportive role balance
55	For some reason age is a factor, it might not be fair, but especially men that appear to be very young and cannot somehow "force" respect from older men have a very hard time controlling the actions of team members. So, must appear wise, insightful and experienced, if he can be young and still have the knowledge and know how to lead older men, then it's fine.	Maturity
56	Ability to plan ahead and securing contingency plans	Planner
57	Patience	Patience
58	Transparency, honesty and to be completely open with the team	Transparency Honesty Openness
59	It is important to have sufficient or at least some knowledge of the work/programs of the various members	Science program knowledge
60	Transparency, Positivity	Transparency Positive outlook
61	No, but note that ranking the above was difficult for me; I would've liked to rank each one first!	
62	Natural ability to command team respect	Natural leader
63	Balance	
64	Organized	Organised
65	Knowledge about the island, field conditions and what team members are required to do while fulfilling their duties. Good judgement.	Science program knowledge Environment knowledge

66	A station leader must have a charisma about him or her. They should be a person you would be proud to call your teams spokesperson and representative. Trustworthiness is of utmost importance. They should have the teams best interests at heart, and convey messages and the desires of the team effectively, efficiently and openly to the departments involved.	Trustworthiness Ability to interact with SANAP management Sensitive to team member needs
67	Natural leader	Natural leader
68	Having the best interests of the team at heart	Sensitive to team member needs
69	Calm temperament, patience, consideration for others, respect (ability to put him/herself in someone else's shoes.	Calm demeanour
70	He/She must be confident in themselves	Confidence
71	Fairness	Fairness
72	Family man	
73	It is near to impossible to rank the order of importance of characteristics above as what is important will depend on what the team is like. However saying being flexible does not really describe what is needed it is mostly important that the leader uses the resources available to him. In our team the leader was very well supported by the second in command and they complemented each other very well. The leader was good at keeping people happy while the second in command was good at getting things done.	Task-support balance
74	Confidence	Confidence
75	The station leader must be generally technically competent for the environment.	Science program knowledge Environment knowledge
76	Respectfulness	Respectful
77	Kindness, sense of humour	Kind Sense of humour
78	Experience	Experience
79	Must lead by example	Lead by example
80	Must be able to communicate at groundroots level AND interact at departmental Director level when required.	Communication Ability to interact with SANAP
81	Subject knowledge - he/she must be part of the team with a specialty.	Science program knowledge
82	Must be able to set example with regards to tasks, duties etc.	Lead by example

APPENDIX D:

QUESTION 31 OPEN ENDED RESPONSES

The following open-ended responses were received in response to Question 31. The question explored if the respondent has any views on special leadership qualities that a station leader requires in the unique Antarctic and Sub-Antarctic environments, which are not so prominent in a traditional business environment back in South Africa.

Table D.1: Leadership requirement differences

Number	Response Text	Themes on leadership differences
1	Work and live in a vacuum irt direct support from DEA	Work without direct support from parent organisation
2	A team that gets along very well is far more important than the role the leader is playing. E.g. we as a team, except the team leader, got along exceptionally well; we tolerated him, but was difficult to deal with him as a person since he was not matured enough to fulfil that position. The deputy leader was a great person (most popular in the team) and had great leadership qualities; he should have been our leader. More emphasis should be around team selection (and sharing responsibility) rather than team leadership.	Team climate more important than leadership competency. Maturity
3	Balanced, interact and listen, lead by example indoors and outdoors.	Active involvement / knowledge / interest in science, conservation & outdoor. Lead by example.
4	A special blend of strict and not too strict, also blend of caring, keeping an eye on all for safety and team success but at same time allowing islanders to be free in the special environment.	Task – supportive balance.
5	The team has ten members whose appointment were based on skill and competency. Therefore, each member is a leader in his or her designated occupation and must be allowed to take a lead in that particular field. Having to report to more than one team leader is frustrating and reduces and delays response and quick execution of the member's duties. Only one team leader is needed. The deputy will be formed by the team itself. Each team member must be given a free role to execute his or her duties to his or her best capabilities without any interference. It is the team member himself or herself who must seek assistance if need be. The team leader must have a basic of people management and leadership skills. He must be trustworthy and honest to all team members. Respect all members but fear no one. A flat management structure is the ideal for Antarctic because it allows quick response to the technical challenges in the base.	Confidence to share leadership in topics that the leader is not a specialist in. Respect professional capacity of team member. Only react in response to request to intervene.
6	Some decisions can be discussed but many need to be made quickly and decisively. Knowing which is which and how to act in each case is important. Not wasting valuable time with meetings is important.	Less meetings, quicker decision-making.

