

**SCIENTISTS' LEADERSHIP STYLE IN A SCIENTIFIC  
ORGANISATION**

by

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I hereby declared that the dissertation submitted for the degree Masters in Business Leadership, at the University of South Africa, Pretoria, is my own original work and has not previously been submitted to any other institution of higher education. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references.

M.H.M. von Wielligh

**DEDICATED TO MY PARENTS MICHIEL  
AND COREEN NAUDE, MY HUSBAND  
HEINRICH AND MY CHILDREN MARISKA  
AND RECHARDT VON WIELLIGH**

# ABSTRACT

The Council for Geoscience (CGS) is one of the National Science Councils of South Africa and is the legal successor to the Geological Survey of South Africa. The total staff complements numbered 291 as of March 2006, consisting of four executive managers, 18 unit managers, 124 professionals, 84 technicians, 41 administrative personnel, 17 unskilled labourers 3 skilled workers.

The strength of the CGS is manifested in its core of competent geoscience and technical staff. The primary business of the CGS is science; therefore scientists, apart from human resources, finance and procurement, are appointed to senior positions in the organisation. The criteria for scientists to qualify for managerial positions are either a masters or doctorate degree in science. Although a sound knowledge of science is needed for these positions, the necessary managerial and leadership characteristics have never played a significant role in the appointment of unit leaders. Therefore, it is the aim of this study to determine the leadership style of the scientists that were appointed as unit leaders.

Theories on leadership provide for a variety of potential explanations regarding effective leadership, including personal attributes, contingencies, and the role of subordinates. By analysing managerial leadership, it becomes important to consider and recognise the complex interplay among the structure of organisational life, patterns of behaviour, varied beliefs, values, interests, and initiatives of the individuals who create and work within this structure. Research on organisational leadership has grown systematically with the advance of industrialisation. Large work organisations are associated with bureaucratic and technological complexity that affects the demand for managers and the need for coordination and leadership roles.

Leadership theories have evolved over time, becoming more sophisticated and even more applicable for their "innovation". Different perspectives have featured throughout history. Theories of leadership are primarily analytical, directed at better understanding of the leadership process and the variations among them. The most up- to- date concept within leadership is the theory of transformational and transactional leadership.

Transformational leadership comprises five factors — (1) idealised influence: attributed; (2) idealised influence: behaviour; (3) inspirational motivation; (4) intellectual simulation; and (5) individualised consideration — of which the first two factors refer to the concern, power, personal morality, and sacrifice of the leader, as well as his or her ability to instil collective pride in the group's mission. The third factor relates to motivating the group to accomplish missions through challenging goals and by

indicating certainty in areas of uncertainty, which, in turn, arouse individual and team spirit. The fourth factor refers to the leaders' ability to relate at an individual level to the follower and the fifth factor to intellectual stimulation.

Transactional leadership display behaviours associated with constructive and corrective transactions, and comprises three factors— (1) contingent reward leadership; (2) management-by-exception: active; and (3) management-by-exception: passive — of which relates to leaders who involve themselves only when things go wrong, i.e. the constructive style. Their interventions are associated with failure and punishment. The corrective style is labelled management-by-exception: active, which refers to the closer involvement in monitoring the subordinates' actions. Contingent reward leadership relates to rewards for work performance.

The Multifactor Leadership Questionnaire (MLQ) has become a standard instrument for assessing a variety of transformational, transactional and non-leadership scales and was used to assess the leadership style of scientists of the Council for Geoscience. The instrument measures a broad range of leadership types: passive leaders, leaders who give contingent rewards to subordinates and leaders who transform their subordinates into leaders themselves.

The objectives of the study were to (1) determine the leadership style of scientists in positions of unit leaders; (2) how their supervisors, peers and subordinates perceive their leadership style; and (3) whether scientists as unit leaders, perceive their own leadership style differently than do their supervisors, peers and subordinates.

The MLQ instrument contains 45 items that identify and measure key leadership and effectiveness behaviours. A five point rating scale (0: 1: 2: 3: 4) is used for rating the frequency of observed leader behaviour where 0=not at all, and 4=frequently, if not always. The average scores of the MLQ questionnaire for the Council for Geoscience ranged from 2 to 3 on the transformational leadership factors. Participants in general perceive scientists in unit leader positions more as transformational leaders as apposed to transactional leaders. The 2.5 rating on transformational leadership indicates that the unit leaders are often influential in the awareness of what is important. The ratings of scientists as unit leaders were similar to the ratings of their peers and 'others'. Supervisors and subordinates, however, rated them lower.

Transactional leadership ratings for the majority of leaders were between 2.0–3.0 on CR, and MBEA and 1.0–2.0 on MBEP. The ratings obtained, indicate that unit leaders would be seen as people who

prefer to monitor and take action before failures occur. Supervisors, peers and others rated the scientists as unit leaders higher on transactional leadership, except for subordinates who rated them lower.

Leaders are rated 0–1 on laissez-faire leadership style. Supervisors, peers and subordinates rated scientists as unit leaders higher on laissez-faire leadership style than the rating they gave themselves (self-rating). The low rating on the laissez-faire leadership style confirms that leaders do get involved in important issues and have a need to be involved in the decision-making process. Scientists as unit leaders, however, perceive themselves to be more involved than do supervisors and subordinates.

Attribution ratings (extra-effort, effectiveness and satisfaction) varied from 2.0–3.0. For attribution dimensions, supervisors and subordinates rated the scientists as unit leaders lower on extra-effort, effectiveness and satisfaction, whereas peers rated them higher. The satisfaction dimension indicates that unit leaders often work with others in a satisfactory way. For attribution dimensions, supervisors and subordinates rated the scientists as unit leaders lower on extra-effort, effectiveness and satisfaction, whereas peers rated them higher. Supervisors are less satisfied with the leaders than subordinates are.

The results obtained from the MLQ questionnaire for the leadership style of scientists in the Council for Geoscience are slightly different from those of United States companies. The Council for Geoscience, compared with United States (US) companies, rated lower on both transformational leadership and attribution dimensions (extra-effort, effectiveness and satisfaction) and higher on both transactional and laissez-faire leadership styles. This seems to indicate that the Council for Geoscience tends to follow a less inspirational and influential leadership style with more objective setting and less satisfying methods of leadership, compared with US companies.

Transformational leadership development is recommended for the scientists as unit leaders of the Council for Geoscience. It is important to note that false transformational leaders (seemingly transformational leaders with a self-absorbed tendency) should be distinguished from the genuine ones. Optimism and employee frustration can be used in future surveys by the Council for Geoscience to determine the progress of transformational leadership development in the organisation.

The leadership of an organisation influences the organisational culture. Upper management is responsible for the implementation of the necessary changes to promote transformational leadership. The culture of an organisation is a reflection of upper management. If upper management does not realise the importance of transformational leadership, the chances for the rest of the organisation to

promote a transformational leadership culture in the organisation are not good. One recommendation to consider is for the Council for Geoscience to employ people with adequate managerial skills in unit leader positions. These skills would include leadership traits, operational skills, financial skills, etc.

A decision needs to be taken by the Council for Geoscience that when scientists are employed as unit leaders or as members of the upper management cadre, they must have adequate managerial and leadership skills, and all parties have to agree with the competency and be satisfied with the management styles.

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# LIST OF ABBREVIATIONS

## ABBREVIATIONS

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CGS	Council for Geoscience
CR	Contingent Reward
EEF	Extra Effort
EFF	Effectiveness
EQ	Emotional Intelligence
etc.	et cetera, means and so forth
i.e.	id est, means that is
II-A	Idealised Influence: attributes
II-B	Idealised Influence: behaviour
IC	Individualised consideration
IM	Inspirational Motivation
IS	Intellectual Stimulation
LF	Laissez-faire
$H_0$	Null Hypothesis
$H_A$	Alternative Hypothesis
MDP	Management development program
MLQ	Multifactor Leadership Questionnaire
MBEA	Management-by-exception: active
MBEP	Management-by-exception: passive
SAT	Satisfaction
US	United States

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# CHAPTER 1

## 1. INTRODUCTION

The Council for Geoscience (CGS) is one of the National Science Councils of South Africa and is the legal successor to the Geological Survey of South Africa, which was formed in 1911 by the amalgamation of three former geological surveys, the oldest of which — the Geological Commission of the Cape of Good Hope — was founded in 1895. The CGS in its present form was established by The Geoscience Act, Act No. 100 of 1993.

The total staff complements numbered 291 as of March 2006, consisting of four executive managers, 18 unit managers, 124 professionals, 84 technicians, 41 administrative personnel, 17 unskilled labourers and 3 skilled workers.

Executive management comprises the Chief Executive Officer and three Executive Managers. Professionals include scientists, accountants, librarians, linguists, strategists, human-resources specialists and auditors. Technicians include technical officers and assistant technical officers. Administrative staff includes clerks and other administrative officers. Labourers include gardeners, cleaners, tea-makers, security officers and messengers, and skilled workers include qualified carpenters and electricians.

The organisational chart for the Council for Geoscience is represented in Figure 1.1. The Council for Geoscience of today is a modern institution that has excellent facilities and expertise, ranking among the best in Africa.

The organisational chart of the Council for Geoscience is illustrated in Figure 1.1 below.

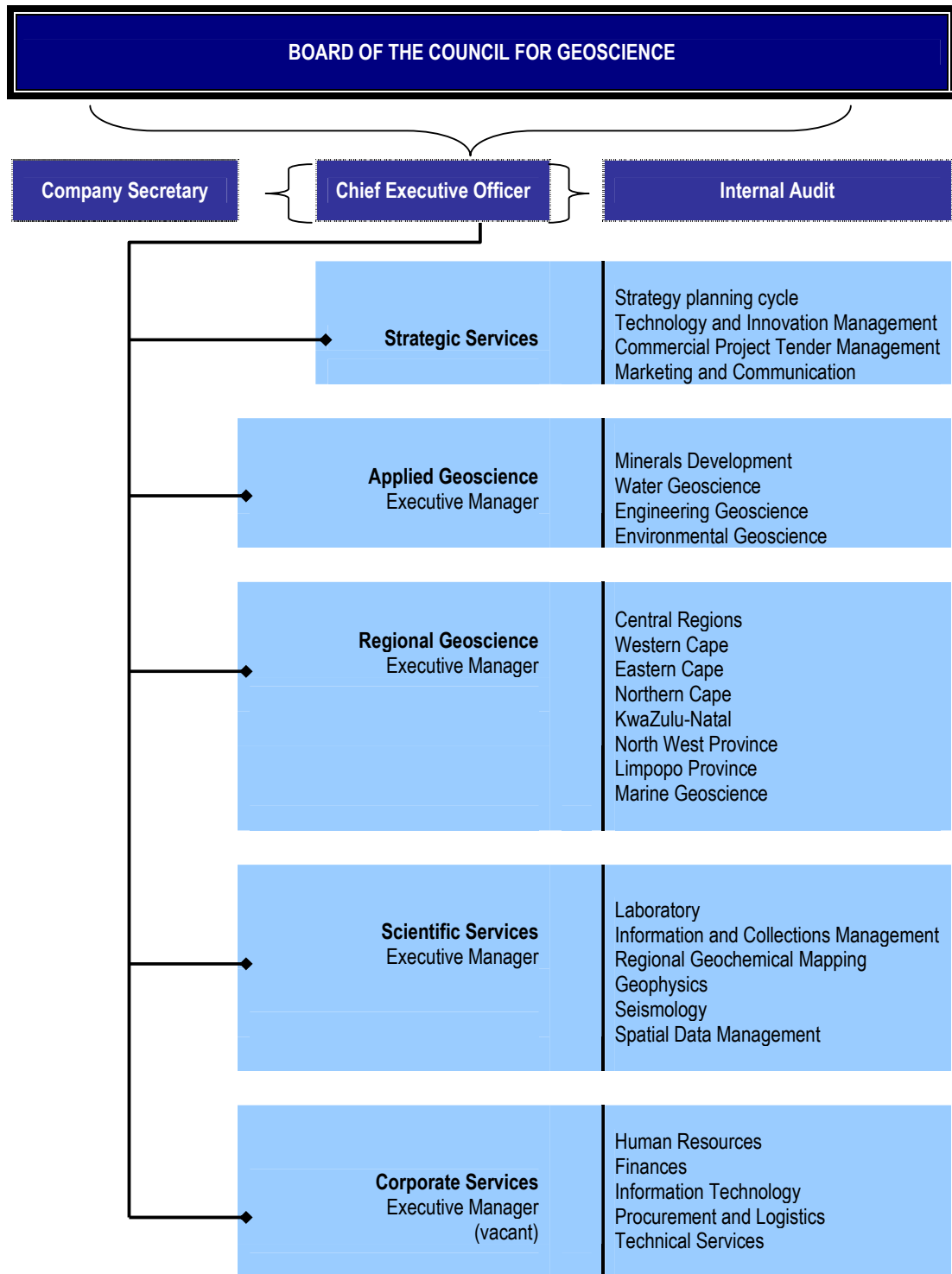


Figure 1.1: Organisational chart for the Council for Geoscience.

## **Core competencies and technical facilities of the Council for Geoscience**

The strength of the CGS is manifested in its core of competent geoscience and technical staff, encompassing virtually all the disciplines of the geosciences. The core competencies include:

- Geological, geophysical, metallogenic, geotechnical and geochemical mapping, surveys, and services.
- Mineral-resource data collection, evaluation and assessment.
- Engineering-geological site investigations.
- Seismic-hazard assessment.
- Groundwater investigations.
- Coastal-erosion studies.
- Marine geology.
- Environmental-impact assessments.
- Isotope geochemistry and geochronology.
- Analytical services (wet-chemical determinations, atomic-absorption spectroscopy), optical and electron microscopy, petrographic descriptions, mineralogy, X-ray diffractometry; X-ray fluorescence.
- Palaeontology.
- Geographic information system (GIS) development and spatial database design.
- Data analysis, geoscience database design, development and management.
- Data integration, processing and the creation of customised products.
- Cartographic services.
- Information management and dissemination, library services, promotion of public awareness of the impact of geology on daily human activities.
- Compilation and publishing of geoscience maps and publications of various formats.
- Collections management (museum, borehole core library, scientific collections), graphic design, and exhibitions.

Statutory services — required and funded by the Government.

- Supply of basic geological information to the Government and the public.
- Supply of specialised geotechnical and engineering-geological consultants to conduct investigations on ground conditions prior to the commencement of civil-engineering work for Government projects.
- Regional gravity surveys and geophysical interpretation, carried out by the Geophysics Unit

- Recording and reporting on all seismic events, recorded at any one of 28 seismological stations positioned throughout South Africa.
- The laboratory is responsible for analytical services, ranging from petrography, XRF and chemistry, to XRD, isotope studies and neutron-activation studies. In addition, the laboratory is responsible for an ongoing regional geochemistry programme. .
- Mineral-commodity studies, designed to investigate the nature, distribution and genesis of mineralisation, are carried out.
- The modular GEODE corporate database provides an online enquiry system to effectively handle enquiries pertaining to data in all the submodules.

Non-statutory services include projects conducted for remuneration. These services are available to the local, as well as overseas public and foreign governments.

The primary business of the CGS is science; therefore scientists, apart from human resources, finance and procurement, are appointed to senior positions in the organisation. The criteria for scientists to qualify for managerial positions are either a masters or doctorate degree in science. Although a sound knowledge of science is needed for these positions, the necessary managerial and leadership characteristics have never played a significant role in the appointment of unit leaders (heads). Therefore, it is the aim of this study to determine the leadership style of the scientists that were appointed as unit leaders (scientists as unit heads).

### **The position of scientific unit leaders**

Scientists in unit leader positions directly reports to the applicable executive manager of a specific unit — applied geoscience, regional geoscience and scientific services — who again reports to the Chief Executive Officer (see Figure 1.1). The position of scientist as unit leader generally entails that he/she should:

- Inspire, lead and motivate staff and be able to demonstrate scientific leadership.
- Be able to show business and financial management skills in order to manage project costs through sensible and effective project and financial management techniques.
- Show commitment to management and should nurture people and resources through close supervision and provide them with opportunities for self-development.
- Show commitment to workforce transformation and should have the ability to initiate innovative and pre-competitive research, secure funding and resources and manage projects to completion.

- Show the willingness to accept and work towards mutually acceptable targets and objectives and be able to increase the revenue of the unit.
- Be able to promote the Council for Geoscience and the unit to stake-holders and customers.
- Be able to build and develop strategic partnerships with governmental, technological, academic and financial institutions.
- Ensure the implementation of and adherence to the Council for Geoscience's policies and procedures regarding human resources, finance, procurement, information management, contracts and tender management and reporting schedules.
- Be able to set, manage and complete realistic and appropriate annual technical programmes.

### **1.1 Purpose of this research**

The primary purpose of this research is to determine the leadership style of scientists as unit leaders (heads/managers).

### **1.2 The objective of the study**

The objective of the study is to determine:

- If scientists in unit leader positions rate themselves differently on transformational leadership compared to their supervisors.
- If scientists in unit leader positions rate themselves differently on transactional leadership compared to their supervisors, peers and subordinates.
- If scientists in unit leader positions rate themselves differently on laissez-faire leadership compared to their supervisors, peers and subordinates.
- If scientists in unit leader positions rate themselves differently on extra-effort compared to their supervisors, subordinates and peers.
- If scientists in unit leader positions rate themselves differently on effectiveness compared to their supervisors, peers and subordinates.
- If scientists in unit leader positions rate themselves differently on satisfaction compared to supervisors, peers and subordinates.
- If there is a difference in transformational leadership, transactional leadership and attribution ratings between the self-ratings of the different scientific unit leaders.
- If there is a difference in transformational leadership, transactional leadership and attribution ratings between the self-ratings of scientific unit leaders compared to their supervisors.

## 1.1 Definitions

A distinction is drawn between management and leadership. The definition of both management and leadership style are as follows:

### **Management:**

*Classical management* theorists define the role of management in terms of planning, organising, commanding, coordinating and controlling (Drucker, 1954; Fayol, 1949; Mintzberg, 1989; Taylor, 1911).

*Modern management* has three different, but interrelated, dimensions: 1) activities, 2) contingencies, 3) processes. At the core, are the classic managerial activities of planning, organising, commanding, coordinating and controlling. Management processes produce a degree of order and consistency in human systems (Kotter, 1990).

### **Leadership style:**

Leadership style is the consistent patterns of behaviour which are exhibited, as perceived by others, when attempting to influence the activities of people (Hersey and Blanchard, 1972).

## 1.2 Delimitations of the study

The scope of this study is to examine the leadership style of managers in unit head positions in the Council for Geoscience. The study is based on the body of knowledge in the field of leadership. The study is limited to managers in a science organisation (Council for Geoscience) and is sufficient for the purpose of the MBL degree.

## 1.3 Importance of the study

The implication of this study is that a difference may well be found between the perceptions of scientists as unit leaders of their own leadership styles, and the perceptions that their subordinates have of their leadership styles. The study can also assist in identifying if it is necessary for scientists in unit leader positions to acquire and develop managerial skills.

## 1.4 Outline of the research report

This report describes the foundation of leadership. A detailed literature review of the body of knowledge regarding leadership is given. The research methodology is described and the research results are presented. The research results obtained are discussed, a conclusion is made and recommendations are given.

# CHAPTER 2

## 2. LITERATURE REVIEW

### 2.1 Background on leadership

Leadership has been the subject of debate for hundreds of years, but it was only in the twentieth century that it became a topic of sustained formal analysis by scholars and researchers. This is because it is assumed that leaders — through their personal qualities, influence, and actions — strongly shape societal events (Bratton, Grint and Nelson, 2005: 4). Blunt and Jones (1997) state that ways of testing theories of human behaviour and establishing scientific credentials are hard to pin down. They feel that theories of leadership that have fallen from favour are more likely to be victims of changes in fashion in the broad field of management, than of anything else.

Theories on leadership provide for a variety of potential explanations regarding effective leadership, including personal attributes, contingencies, and the role of subordinates. By analysing managerial leadership, it becomes important to consider and recognise the complex interplay among the structure of organisational life, patterns of behaviour, and varied beliefs, values, interests, and initiatives of the individuals who create and work within this structure (Bratton, Grint and Nelson, 2005: 4).

The central role of leaders in the leadership process is well illustrated in literature and documented in history. This can be illustrated by the images of a charismatic brave knight on a white charger, as portrayed by European literature, and the modern superhero of North American popular culture.

Research on organisational leadership has grown systematically with the advance of industrialisation. Large work organisations are associated with bureaucratic and technological complexity that affects the demand for managers and the need for coordination and leadership roles (Hodson and Sullivan, 2002).

Extensive research acknowledges that “leadership is one of the most observed and least understood phenomena on earth” (Burns, 1978: 2). Leadership as a concept permeates and structures the theory and practice of formal organisations and the way that management is understood. Leadership has been accepted as a matter of personality and contingency, as a

power relationship, as particular behaviours, as the focus of group processes, and in terms of multiple combinations of these variables. Most definitions reflect the assumption that managerial leadership involves a process whereby an individual exerts influence on others in an organisational context (Bratton, Grint and Nelson, 2005: 6). The concept of influence is illustrated by the following definition of leadership (Yukl, 2002: 7):

*Leadership is the process of influencing others to understand and agree about what needs to be done and how it can be done effectively, and the process of facilitating individual and collective efforts to accomplish the shared objectives.*

In organisations concerned with developing strong workplace cultures and the building of high-performance human systems, the concept of leadership has acquired exceptional pertinence and importance. The search for alternatives to the traditional command and control leadership model has given rise to models variously labelled *transformational leadership* (Bratton, Grint and Nelson, 2005), charismatic leadership (Conger, 1989), and self-leadership (Manz and Sims, 1987).

Considering the concepts of leadership and the role of the leader as a manager, it is important to distinguish between leadership and management.

## **2.2 Distinction between leadership and management**

A distinction is drawn between management and leadership. This section sets out to discuss the differences between management and leadership. A comparison between management and leadership is also attended to in detail.

### **2.2.1 Management**

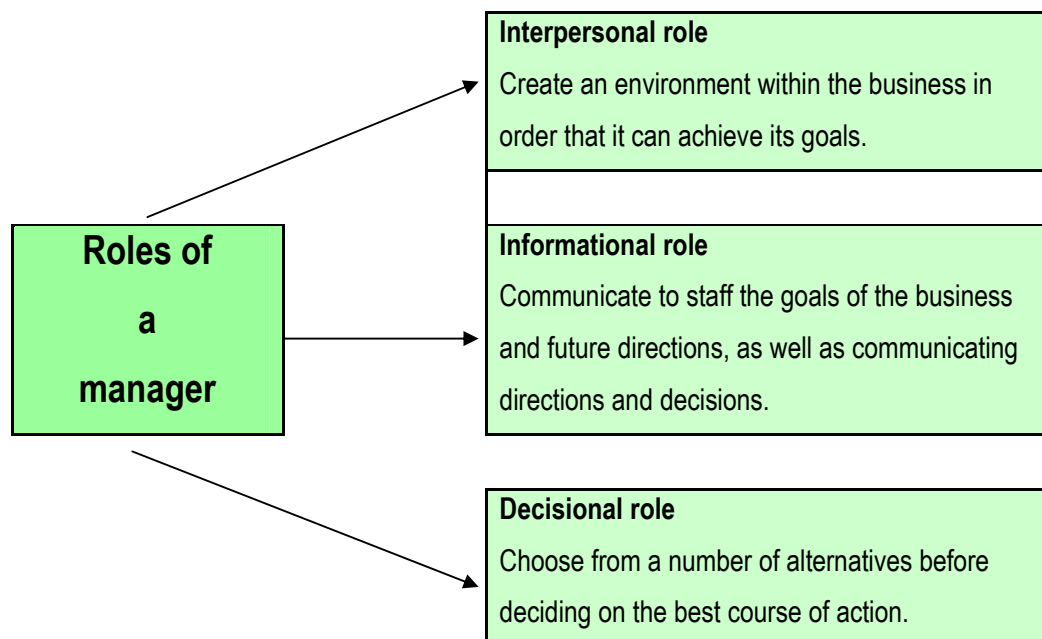
The English word manage is derived directly from the Italian word *maneggiare*, meaning “to handle horses” (Williams, 1976). There are several approaches to studying the phenomenon of management, each with a preferred model. Some approaches consider management to be the central process for organisations to achieve the impression of similarity and direction. Other approaches conceptualise management as a process designed to coordinate and control productive activities. The latter definition leaves room for uncertainties, paradoxes and conflicts (i.e. Alvesson and Willmott, 1996; Reed, 1989).



To understand the difference between leadership and management, the roles played by managers need to be examined. A role in an organisational situation is an expected set of activities or behaviours stemming from a position held. Classical management theorists define the roles of management in terms of planning, organising, commanding, coordinating, and controlling (Drucker, 1954; Fayol, 1949; Mintzberg, 1989; Taylor, 1911). This definition indicates that leading is only one of the many roles performed by managers, and the extent of this activity depends on how highly placed the manager is within the organisational bureaucracy (Bratton, Grint and Nelson, 2005: 8).

Modern management has three different interrelated dimensions: 1) activities, 2) contingencies, and 3) processes, and at the core are the classical managerial activities of commanding, coordinating, controlling, organising, and planning. Managerial contingencies are the forces and events, inside and outside of the organisation that affect management behaviour (Bratton, Grint and Nelson, 2005: 8).

Biddle (2005) explains that the role of a manager will vary considerably in relation with the size of the organisation, its goals and immediate needs. The key to effective management is to enable a business to achieve goals by effectively utilising the resources available to the business. Figure 2.1 illustrates the range of roles carried out by an effective manager.



**Figure 2.1:** Roles of an effective manager (after Briddle, 2005).

Briddle (2005) continues by stating that a good manager is one who utilises the available resources of an organisation in an efficient way in the process of achieving the organisations' goals. Skills required by a manager to be a successful leader include:

- People skills — managers need to gain loyalty, commitment and gender respect.
- strategic thinking — managers need to develop a longer- term view for the future directions of the business.
- Vision — managers must develop a vision that will stimulate and advance the organisation
- flexibility and adaptability — managers must be prepared to seek and implement ideas and strategies appropriate to the circumstances.
- Self management — effective managers need to be able to manage their tasks in the time available.
- Teamwork — managers need to be able to utilise the skills and abilities of the staff as members of a larger team.
- Problem -solving and decision-making — managers need to be able to choose a solution from a range of alternatives.
- Ethical and personal standards —managers of businesses need to have high personal standards.

### 2.2.2 Leadership

Leadership is linked to terms such as vision, charisma, and change agent. The leadership processes associated with these words create significant change or movement (Kotter, 1990).

Some theorists argue that leadership is an interpersonal process, involving dyadic relationships and communications with subordinates; other theorists assert that leadership is a value-laden activity, whereas management is not. It has also been stated that leaders “do the right things” whereas managers “do things right” (Zaleznik, 1983). It has also been emphasised that whereas management is concerned with a set of contractual exchanges — “do this work for that reward” — leadership is concerned with the reciprocal influence process, or psychological contract (a term that describes the variety of leader-follower relations in an organisation) (Zaleznik, 1983).

The leadership theorist John Kotter (1990, 1996a) argues that if organisations are to survive, managers must be able to manage and lead. He identifies three sub-processes that distinguish leadership from management, and says that the leader should be able to 1) establish direction,

2) align people with that vision, and 3) motivate and inspire them to make change happen despite the obstacles.

According to Briddle (2005) an effective leadership style is one that works. Possible indicators for unsuccessful leadership are:

- High levels of staff turnover — these cause problems and costs for business operations and result from dissatisfaction, boredom, inadequate rewards and unresolved conflict.
- High levels of absenteeism — indicate low levels of loyalty and motivation and are costly to an organisation.
- Levels of disruption — are costly and indicate lower levels of negotiation skills; managers need to be realistic and dignified in their negotiations.
- Quality output and levels of productivity — a good working relationship between manager and employees will encourage effective motivation and work practices and lead to high levels of productivity and quality output, whereas bad working relationships will lead to the opposite.

### 2.2.3 Management versus Leadership

According to Briddle (2005) it is a common practice to equate good management with strong leadership although they are not necessarily the same. Managers and leaders can achieve their individual and their organisation's goals in a variety of ways. These approaches and styles can, and almost certainly will, differ as environments and situations change. By observing successful managers and business leaders, several common strategies or approaches can be identified:

- establish and articulate a personal and business value system before implementing policies and practices
- develop and show respect for staff, especially with regard to their strengths and differences
- realise that the development of workplace relationships is much more important than an emphasis on structure and hierarchy
- recognise that employees have rights and responsibilities in addition to those legally and formally stated — needs and concerns have to be adequately addressed.

Kotter (1990, 1996a) compares management and leadership, as reflected in Table 2.1.

Table 2.1: Comparing management and leadership (after Kotter, 1990, 1996a).

	MANAGEMENT	LEADERSHIP
<b>Agenda creation</b>	<i>Plans and budgets:</i> Establishes detailed steps and timetables for achieving set targets, and allocates the essential resources.	<i>Establishes direction:</i> Develops a vision for the future and strategies for achieving that vision.
<b>Network development for agenda achievement</b>	<i>Organises and staffs:</i> Establishes structure for achieving the plans, assigns staff, delegates, develops policies to guide subordinates, and designs control systems.	<i>Aligns people:</i> Communicates direction and duties to all whose cooperation is needed, in order to create teams and coalitions that understand the vision and strategies and accept their validity.
<b>Agenda execution</b>	<i>Controls and solves problems:</i> Monitors progress, i.e. reaching of targets against plans, identifies deviations, and organises to close any gaps.	<i>Motivates and inspires:</i> By satisfying basic human needs, energises people to overcome obstacles to change.
<b>Outcomes</b>	Produces a degree of predictability and order. Has the potential to produce the key results expected by stakeholders.	Produces change, often to a dramatic degree. Has the potential to produce extremely useful change (i.e. new products).

The distinction between management and leadership is important, especially in an era of turmoil and change because “successful transformation is 70 per cent leadership and only 10 to 30 per cent management” (Kotter, 1996a: 26). Bennis and Nanus (1997) draw another important distinction between management and leadership. They hold that managers, by the nature of their role, encourage compliance, whereas leaders encourage empowerment and a culture of pride.

A mix of both management and leadership processes are apparent in modern management. Individuals will vary in terms of their role within the bureaucracy and their capacity and inclination to use each process. Observers of management have pointed out that not all managers lead and not all leaders manage (Bass, 1990; Zaleznik, 1977).

### 2.3 Leadership theories

Leadership theories have evolved over time, becoming more sophisticated and even more applicable for their “innovation”. Seven perspectives have featured throughout history, all seven also having various subcategories. Theories of leadership are primarily analytical, directed at

better understanding of the leadership process and the variations among them (Bratton, Grint and Nelson, 2005).

Early research was focussed on determining:

- Traits of leaders that distinguished them from subordinates.
- Traits that notably correlated some measures of effectiveness with leaders.
- A group of specific traits that differentiated effective leaders from ineffective leaders.

### 2.3.1 Trait theories

This perspective is the oldest of all the theories and has received much criticism, yet still seems to feature often in articles. This model of leadership categorises leaders according to their inherent traits (Bratton, Grint and Nelson 2005). Stogdill (1974: 87) describes a successful leader as having the following trait profile:

*The leader is characterized by a strong drive for responsibility and completion of tasks, vigour and persistence in the pursuit of goals, venturesome and originality in problem solving, drive to exercise initiative in social situations, self-confidence and a sense of personal identity, willingness to accept the consequences of his or her decisions and actions, readiness to absorb interpersonal stress, willingness to tolerate frustration and delay, ability to influence other people's behaviour, and the capacity to structure social interaction systems to the purpose at hand.*

Kirkpatrick and Locke (1991) identified seven traits of an effective leader: drive, leadership, motivation, integrity, self-confidence, intelligence, knowledge of the business, and a self-monitoring personality. Yukl (2002) suggested eight traits positively associated with effective leadership: high energy levels, strong internal locus of control, self-confidence, emotional maturity, integrity, need for power, moderately high achievement orientation, and moderately low need for social affiliation.

Trait theory characterised the entrepreneur as an independent and innovative thinker, a risk taker, and a wealth seeker. It seems that the personal traits possessed by entrepreneurs are similar to those that differentiate leaders from subordinates (see Table 2.2).

**Table 2.2:** Classification of entrepreneurial traits (after Blawatt, K.1998).

Rank	Trait	Description
1	Comfort	Needs personal support
2	Energy	Has high energy level
3	Harm avoidance	Enjoys exciting activities
4	Conformity	Is independent in thought and action
5	Risk taking	Is willing to be exposed to uncertainty
6	Social adroitness	Is skilled in persuading others
7	Entrepreneurial effect	Is emotionally aloof
8	Autonomy	Resists being confined or restricted

Weaknesses of the trait perspective are:

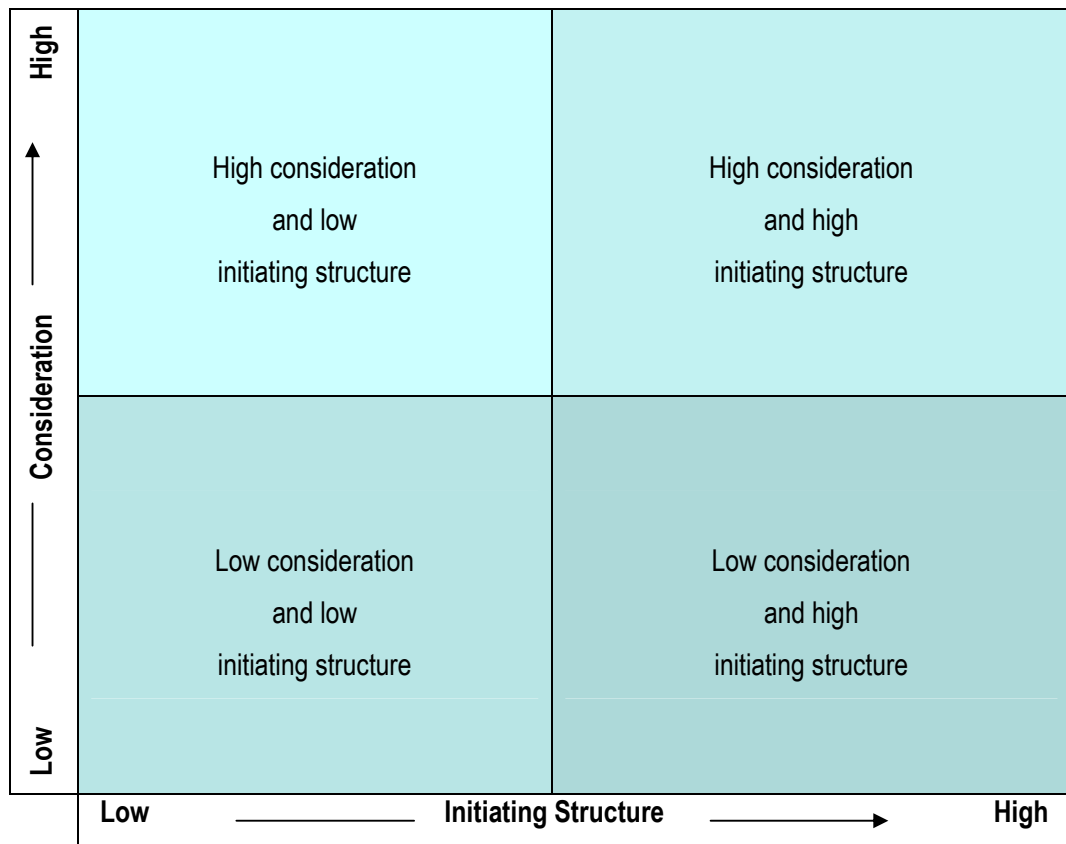
- The context within which leaders and subordinates find themselves has been neglected.
- The importance of subordinates in the leadership process is ignored.
- Leadership traits are culturally determined and culture is viewed as the sum of shared values and beliefs, assumptions, and philosophies with which people identify.

### 2.3.2 Behaviour theories

Trait leadership theorists emphasise the personal characteristics of leaders, whereas behavioural leadership theorists emphasise their behaviour. This theory states that leaders will behave in a certain way towards their subordinates, i.e. either task orientated (production driven), or people orientated (relationship driven). The concept of a leader shifted from attributes to activity (Fleishman, 1953).

Task orientated leaders emphasise productivity targets or goal accomplishment and is said to have a task-orientated leadership style. People orientated leaders, on the other hand, are concerned about the followers as people: their needs, development and problems. These leaders are said to have an employee-centred or a person-orientated leadership style. Leadership studies that provided the foundation for the behaviour theories include: the 1930s Boy's Club studies (Lewin *et al.*, 1939), the University of Michigan studies, the Ohio State studies, and work by Blake and Mouton (1964).

Figure 2.2 illustrates the high-high leadership hypothesis that was developed as a means to classify leaders who showed both high relationship- and high task-driven behaviours (Bratton *et al.*, 2005).



**Figure 2.2:** Leadership style model (after Stogdill and Coons, 1957).

Weaknesses of the trait perspective are:

- Not able to identify the universal style of leadership that is effective in the vast majority of situations.
- It suggests that the most effective leadership style is the so-called high-high style.
- The earlier behaviour theories did not adequately demonstrate how leaders' behaviour is associated with performance outcomes (Bryman, 1992; Yukl, 2002), as they provided only a crude representation of a complex reality.

### 2.3.3 Contingency theories

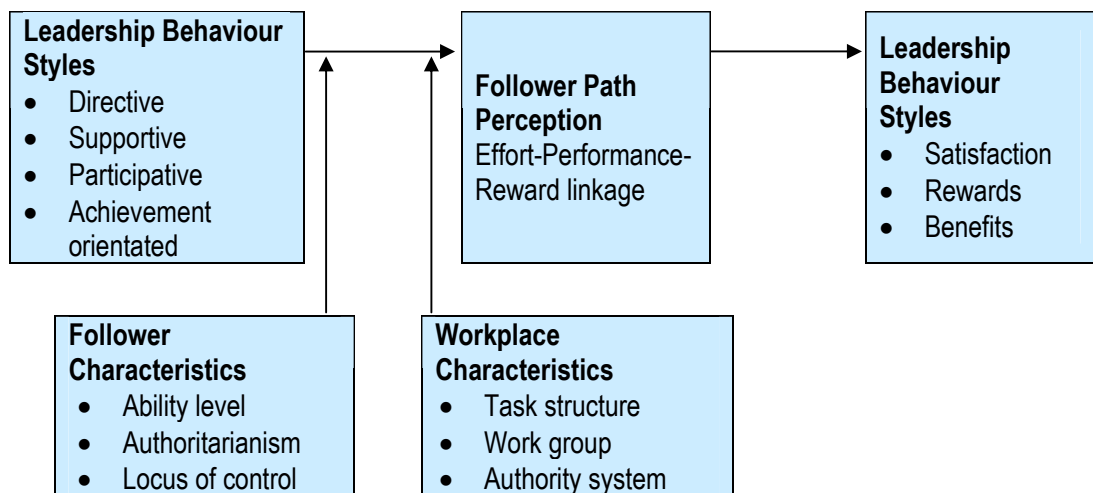
This model of leadership is based on the idea that the most effective leadership style in a particular case depends on the interactions among the leader, follower and the situation. Therefore, whether a set of traits or behaviour will result in effective leadership will depend on the situational variable. These theories are "if-then" theories and include the Least Preferred Co-worker Theory, the Path-Goal Theory, the Performance Maintenance Theory, the Normative Decision Theory, the Situational Leadership Theory, the Leader-Member Exchange Theory and Substitutes for Leadership Theory (Bratton, Grint and Nelson, 2005).

### Least Preferred Co-worker Theory

This theory assumes that a leader is either relationship or task orientated. Leaders who describe their least preferred co-worker in positive terms, such as pleasant, efficient, and cheerful, are classified as high LPC (Least Preferred Co-worker), or relationship-orientated leaders. Those who describe their least preferred co-worker negatively, such as unpleasant, inefficient, and gloomy, are classified as low LPC, or task-orientated leaders (Bratton, Grint and Nelson, 2005). This theory suggests that both low and high LPC leaders can be effective if placed in the right situation (Fiedler, 1978). Low LPC (task-orientated) leaders are most effective in either very favourable or very unfavourable leadership situations.

### Path-Goal Theory

This theory identifies two leadership styles, namely performance-orientated leadership behaviour and maintenance-orientated leadership behaviour. Performance-orientated leadership behaviour emphasises a fast work pace and good-quality, high-accuracy and high-quantity production. These leaders show concern for rules and regulations, as they adopt a task-orientated style of behaviour. Maintenance-orientated leadership behaviour, on the other hand, is sensitive to employees' feelings, focuses on a comfortable work environment, seeks to reduce work stress, and shows appreciation for the contributions of subordinates. The performance-maintenance theory holds that effective leaders exhibit both behavioural styles (Bratton, Grint and Nelson, 2005: 169). The path-goal model is illustrated in Figure 2.3.



**Figure 2.3:** The Path-Goal Model (after House, 1971; Mitchell, 1974).



### Normative Decision Theory

The normative decision model Vroom-Yetton-Jago assists leaders in determining when employees should participate in the decision-making process, and recognises the benefits of authoritative, democratic, and consultative styles of leadership behaviour (Vroom, 2000; Vroom and Jago, 1988; Vroom and Yetton, 1973). The model is based on five forms of decision making, namely: decide, consult individually, consult group, facilitate, and delegate. The key to this model is the leader's use of the decision method most appropriate to a given situation (Bratton, Grint and Nelson, 2005: 170).

The model proposes that the effectiveness of a decision is a function of three classes of outcomes, each of which may be expected to be affected by the decision process used (Jago, 1986). These are:

- The quality or rationality of the decision.
- The acceptance or commitment on the part of subordinates to execute the decision effectively.
- The amount of time required to make the decision.

The Vroom-Yetton decision-making processes are illustrated in Table 2.3. Each of these processes is represented by a symbol (i.e. AI, CI, GII).

**Table 2.3:** Vroom-Yetton decision-making process (after Vroom and Jago, 1974).

Symbol	Definition
AI	You solve the problem or make the decision yourself using the information available to you at the present time.
AII	You obtain any necessary information from subordinates and then decide on a solution to the problem yourself. You may or may not tell subordinates the purpose of your questions or give information about the problem or decision you are working on. The input provided by them is clearly in response to your request for specific information. They do not play a role in the definition of the problem or in generating or evaluation alternative solutions.
CI	You share the problem with the relevant subordinates individually, getting their ideas and suggestions without bringing them together as a group. Then you make the decision. This decision may or may not reflect your subordinates' influence.
CII	You share the problem with your subordinates in a group meeting. In this meeting you obtain their ideas and suggestions. Then you make the decision which may or may not reflect your subordinates' influence.
GII	You share the problem with your subordinates as a group. Together you generate and evaluate alternatives and attempt to reach agreement (consensus) on a solution. Your role is much like that of chairperson, coordinating the discussion, keeping it focused on the problem and making sure that the critical issues are discussed. You can present information or ideas that you have to the group, but you do not try to "press" them to adopt "your" solutions and are willing to accept and implement any solution which has the support of the entire group.

### Situational Leadership Theory

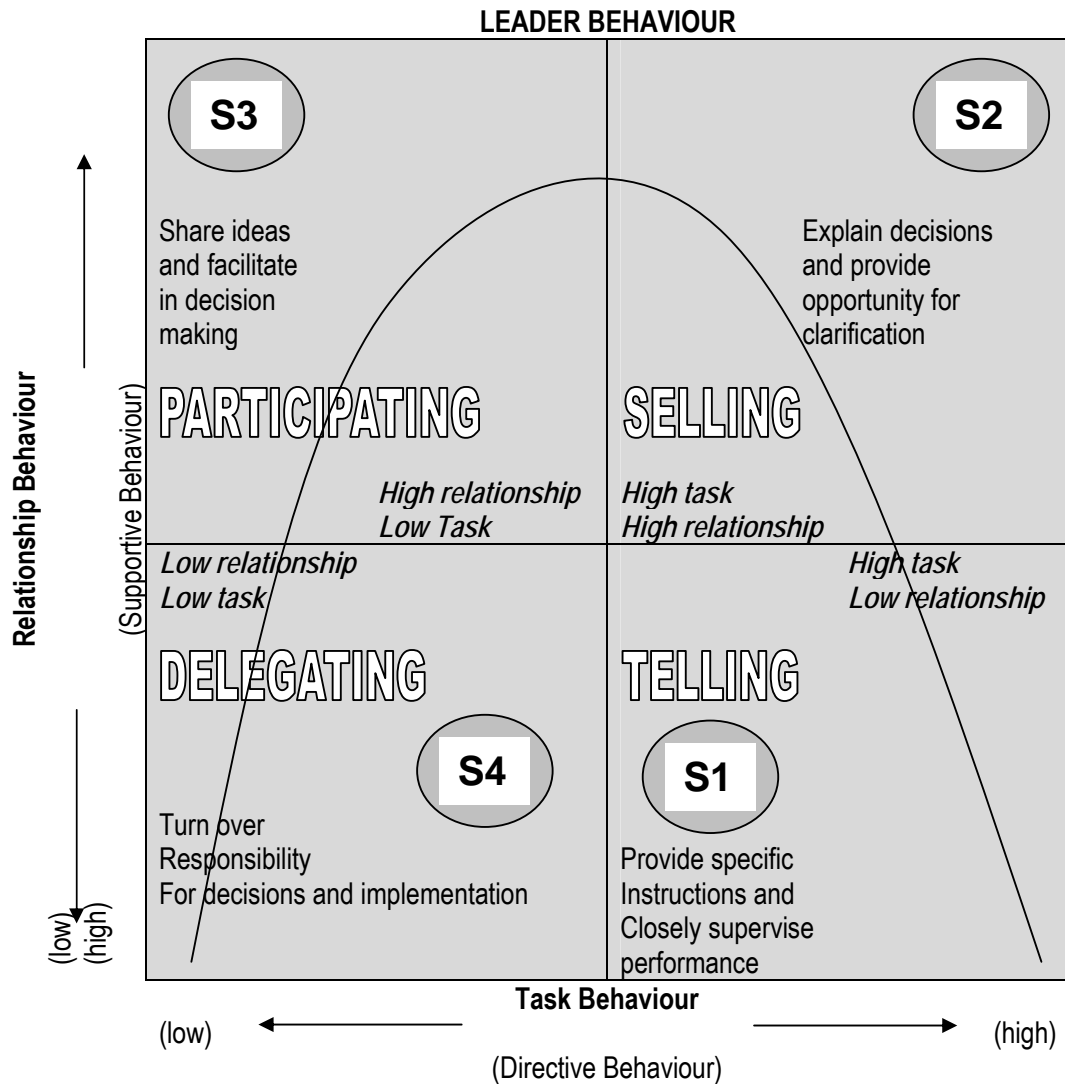
This model suggest that leaders will adjust their behaviour depending on the readiness of subordinates — the extent to which subordinates demonstrate ability and willingness to accomplish a specific task (Hersey, Blanchard and Johnson, 2001). Ability in this definition refers to the extent to which subordinates possess the skills, experience, and knowledge needed to perform the task without the leader’s intervention; whereas willingness refers to the followers’ commitment, confidence, and self-motivation to perform the task (Bratton, Grint and Nelson, 2005: 172).

This model indicates that there is “no best style of leadership” and that the appropriate leadership style for any given situation depends on the particular conditions present, including the readiness of subordinates. Readiness does not indicate personal characteristics, but rather how a person is to perform in a particular task. The model identifies four leader behaviour styles, namely: telling, selling, participating, and delegating.

This model recommends that leaders should adopt:

- A telling style of leadership with subordinates that is unable and unwilling to take responsibility for completing their work.
- A selling style, as there is high concern with both task and relationship.
- A participating style if subordinates are able but unwilling.
- A delegating style if subordinates are both willing and able.

Figure 2.4 is an illustration of the situational leadership model. The model describes the relationship behaviour and task behaviour of leaders. The readiness of subordinates is also illustrated in the model.



**FOLLOWER READINESS**

High	Moderate		Low
← R4	R3	R2	→ R1
Able and willing or confident	Able but unwilling or insecure	Unable but willing or confident	Unable and unwilling or insecure
} Follower directed		} Leader directed	

**Figure 2.4:** The situational leadership model (after Hersey, 1985).

Leader-Member Exchange Theory

The Leader-Member Exchange Theory is also referred to as the LMX theory. This theory builds on social relationships that place the follower in “in-” and “out-groups” depending on their relationships with leaders (Bratton, Grint and Nelson, 2005). This theory indicates that in-group

members are more likely to engage in organisational citizenship behaviour, while out-group members are more likely to retaliate against the organisation (Townsend, Phillips and Elkins, 2000). It also indicates that the type of stress experienced by subordinates depends on which group they belong to. In-group members' stress comes from additional responsibilities placed on them by the leader, whereas out-group members' results from being left out of the communication network (Nelson, Basu and Purdie, 1998).

#### Substitutes for Leadership Theory

According to Kerr and Jermier (1978), situations can neutralise or even complement any behaviour by the leader, which is the central idea behind the substitutes for leadership theory. It is suggested that if employees get positive feedback about their performance, the leader behaviour is irrelevant, because the employees' satisfaction derives from the interesting work and feedback. Other substitutes for leadership include high skill levels on the part of employees, team cohesiveness, and formal controls on the part of the organisation (Bratton, Grint and Nelson, 2005).

Weaknesses of the contingency theories:

- The Least Preferred Co-worker theory has better supported lab studies than field studies. In addition, the LPC scale does not truly measure leadership style (Schriesheim and Kerr, 1977).
- The Vroom-Yetton-Jago model is limited to the leader's decision situation.
- A limitation of the Situational Leadership model is the absence of a central hypothesis that might be tested to determine whether it is a valid, reliable theory of leadership.

#### 2.3.4 The power-influence perspective

Because power plays an important role in the influence process of leadership, the power-influence perspective states that social relations within an organisation involve interplay of power, constraints, conflict and cooperation (Bratton, Grint and Nelson, 2005). It is noted that:

- Those with the most power resources do not always triumph. Because power depends on the relationship between resources, a power struggle will depend on what is happening at the time, and not on what the power analysis indicates should happen, given the distribution of resources.
- Power is a consequence of events, not a cause of events.