7	The leader must be able to admit when they wrong and must have best interest of the team not of the DEA only because most the time they are caught in-between team members needs and DEA expectations. The team leader must be trained on how to handle and sustain relationships with team members and management without compromising their values.	Task – supportive balance
8	Calm in problem situations.	Remain calm under stress in isolated and extreme conditions.
9	Understanding of the varied team member tasks and work schedules.	Balancing professional duties with shared team duties.
10	By the nature of the job and the small teams, a station leader needs to get down and dirty. Due to the environment, a leader cannot enforce discipline in the normal fashion by "dismissing" a team member hence the need to ensure a very fine balance in the way they do things. In a sense, the leader is compelled to form a deeper level of relationship with each member in order to gain trust and a platform from which to speak.	Closer personal bonds. Ability to deal with non-performance through alternate means than firing individuals.
11	I believe the leader should have Field or Outdoor knowledge in order to understand the work environment. I do believe that having this understanding that the leader will understand interpersonal relationships between Base and Field personnel	Active involvement / knowledge / interest in science, conservation & outdoor. Balancing professional duties with shared team duties.
12	A leader should be people orientated.	More people-driven competencies.
13	Same qualities required.	
14	This is quite a difficult question. I would say it is team dependent, if the team is made up of responsible mature individuals the leadership can be more relaxed but if there are some irresponsible team members then a different type of Leader is required. I think SANAE 29 had a brilliant balance.	Skilled at situational leadership.
15	He or she must care about the team and the environment.	Active involvement / knowledge / interest in science, conservation & outdoor.
16	Perseverance and ability to inspire teams.	More endurance, perseverance and resilience required Bigger ability to inspire
17	Must be always available or been seen around base. Active person	Availability 24/7 – always on call. Physically active person.
18	The leader must be a democratic autocrat, much like an airline captain who seeks/leverages input and buy in, but takes the lead when required.	
19	Station leaders should lead by their own good example so hardworking, morally ethical, socially pleasant individuals may do well as leaders.	Lead by example. Socially pleasant.
20	Yes, it is completely a different ball game and somebody who was a member has a better chance to be a leader in a next expedition.	Need previous Antarctic or remote station experience.

21	A leader's ability to be actively involved was is a big help. I ran the Rhodes University programs and taught martial arts for the full duration of over wintering.	Active involvement / interest in science, conservation & outdoor.
22	Try to remain calm under pressure	Remain calm under stress in isolated and extreme conditions.
23	Even how strong the leadership stay human and humble	
24	These are people that need to be very adaptable. As this is an extreme environment, people generally act differently than they would be back at the mainland and the leader should be able to anticipate and understand the psychology behind these extreme environments. Preferably, it should be someone a bit older, with more life experience, not necessarily just experience in the Antarctic/Sub-Antarctic. Must be very emotionally stable and firm, able to separate their own emotions from that of what is required when leading a team.	More adaptable than back in South Africa. Psychology knowledge. Better balance between personal and professional opinions.
25	He must be able to be social but also comfortable with his own company as although he must mix with all team members he has to make sometime unpopular decisions for the good of the team.	Comfortable with unpopular decisions and interacting socially with the same people
26	Inclusive without taking sides	Better balance between personal and professional opinions.
27	Must be a conservationist, Lead by example and not just for the bigger salary	Active involvement / interest in science, conservation & outdoor. Lead by example.
28	An Antarctic station leader needs to be far less autocratic than a business leader.	Less authoritative / military approach.
29	Because teams can be vastly different depending on the personalities of the team members, the qualities of the team leader must be determined with the team members in mind. In our case 14 of the 15 members were united as a team and family (strong personalities but cooperative and responsible) which placed less pressure on the leader. Only one member who caused issues. This created a very unique leadership approach to balance 2 different scenarios continually	Skilled at situational leadership.
30	A team leader should be flexible and adaptable to the teams' cultural backgrounds. In a Country with 11 official languages; potentially 11 different cultures; you are bound to get cultural clashes. On a remote site small things get blown out proportion. This causes friction and how a leader handles this can be the make or break of a good year. This comment is not aimed at race, but rather the cultures that each individual team member is familiar with.	Better at dealing with diversity.
31	One needs to remember that the place you call work is the same place you call home for the duration of your expedition. Remember your work colleagues for this stay are your family for the duration of your stay.	Able to deal with lack of boundary between work and social environment.
32	The station leader must ensure the parties he is leading trust and are confident in him. Arrogance and aloofness are unacceptable whilst at the same time being everyone's friend is inappropriate. Courage and physical strength should also be an attribute.	Able to deal with lack of boundary between work and social environment.