French and Raven (1959) generated a taxonomy that explained subordinates' compliance with leaders' wishes based on reward power, coercive power, legitimate power, expert power, and referent power, as indicated in Table 2.4.

**Table 2.4:** Taxonomy of power (after French and Raven, 1959).

	<b>Source of Compliance</b>	<b>Assessment</b>
<b>Reward power</b>	Compliance is secured by providing rewards that subordinates want.	A characteristically blunt approach, the use of reward power is as likely to damage relationships between leaders and subordinates as improve them.
<b>Coercive power</b>	Compliance is secured by using punishments that subordinates want to avoid.	As difficult as reward power to handle well, coercive power seldom generates perfect compliance. It provides an inadequate base for long-term effective leadership.
<b>Legitimate power</b>	Compliance is secured through followers' belief that requests are rational and that the leader's position is legitimate.	Legitimacy depends as much on subordinates' interpretations as on the leader's claim.
<b>Expert power</b>	Compliance is secured through subordinates' belief that the leader has sufficient expertise to make rational requests.	The conventional concept of a leader with knowledge and certainty may be unwarranted. Experts may be less confident of the utility or predictability of their expertise than are non-experts.
<b>Referent power</b>	Compliance is secured by subordinates' identifying with the leader and wanting to gain his or her approval.	No leader can be effective without a network of supporters.

### 2.3.5 The gender-influence perspective

This theory highlights the fact that female leaders show more empathy, are prepared to share power and are concerned with consensus building (Bratton, Grint and Nelson, 2005). This theory was developed much later, and is based on findings from the different leadership styles of males and females.

Alvesson and Billing (1997) proposed a model, shown in Figure 2.5 that proposed a framework for making sense of gender and leadership.



**Figure 2.5:** A framework for understanding gender and leadership (after Alvesson and Billing, 1997).

- **Equal opportunities**  
 This position holds that fundamental inequalities and injustices exist in the work environment that restricts the number of female leaders. Prejudgement and discrimination inhibit women from attaining positions of authority. Women find it difficult to advance above supervisory level, even with education and qualifications similar to male counterparts. Arguments for equal opportunity are based on moral values that focus on fundamental fairness. Unfair stereotyping affects not only selection and promotion, but also career-development opportunities and performance appraisals. The culprits in this situation are the prevailing organisational conditions of stereotyping and discrimination (Adler, 1997). The equal-opportunity view is also critical of top management, calling for legislation to address the issue of equality. This view focuses on similarities between men and woman (Bratton, Grint and Nelson, 2005).
  
- **Alternative values**  
 This position holds the most extreme view of differences between men and woman. It points out that the interests, priorities, and basic attitudes toward life of women and men are totally different and, in fact, are sometimes completely opposed. Women are viewed as caring and nurturing and, therefore, find themselves in positions that afford them the opportunity to apply this aspect of their nature. Typically, fields of employment would be health care, social services, and other humanistic fields, which do not provide as many leadership opportunities as those that males pursue. Men, typically, would pursue careers such as engineering and business. Men and women, therefore, enter organisations with totally different values (Bratton, Grint and Nelson, 2005).

- Meritocracy

This position holds that social and political forces are obstacles preventing women from advancing to leadership positions. The theory focuses on organisational efficiency. The under utilisation of the able women of the workforce is viewed as preventing efficient use of resources (Alvesson and Billing, 1997). Similarly to meritocracy, the equal-opportunities view recognises the shortcomings responsible for the obstacles women face in advancing in their careers. Both these views focus on preventing and removing these obstacles. Differences between these two views include their underlying interests in democracy versus organisational efficiency and the faith each view places in top management to address the issue. The meritocracy view holds that if top management attempts to compete in the market they need to attract and utilise the best candidates, thereby improving the chances of women to advance to leadership positions.

- Special contribution

Writers and researchers have taken the view that the experiences of women differ in significant ways from those of men. In the modern context, this view contends that these differences are slight but important — women's strengths complement those of men and, therefore, can be beneficial to more effective leadership. This belief is often referred to as "feminist leadership". Feminist leadership states that women can contribute something unique to organisations, including a more democratic, people-orientated leadership style, a preference for flatter organisational structures, and a focus on intuitive decision making. In the special-contribution approach, women are seen as directing their power toward building the community rather than exerting domination and control (Bratton, Grint and Nelson, 2005).

### 2.3.6 The integrative perspective

#### Charismatic leadership

The integrative perspective is also known as charismatic leadership. This model attempts to find the reason why some subordinates are prepared to "go the extra mile" to satisfy leaders (Bratton, Grint and Nelson, 2005).

Weber (1978) suggests that subordinates comply with superordinates' demands based on one of three forms of legitimate authority:

- Traditional authority, in which compliance is due because of the sacred nature of the office.
- Rational-legal authority, in which compliance is derived from the rationality of the authority.
- Charismatic authority, in which obedience is attributed fundamentally to the extraordinary personal powers of a charismatic individual.

According to Weber (1978) charisma involves five related elements:

- An individual of exceptional powers or qualities.
- A social crisis.
- A radical solution to the crisis offered by the individual.
- Devoted subordinates, attracted to the individual's transcendent powers.
- Repeated successes.

According to Hughes, Ginnett, and Curphy (1999: 286) charismatic leaders have “personal magnetism”, spellbinding powers, and heroic qualities. They are passionate, driven individuals who are able to paint a convincing vision of the future. This type of charisma is called weak charisma. Hughes, Ginnett and Curphy (1999) list four characteristics for charismatic leaders: vision, rhetorical skills, image and trust building, and personalised leadership.

Shils (1965) argued that the most important element of charismatic leadership is neither the individual leader nor the situation, but the relationship between leader and follower — particularly the emotional bond that encourages subordinates to take significant risks on behalf of their leader.

Zaleznik (1974) divided charismatic leaders into psychologically “healthy” and “unhealthy”, with the latter developing an unhealthy over dependence on their mothers and on their subordinates. Howell (1988) considers charismatic leaders to be either “socialised (pursing the interests of their subordinates) or “personalised” (following their own interests). Bass (1985) distinguished between “authentic” and “inauthentic” or “pseudo--transformational” leaders. Bass (1999: 548) recommended that:

*We have [to find] ways to understand, predict, and control the emergence of pseudo--transformational leadership in the age of impression management and presidential spinmeisters (people who excel at a particular activity). Only from unbiased well-informed sources of data will we be able to sort out the authentic from the pseudo-transformational leaders.*

### Transformational leadership

This is a practical leadership style of influence. According to Avolio and Bass (2004) this leadership style highlights the follower's understanding of inspirational collective awareness of what is important. This process of influence moves associates to see themselves and the opportunities and challenges of their environment in a new way, and helps subordinates to



achieve unusual goals. Transformational leadership is said to consist of the following five factors (Antonakis, Avolio and Sivasubramaniam, 2003: 264):

- *Idealised influence: attributes (II-A)*

This factor refers to the socialised charisma of the leader, whether the leader is perceived as being confident and powerful, and whether the leader is viewed as focussing on higher-order ideals and ethics. According to Avolio and Bass (2004:97) the following are characteristic of idealised attributes:

- Encourages pride in others for being associated with the leader
- Goes beyond self-interest for the good of the group.
- Acts in ways that build the respect of others for the leader.
- Displays a sense of power and confidence.

- *Idealised influence: behaviour (II-B)*

This factor refers to charismatic actions of the leader that are centred on values, beliefs and a sense of mission. According to Avolio and Bass (2004:97) the following are characteristic of idealised behaviour:

- Talks about their most important values and beliefs.
- Specifies the importance of having a strong sense of purpose
- Considers the moral and ethical consequences of decisions.
- Emphasises the importance of having a collective sense of mission.

- *Inspirational motivation (IM)*

This factor refers to the ways leaders energise their subordinates by viewing the future with optimism, stressing ambitious goals, projecting an idealised vision and communicating to subordinates that the vision is achievable. According to Avolio and Bass (2004:97) the following are characteristic of idealised motivation:

- Talks optimistically about the future.
- Talks enthusiastically about what needs to be accomplished.
- Articulates a compelling vision of the future.
- Expresses confidence that goals will be achieved.

- *Intellectual stimulation (IS)*

This factor refers to the leader's actions that appeal to subordinates' sense of logic and analysis by challenging subordinates to think creatively and find solutions to difficult problems. According to Avolio and Bass (2004:98) the following are characteristic of idealised stimulation:

- Re-examines critical assumptions to question whether they are appropriate.
- Seeks differing perspectives when solving problems.
- Gets others to look at problems from many different angles.

- Suggests new ways of looking at how to complete assignments.
- *Individualised consideration (IC)*  
 This factor refers to the leader's behaviour that contributes to followers' satisfaction by advising, supporting and paying attention to the individual needs of subordinates, and thus allowing them to develop and self-actualise. According to Avolio and Bass (2004:97) the following are characteristic of idealised consideration:
  - Spends time teaching and coaching.
  - Treats others as individuals, rather than just as a member of the group.
  - Considers each individual as having individual needs, abilities and aspirations that differ from those of the rest of the group.
  - Helps others to develop their strengths.

#### Transactional leadership

This is an exchange process confined to the completion of contractual obligations and is typically represented as setting objectives and monitoring and controlling outcomes. This model is said to comprise the following three factors (Antonakis, Avolio and Sivasubramaniam, 2003: 265):

- *Contingent reward (CR) (i.e. constructive transactions)*  
 This factor refers to leader's behaviours focused on clarifying role and task requirements and providing contractual obligations. According to Avolio and Bass (2004:98) the clarification of goals and objectives and providing of recognition once goals are achieved should result in individuals and groups achieving expected levels of performance. The following is characteristic of contingent reward:
  - Provide others with assistance in exchange for their efforts.
  - Discusses in specific terms who is responsible for achieving performance targets.
  - Makes clear what one can expect to receive when performance goals are achieved.
  - Expresses satisfaction when others meet expectations.
- *Management-by-exception: active (MBEA) (i.e. active corrective transactions)*  
 This factor refers to the active awareness of a leader whose goal is to ensure that standards are met. The leader also stipulates what is ineffective performance, and may punish subordinates for not complying with those standards. According to Avolio and Bass (2004:98) this style of leadership implies closely monitoring for deviances, mistakes, and errors, and taking corrective action as quickly as possible after they occur. The following is characteristic of management-by-exception: active:
  - Focuses attention on irregularities, mistakes, exceptions, and deviations from standards.

- Concentrates full attention on dealing with mistakes, complaints and failures.
- Keeps track of all mistakes.
- Directs attention toward failures to meet standards.
- *Management-by-exception: passive (MBEP) (i.e. passive corrective transactions)*

According to this factor, leaders only intervene after non-compliance has occurred or when mistakes have already happened. According to Avolio and Bass (2004:99) the following characteristics are typical of this leadership style:

- Fails to intervene until problems become serious.
- Waits for things to go wrong before taking action.
- Shows a firm believe in “if it isn't broken, don't fix it”.
- Demonstrates that problems must become chronic before action is taken.

Another form of management-by-exception leadership is more passive and “reactive”: situations and problems are not systematically attended to. Passive leaders avoid specifying agreements, clarifying expectations, and providing goals and standards to be achieved by subordinates, and have a negative effect on outcomes — contradictory to what is anticipated by the leader-manager. In this regard, it is similar to laissez- faire styles — or “no leadership”. These behaviours have a negative impact on subordinates and associates. Both these styles can be grouped together as ‘passive-avoidant leadership’.

#### Non-transactional laissez-faire leadership (LF)

Laissez-faire leadership signifies the lack of a transaction. In terms of leadership it refers to the leaders' avoidance of making decisions, abandoning of responsibility, and avoiding the use of authority. This leadership style is active to the extent that the leader “chooses” to pass up the opportunity of taking action. This can be seen as the most passive and unsuccessful form of leadership (Antonakis, Avolio and Sivasubramaniam, 2003). According to Avolio and Bass (2004:98) the following is characteristic of this leadership style:

- Avoids getting involved when important issues arise.
- Absent when needed.
- Avoids making decisions.
- Delays responding to urgent questions.

#### Outcomes of leadership

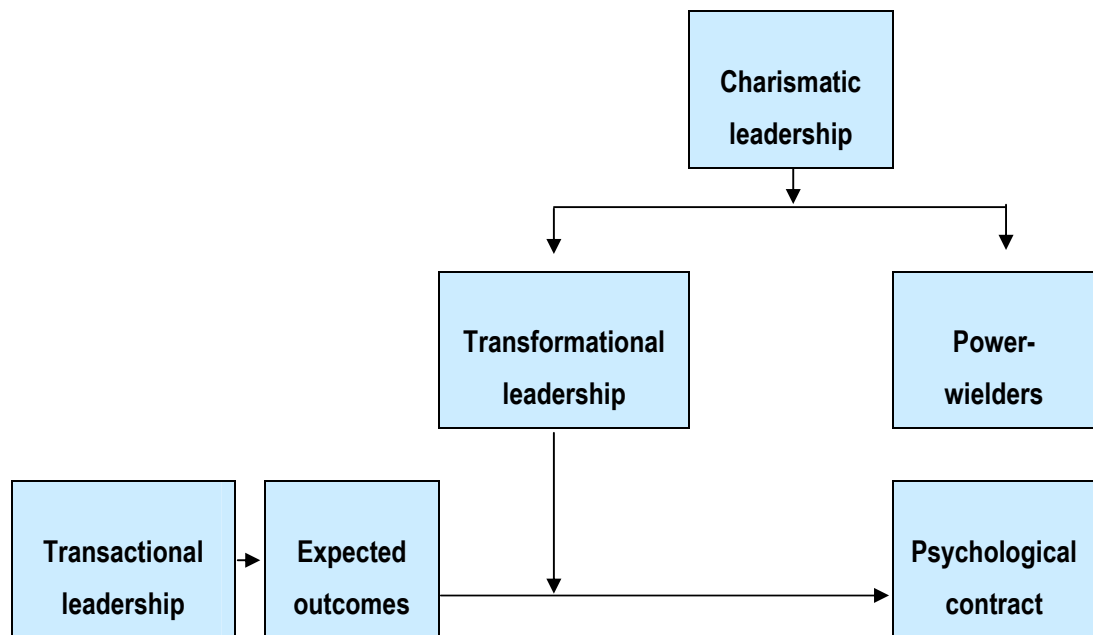
Both transformational and transactional leadership is related to the success of the group. The MLQ questionnaire is used to measure how often raters (assessors) perceive their leader to be

motivating, how effective raters perceive their leader to be interacting at different levels of the organisation, and how satisfied raters are with their leader's method of working with others (Avolio and Bass, 2004:99).

- *Extra-effort*
  - Getting others to do more than they are expected to do.
  - Improving others' desire to succeed.
  - Increasing others' willingness to try harder.
- *Effectiveness*
  - Is effective in meeting others' job-related needs.
  - Is effective in representing the group to higher authority.
  - Is effective in meeting organisational requirements.
  - Leads a group that is effective.
- *Satisfaction with leadership*
  - Uses methods of leadership that are satisfying.
  - Works with others in a satisfactory way.

#### Transformational versus Transactional Leadership

Figure 2.6 illustrates the relationship between charismatic, transformational and transactional leadership (Bass and Avolio, 1994).



**Figure 2.6:** Charismatic, Transformational, and Transactional Leadership (after Bass and Avolio, 1994).

Within transformational leadership leaders emphasise higher-motive development, and stimulate subordinates' motivation and positive emotions by means of creating, representing and inspiring a vision of the future (Bass, 1997). In contrast, transactional leaders rely on a clearly defined system of contracts and rewards.

According to Hooper and Potter (1997), transformational leadership involves four elements, namely: vision, values, communication and behaviour. Transformational leadership seems similar to weak charisma, which makes it a critical element in the success of a leader. Transformational leadership results from an emotional bonding between subordinates and the leader, which causes the subordinates to do things they would otherwise not do (Bratton, Grint and Nelson, 2005).

Burns (1978) distinguished between power-wielders and leaders and differentiated the latter into transactional and transformational leaders. Power-wielders are similar to Zaleznik's (1974) unhealthy charismatic leaders and Howells' (1988) personalised charismatic leaders in that they use their subordinates for their own purpose.

Goleman (1998) has done work on emotional intelligence (EQ). He argues that emotional intelligence is important for leadership success, and research strongly links it to transformational leadership (Barling, Slater, and Kelloway, 2000; Palmer *et al.*, 2001). Emotional intelligence involves self-awareness, self-regulation, motivation, social skills, and empathy. It imparts the ability to monitor both one's own and others' emotional state and to constructively control that emotional state — Goleman (1998: 101) refers to it as “friendliness with a purpose”.

## **2.4 Summary**

Leadership is a process of influence that enlists and mobilises the involvement of others in the attainment of collective goals, it is not a coercive process in which power is exercised over others. Leadership qualities in people are, therefore, easier to recognise than to define. The reason for this being that, very often, the nature of leadership will vary greatly, depending on the needs of the particular situation or context in which it occurs.

A distinction between management and leadership is noteworthy. The difference between leadership and management is, in essence, that the leader creates both a vision and a strategy to achieve that vision, whereas the manager's key role is to choose the means to implement the

vision formulated by the leader. It is also noted that modern management involves a mix of both management and leadership processes. Individuals will vary in terms of their roles within the bureaucracy, and their capacity and inclination to use each sub-process.

Leadership theories have evolved over time and have become more sophisticated and even more applicable because of their evolution. Throughout history these leadership theories have featured, each with its own subcategories. These theories and their subcategories and weaknesses (where applicable) are summarised as follows:

### **Trait theory**

This theory describes the leader's inherent traits. Weaknesses related to this theory are that the contexts in which the follower and leaders find themselves are neglected, the importance of the follower in the leadership process is ignored, and leadership traits are culturally determined.

### **Behaviour theory**

This theory indicates how leaders will behave towards their subordinates, and they are classified as either task orientated or people orientated. Weaknesses associated with this theory are that it is unable to identify the universal style of leadership that is effective in the majority of situations; it suggests that the most effective leadership style is the so-called high-high style, and it does not adequately demonstrate how leaders' behaviour are associated with performance outcomes.

### **Contingency theory**

This theory includes the Least-preferred co-worker theory, the Path-goal theory, the Normative decision theory, the Situational leadership theory, the Leader-member-exchange theory, and the Substitutes for leadership theory. These theories hold that the most effective leadership style of the leader will depend on the interaction between the leader, the follower and the situation. Weaknesses associated with this theory are that of the least preferred co-worker theory which has obtained better supported results in laboratory studies than in field studies, the vroom-yetton-jago model which has been limited to the leader's decision-making situation, and the Situational Leadership model which is limited to the absence of a central hypothesis that might be tested to determine whether it is a valid, reliable theory of leadership.

### **Power-influence perspective**

This theory holds that the social relations within an organisation involve the interplay of power, constraints, conflict and cooperation.

### **Gender-influence perspective**

Attention is drawn to the fact that female leaders show more empathy, are prepared to share power and are concerned with consensus building.

### **Integrative perspective**

This theory is subdivided into charismatic leadership, transformational leadership and transactional leadership. These theories attempt to find the reason why some subordinates are prepared to go the "extra mile" to satisfy leaders.

#### *Transformational leadership*

Transformational leadership comprises five factors — (1) idealised influence: attributed; (2) idealised influence: behaviour; (3) inspirational motivation; (4) intellectual stimulation; and (5) individualised consideration — of which the first two factors refer to the concern, power, personal morality, and sacrifice of the leader, as well as his or her ability to instil collective pride in the group's mission. According to Avolio and Bass (2004: 97) these leaders are admired, respected, and trusted. Subordinates identify with their leaders and want to follow them. The third factor relates to motivating the group to accomplish missions through challenging goals and by indicating certainty in areas of uncertainty, which, in turn, arouse individual and team spirit.

The fourth factor refers to the leaders' ability to relate at an individual level to the follower. According to Avolio and Bass (2004:98) these leaders stimulate their subordinates' effort to be innovative and creative by questioning assumptions, reframing problems, and approaching old situations in new ways. There is no ridicule or public criticism of individual members' mistakes. New ideas and creative solutions to problems are solicited from subordinates, who are included in the process of addressing problems and finding solutions.

The fifth and final factor refers to intellectual stimulation. This factor relates to the leader's ability to construct a convincing vision and to generate greater understanding of it among subordinates (Bratton, Grint and Nelson, 2005). According to Avolio and Bass (2004:98) these leaders pay attention to each individual's needs for achievement and growth by acting as a coach or mentor.

Subordinates are developed to successively higher levels of potential. New learning opportunities are created, along with a supportive climate in which to grow. Individual differences in terms of needs and desires are recognised.

#### *Transactional leadership*

Transactional leadership display behaviours associated with constructive and corrective transactions, and comprises three factors— (1) contingent reward leadership; (2) management-by-exception: active; and (3) management-by-exception: passive — of which the first factor relates to leaders who involve themselves only when things go wrong, i.e. the constructive style. Their interventions are associated with failure and punishment. The corrective style is labelled management-by-expectation, which refers to the closer involvement in monitoring the subordinates' actions. The third factor relates to rewards for work performance. This has a side effect in terms of an exchange relationship between the follower and the leader. If the follower realises that the only way to get a reward is through performance, he will refrain himself from doing so if no reward is offered (Bratton, Grint and Nelson, 2005).

According to Avolio and Bass (2004:98) contingent reward and management-by-expectation are two core behaviours associated with 'management' functions in organisations. Full-range leadership does this and more.

The most up- to- date concept of leadership is the theory of transformational and transactional leadership proposed by Burns (1978) and further developed by Bass and Avolio (2002). Over the last two decades, the Multifactor Leadership Questionnaire (MLQ) has been developed and validated (Avolio and Bass, 2004). It has become a standard instrument for assessing a variety of transformational, transactional and non-leadership scales. This instrument can appropriately be used for selection transfer and promotion activities, as well as for individual, group, or organisational development and counselling.

Field and laboratory research have indicated that transformational leadership had a more positive impact on effectiveness and satisfaction than transformational leadership, which, in turn, had a more positive impact than passive and non-transformational leadership (Avolio and Bass, 2004:7)

The multifactor leadership questionnaire developed by Bass and Avolio (2002) will be used to assess the leadership style of scientists of the Council for Geoscience. The validation of this



instrument will allow for the collection of valid and reliable data. This instrument is described in detail under the heading research methodology.

# CHAPTER 3

## 3. RESEARCH METHODOLOGY

The Council for Geoscience, a science organisation, is the focus of this research study. The scientific nature of the organisation has led to the appointment of mainly scientists and technical staff members over the years. The criteria set for the advancement of scientists to managerial positions are either a masters or doctorate degree in science. Managerial and leadership skills were never regarded as important criteria for the advancement of scientists to managerial positions; therefore this study aims to:

- i. Determine the leadership style of scientists in positions of unit leaders.
- ii. Determine how supervisors, peers and subordinates perceive the leadership style of the unit leaders.
- iii. Determine whether scientists as unit leaders, perceive their own leadership style differently than do their supervisors, peers and subordinates.

### 3.1 Hypothesis

Hypothesis 1: Scientists as unit leaders rate themselves higher on transformational leadership than do their supervisors, peers and subordinates.

$$H_0: \mu_{\text{leaders}} \leq \mu_{\text{supervisors}} \text{---} H_A: \mu_{\text{leaders}} > \mu_{\text{supervisors}} \quad 1-1$$

$$H_0: \mu_{\text{leaders}} \leq \mu_{\text{peers}} \text{---} H_A: \mu_{\text{leaders}} > \mu_{\text{peers}} \quad 1-2$$

$$H_0: \mu_{\text{leaders}} \leq \mu_{\text{subordinates}} \text{---} H_A: \mu_{\text{leaders}} > \mu_{\text{subordinates}} \quad 1-3$$

Hypothesis 2: Scientists as unit leaders rate themselves lower on transactional leadership than do their supervisors, peers and subordinates.

$$H_0: \mu_{\text{leaders}} \geq \mu_{\text{supervisors}} \text{---} H_A: \mu_{\text{leaders}} < \mu_{\text{supervisors}} \quad 2-1$$

$$H_0: \mu_{\text{leaders}} \geq \mu_{\text{peers}} \text{---} H_A: \mu_{\text{leaders}} < \mu_{\text{peers}} \quad 2-2$$

$$H_0: \mu_{\text{leaders}} \geq \mu_{\text{subordinates}} \text{---} H_A: \mu_{\text{leaders}} < \mu_{\text{subordinates}} \quad 2-3$$

Hypothesis 3: Scientists as unit leaders rate themselves lower on laissez-faire leadership than do their supervisors, peers and subordinates.

$$H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{supervisors laissez-faire}} \quad 3-1$$
$$H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{supervisors laissez-faire}}$$

$$H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{peers laissez-faire}} \quad 3-2$$
$$H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{peers laissez-faire}}$$

$$H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{subordinates laissez-faire}} \quad 3-3$$
$$H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{subordinates laissez-faire}}$$

Hypothesis 4: Scientists as unit leaders rate themselves higher on extra-effort than do their supervisors, subordinates and peers.

$H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{supervisors extra-effort}}$

$H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{supervisors extra-effort}}$  4-1

$H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{subordinates extra-effort}}$

$H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{subordinates extra-effort}}$  4-2

$H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{peers extra-effort}}$

$H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{peers extra-effort}}$  4-3

Hypothesis 5: Scientists as unit leaders rate themselves higher on effectiveness than do their supervisors, peers and subordinates.

$H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{supervisors effectiveness}}$

$H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{supervisors effectiveness}}$  5-1

$H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{peers effectiveness}}$

$H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{peers effectiveness}}$  5-2

$H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{subordinates effectiveness}}$

$H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{subordinates effectiveness}}$  5-3

Hypothesis 6: Scientists as unit leaders rate themselves higher on satisfaction than do their supervisors, peers and subordinates.

$H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{supervisors satisfaction}}$

$H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{supervisors satisfaction}}$  6-1

$H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{peers satisfaction}}$

$H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{peers satisfaction}}$  6-2

$H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{subordinates satisfaction}}$

$H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{subordinates satisfaction}}$  6-3

Hypothesis 7: There is a difference in transformational, transactional and attribution (extra-effort, effectiveness and satisfaction) between the self-ratings of the different scientists as unit leaders.

$H_0: \mu_{\text{different leaders transformational}} = \mu_{\text{different leaders transformational}}$

$H_A: \mu_{\text{different leaders transformational}} \neq \mu_{\text{different leaders transformational}}$  7-1

$H_0: \mu_{\text{different leaders transactional}} = \mu_{\text{different leaders transactional}}$

$H_A: \mu_{\text{different leaders transactional}} \neq \mu_{\text{different leaders transactional}}$  7-2

$H_0: \mu_{\text{different leaders attributions}} = \mu_{\text{different leaders attributions}}$

$H_A: \mu_{\text{different leaders attributions}} \neq \mu_{\text{different leaders attributions}}$  7-3

Hypothesis 8: There is a difference in transformational, transactional and attribution (extra-effort, effectiveness and satisfaction) ratings of the supervisors compared with the self-ratings of the scientists as unit leaders.

$H_0$ transformational: $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}}$ $= \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}}$ $= \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$	
$H_A$ transformational: $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}}$ $\neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}}$ $\neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$	8-1
$H_0$ transactional: $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}}$ $= \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}}$ $= \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$	
$H_A$ transactional: $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}}$ $\neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}}$ $\neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$	8-2
$H_0$ laissez-faire: $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}}$ $= \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}}$ $= \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$	
$H_A$ laissez-faire: $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}}$ $\neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}}$ $\neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$	8-3
$H_0$ attributions: $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}}$ $= \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}}$ $= \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$	
$H_A$ attributions: $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}}$ $\neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}}$ $\neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$	8-4

## 3.2 Research design

### 3.2.1 Design strategy

The research design strategy is summarised in Table 3.1, which lists the category, classification and description of the research design.

**Table 3.1:** Research design strategy.

Category	Classification	Description
Type	Exploratory	The objective is to determine the leadership style of scientists, and how their supervisors, subordinates, peers and other perceive their leadership style.
Purpose	Descriptive	To determine what the leadership style of scientists is, and how their supervisors, peers, subordinates and others perceive their leadership style to be.
Time frame	Cross-sectional	The study will be conducted once off, and will represent a snapshot in time.
Scope	Statistical study	The leadership style of scientist and their supervisors, peers, subordinates and others' perception thereof will be determined with a questionnaire from which inferences will be made. The hypothesis will be tested quantitatively.
Participants	Modified routine	Research is done outside of normal routine and unexpectedly. Participants may be cautious in answering the questionnaire.
Method	Interrogation/communication	Data will be collected by way of a questionnaire, which will be distributed via electronic mail.
Environment	Field setting	The research will be done during the normal working hours of the Council for Geoscience. Employees need to complete the questionnaire mailed to them.
Control variable	<i>Ex post facto</i> design	Questionnaires will be distributed with a well-structured sampling frame, whereby factors in the questionnaire will be held constant. Statistical manipulation of findings will be done.

### 3.2.2 Data collection design

A computer-delivered questionnaire will be forwarded to unit leaders (heads), supervisors, peers, subordinates and other personnel who work with and for the individual unit managers (leaders). The distribution of the questionnaire will be done with the web facility of Mindgarden. Mindgarden will manage the questionnaires, and the results will be forwarded to the researcher. The publisher, Mindgarden ([www.mindgarden.com](http://www.mindgarden.com)), gave special permission to use the Multifactor Leadership Questionnaire (MLQ) developed by Bass and Avolio (2000) (Appendix B). The cost for using the MLQ questionnaire is summarised in Table 3.2.

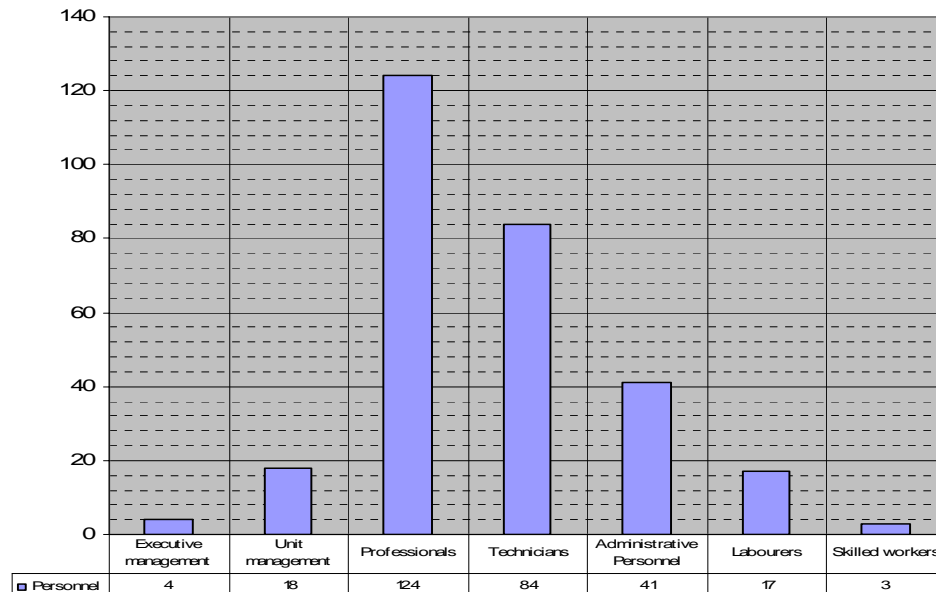
**Table 3.2:** MLQ questionnaire cost.

Description	Cost
MLQRS3 Manual/Sampler set 3rd edition	\$ 40,00
MLQRD Duplication set (150 copies @ \$0.80 each)	\$ 120,00
MLQ web data collection (20 leaders @ \$8.00 each)	\$ 160,00
MLQ intranet web distribution (120 people at \$10 each)	\$1200,00
<b>TOTAL</b>	<b>\$1520,00</b>

### 3.2.3 Sample design

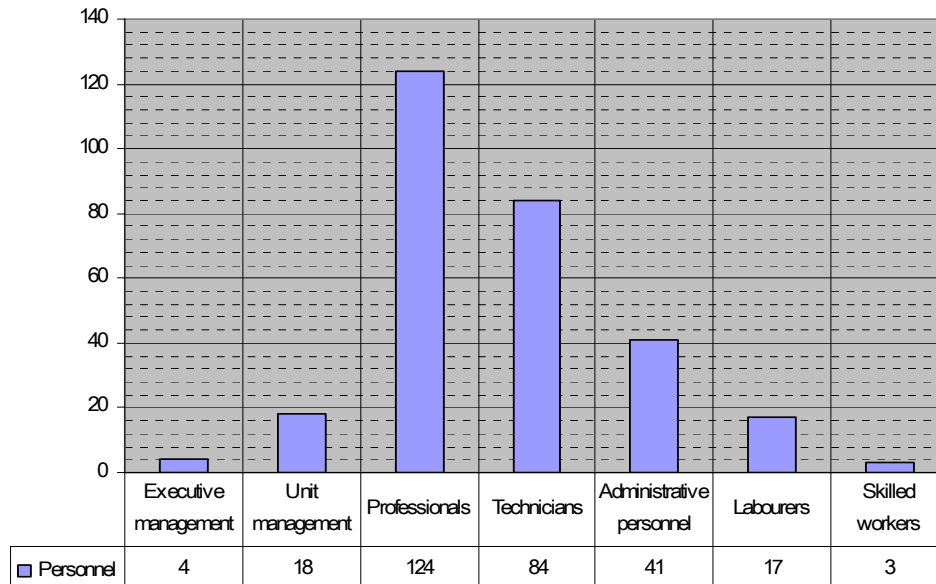
The population sample will be the employees of the Council for Geoscience. A non-probability sampling technique, judgement sampling, will be used. Only scientists as unit leaders and personnel working for and with them, and who have access to a computer, will form part of the sampling frame. Access to computers is essential, as this enables participants to complete the

questionnaire. The Council for Geoscience has 291 employees, comprising 4 executive managers, 18 unit leaders (heads), 124 professionals (scientists, accountants, librarians, linguists, strategists, human- resource specialists and auditors) of which 109 are scientists, 84 technicians, 41 administrative personnel, 17 labourers and 3 skilled workers (Figure 3.1).



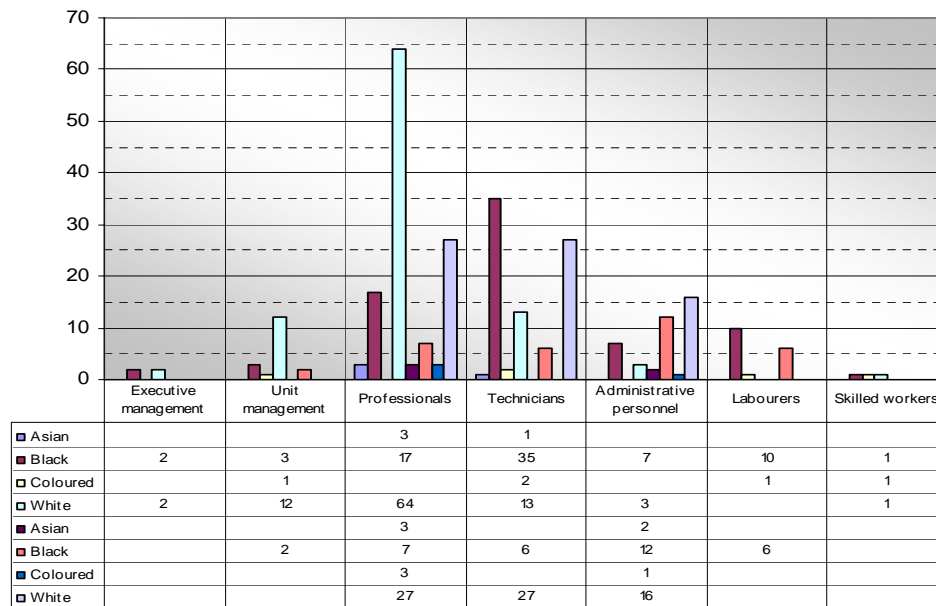
**Figure 3.1:** Personnel employed at the Council for Geoscience.

The ratio of executives, unit leaders (heads), professionals, technicians, administrative personnel, labourers and skilled workers are 1.4 per cent executive managers, 6.2 per cent unit managers, 42.6 per cent professionals (of which 37.5 per cent are scientists), 28.9 per cent technicians, 14.1 per cent administrative personnel, 5.8 per cent labourers and 1.0 per cent skilled workers (Figure 3.2). Choosing executive managers, unit managers, professionals (scientists), technicians and only some administrative personnel will allow for a sample frame of at least 74 per cent of the total staff complement (population) of the Council for Geosciences. This complement of 74 per cent excludes personnel who are not working with and for the individual scientists as unit leaders.



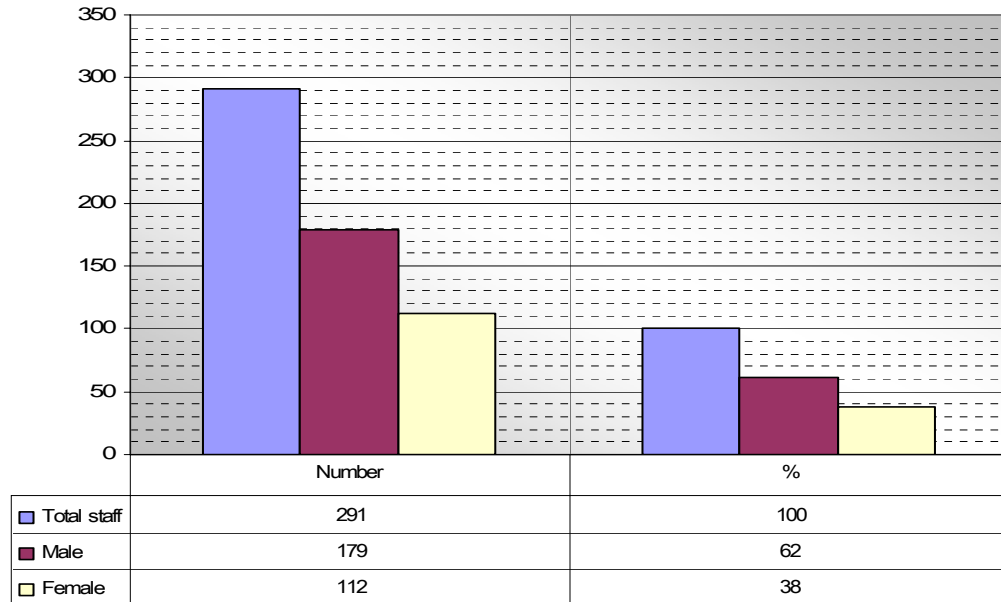
**Figure 3.2:** Percentage of personnel employed at the Council for Geoscience.

The demographics of the Council for Geoscience are presented in Figure 3.3 (below). The organisation employs primarily white professionals, black technicians and Asian professionals and technicians. The scientists as unit leaders targeted are predominantly white males and represent the largest pool of scientists as leaders of the Council for Geoscience.



**Figure 3.3:** Council for Geoscience demographics.

Figure 3.4 indicates the percentage of males and females employed by the Council for Geoscience. Males are in the majority, representing 62 per cent of the total personnel employed, whereas females represent 38 per cent of the staff complement.



**Figure 3.4:** Total staff employed by the Council for Geoscience, with percentages of male and female staff members.

### 3.2.4 Timeline

The estimated timeline for the completion of the research is illustrated in Table 3.3 (below).

**Table 3.3:** Proposed research timeline.

Time	Activity
April 2006	Proposal
June 2006	Draft 1
July 2006	Draft 2
August 2006	Draft 3
September 2006	Final report

A Gantt chart for this timeline is included in Appendix A.

### 3.2.5 Instrument

The Multifactor Leadership Questionnaire (MLQ), developed by Bass and Avolio (2004), will be used to assess the leadership style of scientists as unit leaders, as well as the perception that the supervisors (executive managers), peers, subordinates and some of the administrative personnel have of the leadership styles of these scientists as unit leaders. This instrument



(MLQ) measures a broad range of leadership types: passive leaders, leaders who give contingent rewards to subordinates and leaders who transform their subordinates into leaders themselves. This instrument identifies the characteristics of both transformational and transactional leaders. The instrument offers a full range of assessment of leadership behaviours:

- Transformational leadership, which comprises five factors, namely: idealised attributes (II-A), idealised behaviours (II-B), inspirational motivation (IM), intellectual stimulation (IS), and individualised consideration (IC).
- Transactional leadership, namely: contingent reward (CR), management-by-expectation: active (MBEA) and management-by-expectation: passive (MBEP).
- Laissez-faire (LF).
- Outcomes of leadership (attributions), namely: extra-effort (EEF), effectiveness (EFF) and satisfaction (SAT) with leadership.

The MLQ (Form 5X short) contains 45 items that identify and measure key leadership and effectiveness behaviours that, in prior research, were shown to be strongly linked with both individual and organisational success. This questionnaire represents nine leadership factors, categorised as transformational leadership, transactional leadership and passive/avoidant leadership, and is summarised in Appendix B. Each of the nine leadership components, along with a full range of leadership styles, is measured by four highly intercorrelated items that are as low in correlation as possible with items of the other eight components.

Raters (assessors) completing the MLQ questionnaire evaluate how frequently, or to what degree, they have observed the specific leader engaged in 32 behaviours, while additional leadership items are the rating of attributions. These ratings of attributions are included in the four items in the idealised attributes.

The targeted scientists as unit leaders complete the MLQ as a self-rating. Similarly, they evaluate how frequently, or to what degree, they believe they engage in the same types of leadership behaviour toward their associates (those above, below, and on the same organisational/hierarchy level). A five-point scale for rating the frequency of observed leader behaviours is used that allows a degree evaluation, based on a ratio of 4:3:2:1:0, according to a tested list of anchors, provided by Bass, Casscio, and O'Connor (1974). The anchors used to evaluate the MLQ factors are presented below:

0	=	Not at all
1	=	Once in a while
2	=	Sometimes
3	=	Fairly often, and
4	=	Frequently, if not always

Appendix B summarises the scales constituting the full-range leadership theory. There are three outcome criteria included in the Multifactor Leadership Questionnaire (MLQ) which represent the leader. These include the subordinates' extra-effort (EEF), the effectiveness of the leadership behaviour (EFF), and subordinates' satisfaction (SAT).

### Data analysis

Statistical techniques require the use of certain assumptions in order to analyse the results appropriately. Parametric techniques are used when data are derived from interval ratio measurements, in this case the above-mentioned scale 0–4. Independent t-tests and ANOVA tests will be performed. The t-test is used to determine the statistical significance between the sample distribution mean and the parameter under investigation. The ANOVA is a statistical method for testing the null hypothesis that the mean of several populations are equal. A one-way of analysis of variance is chosen. It uses a single-factor, fixed-effects model to compare the effects of one factor, on a continuous dependent variable.

- Parametric techniques  
The observations of the samples are independent. The sample values are chosen randomly, i.e. there is no chance of one value affecting the chance for another value to be included in the sample. The observations are drawn from a normally distributed population. The population referred to in the null hypothesis has values normally distributed. The measurement scale is interval, so that arithmetic operations can be used with them.
- Correlation analysis ( $r$ )  
Correlation analysis is to be performed, for which the requirement for  $r$  is linearity, that is, the relationship between variables can be described by a straight line passing through the data. Data are obtained from a random sample population, where the variables are normally distributed in a joint manner (multivariate normal distribution).
- Multiple regression  
A multiple regression will be used, where the coefficients in the regression model are standardised.

- Computer programme

Microsoft Excel 2003 software will be utilised for calculating all the necessary statistical data required.

#### Instrument validity

Antonakis, Avolio and Sivasubramaniam (2003:266) state that by using conformity factor analysis (CFA) and a large sample of pooled data (N=1394), Avolio *et al.*, (1995) provided preliminary evidence for the construct validity of the MLQ (Form 5X). According to Avolio *et al.*, (1995), the MLQ (Form 5X) scales have, on average, exhibited high internal consistency and factor loadings. Similar validation results, confirming the validity of the MLQ (Form 5X), have been reported by Bass and Avolio (1997) who used another large sample of pooled data (N=1490).

Antonakis *et al.*, (2003) concluded that the results they obtained with the current MLQ (Form 5X) version are valid, and sufficiently measure the nine leadership factors consisting of the full-range theory of leadership. These authors also state that although the MLQ (Form 5X) will hardly ever account for all leadership dimensions, it represents at least the groundwork from which further research can be conducted in order to enhance the understanding of the “new models of leadership”. Appendix C summarises published studies, which test the factor structure of the MLQ, fit indices of MLQ validation models, invariance of the nine-factor MLQ model: males versus females, and the goodness-of-fit results for contextual conditions (Antonakis *et al.*, 2003).

### **3.3 Limitations of the study**

The limitations can be outlined as follows:

- The study was restricted to only one science organisation, i.e. the Council for Geoscience (semi-government institution).
- The leadership style of scientists as unit leaders only was determined.
- Only personnel who work with and for scientists as unit leaders were targeted.
- Only personnel with access to a computer and e-mail facility were able to participate.
- Statistical analyses were confined to Microsoft Excel software.
- Data were not analysed in terms of organisational demographics, as this would jeopardise the confidentiality of the participants.

# CHAPTER 4

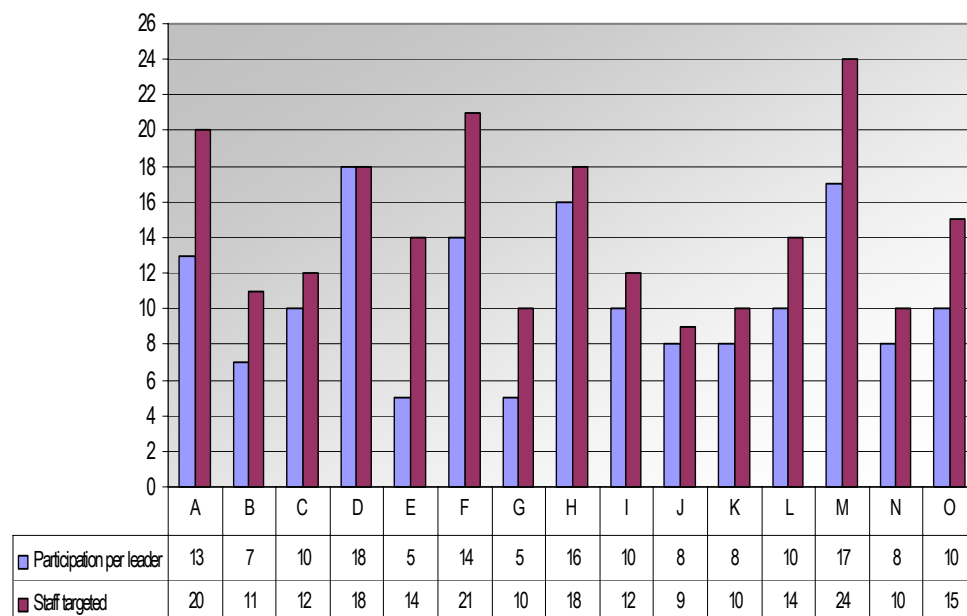
## 4. RESULTS

### 4.1 Council for Geoscience participation demographics

Figures 4.1–4.12 below summarise the demographic results obtained from participants in the MLQ questionnaire survey.

#### Sample population

Figure 4.1 illustrates the personnel targeted to take part in the survey, as well personnel members who did participate in the survey. Scientists as unit leaders A, F and E represent the largest units, with 20 and more staff members of these units targeted, followed by leaders D, H, O with between 15 and 20 staff members targeted, followed by leaders B, C, E, I and L with 11–14 staff members and, lastly, leaders G, J, K and N with 10 and less staff members targeted.

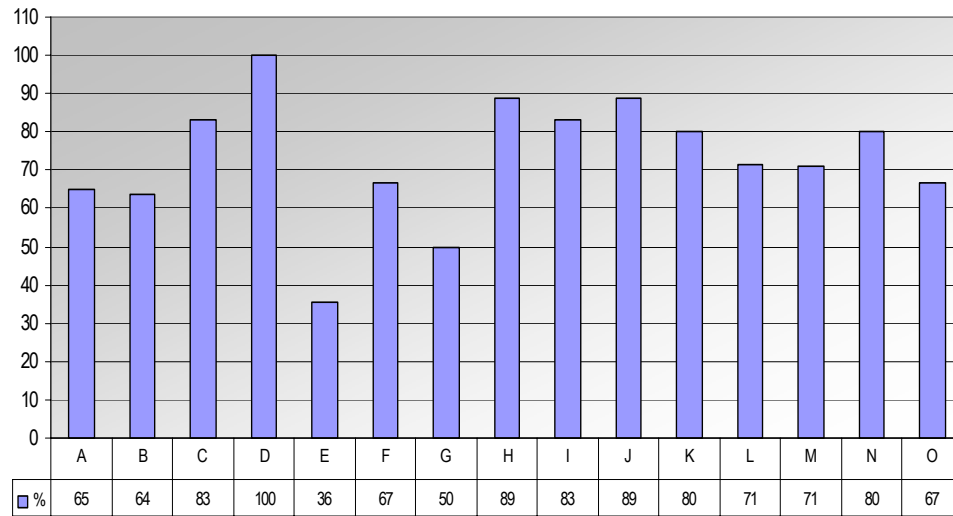


**Figure 4.1:** Staff targeted to participate in survey, and staff participation in survey.

Figure 4.2 shows the percentage of staff member participation for each scientist as unit leader, which can be summarised as follows in increasing order:

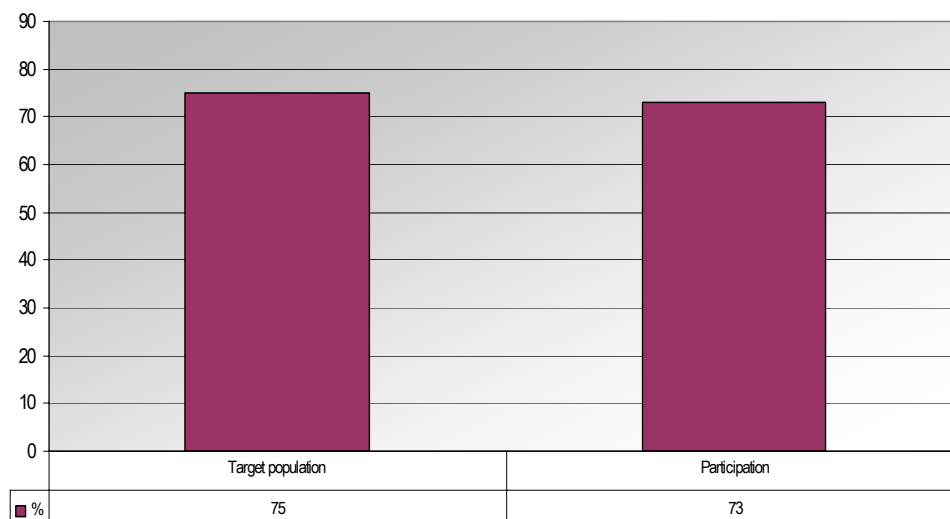
- Leader E less than 50 per cent participation.
- Leader G had 50 per cent participation.
- Leaders A, B, F and O had 60–69 per cent participation.
- Leaders L and M had 70–79 per cent participation.