33	In my year, though there was some conflict, it was managed by our leader eliciting input from all team members; alternatively he had a very open and reasonable approach to those whose behaviour resulted in a degree of conflict. Some team members actively participated in discussions and solution-seeking; others were disinterested and happy to go along with the decision. The key is to engage with all team members in a democratic fashion, while retaining a "veto" for critical issues. Some will be sociable; others not. A good leader will ensure he/she understands each team members' mindset so he/she knows how to deal with that person when stresses arise. He/she would then also be able to engender support for his/her point of view, and have the backing of other team members when hard decisions have to be made.	More skills to deal with interpersonal conflict. Better understanding of individuals.
34	The Leader should've been in a mid-management position during his/her career and it is best if one of the "support staff" is appointed as leader.	Previous leadership experience.
35	Some psychological self-help knowledge	Psychology knowledge.
36	I feel that the station leader and the rest of the team should undergo mandatory psychological screening prior to appointment. This is not a special leadership quality but absolutely essential in ensuring the psychological well-being of the team and a successful expedition. I also feel that the SANAP program should send the station leaders to conflict management training beforehand.	Psychological screen for team compatibility. More skills to deal with interpersonal conflict.
37	Must to the best of his/her ability leave personal feelings out of team related issues.	Better balance between personal and professional opinions.
38	Must not have a psychological background and just be a good and effective person.	
39	Social interaction on all levels is also important	Social intelligence.
40	SANAP is more like a family unit than a business unit. Everyone needs to be involved in the whole process. Respect within the group for the leader is therefore vital as the leader is seen less as a manger and more a team mate with additional responsibilities.	Higher duty of care.
41	Must lead from the front. Be out there working with everyone else.	Lead by example More involved in day-to-day activities.
42	I believe on any leadership style as long as consultations with members is done because Antarctic stations are far from South Africa and spend most of life time during expedition.	More participative and consultative in nature.
43	He has to have a personal relationship with all members. There were 5 of us at the Grunnehogna base over winter. A slightly different scenario to the others.	More focus on personal relationships.
44	Consistency and flexibility	More flexible.
45	Of good ethics & morals, objective & fair with strong self control and self discipline, especially after hours as you not only work together but also live together, 7/24!	Able to deal with lack of boundary between work and social environment.
46	Leadership should be from the bottom up - not from the top down. The leader should be able to stand his ground to higher levels of management - not cower to decisions made at higher levels of management. Team leaders serve the needs of management - not the needs of the team.	Task – supportive balance.