- Leaders C, H, I, J and N had 80–90 per cent participation.
- Leader D had 100 per cent participation.



**Figure 4.2:** Participation percentages per scientist as unit leader.

A sample group of 75 per cent of the total workforce of the Council for Geoscience (CGS) were targeted, as illustrated in Figure 4.3. The 25 per cent of staff members not targeted in the sample group were administrative and support personnel that did not form part of the scientists as unit leaders' sections. It is clear from Figure 4.3 that 73 per cent of the targeted sample group responded to the MLQ questionnaire. The 73 per cent response indicates that a good representative sample-group response was secured.



**Figure 4.3:** Target population percentage and participation percentage.

### Participation by gender

The number of males and females who responded for each unit leader is illustrated in Figures 4.4–4.6. Predominantly males participated in the survey. The responses for leaders B, C, G, H, L, M, N and O were predominantly from males. The male and female participation were equal for leaders D, F, J and K. Females dominated the participation for leaders A, E and I (Figure 4.4). Figure 4.5 shows the male/female participation percentages, which are summarised below (increasing order):

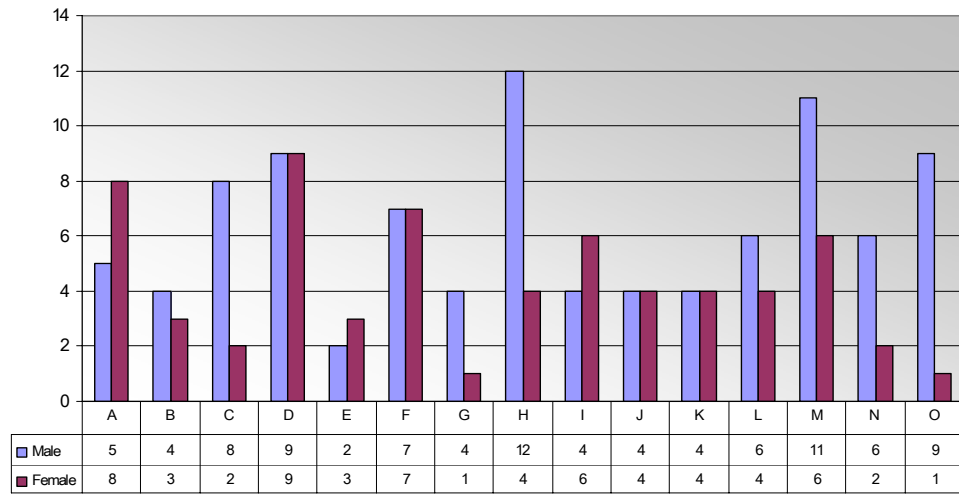
#### Male participation:

- leader A had 38 per cent male participants;
- leaders E and I had 40–49 per cent male participants;
- leaders B, D, F, J and K had 50–59 per cent male participants;
- leaders L and M had 60–69 per cent male participants;
- leaders H and N had 70–79 per cent male participants;
- leaders C and G had 80–89 per cent male participants; and
- leader O had 90–100 per cent male participants.

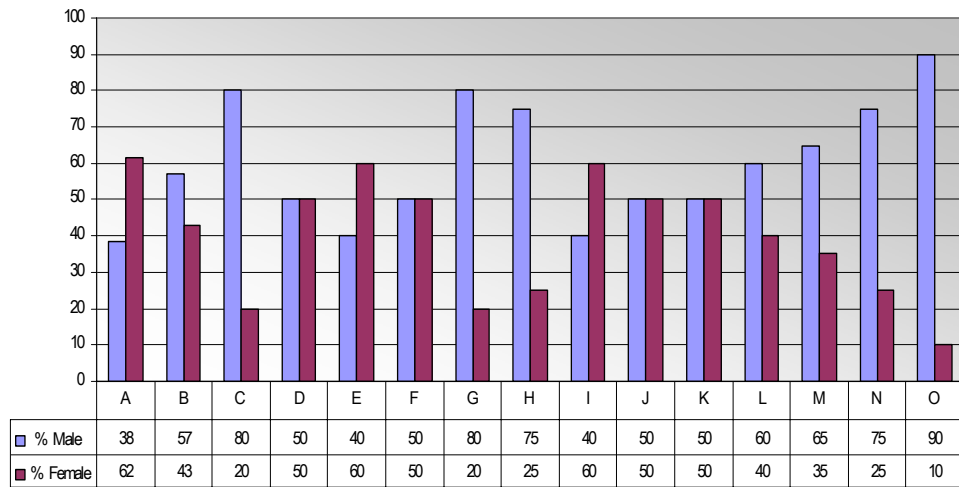
#### Female participation:

- leader O, 0–10 per cent female participation;
- leaders C, G, H and N had 20–29 per cent female participation;
- leader M had 30–39 per cent female participation;
- leaders B and L had 40–49 per cent female participation;
- leaders D, F, J and K had 50–59 per cent female participation, and
- leaders A, E and I had 60–69 per cent female participation.

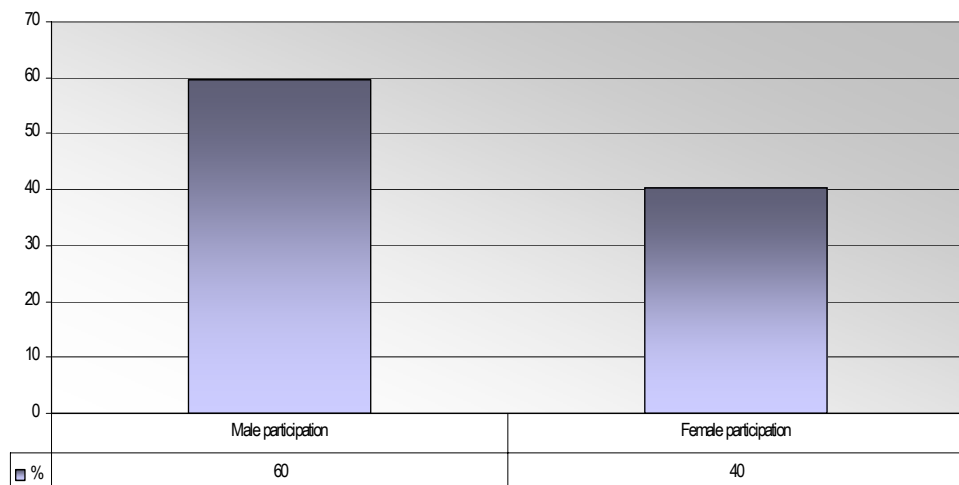
Figure 4.6 illustrates that 60 per cent of participants were males and 40 per cent females, confirming that males were in the majority and females in the minority.



**Figure 4.4:** Male and female participation for each scientist as unit leader.



**Figure 4.5:** Percentage of male and female participant per scientist as unit leader.



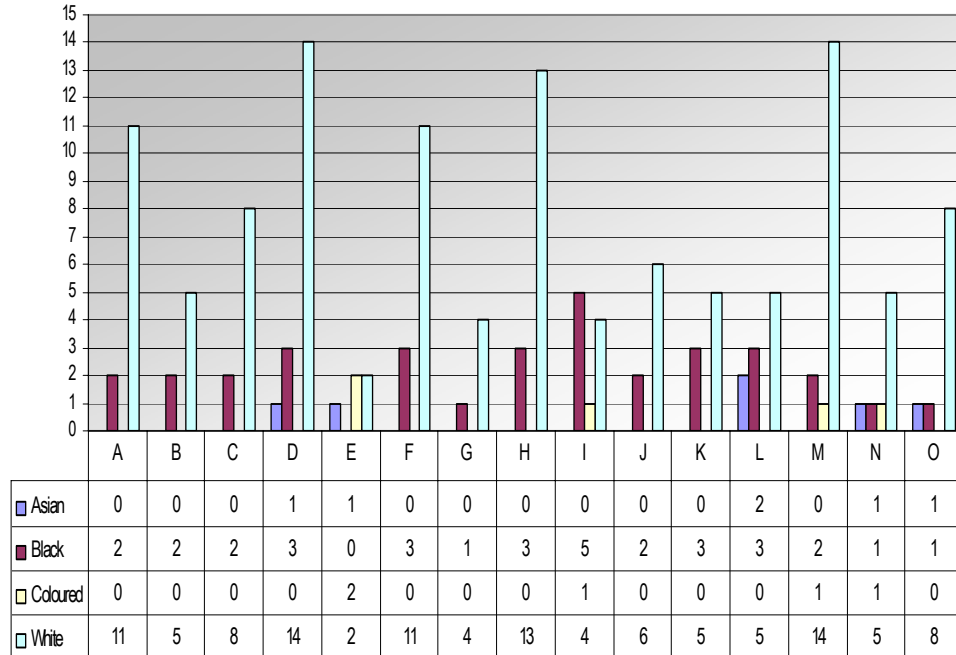
**Figure 4.6:** Total percentage of male and female participation.

Participation by race

Figures 4.7–4.9 illustrate participation by race. It is clear from Figure 4.7 that the majority of participants were White, followed by Black, Asians and Coloureds. Figure 4.8 shows that white participants ranged from 14–85 per cent, black from 7–42 per cent, Asians from 0–14 per cent and Coloureds from 0–14 per cent. The total percentage participation by race is given in Figure 4.9 in increasing order, as:

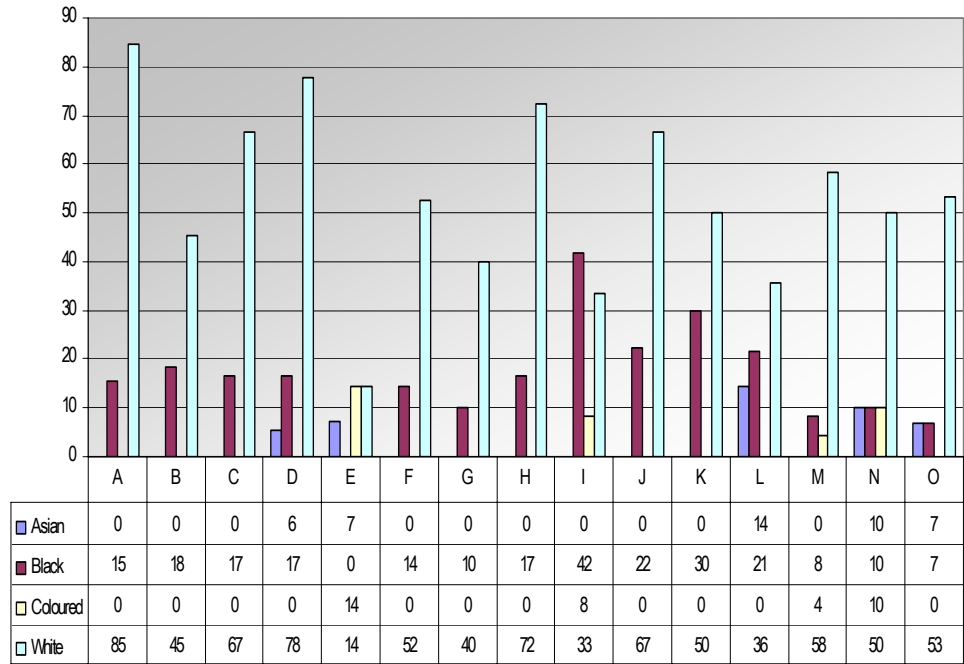
- Coloureds 3 per cent;
- Asians 4 per cent;
- Blacks 21 per cent, and
- Whites 72 per cent.

It can therefore be concluded that according to race, Whites dominated in the survey, followed by Blacks, Asians and Coloureds. Therefore, the majority of the ratings were that of Whites. In order to protect the identity of the participants, the results of the questionnaire could not be traced to the individuals and, therefore, the ratings for each race could not be analysed per group to detect any differences between the perceptions of the various races.

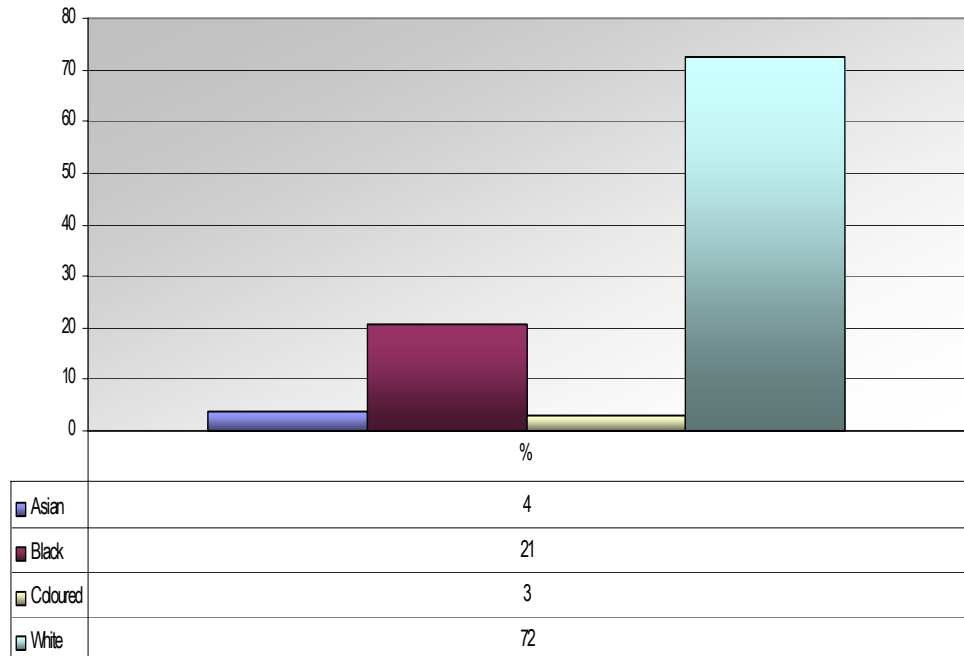


**Figure 4.7:** Race participation for each scientist as unit leader.





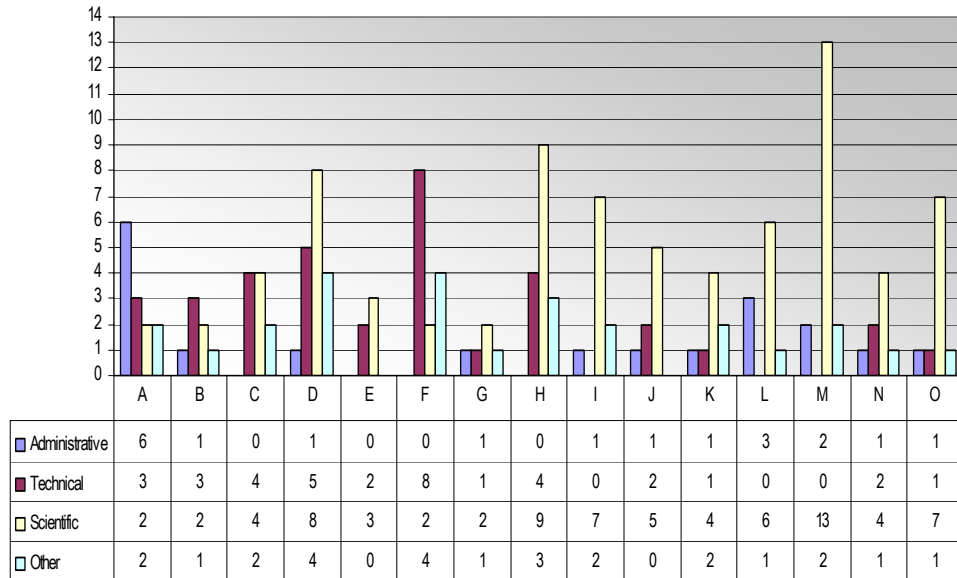
**Figure 4.8:** Race participation percentages for each scientist as unit leader.



**Figure 4.9:** Total percentage for race participation.

Job description participation

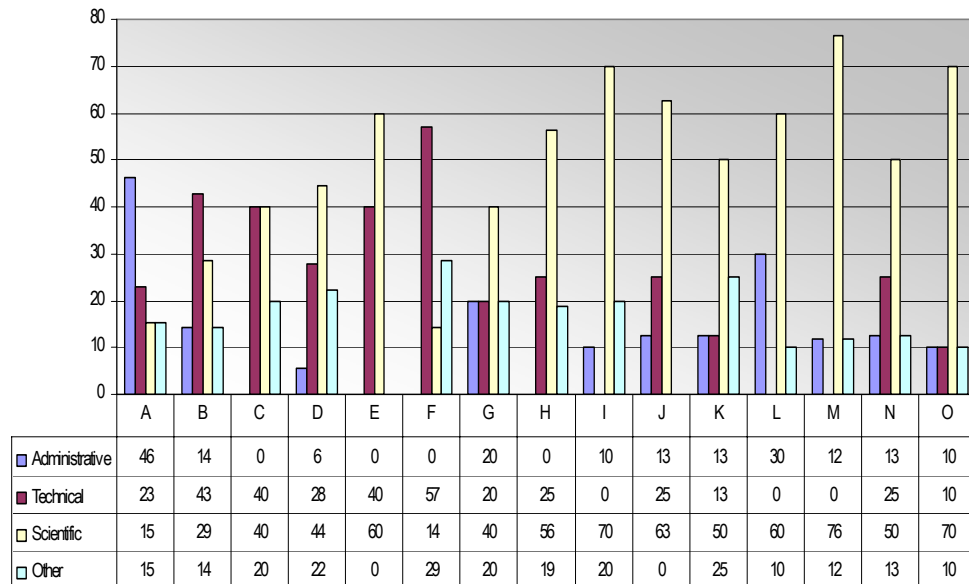
The administrative, technical, science, and other staff (contractors, etc.) who participated in the survey are indicated by Figure 4.10. The majority of participants were scientists, followed by technicians, others (contractors, executive managers, etc.) and administrative personnel.



**Figure 4.10:** Administrative, technical, science and other participation for each scientist as unit leader.

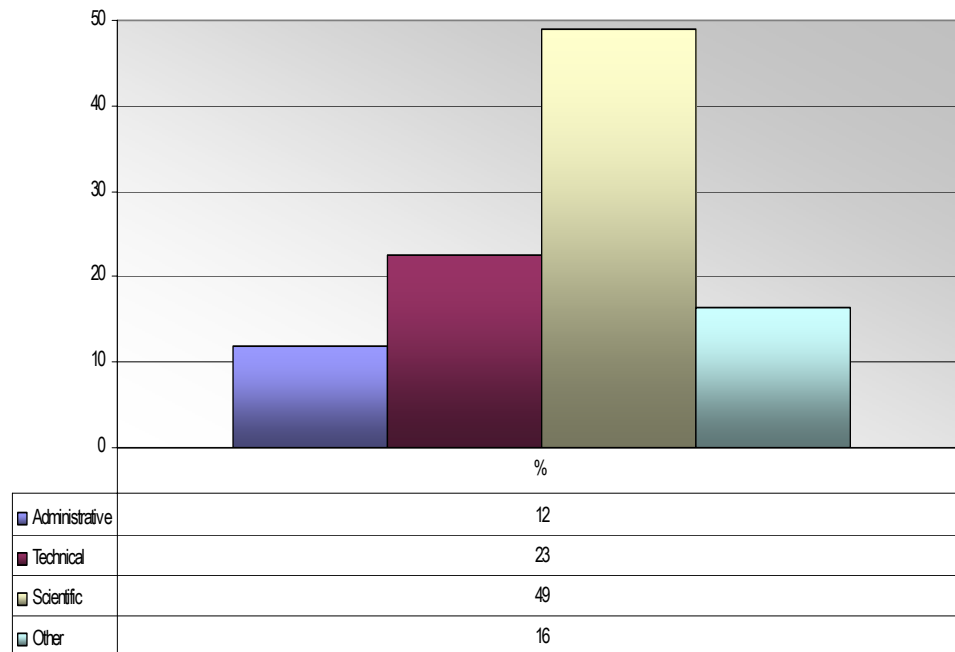
Figure 4.11 summarises the percentage participation of administrative, technical, science and other staff (contractors, etc.) for each scientist as unit leader, and can be described as follows:

- administrative staff 0–46 per cent participation;
- technical staff 0–57 per cent participation;
- science staff 14–76 per cent participation, and
- other staff (contractors, etc.) 0–29 per cent participation.



**Figure 4.11:** Percentage administrative, technical, science and other participation for each scientist as unit leader.

Figure 4.12 illustrates the total percentage participation for administrative, technical, science and others (contractors, etc.). Science staff members were in the majority, with 49 per cent participation, followed by technicians with 23 per cent participation, other staff (contractors, executive managers, etc.) with 16 per cent participation, and administrative staff with 12 per cent participation.



**Figure 4.12:** Total percentage administrative, technical, science and other participation.

The demographic results indicate that the majority of the results are from white male scientists. This result corresponds with the demographic status of the Council for Geoscience (Figures 3.1–3.4, Chapter 3), and assists in representativeness of the study.

#### 4.2 Description of MLQ questionnaire results

Table 4.1 that follows summarises the average leadership style and attribution results obtained from the sample group of the Council for Geoscience, categorised under each scientist as unit leader (A–O).

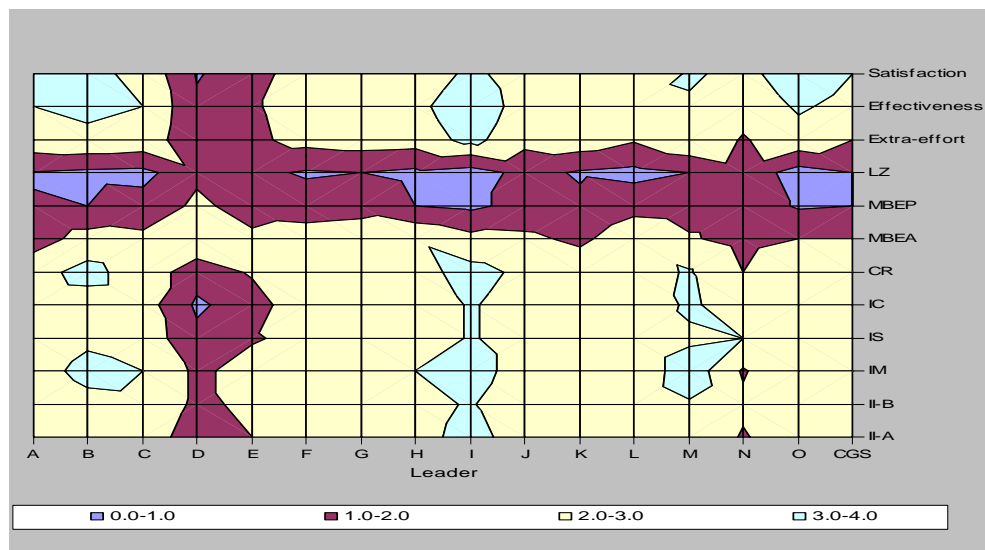
**Table 4.1:** Average leadership style and attribution ratings per leader.

Leader	Transformational					Transactional			Laissez-faire	Attributions		
	II-A	II-B	IM	IS	IC	CR	MBEA	MBEP	LZ	Extra-effort	Effectiveness	Satisfaction
A	2.8	2.2	2.6	2.3	2.5	2.7	1.5	1.1	0.9	2.7	3.0	3.0
B	2.8	2.7	3.3	2.8	2.6	3.3	2.4	1.0	0.8	2.9	3.1	3.2
C	2.5	2.8	3.0	2.6	2.5	2.5	2.2	1.4	0.7	2.7	3.0	2.8
D	1.5	1.8	1.8	1.3	0.8	1.5	2.7	2.2	1.8	1.1	1.2	0.9
E	2.0	2.2	2.4	1.9	1.6	2.1	2.2	1.6	1.2	1.8	1.9	1.7
F	2.3	2.0	2.5	2.3	2.6	2.1	2.5	1.5	0.9	2.3	2.4	2.4
G	2.5	2.5	2.1	2.6	2.5	2.5	2.6	1.6	1.0	2.5	2.5	2.5
H	2.7	2.6	3.0	2.2	2.2	2.7	2.9	1.0	0.8	2.4	2.8	2.4
I	3.3	3.1	3.5	3.1	3.1	3.3	2.3	0.8	0.5	3.3	3.5	3.2
J	2.6	2.2	2.5	2.5	2.5	2.8	2.2	1.3	1.3	2.3	2.7	2.6
K	2.6	2.1	2.6	2.8	2.8	2.6	1.8	1.2	0.9	2.6	2.7	2.9
L	2.4	2.3	2.2	2.2	2.0	2.5	2.6	1.7	0.7	2.1	2.8	2.3
M	2.9	2.9	3.6	2.8	3.2	3.1	2.1	1.6	1.0	2.9	2.9	3.1
N	1.9	2.2	1.9	3.0	2.3	2.0	1.7	1.6	1.6	1.9	2.4	2.8
O	2.8	2.6	2.9	2.6	2.6	2.8	2.0	0.9	0.6	2.7	3.1	3.4
CGS	2.5	2.4	2.7	2.5	2.4	2.6	2.2	1.4	1.0	2.4	2.7	2.6

4.2.1 Discussion of leadership styles and attribution ratings for individual scientists as unit leaders.

Figure 4.13 is a surface area plot, which graphically displays the results listed in Table 4.1. The measurement scale is categorised according to the following rating scale:

- 0.0–1.0 (not at all to once in a while);
- 1.0–2.0 (once in a while to sometimes);
- 2.0–3.0 (sometimes to fairly often), and
- 3.0–4.0 (fairly often to frequently, if not always).



**Figure 4.13:** Surface area plot of the leadership style and attribution ratings per individual scientist as unit leader.

Transformational leadership: (idealised attributes II-A, idealised behaviour II-B, inspirational motivation (IM), intellectual stimulation (IS) and individual consideration (IC), Figure 4.13.

The scientists as unit leaders are indicated on the x-axis and the leadership styles (transformational II-A, II-B, IM, IS, IC, and transactional CR, MBEA, MEP) and attributions (extra-effort, effectiveness and satisfaction) on the y-axis.

The average score from all participants for individual unit leaders, including all unit leaders together (CGS), ranged between 2 and 3 for the transformational leadership factors (II-A, II-B, IM, IS and IC), except for:

- leader B who rated higher (3.0–4.0) on IM;
- leader I who rated higher (3.0–4.0) on all the transformational factors (II-A, II-B, IM, IS and IC);
- leader M who rated higher (3.0–4.0) on IM and IC, and
- leader D who rated lower (1.0–2.0) on factors II-A, II-B, IM, IS and (0.0–1.0) on factor IC.

These results indicate that participants rate the scientists as leaders sometimes to fairly often as transformational leaders, indicating that the participants, in general, perceive the unit leaders to be more transformational than transactional leaders. This indicates that leaders, sometimes to fairly often, change the awareness of their staff as to what is important. The leaders, sometimes to fairly often, impel their staff members to see themselves, opportunities and the challenges of their environment in a new way. These leaders are proactive, seeking to optimise staff members and the organisation's development. In addition, they are innovative, inducing their colleagues and staff members to strive to higher levels of potential as well as higher levels of moral and ethical standards.

Transactional leadership (contingent reward CR, management by exception active MBEA, management by exception passive MBEP), Figure 4.13

Transactional leadership ratings for the majority of scientists as unit leaders were between 2.0 and 3.0 on CR and MBEA, and 1.0 and 2.0 on MBEP, except for the following scientists as unit leaders:

- M who rated higher (3.0–4.0) on CR;
- B and I who rated higher (3.0–4.0) on CR, and lower (0.0–1.0) on MBEP;
- A and K who rated lower (1.0–2.0) on MBEA;
- D who rated lower (1.0–2.0) on CR, and higher (2.0–3.0) on MBEP;

- H who rated lower (0.0–1.0) on MBEP;
- N who rated lower (1.0–2.0) on CR and MBEA and MBEP;
- O who rated lower (1.0–2.0) on MBEA, and lower (0.0–1.0) on MBEP; and
- The Council for Geoscience as a whole rated lower (1.0–2.0) on MBEP.

These ratings indicate that transactional leadership dimensions, contingent reward (CR) and management-by-exceptions active (MBEA) for scientists as unit leaders are experienced sometimes to fairly often, whereas management-by-exceptions passive (MBEP) is experienced once in a while to sometimes. These results indicate that the unit leaders prefer to monitor the situation and take action before failures occur, rather than to intervene only after a mistake or non-compliance has been identified. Unit leaders are perceived to, more than often, clarify goals and objectives and provide others with assistance in exchange for their efforts.

#### Laissez-faire leadership style (LZ), Figure 4.13

The majority of scientists as unit leaders rated between 0.0 and 1.0 on laissez-faire leadership style, except for leaders D, E, G, J, M, N and the Council for Geoscience, who rated higher (1.0–2.0) on this leadership style.

The ratings indicate that the laissez-faire leadership style of scientists as unit leaders is generally perceived as not at all laissez-faire to once in a while laissez-faire.

This result supports the findings of transactional leadership, i.e. that the unit leaders of the Council for Geoscience strive to be actively involved in decision making, rather than to be absent when needed or to avoid decision making.

#### Attributions (extra-effort, effectiveness and satisfaction), Figure 4.13

Attribution ratings generally varied in the range of 2.0–3.0, except for the following leaders:

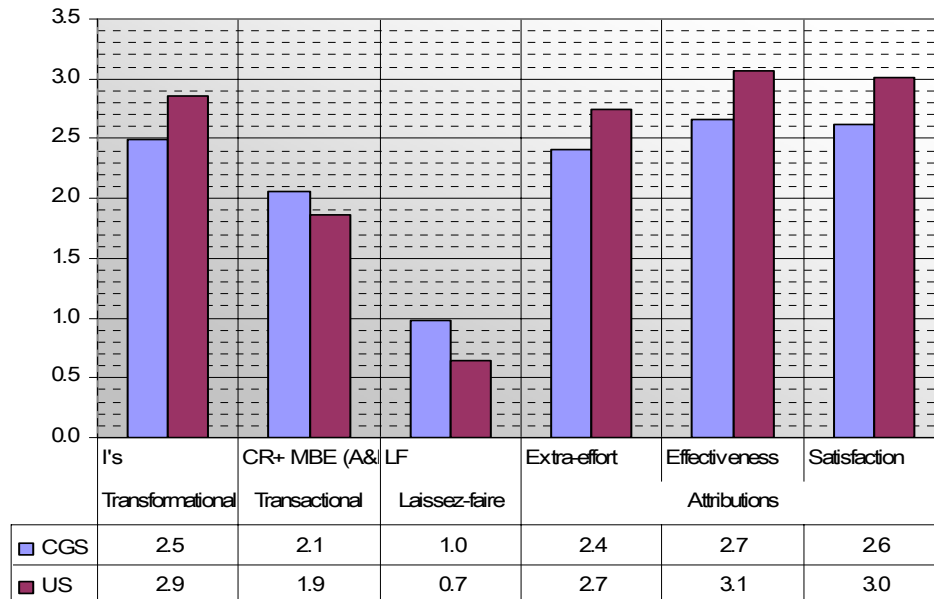
- A, B, I and O, who rated higher (3.0–4.0) on effectiveness and satisfaction;
- C, who rated higher (3.0–4.0) on effectiveness;
- M, who rated higher (3.0–4.0) on satisfaction;
- D and E, who rated lower (1.0–2.0) on extra-effort, effectiveness and satisfaction.

These ratings indicate that the attribution dimensions (extra-effort, effectiveness and satisfaction) for scientists as unit leaders are experienced sometimes to fairly often, showing that the unit leaders of the Council for Geoscience motivate others to do more than they are

expected to, and are effective in meeting organisational requirements more often. The satisfaction dimension indicates that unit leaders often work with others in a satisfactory way.

#### 4.2.2 Discussion of aggregated leadership results for the Council for Geoscience as a whole.

The aggregated leadership results for the Council for Geoscience as a whole are indicated in Figure 4.14 and discussed below.



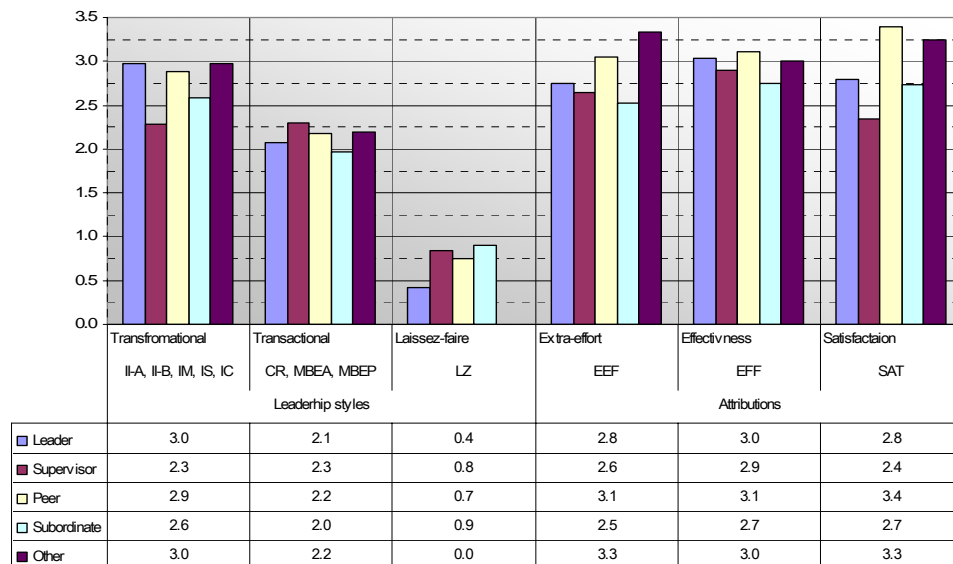
**Figure 4.14:** Aggregated leadership style and attribution ratings for the Council for Geoscience (CGS).  
 Source for United States (US) data: Bass BM. and Avolio BJ. 2004: *Multifactor Leadership Questionnaire, Manual and Sampler Set*, 3<sup>rd</sup> edition. University of Nebraska and SUNY Binghamton: Mind Garden, Inc.

#### Transformational, transactional, laissez-faire, extra-effort, effectiveness and satisfaction percentages

A rating of 2.5 for transformational leadership dimensions indicates that transformational leadership is experienced sometimes to fairly often in the Council for Geoscience, showing that the unit leaders are often influential in their awareness of what is important. The rating for transactional leader dimensions fits in the same range of sometimes to fairly often, but is not rated as highly as the transformational leadership style dimensions, showing that the unit leaders regard the setting of objectives, motivation and control measures fairly important to performing their day to day jobs. The low rating on the laissez-faire dimensions confirms that leaders do get involved in important issues and want to be involved in the decision-making process.

The extra-effort rating of 2.4 indicates that unit leaders often get others to do more than what is expected of them, and assist often to motivate others. Unit leaders are also perceived to be effective in meeting other's job-related needs and use methods of leadership that are fairly often satisfying.

The results obtained for this study are slightly different than those for United States companies (Figure 4.14), with a sample size of 27,285 (Avolio and Bass, 2004:70). The Council for Geoscience rated lower on both transformational leadership and attribution dimensions (extra-effort, effectiveness and satisfaction), and higher on both transactional and laissez-faire leadership styles. However, there is room for improvement in that leaders could be more influential and inspirational to achieve objectives, as well as putting in extra effort to increase others' willingness to try harder, as well as satisfying the needs of others and the organisation by using appropriate leadership styles. If the results are compared with the data published by Avolio and Bass (2004:70), Figure 4.15, it seems that the Council for Geoscience tends to follow less of an inspirational and influential leadership style — together with less satisfying methods of leadership, setting objectives, discussing terms of success, dealing and keeping track of mistakes with control to redirect to meet standards — and objective setting and less satisfying methods of leadership appear to be slightly more important.



**Figure 4.15:** Comparing the leadership ratings of leaders, supervisors, peers and subordinates.



4.2.3 Comparing MLQ self-ratings for scientists as unit leaders with those of supervisors, subordinates, peers and others (contractors, etc.) in Figure 4.15.

Scientists as unit leaders rated themselves on various leadership style dimensions, such as transformational, transactional and laissez-faire leadership styles and on attributions, such as extra-effort, effectiveness and satisfaction, where after supervisors, peers, subordinates and others also rated the unit leaders on these same dimensions, as shown in Figure 4.15.

The transformational leadership style ratings of scientists as unit leaders were the same as the ratings of their peers and others. Supervisors and subordinates, however, rated the leaders lower. The people having constant contact with the unit leaders on a day-to-day basis (subordinates and supervisors), rated the leaders lower on essentially all the dimensions. If the leaders perceive themselves as doing a good job of leading, while the opinion of their supervisors and subordinates is the opposite, it could be a cause for concern. These findings indicate that the groups above and below the leaders in the hierarchy perceive them drastically less inspirational, motivational and influential than what they perceive themselves to be.

Supervisors, peers and others rated the scientists as unit leaders higher on transactional leadership, but subordinates rated them lower. Supervisors, peers and subordinates rated scientists as unit leaders higher on laissez-faire leadership style, compared with the rating the leaders gave themselves, indicating that unit leaders perceive themselves to be more involved, decisive and attentive to urgent questions, than the supervisors, peers and subordinates do. For attribution dimensions supervisors and subordinates rated the scientists as unit leaders lower on extra-effort, effectiveness and satisfaction, whereas peers rated them higher. Others rated them higher on extra-effort and satisfaction, but the same on effectiveness.

### 4.3 Descriptive statistics

Figures 4.16 and 4.17 summarise the descriptive statistics of the leadership style and attribution dimensions, which entail the following:

- Figure 4.16 summarises the transformational leadership dimensions — idealised attributes (II-A), idealised behaviour (II-B), inspirational motivation (IM), intellectual stimulation (IS) and individual consideration (IC) — the transactional leadership dimensions (contingent reward CR, management by exception active MBEA, management by exception passive MBEP — and the laissez-faire leadership dimensions.

- Figure 4.17 summarises the attribution dimensions, extra-effort, effectiveness and satisfaction

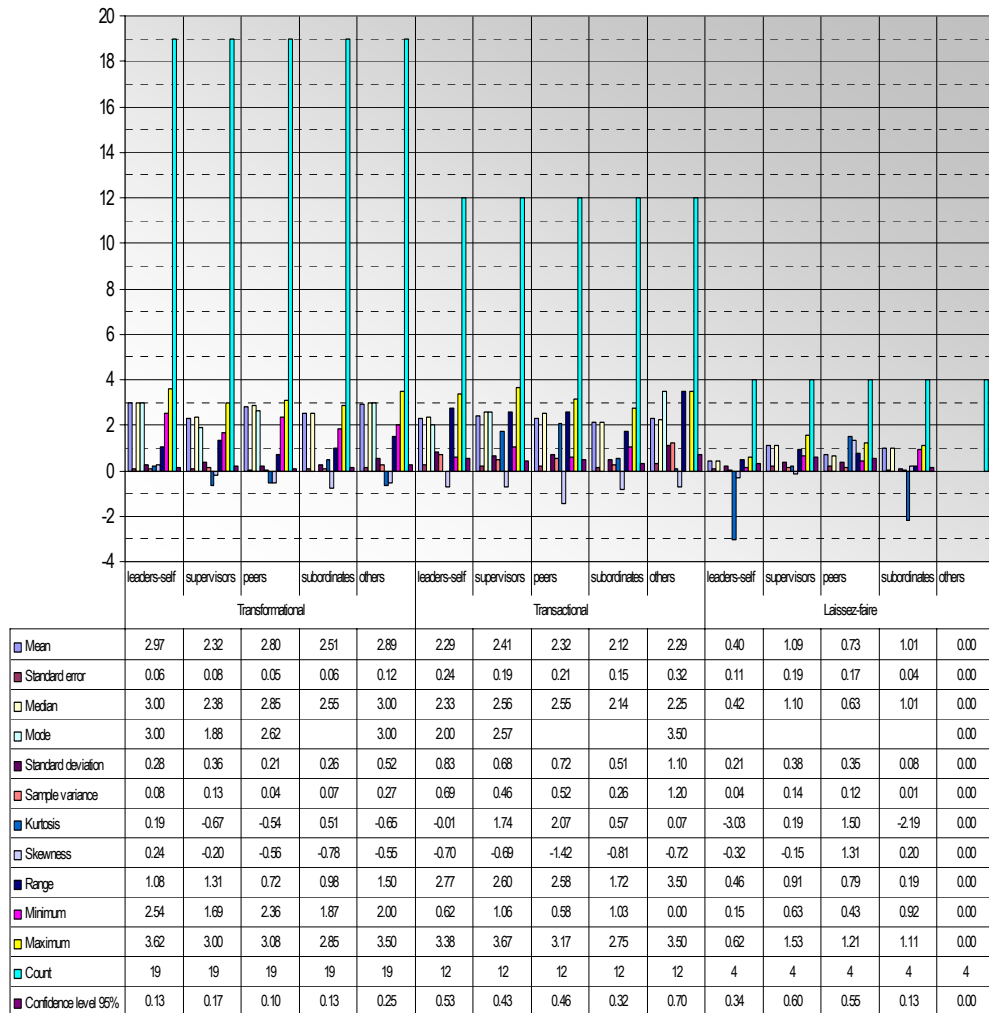
The scale of measurement is between 0 and 4 (0=not at all; 1=once in a while; 2=sometimes; 3=fairly often, and 4=frequently, if not always) as described in Chapter 3 and in Section 5.2.1 (above).

#### 4.3.1 Discussion of the descriptive statistics of transformational, transactional and laissez-faire leadership styles (Figure 4.16).

##### Description of mean, median and mode

The *mean, median and mode* are measures of location. The arithmetic average is the mean, the median the midpoint of the distribution, and the mode the most frequently occurring value. The mean, median and mode of transformational, transactional and laissez-faire leadership styles are discussed below. The following can be concluded from the mean, median and mode results when taking into account the rating scale (0=not at all, 1=once in a while, 2=sometimes, 3=fairly often, and 4=frequently).

- The mean, median and mode results for transformational leadership style indicate that scientists as unit leaders, peers and others perceive the leadership style of scientists to be fairly often transformational, whereas supervisors and subordinates perceive them to vary between sometimes to fairly often (lower than what leaders, peers and others perceive it to be).
- The mean, median and mode results for transactional leadership style indicate that all raters perceive scientists as unit leaders to be transactional leaders sometimes to fairly often.
- The mean, median and mode results for laissez-faire leadership style indicate that supervisors and subordinates experience scientists as unit leaders to be laissez-faire once in a while, whereas peers experience them to vary between not at all laissez-faire to once in a while, and leaders view themselves as not at all laissez-faire.



**Figure 4.16:** Descriptive statistics for transformational, transactional and laissez-faire leadership style ratings of scientist as unit leader (self), supervisors, peers, subordinates and others.

#### Description of standard error

Precision is measured by the *standard error* of estimate (a type of standard deviation). The smaller the standard error of estimate, the higher is the precision of the sample.

The standard error on transformational, transactional and laissez-faire leadership styles are discussed below.

The standard error values for all the leadership styles were very low, indicating a high precision of measurement. The standard error was the highest for 'others' (0.32) with regard to transactional leadership style. This indicates that although the precision of all the leadership dimensions was high, it was the lowest for the 'other' ratings of transformational leadership.

This can be ascribed to the fact that only two 'others' (contractors) rated the scientists as unit leaders.

#### Description of measure of spread: standard deviation, variance and range

- The *standard deviation* summarises how far away from the average the data values are and is affected by extreme scores.
- The *variance* is the average of the squared deviation scores from the mean of the distribution. It is a measure of score dispersion about the mean. If all the scores are identical, the variance is zero. The greater the score dispersion, the greater the variance.
- The *range* is the difference between the largest and the smallest score in the distribution and is computed from only the minimum and maximum scores.

The standard deviation and variance were the smallest for transformational leadership and the highest for transactional leadership. This finding indicates that transformational leadership had ratings closest to the average with the smallest dispersion of scores, whereas transactional leadership had ratings the furthest away from the average with the highest dispersion of scores.

The transactional leadership range value of 'others' were the highest, indicating that 'others' had the highest extreme score ratings for transactional leadership followed by 'others' ratings for transformational leadership and lastly supervisor ratings for laissez-faire leadership. The high range values for 'others' can be ascribed to the participation of only two people as 'others'.

#### Description of measure of shape: skewness and kurtosis

- *Skewness* is a measure of a distribution's deviation from symmetry. When a distribution approaches symmetry, the skewness is approximately zero. A positive skew will have a positive number, while a negative skew will have a negative number.
- *Kurtosis* is a measure of a distribution's flatness. Distributions that have scores which cluster heavily, or pile up in the centre are peaked or leptokurtic. Flat distributions are called platykurtic. Intermediate, or mesokurtic, distributions are neither too peaked nor too flat. The value of mesokurtic distributions is close to zero. A leptokurtic distribution will have a positive value, and the platykurtic distribution will be negative. The larger the value of the index, the more extreme is the characteristic.

The laissez-faire leadership skewness value for peers was the highest, followed by the transactional leadership values for peers, and then the transformational leadership values of subordinates. These findings indicate that the ratings of peers regarding laissez-faire leadership style were the furthest from symmetry and that of laissez-faire 'others' closest to symmetry.

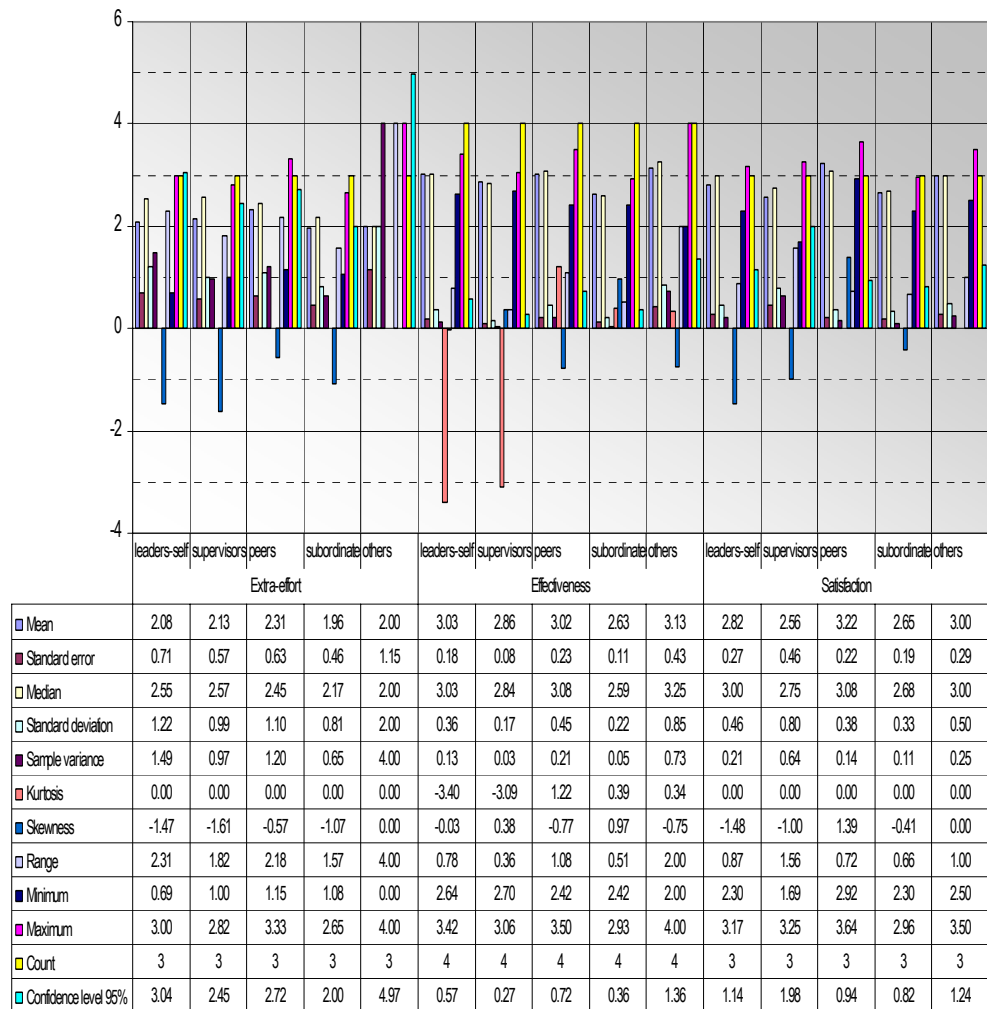
The kurtosis of the raters varied between a maximum of -3.03 (platykurtic) for leaders' self-ratings for laissez-faire, and a minimum of 0.00 (mesokurtic) for 'others' laissez-faire ratings. The laissez-faire ratings of the leaders-self indicate more extreme measurements than the laissez-faire ratings of 'others', which are less extreme.

#### 4.3.2 Discussion of descriptive statistics on extra-effort, effectiveness and satisfaction attributions (Figure 4.17).

##### The mean, median and mode on extra-effort, effectiveness and satisfaction attributions

The following can be concluded from the mean, median and mode results when taking into account the rating scale (0=not at all, 1=once in a while, 2=sometimes, 3=fairly often, and 4=frequently).

- The mean, median and mode results for the extra-effort attribution indicate that subordinates perceive scientists as unit leaders to put in extra effort sometimes, whereas peers believe scientists as unit leaders to put in extra-effort fairly often. The ratings of scientists as unit leaders, supervisors and peers fall between sometimes to fairly often on the extra-effort dimension.
- The mean, median and mode results for effectiveness indicate that supervisors and subordinates perceive the effectiveness of scientists as unit leaders to vary between sometimes to fairly often. The effectiveness ratings of scientists as unit leaders, peers and 'others' fall between fairly often to frequently.
- The mean, median and mode results for satisfaction indicate that leaders, supervisors and subordinates sometimes to fairly often experience scientists as unit leaders to do work satisfactorily, whereas peers and others perceive them as giving satisfactory work fairly to frequently.