47	The leader must be more facillitator and much less commander. More introvert than extrovert - friendly with all members, no clear or evident favourite(s) (comes easier for introverts??) But NOT aloof - has to be active part of the Team - in all respects, but particularly w.r.t base work	More involved in day-to-day activities.
48	Tolerance: due to the diverse nature of the team and the circumstances do not allow for avoiding an individual or hiring / firing.	Ability to deal with non-performance through alternate means than firing individuals.
49	Must be able to communicate with team without attitude that they are in charge. Must understand that we are all in the same isolated environment together for an extended period so they must be equipped to deal with conflict, disorderly behaviour that impacts the rest of the team and must be able to delegate to team members.	More shared leadership. More skills to deal with interpersonal conflict.
50	Most characteristics remain the same for business and even military application - yet their requirement seem to be more amplified in the sub/Antarctic environment. Resilience and perseverance (not stubbornness) becomes very key factor, as it is probably one of the most loneliest leadership positions on the planet (Back in SA more opportunity for external objective advice and guidance). In the unique Antarctic environment eventually it can be become hard to remain objective as a leader and sadly enough neither do team members (when they need to give their input and advice). Unfortunately further objective support from the mainland remains lacking, as complete and full objective understanding of each situation is impossible as those individuals either have never overwintered or are 'Not there' to fully appreciate the dynamics or factors influencing each decision. Though in summary the most important rule still applies for and sub/Antarctic leader with regards to their team as I believe it should do so in business - "LOVE". "In the toughest place in the world, tough leadership didn't work. It was those who listened and collaborated who thrived." - An Opinion Article published in Time Magazine - Titled - What Can You Learn From the Toughest Leadership Job on Earth?" - July 2014	Similar leadership characteristics but more amplified. Less support from peers. Less authoritative / military approach.
51	Resourceful, can adapt to the conditions at hand, calm under pressure and emergencies , prepared to do the "dirty Work" himself, realistic in his expectation of the goals,	Lead by example. More involved in day-to-day activities. Remain calm under stress in isolated and extreme conditions.
52	They must be able to support and deal with situations that are more personal than normally encountered in a business environment.	Able to deal with lack of boundary between work and social environment.
53	Be independent - adapting to local conditions on the "Fly" as Weather or personnel injuries.	More adaptable than back in South Africa.
54	A high level scientific understanding of the purpose of Stations. The stations are nodes for scientific and monitoring work. This is arguably their most important function. An understanding of the importance and priority of scientific work is paramount. Admin/logistics (inclusive of the leaders and structures) exist to enable and support the science, the	Active involvement / interest in science, conservation & outdoor.

	science DOES NOT exist so that admin/logistics (leaders and structures) can exist.	
55	People give up a year of their lives to work in these extreme places and I have often seen dejected disappointed team members returning. I worked on the old SA Agulhas for 11years after my SANAE year. So I have seen a good few. Management need to accommodate personal aspirations as well as the work, for instance small side show expeditions are a huge help in boosting morale	
56	Positivity, positivity, positivity.	
57	The biggest difference would be that it's not just a professional relationship and then you go home at the end of the day. You are living together, so everything becomes personal, you can't just have a professional relationship with team members, you want someone who does not solely focus on work, but also on social aspects, it's very much like a residence at university. You kind of need a team leader and then two chair people, one like a social chair organizing events birthdays etc, and a chair for normal base responsibilities, like cleaning and cooking and stuff, and they make sure those things happen, and then the leader does the planning of the overall work plan, and can then also be involved in social stuff without having to do all the work. I don't know if it makes sense, so you have 3 people leading with one decider, it seems more fair, you can approach different issues with different people and makes leadership more approachable, as long as they don't form a click, which is important.	Able to deal with lack of boundary between work and social environment.
58	I think it is necessary that the team leader also displays an interest in the environment and to have extensive geographical knowledge of the terrain outside, and not to focus only on base & team related matters. It sets a good example and may prompt team members to appreciate the very unique terrain and experience.	Active involvement / interest in science, conservation & outdoor.
59	Flexibility	More flexible.
60	Endurance and resilience	More endurance, perseverance and resilience required.
61	The overwintering process is difficult for most members. In South Africa, a strong approach is viable as you can simply fire non-performing members. In the isolated environment, this is not an option. In order to survive amicably the team leader needs a lot of empathy as non-performing members cannot be reprimanded in traditional ways and sometimes the rest of the team simply needs to pick up the slack. The most important part is for all members of the team to survive. The best way is to keep everyone on speaking terms throughout the journey and this is seldom achieved.	Ability to deal with non-performance through alternate means than firing individuals.
62	The age of the team leader should not be the determining factor. It feels like many, better qualified individuals are overseen for the position. It feels like medics and older, less experienced expeditioners get preference to the position of team leader.	
63	Ability to adapt to the unique circumstances, to consider the character of the team as a whole, be able to detect possible conflict or problems in advance	More adaptable than back in South Africa.