**Figure 4.17:** Descriptive statistics for attribution ratings (extra-effort, effectiveness and satisfaction) of scientist as unit leader (self), supervisors, peers, subordinates and others.

The standard error extra-effort, effectiveness and satisfaction attributions

The standard error values for all the attribution ratings were low, indicating a high precision of measurement. The standard error was the highest for scientists as unit leaders (0.71) on the extra-effort dimension, indicating that although the precision for all the attribution dimensions was high, it was the lowest for scientists as unit leaders on the extra-effort dimension of attributions.

The standard deviation, variance and range extra-effort, effectiveness and satisfaction attributions

The standard deviation and variance were the smallest on the satisfaction dimension and the highest on the extra-effort dimension of attributions, indicating that ratings for satisfaction were

closest to the average for all raters with the smallest dispersion of scores, whereas extra-effort ratings were furthest away from the average with the highest dispersion of scores for 'others'. The extra-effort range values of 'others' were the highest, indicating that 'others' had the highest extreme score ratings for extra-effort, followed by ratings of 'others' on the effectiveness dimension and lastly the ratings of supervisors on the satisfaction dimension of the attributions.

#### The skewness and kurtosis extra-effort, effectiveness and satisfaction attributions

The skewness of the extra-effort dimension was the highest for supervisors on the attribution dimensions, followed by satisfaction ratings of leaders-self, and then effectiveness ratings of subordinates. These findings indicate that the ratings of supervisors on the extra-effort dimension of attributions were the furthest from symmetry and that of subordinates on the effectiveness dimension of attribution closest to symmetry.

The kurtosis was the highest on the effectiveness dimension (-3.40, platykurtic) for leaders-self and at a minimum (0.00, mesokurtic) for all raters on the extra-effort and satisfaction dimensions of attributions. These findings indicate that the effectiveness ratings of the leaders-self had the most extreme scores. There were no extreme scores on the extra-effort and satisfaction dimensions of attributions.

#### **4.4 Statistical results: Hypothesis (t-tests and ANOVAS)**

Hypothesis testing is done to determine the differences in assessor (rater) ratings and is represented in Figures 4.16 and 4.17 and summarised in Tables 4.2 to 4.4 below.

##### Hypothesis 1–6, t-tests

Hypotheses 1–6 are tested with their alternative hypothesis in a specific direction. To test these hypotheses, the regions for rejections are divided into a one-tail of the distribution, and are measured at a 95 per cent significance level. The statistical results for these hypotheses (2–7) are discussed below, after Tables 4.2.

**Table 4.2:** Hypothesis t-tests.

Hypothesis (H <sub>0</sub> )		Statistical test	Result t-stat	Result t-critical α = 0.05	Result description	H <sub>0</sub>	
						Accept	Reject
<b>Hypothesis 1</b>							
1-1	Scientists as unit leaders perceive themselves to be more transformational leaders than what their supervisors rate them to be. H <sub>0</sub> : μleaders transformational ≤ μsupervisors transformational H <sub>A</sub> : μleaders transformational > μsupervisors transformational	t-test two-samples assuming unequal variances, one tail	10.37	1.86	t > tcrit		•
1-2	Scientists as unit leaders perceive themselves to be more transformational leaders than what their peers rate them to be. H <sub>0</sub> : μleaders transformational ≤ μpeers transformational H <sub>A</sub> : μleaders transformational > μpeers transformational	t-test two-samples assuming unequal variances, one tail	1.17	1.86	t < tcrit	•	
1-3	Scientists as unit leaders perceive themselves to be more transformational leaders than what their subordinates rate them to be. H <sub>0</sub> : μleaders transformational ≤ μsubordinates transformational H <sub>A</sub> : μleaders transformational > μsubordinates transformational	t-test two-samples assuming unequal variances, one tail	6.09	1.86	t > tcrit		•
<b>Hypothesis 2</b>							
2-1	Scientists as unit leaders rate themselves lower on transactional leadership than what their supervisors do. H <sub>0</sub> : μleaders transactional ≥ μsupervisors transactional H <sub>A</sub> : μleaders transactional < μsupervisors transactional	t-test two-samples assuming unequal variances, one tail	-0.34	2.13	t < tcrit	•	
2-2	Scientists as unit leaders rate themselves lower on transactional leadership than do their peers. H <sub>0</sub> : μleaders transactional ≥ μpeers transactional H <sub>A</sub> : μleaders transactional < μpeers transactional	t-test two-samples assuming unequal variances, one tail	-0.14	2.13	t < tcrit	•	
2-3	Scientists as unit leaders rate themselves lower on transactional leadership than their subordinates do. H <sub>0</sub> : μleaders transactional ≥ μsubordinates transactional H <sub>A</sub> : μleaders transactional < μsubordinates transactional	t-test two-samples assuming unequal variances, one tail	0.17	2.13	t < tcrit	•	
<b>Hypothesis 3</b>							
3-1	Scientists as unit leaders rate themselves lower on laissez-faire leadership than what their supervisors do. H <sub>0</sub> : μleaders laissez-faire ≥ μsupervisors laissez-faire H <sub>A</sub> : μleaders laissez-faire < μsupervisors laissez-faire	t-test two-samples assuming unequal variances, one tail	-1.91	1.73	t > tcrit		•
3-2	Scientists as unit leaders rate themselves lower on Laissez-faire leadership than what their peers do. H <sub>0</sub> : μleaders laissez-faire ≥ μpeers laissez-faire H <sub>A</sub> : μleaders laissez-faire < μpeers laissez-faire	t-test two-samples assuming unequal variances, one tail	-1.80	1.79	t > tcrit		•
3-3	Scientists as unit leaders rate themselves lower on laissez-faire leadership than do their subordinates. H <sub>0</sub> : μleaders laissez-faire ≥ μsubordinates laissez-faire H <sub>A</sub> : μleaders laissez-faire < μsubordinates laissez-faire	t-test two-samples assuming unequal variances, one tail	-2.99	1.71	t > tcrit		•



**Table 4.2:** Hypothesis t-tests (continued).

	Hypothesis (H <sub>0</sub> )	Statistical test	Results t-stat	Results t-critical $\alpha = 0.05$	Result description	H <sub>0</sub>	
						Accept	Reject
<b>Hypothesis 4</b>							
4-1	Scientists as unit leaders rate themselves higher on extra-effort than what their supervisors do. H <sub>0</sub> : $\mu_{\text{leaders extra-effort}} \leq \mu_{\text{supervisors extra-effort}}$ H <sub>A</sub> : $\mu_{\text{leaders extra-effort}} > \mu_{\text{supervisors extra-effort}}$	t-test two-samples assuming unequal variances, one tail	0.35	1.74	t < tcrit	•	
4-2	Scientists as unit leaders rate themselves higher on extra-effort than what their subordinates do. H <sub>0</sub> : $\mu_{\text{leaders extra-effort}} \leq \mu_{\text{subordinates extra-effort}}$ H <sub>A</sub> : $\mu_{\text{leaders extra-effort}} > \mu_{\text{subordinates extra-effort}}$	t-test two-samples assuming unequal variances, one tail	0.96	1.71	t < tcrit	•	
4-3	Scientists as unit leaders rate themselves higher on extra-effort than what their peers do. H <sub>0</sub> : $\mu_{\text{leaders extra-effort}} \leq \mu_{\text{peers extra-effort}}$ H <sub>A</sub> : $\mu_{\text{leaders extra-effort}} > \mu_{\text{peers extra-effort}}$	t-test two-samples assuming unequal variances, one tail	1.57	1.73	t < tcrit	•	
<b>Hypothesis 5</b>							
5-1	Scientists as unit leaders rate themselves higher on effectiveness than what their supervisors do. H <sub>0</sub> : $\mu_{\text{leaders effectiveness}} \leq \mu_{\text{supervisors effectiveness}}$ H <sub>A</sub> : $\mu_{\text{leaders effectiveness}} > \mu_{\text{supervisors effectiveness}}$	t-test two-samples assuming unequal variances, one tail	0.37	1.71	t < tcrit	•	
5-2	Scientists as unit leaders rate themselves higher on effectiveness than what their peers do. H <sub>0</sub> : $\mu_{\text{leaders effectiveness}} \leq \mu_{\text{peers effectiveness}}$ H <sub>A</sub> : $\mu_{\text{leaders effectiveness}} > \mu_{\text{peers effectiveness}}$	t-test two-samples assuming unequal variances, one tail	0.13	1.74	t < tcrit	•	
5-3	Scientists as unit leaders rate themselves higher on effectiveness than what their subordinates do. H <sub>0</sub> : $\mu_{\text{leaders effectiveness}} \leq \mu_{\text{subordinates effectiveness}}$ H <sub>A</sub> : $\mu_{\text{leaders effectiveness}} > \mu_{\text{subordinates effectiveness}}$	t-test two-samples assuming unequal variances, one tail	1.39	1.71	t < tcrit	•	
<b>Hypothesis 6</b>							
6-1	Scientists as unit leaders rate themselves higher on satisfaction than what their supervisors do. H <sub>0</sub> : $\mu_{\text{leaders satisfaction}} \leq \mu_{\text{supervisors satisfaction}}$ H <sub>A</sub> : $\mu_{\text{leaders satisfaction}} > \mu_{\text{supervisors satisfaction}}$	t-test two-samples assuming unequal variances, one tail	1.64	1.71	t < tcrit	•	
6-2	Scientists as unit leaders rate themselves higher on satisfaction than what their peers do. H <sub>0</sub> : $\mu_{\text{leaders satisfaction}} \leq \mu_{\text{peers satisfaction}}$ H <sub>A</sub> : $\mu_{\text{leaders satisfaction}} > \mu_{\text{peers satisfaction}}$	t-test two-samples assuming unequal variances, one tail	-2.09	1.75	t > tcrit		•
6-3	Scientists as unit leaders rate themselves higher on satisfaction than what their subordinates do. H <sub>0</sub> : $\mu_{\text{leaders satisfaction}} \leq \mu_{\text{subordinates satisfaction}}$ H <sub>A</sub> : $\mu_{\text{leaders satisfaction}} > \mu_{\text{subordinates satisfaction}}$	t-test two-samples assuming unequal variances, one tail	0.40	1.72	t < tcrit	•	

4.4.1 Hypothesis 1. Scientists as unit leaders rate themselves higher on transformational leadership than do their supervisors, peers and subordinates.

✚ *Hypothesis 1-1:* Scientists as unit leaders perceive themselves to be more transformational leaders than their supervisors do ( $H_0: \mu_{\text{leaders transformational}} \leq \mu_{\text{supervisors transformational}}$ ;  $H_A: \mu_{\text{leaders transformational}} > \mu_{\text{supervisors transformational}}$ ).

The calculated  $t$ -value (10.37) is larger than the critical  $t$ -value (1.86), therefore the null hypothesis would be rejected and this would mean that scientists as unit leaders perceive their transformational leadership style to be higher than their supervisors do.

✚ *Hypothesis 1-2:* Scientists as unit leaders perceive themselves to be more transformational leaders than what their peers do ( $H_0: \mu_{\text{leaders transformational}} \leq \mu_{\text{peers transformational}}$ ;  $H_A: \mu_{\text{leaders transformational}} > \mu_{\text{peers transformational}}$ ).

The calculated  $t$ -value (1.17) is smaller than the critical  $t$ -value (1.86), therefore the null hypothesis is accepted. This indicates that scientists as unit leaders perceive transformational leadership similar or less than peers do.

✚ *Hypothesis 1-3:* Scientists as unit leaders perceive themselves to be more transformational leaders than their subordinates do ( $H_0: \mu_{\text{leaders transformational}} \leq \mu_{\text{subordinates transformational}}$ ;  $H_A: \mu_{\text{leaders transformational}} > \mu_{\text{subordinates transformational}}$ ).

The calculated  $t$ -value (6.09) is higher than the critical  $t$ -value (1.86); therefore the null hypothesis is rejected. This indicates that scientists as unit leaders do rate themselves higher on transformational leadership style than their subordinates do.

These findings also correspond with the descriptive statistics of Figure 4.15, whereby the leaders' ratings are higher than those of the supervisors and subordinates, but similar to those of the peers. On the transformational dimension, the practical application is that the leaders perceive themselves to be more transformational than the people below and above them in the hierarchy.

4.4.2 Hypothesis 2. Scientists as unit leaders perceive themselves to be less transactional leaders than their supervisors, peers and subordinates do.

✚ *Hypothesis 2-1:* Scientists as unit leaders perceive themselves to be less transactional leaders than their supervisors do ( $H_0: \mu_{\text{leaders transactional}} \geq \mu_{\text{supervisors transactional}}$ ;  $H_A: \mu_{\text{leaders transactional}} < \mu_{\text{supervisors transactional}}$ ).

The calculated  $t$ -value is smaller (-0.34) than the critical  $t$ -value (2.13); therefore the null hypothesis is accepted. It can be concluded that the transactional leadership style of scientists as unit leaders is higher than or equal to what supervisors rate it to be.

✚ *Hypothesis 2-2:* Scientists as unit leaders perceive themselves to be less transactional leaders than their peers do ( $H_0: \mu_{\text{leaders transactional}} \geq \mu_{\text{peers transactional}}$ ;  $H_A: \mu_{\text{leaders transactional}} < \mu_{\text{peers transactional}}$ ).

The calculated  $t$ -value is smaller (-0.14) than the critical  $t$ -value (2.13); therefore the null hypothesis is accepted. It can be concluded that the transactional leadership style of scientists as unit leaders is higher or similar to what peers rate it to be.

✚ *Hypothesis 2-3:* Scientists as unit leaders perceive themselves to be less transactional leaders than what their subordinates rate them to be ( $H_0: \mu_{\text{leaders transactional}} \geq \mu_{\text{subordinates transactional}}$ ;  $H_A: \mu_{\text{leaders transactional}} < \mu_{\text{subordinates transactional}}$ ).

The calculated  $t$ -value is smaller (0.17) than the critical  $t$ -value (2.13); therefore the null hypothesis is accepted. It can be concluded that the transactional leadership style of scientists as unit leaders is higher than or equal to what subordinates rate it to be.

Again, the leaders' perception of their transactional leadership dimension is equal or higher than all the other rater groups (supervisors, peers, subordinates and others). This trend is also indicated by Figure 4.15.

4.4.3 Hypothesis 3. Scientists as unit leaders rate themselves lower on laissez-faire leadership than their supervisors, peers and subordinates do.

✚ *Hypothesis 3-1:* Scientists as unit leaders rate themselves lower on laissez-faire leadership than

their supervisors do ( $H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{supervisors laissez-faire}}$ ;  $H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{supervisors laissez-faire}}$ ).

The calculated  $t$ -value (-1.91) is higher than the critical  $t$ -value (1.73); therefore the null hypothesis is rejected. It can be concluded that scientists as unit leaders rate themselves lower on laissez-faire leadership than what their supervisors rate it to be.

✚ *Hypothesis 3-2:* Scientists as unit leaders rate themselves lower on laissez-faire leadership than their peers do ( $H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{peers laissez-faire}}$ ;  $H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{peers laissez-faire}}$ ).

The calculated  $t$ -value (-1.80) is higher than the critical  $t$ -value (1.79); therefore the null hypothesis is rejected. It can be concluded that scientists as unit leaders rate themselves lower on laissez-faire leadership than do their peers.

✚ *Hypothesis 3-3:* Scientists as unit leaders rate themselves lower on laissez-faire leadership than do their subordinates ( $H_0: \mu_{\text{leaders laissez-faire}} \geq \mu_{\text{subordinates laissez-faire}}$ ;  $H_A: \mu_{\text{leaders laissez-faire}} < \mu_{\text{subordinates laissez-faire}}$ ).

The calculated  $t$ -value (-2.99) is higher than the critical  $t$ -value (1.71); therefore the null hypothesis is rejected. It can be concluded that scientists as unit leaders rate themselves lower on laissez-faire leadership than do their subordinates.

The descriptive statistics of Figure 4.15 indicated a lower rating by the leaders compared with that of the supervisors, peers and subordinates. Statistically, the ratings of the subordinates are lower than those of the leaders.

In general, the above results indicate that the leaders perceive themselves to be more transformational and transactional and less laissez-faire than do the other rater (assessor) groups. This finding applies to people above and below the leaders in the hierarchy, and it should be a cause for concern if the leaders perceive themselves to be 'better' than do the other rater groups. It is the opinion of the researcher that this finding is too much of a coincidence, and that the leaders probably have a false perception of themselves compared with how the other groups perceive them to be.

4.4.4 Hypothesis 4. Scientists as unit leaders rate themselves higher on extra-effort than do their supervisors and subordinates.

✚ *Hypothesis 4-1:* Scientists as unit leaders rate themselves higher on extra-effort than do their supervisors ( $H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{supervisors extra-effort}}$ ;  $H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{supervisors extra-effort}}$ ).

The calculated  $t$ -value (0.35) is smaller than the critical  $t$ -value (1.74); therefore the null hypothesis is accepted. This indicates that scientists as unit leaders do not rate themselves higher on the extra-effort dimension of attributions than their supervisors do.

✚ *Hypothesis 4-2:* Scientists as unit leaders rate themselves higher on extra-effort than do their subordinates (and  $H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{subordinates extra-effort}}$ ;  $H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{subordinates extra-effort}}$ ).

The calculated  $t$ -value (0.96) is smaller than the critical  $t$ -value (1.71); therefore the null hypothesis is accepted. It can therefore be concluded that scientists as unit leaders do not rate themselves higher on the extra-effort dimension of attributions than do their subordinates.

✚ *Hypothesis 4-3:* Scientists as unit leaders rate themselves higher on extra effort than do their peers (and  $H_0: \mu_{\text{leaders extra-effort}} \leq \mu_{\text{peers extra-effort}}$ ;  $H_A: \mu_{\text{leaders extra-effort}} > \mu_{\text{peers extra-effort}}$ ).

The calculated  $t$ -value (1.57) is smaller than the critical  $t$ -value (1.73); therefore the null hypothesis is accepted. It can therefore be concluded that scientists as unit leaders do not rate themselves higher on the extra-effort dimension of attributions than do their peers.

It can be concluded from the above that ratings for extra-effort are fairly similar between leaders, supervisors, peers and subordinates. Although Figure 4.15 indicates some differences, this is not significant as the differences vary between 2.5 (subordinates) and 3.1 (peers).

4.4.5 Hypothesis 5. Scientists as unit leaders rate themselves higher on effectiveness than do their supervisors, peers and subordinates.

✚ *Hypothesis 5-1:* Scientists as unit leaders rate themselves higher on effectiveness than do their

supervisors ( $H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{supervisors effectiveness}}$ ;  $H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{supervisors effectiveness}}$ ).

The calculated  $t$ -value (0.37) is smaller than the critical  $t$ -value (1.71); therefore the null hypothesis is accepted. This leads to the conclusion that scientists as unit leaders do not rate themselves higher on effectiveness than do their supervisors.

✚ *Hypothesis 5-2*: Scientists as unit leaders rate themselves higher on effectiveness than do their peers ( $H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{peers effectiveness}}$ ;  $H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{peers effectiveness}}$ ).

The calculated  $t$ -value (0.13) is smaller than the critical  $t$ -value (1.74); therefore the null hypothesis is accepted. It can be concluded that scientists as unit leaders do not rate themselves higher on effectiveness than do their peers.

✚ *Hypothesis 5-3*: Scientists as unit leaders rate themselves higher on effectiveness than do their subordinates ( $H_0: \mu_{\text{leaders effectiveness}} \leq \mu_{\text{subordinates effectiveness}}$ ;  $H_A: \mu_{\text{leaders effectiveness}} > \mu_{\text{subordinates effectiveness}}$ ).

The calculated  $t$ -value (1.39) is smaller than the critical  $t$ -value (1.71); therefore the null hypothesis is accepted. This indicates that scientists as unit leaders do not rate themselves higher on effectiveness compared with the rating of their subordinates.

Again, the ratings of leaders correspond with those of supervisors, peers and subordinates. If the results on effectiveness (Figure 4.15) are compared, the difference in ratings is not significant and ranges between 2.7 (subordinates) and 3.1 (peers). Therefore, all the ratings correspond with each other for the effectiveness dimension.

4.4.6 Hypothesis 6. Scientists as unit leaders rate themselves higher on satisfaction than their supervisors, peers and subordinates do.

✚ *Hypothesis 6-1*: Scientists as unit leaders rate themselves lower on satisfaction than their supervisors do ( $H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{supervisors satisfaction}}$ ;  $H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{supervisors satisfaction}}$ ).

The calculated  $t$ -value (1.64) is smaller than the critical  $t$ -value (1.71); therefore the null hypothesis is accepted. This indicates that scientists as unit leaders do rate themselves higher or equal on satisfaction, compared with the ratings of their supervisors.

- ✚ *Hypothesis 6-2:* Scientists as unit leaders rate themselves lower on satisfaction than their peers do ( $H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{peers satisfaction}}$ ;  $H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{peers satisfaction}}$ ).

The calculated  $t$ -value is higher (-2.09) than the critical  $t$ -value (1.75); therefore the null hypothesis is rejected. It can be concluded that scientists as unit leaders do rate themselves lower on satisfaction, compared with the ratings of their peers.

- ✚ *Hypothesis 6-3:* Scientists as unit leaders rate themselves lower on satisfaction than their subordinates do ( $H_0: \mu_{\text{leaders satisfaction}} \leq \mu_{\text{subordinates satisfaction}}$ ;  $H_A: \mu_{\text{leaders satisfaction}} > \mu_{\text{subordinates satisfaction}}$ ).

The calculated  $t$ -value is smaller (0.40) than the critical  $t$ -value (1.72); therefore the null hypothesis is accepted. This indicates that scientists as unit leaders do rate themselves higher or equal on satisfaction compared with the ratings of subordinates.

If these results are compared with the results obtained for satisfaction in Figure 4.15, it confirms the finding that leaders tend to rate themselves higher on satisfaction than both their supervisors and subordinates do. It is, however, significant to note that supervisors are less satisfied with the leaders than are the subordinates.

#### Hypothesis 7, ANOVA-test (Table 4.3)

Hypothesis 7 is statistically tested at a 95 per cent significance level. The results are given in Table 4.3 and discussed after Table 4.3. This statistical test indicates the between-group variance, but does not indicate which groups are different. A special class of tests, known as a priori contrast, could be used after the null was rejected with the F-test.

**Table 4.3:** Hypothesis testing (ANOVA).

	Hypothesis (H <sub>0</sub> )	Statistical test	Results F	Results F-critical $\alpha = 0.05$	Result description	H <sub>0</sub>	
						Accept	Reject
<b>Hypothesis 7</b>							
7-1	<p>There is a difference in transformational leadership style between the self-ratings of the different leaders.</p> <p>H<sub>0</sub> transformational: <math>\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}</math></p> <p>H<sub>A</sub> transformational: <math>\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}</math></p>	ANOVA single factor	4.70	1.94	F > Fcrit		•
7-2	<p>There is a difference in transactional leadership style between the self-ratings of the different leaders.</p> <p>H<sub>0</sub> transactional: <math>\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}</math></p> <p>H<sub>A</sub> transactional: <math>\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}</math></p>	ANOVA single factor	0.82	2.15	F < Fcrit	•	
7-3	<p>There is a difference in transactional leadership style between the self-ratings of the different leaders.</p> <p>H<sub>0</sub> laissez-faire: <math>\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}</math></p> <p>H<sub>A</sub> laissez-faire: <math>\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}</math></p>	ANOVA single factor	0.94	2.01	F < Fcrit	•	
7-4	<p>There is a difference in attributions (extra-effort, effectiveness and satisfaction) between the self-ratings of the different leaders.</p> <p>H<sub>0</sub> attributions: <math>\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}</math></p> <p>H<sub>A</sub> attributions: <math>\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}</math></p>	ANOVA single factor	2.31	2.18	F > Fcrit		•

Note: Leaders E and J are not included in the comparison between the leaders, since they have not completed the leader self-rating form.

4.4.7 Hypothesis 7. There is a difference in transformational, transactional and attribution ratings (extra effort, effectiveness and satisfaction) between the self-ratings of the different scientists as unit leaders.

 *Hypothesis 7-1:* There is a difference in transformational leadership style between the self-ratings of the different leaders (H<sub>0</sub> transformational:  $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}}$



=  $\mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$ ;  $H_{A \text{ transformational}}$ :  $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$ ).

The calculated F-value (4.70) is larger than the critical F-value (1.94); this implies the rejection of the null hypothesis. It can be concluded that there is a difference in the transformational leadership style self-ratings of the different leaders.

✚ *Hypothesis 7-2:* There is a difference in transactional leadership style between the self-ratings of the different leaders ( $H_{0 \text{ transactional}}$ :  $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$ ;  $H_{A \text{ transactional}}$ :  $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$ ).

The calculated F-value (0.82) is smaller than the critical F-value (2.15); therefore the null hypothesis is accepted. This implies that there is no difference in the self-ratings of scientists as unit leaders with regard to transactional leadership.