64	He / she must be passionate about his/her position and be driven to be the best and to succeed in the position.	
65	A station leader must be well qualified to be such a leader, and should be a person at ease with him/herself and not be steered by personal issues.	Better balance between personal and professional opinions.
66	A team leader should be relaxed and authoritative at the same time. Base issues are the team leader domain whilst fieldwork is the researcher's domain. I would strongly recommend that team leaders support science first and foremost. They should understand the rigorous nature of field workers jobs and be able to support them in their work activities.	Active involvement / interest in science, conservation & outdoor.
67	Some team leaders mistake their appointment as team leader as being appointed as the boss of the team. However, the team leader is not running a company, or the military. In my experience team leaders have no insight into the work requirements of field personnel and should not try to interfere with the work activities that they are not directly responsible for. The best team leaders do not elevate themselves above the team, have no official team meetings, but communicate well in the informal team environment.	Less authoritative / military approach. Respect professional capacity of team member.
68	Just note that the running of the base is quite separate from each scientist running his own programme. Finally, regarding our "emergencies", they were not extreme -- (1) man falling into deep crevasse, but rescued (2) field party stranded, but able eventually to extricate themselves (3) three accidents causing injuries, but those affected recovered	Respect professional capacity of team member.
69	Respect and impartiality for others religious and cultural background	Better at dealing with diversity.
70	Subtlety	
71	Adjustability, the sub and Antarctic is different from mainland leadership.	More adaptable than back in South Africa.
72	There is middle ground between being too militant and reactionary, and being too laid back, to the point of letting situations get out of hand. That middle ground is what needs to be achieved by a leader (in many situations I guess but especially so in the bases). Also with regard to other areas, like being too detached versus coming across as 'nosy'/annoying. Generally in most areas, I would say that the leader needs to be smart/experienced enough to work out where the middle ground is, and it is going to be the safest place for him/her and in general the best for the team. Very importantly, the leader should not just be someone who is going down just to have a job for the year, but someone who is going for the adventure. The type of people who want to go on these expeditions for the sense of place are more likely to be possessed of qualities that could contribute to successful leadership in the bases, such as patience, calmness, respect etc.	Remain calm under stress in isolated and extreme conditions.
73	A review is required on who decides on the Team Leader	
74	Adaptable and intuitive	More adaptable than back in South Africa.
75	The ability to get along with everyone.	Social intelligence.
76	Must be a jack of all trades and a father figure	
77	Maintaining good relationship between team members	Social intelligence.

78	Good EQ, self-reliance, can handle risky situations with calm, celibacy.	Emotional intelligence. Remain calm under stress in isolated and extreme conditions.
79	A leader's ego is much more likely to lead to disaster in Antarctica than in South Africa. In Antarctica I'd prefer to work under an egoless leader.	Emotional intelligence.
80	If all the future overwintering teams could have a team leader like we had with Sanae 49, all would be ok.	
81	During my expedition, military psychologists who only had experience of life on the station during takeover did psychological evaluation. Both our leader and deputy leader were military trained officers who tried to run the station as a military base.	Less authoritative / military approach.
82	Because of the isolated living environment, station leaders must learn to respect personal, cultural and religious differences in team members.	Better at dealing with diversity.
83	Kindness, sense of humor	
84	Experience in working in the sub-Antarctic/Antarctic is required.	Previous experience in isolated, confined and extreme environments.
85	Since every team member, with the exception of the team leader, has a specific task to do or project/program to care for and is trained for that task, the team leader is mostly a passenger on the expedition with nothing else to do than to communicate with the home office. His job can basically be performed by any of the team members, even rotated on a monthly/weekly basis. There is hardly any overlap in leadership qualities between the team leader of an Antarctic expedition (mission success oriented) and a traditional business environment (shareholder equity oriented). The team leader of an Antarctic expedition cannot interfere with the day-to-day running of any of the scientific programs on the station because expert knowledge and training is needed for each of the scientific programs, therefore no leadership qualities will have any significant effect. The team leader is however useful in emergencies to take command to co-ordinate activities, but even this duty can be fulfilled by any other team member by appointment. In short, the team leader is not a critical component in the mission success of the expedition.	More emergency and survival competencies. Respect professional capacity of team member.
86	Survival experience	More emergency and survival competencies.
87	You must be able to "switch off" the team leader switch at times, and be a friend only, when situation required a shoulder / support . Friends must realise that if they mess us, you, as team leader, will have to act in the best interest of the team, and not take their sides. This doesn't mean you aren't their friend anymore.	Able to deal with lack of boundary between work and social environment.
88	Too much emphasis on the leadership role - Rather appoint an administrator - and let the team select the natural leader? Also a difference in the Operational and Research activities on site.	
89	A good understanding of team dynamics and the psychological pressures of living in an isolated environment.	Psychology knowledge.

90	Adaptability	More adaptable than back in South Africa.