✚ *Hypothesis 7-3:* There is a difference in laissez-faire ratings between the self-ratings of the different leaders ( $H_{0 \text{ laissez-faire}}$ :  $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$ ;  $H_{A \text{ laissez-faire}}$ :  $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$ ).

The calculated F-value (0.94) is smaller than the critical F-value (2.01); therefore the null hypothesis is accepted. This implies that there is no difference in the self-ratings of scientists as unit leaders with regard to laissez-faire leadership.

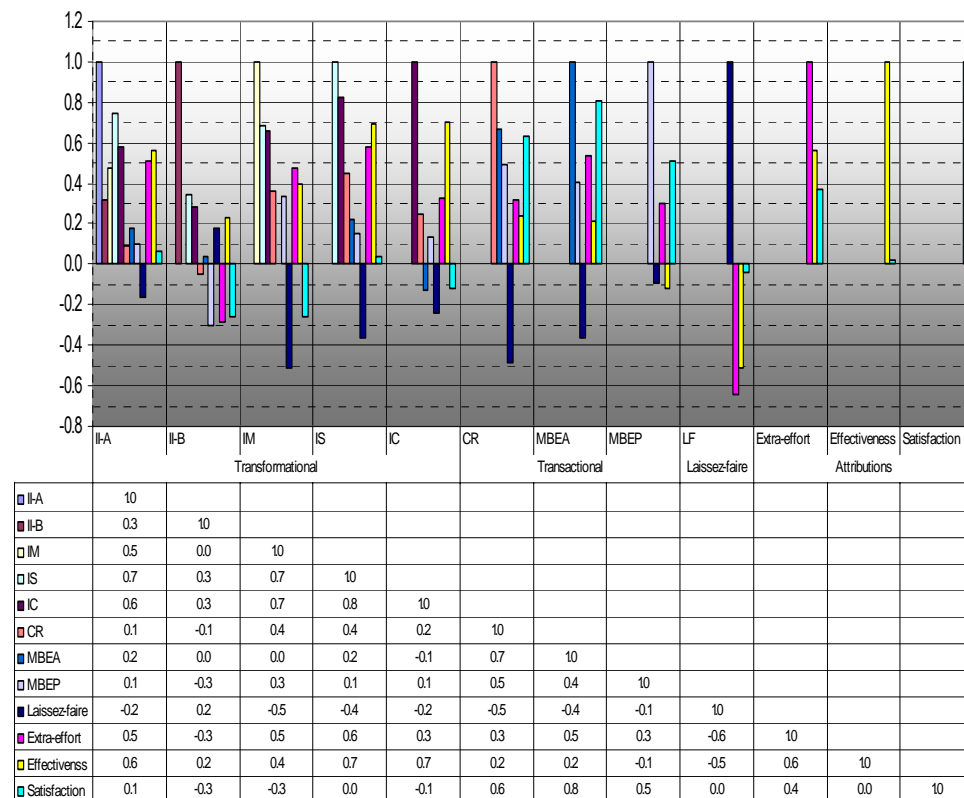
✚ *Hypothesis 7-4:* There is a difference in attribution ratings between the self-ratings of the different leaders ( $H_{0 \text{ attributions}}$ :  $\mu_{\text{leader A}} = \mu_{\text{leader B}} = \mu_{\text{leader C}} = \mu_{\text{leader D}} = \mu_{\text{leader F}} = \mu_{\text{leader G}} = \mu_{\text{leader H}} = \mu_{\text{leader I}} = \mu_{\text{leader K}} = \mu_{\text{leader L}} = \mu_{\text{leader M}} = \mu_{\text{leader N}} = \mu_{\text{leader O}}$ ;  $H_{A \text{ attributions}}$ :  $\mu_{\text{leader A}} \neq \mu_{\text{leader B}} \neq \mu_{\text{leader C}} \neq \mu_{\text{leader D}} \neq \mu_{\text{leader F}} \neq \mu_{\text{leader G}} \neq \mu_{\text{leader H}} \neq \mu_{\text{leader I}} \neq \mu_{\text{leader K}} \neq \mu_{\text{leader L}} \neq \mu_{\text{leader M}} \neq \mu_{\text{leader N}} \neq \mu_{\text{leader O}}$ ).

The calculated F-value (2.31) is larger than the critical F-value (2.18); therefore the null hypothesis is rejected. This indicates that there is a difference in the self-ratings of the different scientists as unit leaders with regard to attributions (extra-effort, effectiveness and satisfaction).

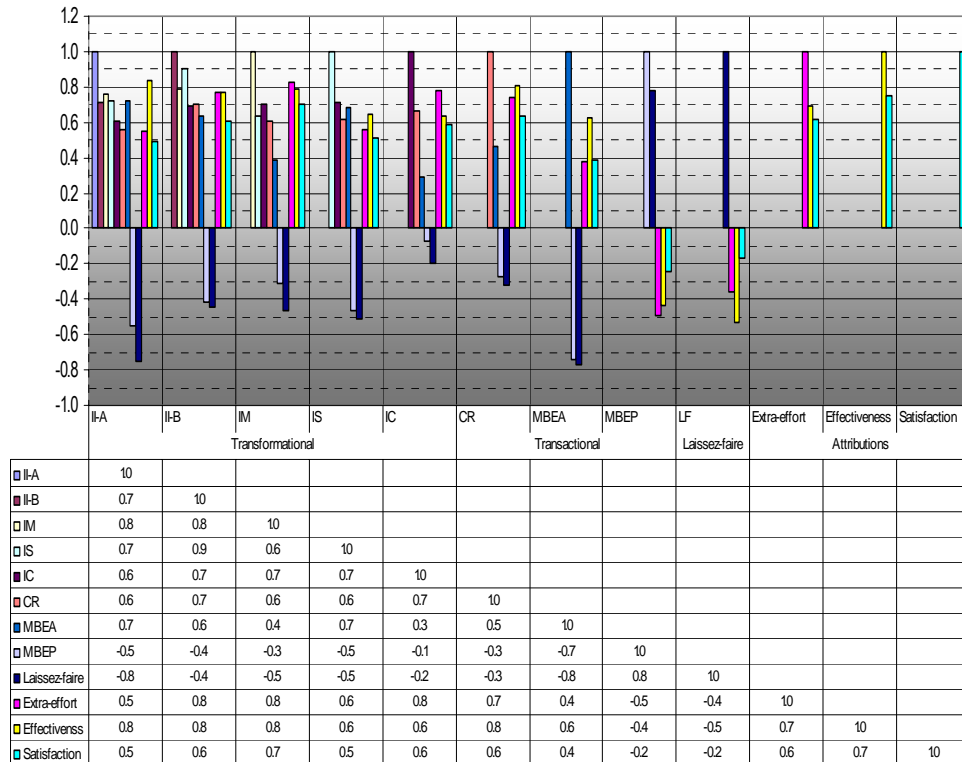
#### 4.5 Correlations (Figures 4.19–4.21, Chapter 4)

Figures 4.18, 4.29 and 4.20

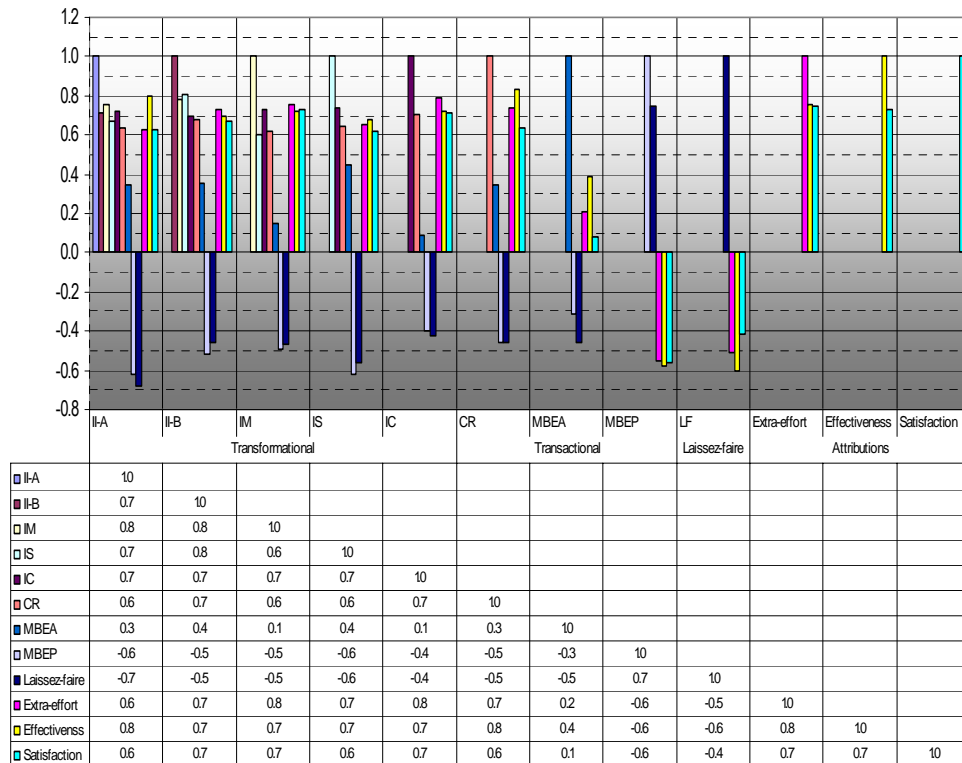
Three correlation matrixes are discussed and compared with each other. These include Figure 4.18 (self-ratings of scientist as unit leaders), Figure 4.19 (only supervisor ratings) and Figure 4.20 (all raters' ratings, excluding scientists as unit leaders).



**Figure 4.18:** Correlation matrix for scientists as unit leaders' ratings.  
Notes: All coefficients are statistically significant,  $p < 0.01$  and  $n = 15$  scientists as unit leaders.



**Figure 4.19:** Correlation matrix for supervisor ratings.  
Notes: All coefficients are statistically significant,  $p < 0.01$  and  $n = 15$  scientists as unit leaders.



**Figure 4.20:** Correlation matrix for all raters (assessors), excluding scientist unit leaders.  
Notes: All coefficients are statistically significant,  $p < 0.01$  and  $n = 15$  scientist unit leaders.

The following is significant regarding the correlation matrix values of scientists as unit leaders in terms of their own ratings, those of their supervisors and those of all the raters excepting the ratings of scientists as unit leaders.

4.5.1 No correlation (leaders) versus some correlation (supervisors and all raters, excluding leaders). It is noteworthy that the ratings of scientists as unit leaders (Figure 4.18) showed *no correlation* between:

- Inspirational motivation (IM) and idealised influence behaviour (II-B), whereas both the supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) did indicate a very strong positive correlation (0.8) between these two dimensions. The results of the ratings of the leaders indicate that there is a weaker relationship between inspirational motivation and idealised influence behaviour; whereas supervisors' and all other raters' (excluding leaders) results indicate that there is a very strong relationship between these two dimensions of transformational leadership. This result indicates that inspirational motivation would positively influence idealised influence behaviour. Therefore, if all groups are included, except for the leaders, then a high rating could be expected on individual motivation (IM) when idealised-influence behaviour (II-B) achieves a high rating.
- Management-by-objective active and idealised influence behaviour (II-B), whereas both supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) did indicate a relatively strong positive correlation (0.6 and 0.4 respectively). This indicates that when supervisors' and other raters' (excluding leaders') ratings of management-by-exception active (focussing attention on irregularities and mistakes and then concentrating on them by giving them full attention) increase, so does idealised influenced behaviour (talking about important values and beliefs, specifying the importance of having a strong sense of purpose, considering the moral and ethical consequences of decisions and emphasising the importance of having a collective sense of mission).
- Management-by-objective active and inspirational motivation (IM), whereas supervisors (Figure 4.19 and all raters (excluding leaders, Figure 4.20) indicate that there is a positive relationship between these dimensions (0.4 and 0.1 respectively). This implies that if management-by-exception is improved, so would inspirational motivation be. It is, however, noteworthy that supervisors perceive this to be more the case than do all other raters. Although all the raters (excluding leaders) believe that there is a positive relationship, this relationship is actually very small.
- Satisfaction and intellectual stimulation, whereas supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) did indicate a positive relationship between these two

dimensions of attribution and transformational leadership (0.5 and 0.6 respectively). This finding indicates that supervisors and all raters (excluding leaders) believe that satisfaction with leadership ratings (proper use of methods that is satisfying and working with others in a satisfactory way) would improve if the results for intellectual stimulation improve (leaders stimulate the efforts of staff members to be innovative and creative, and induce them to look at problems from many different perspectives).

- Satisfaction and laissez-faire leadership, whereas supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) did indicate a negative relationship between these two dimensions of attribution and laissez-faire leadership (-0.2 and -0.4 respectively). This finding is rather interesting, indicating that although leaders' ratings show that there is no relationship between satisfaction with leadership and a laissez-faire leadership style, both the supervisors' and all raters' (excluding leaders) results indicate that there is a negative relationship. The conclusion is that the raters' results on satisfaction with leadership (using good leadership methods and working with others in a satisfactory way) would bring about low laissez-faire ratings (avoiding getting involved when important issues arise, being absent when needed, avoiding making decisions and delaying response to urgent questions).
- Satisfaction and effectiveness; whereas supervisors (Figure 4.19) and all raters (excluding leaders Figure 4.20) did indicate a positive relationship between these two dimensions of attribution (both rated 0.7). This indicates that supervisors' and all raters' (excluding leaders) ratings show that if satisfaction with leadership increases (proper use of methods that is satisfying and working with others in a satisfactory way), so would effectiveness (effective in meeting the job-related needs of others, effective in representing the group, effective in meeting organisational requirements and leading a group that is effective), whereas leaders' ratings indicated that there is no relationship between leadership satisfaction and leadership effectiveness.

#### 4.5.2 Positive correlations (leaders) versus negative correlations (supervisors and all raters, excluding leaders).

It is significant that scientists as unit leaders' ratings (Figure 4.18) showed a *positive correlation* with some of the transformational, transactional and laissez-faire leadership dimensions, including some attribution dimensions, whereas both supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) showed a *negative correlation* for these same dimensions. These positive (scientists as unit leaders) and negative (supervisors and all raters except leaders) correlations can be outlined as follows:

- Leaders indicated a positive correlation between the transactional leadership dimension: management-by-exception passive (MBEP) and transformational leadership dimensions: idealised influence attributes (II-A), inspirational motivation (IM), intellectual stimulation (IS), individual consideration (IC), whereas supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) indicated a negative correlation between these leadership dimensions. This leads to the conclusion that if leaders rate management-by-exception passive high (failing to interfere until problems become serious, waiting for things to go wrong before taking action, showing firm belief that “if it ain't broken, don't fix it”, and demonstrating that problems must become chronic before action is taken), the ratings for transformational leadership dimensions, such as idealised influence attributes (II-A), inspirational motivation (IM), intellectual stimulation (IS), and individual consideration (IC) would increase. The ratings of supervisors and all other raters (excluding leaders), on the other hand, indicated that the opposite is true. That is, managing by means of management-by-exceptions passive would negatively influence the transformational leadership style dimensions: idealised influence attributes (II-A), inspirational motivation (IM), intellectual stimulation (IS), and individual consideration (IC).
- The ratings of leaders (Figure 4.18) on management-by-exception passive (MBEP) also indicated a positive correlation with both management-by-exception active (MBEA) and contingent reward (CR), whereas supervisors (Figure 4.20) and all raters (excluding leaders, Figure 4.20) indicated a negative correlation between management-by-exception passive (MBEP) and both management-by-exception active (MBEA) and contingent reward (CR). This finding indicates that if the ratings of leaders are high on management-by-exception passive (MBEP) (failing to interfere until problems become serious, waiting for things to go wrong before taking action, showing firm belief that “if it ain't broken, don't fix it”, and demonstrating that problems must become chronic before action is taken) it would improve management-by-exception active (MBEA). It would improve the focus of attention on irregularities, and more attention could be given to dealing with mistakes, which would help managers keep track of all mistakes, and help them direct attention towards failures in order to meet standards. The positive correlation of the ratings between management-by-exception passive (MBEP) and contingent reward (CR) also indicates that if management-by-exception passive (MBEP) is rated high, contingent reward (CR) will also increase. This means that the leaders are able to provide others with assistance in exchange for their efforts, discuss in specific terms who is responsible for achieving performance targets, and are able to make clear what rewards could be expected when performance goals are achieved with satisfaction. This, however, is not the situation for both supervisors and all others (excluding leaders) when studying their correlation

ratings (Figures 4.19 and Figure 4.20). These indicate that the opposite is true when leaders manage in terms of management-by-exception passive (MBEP).

- On the laissez-faire leadership style, leaders' correlation matrix (Figure 4.18) indicated a positive relationship with idealised influence behaviour (II-B), whereas supervisors (Figure 4.19) and all raters (excluding leaders, Figure 4.20) indicated a negative correlation between these two dimensions. It appears that if leaders rate laissez-faire leadership low, in other words, the leaders do not get involved until problems become serious, wait for things to go wrong before they take action, show a firm believe in "if it ain't broken, don't fix it", or if they delay to respond to urgent questions, it would positively improve the rating of idealised influence behaviour (talking about most important values and believes, specifying the importance of having a strong sense of purpose, considering the moral and ethical consequences of decisions, and emphasising the importance of having a collective sense of mission). However, the ratings of supervisors and all raters (excluding leaders) indicated the opposite. This result indicates that the ratings for laissez-faire leadership have a negative relationship with idealised-influence behaviour.
- On the extra-effort dimension of attributions, leaders' ratings (Figure 4.18) were positively correlated to management- by-exception passive (MBEP), whereas supervisors' (Figure 4.19) and all raters' (excluding leaders, Figure 4.20) extra-effort ratings were negatively correlated to the management- by-exception passive (MBEP) dimension of transactional leadership. This finding indicates that when leaders' ratings on extra-effort improves, so does management-by-exception passive (MBEP), whereas supervisors' and all raters' (excluding leaders) ratings indicate that this style of management will not induce others to do more than they are expected to do, nor would it heighten their desire to succeed, nor would it increase their desire to try harder.
- Leaders' ratings (Figure 4.18) on the satisfaction dimension of attributions indicate a relatively strong positive correlation with management-by-exception passive (MBEP), whereas supervisors' (Figure 4.19) and all raters' (excluding leaders Figure 4.20) indicated a negative correlation between satisfaction and management-by-exception passive (MBEP). This leads to the conclusion that leaders view subordinates as satisfied with them if they follow a management-by-exception passive (MBEP) leadership style, whereas supervisors and all raters (excluding leaders) indicate that the opposite to be true. This is especially the case for of all raters (excluding leaders).

4.5.3 Negative correlations (leaders) versus positive correlations (supervisors and all raters, excluding leaders).

- Leaders' ratings (Figure 4.18) showed negative correlations between contingent reward (CR) and idealised influence behaviour (II-B), between management-by-exception active (MBEA) and individual consideration (IC), between laissez-faire and management-by-exception passive (MBEP), between extra-effort and idealised influence behaviour (II-B), between satisfaction and idealised influence behaviour (II-B), between satisfaction and inspirational motivation, and between satisfaction and individual consideration. Both supervisors' (Figure 4.19) and all raters' (excluding leaders, Figure 4.20) correlations between these dimensions were positive.
- This leads to the conclusion, for example, that the ratings of leaders indicate that if they provide others with assistance in exchange for their effort, or discuss in specific terms who is responsible for achieving performance targets, their idealised influence behaviour would be seen in a negative light, whereas this is not the case with the correlation ratings of supervisors and all raters (excluding leaders).
- Similarly, leaders' ratings indicated that when they manage in terms of management-by-exception active (MBEA), they would be seen as not having individual consideration (IC), i.e. spending time teaching and coaching, treating others as individuals rather than just as a member of the group, considering each individual as having different needs, or helping others to develop their strengths. This is, however, not indicated by the ratings of supervisors and all raters (excluding leaders), since their ratings have a positive correlation between these two dimensions.
- Leaders' ratings also indicated a negative correlation between laissez-faire leadership and management-by-exception passive (MBEP). This implies that leaders' ratings on laissez-faire leadership (avoiding getting involved, being absent when needed, avoiding making decisions and delaying response to urgent questions) will negatively impact on the ratings of management-by-exception passive (MBEP), that is, failing to intervene when problems become serious, waiting for things to go wrong, etc., whereas supervisors and all raters (excluding leaders) do not perceive it this way.
- Leaders' correlation ratings between extra-effort and idealised influence behaviour (II-B), indicate that if they get others to do more than they are expected to do, heighten others' desire to succeed and increase others' willingness to try harder, it would have a negative effect on their talking about the most important values and beliefs, a negative effect on the importance of having a strong sense of purpose, a negative effect on considering moral and ethical consequences, and a negative effect on emphasising the importance of having a collective



sense of mission. This is not the case with the correlation ratings of supervisors and all raters (excluding leaders).

- Leaders' negative correlation ratings between satisfaction and idealised influence behaviour (II-B), between satisfaction and inspirational motivation, and between satisfaction and individual consideration indicate that, if they use methods of leadership that are satisfying and work with others in a satisfactory way, their emphasising having a collective sense of mission, their considering moral and ethical consequences, their confidence in expressing which goals would be achieved, their articulating a compelling vision of the future, their effort in helping others to develop their strengths, and their time spent on teaching and coaching would be seen in a negative light. This is, however, not the case with the correlation ratings of supervisors and all raters (excluding leaders).

#### 4.5.4 Positive correlations between all the ratings of all raters.

The correlation values for leaders (Figure 4.18), supervisors (Figure 4.19) and all other raters (Figure 4.20) indicated strong positive relationships between the following dimensions:

- Inspirational motivation and idealised-influence active;
- Intellectual stimulation and idealised-influence active;
- Individual consideration and idealised-influence active;
- Extra-effort and idealised-influence active;
- Effectiveness and idealised-influence active;
- Management-by-exception passive and idealised-influence behaviour;
- Individual stimulation and inspirational motivation;
- Individual consideration and inspirational motivation;
- Contingent reward and inspirational motivation;
- Laissez-faire leadership and inspirational motivation;
- Extra-effort and inspirational motivation;
- Individual consideration and intellectual stimulation;
- Contingent reward and intellectual stimulation;
- Laissez-faire leadership and intellectual stimulation;
- Extra-effort and intellectual stimulation;
- Effectiveness and intellectual stimulation;
- Management-by-exception active and contingent reward;
- Laissez-faire leadership and contingent reward;
- Satisfaction and contingent reward;
- Extra-effort and laissez-faire leadership;

- Effectiveness and laissez-faire leadership;
- Effectiveness and extra-effort;
- Satisfaction and extra-effort.

Therefore, all the raters (leaders, supervisors, peers, subordinates and 'others') indicated that they perceive a positive correlation between the above-mentioned dimensions.

It is noteworthy on the positive correlations, that supervisors' (Figure 4.19) ratings indicated a much higher correlation between management-by-exception active and intellectual stimulation than those of all other raters (Figure 4.18 and Figure 4.20). This seems to indicate that supervisors tend to draw a positive correlation between focussing attention on irregularities, mistakes, keeping track of mistakes, directing attention towards failures and re-examining critical assumptions to questions whether they are appropriate, looking for different perspectives when solving problems, getting others to look at problems from many different angles. Leaders and all other raters indicated a positive correlation between these dimensions; however, not as strongly as supervisors did.

Another significant observation is the strong positive correlation leaders (Figure 4.18) drawn between satisfaction and management-by-exception active. Although supervisors and all other raters (excluding leaders) also indicated a positive correlation between these dimensions, it was not as strong. This seems to indicate that leaders' ratings point out that if they use methods of leadership that are satisfying and work with others in a satisfactory way, they are then focussing attention on irregularities and mistakes, and are also concentrating their full attention on dealing with the mistakes. All other raters (Figure 4.19 and Figure 4.20) do not perceive such a strong relationship between these characteristics.

#### **4.6 Regression analysis**

A regression model can be used to predict values for all the different leadership dimensions. For the purpose of this study, it was decided to predict values for satisfaction from the values of the different leadership styles (transformational, transactional and laissez-faire). Satisfaction was chosen for the regression model because of its smallest standard deviation compared with the other attribution dimensions (extra-effort and satisfaction).

From the regression model (Table 4.4), it is observed that 92.9 per cent of satisfaction is explained by the nine leadership style dimensions (II-A, II-B, IM, IC, IS, CR, MBEA, MBEP

and LZ). R<sup>2</sup> (adjusted R square in Table 4.8) is an important indicator of the accuracy of the regression equation. Typically, an R<sup>2</sup> that explains 80 percent or more of the variation is desired. In this case the nine leadership style dimensions explain 92.9 per cent of the variance in satisfaction. Therefore 92.9 per cent would yield a high confidence value in terms of the predictive accuracy.

**Table 4.4:** Regression model, predicting satisfaction (ratings of scientist unit leaders excluded).

<i>Regression Statistics</i>		ANOVA					
		<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Multiple R	0.979596						
R Square	0.959609	Regression	9	399.765078	44.4183420	113.512642	1.52367E-26
Adjusted R Square	0.928839	Residual	43	16.8262201	0.3913074		
Standard Error	0.625545	Total	52	416.591298			
Observations	52						

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
II-A	-0.082792	0.227370	-0.36413	0.717545	-0.541329	0.37574410	-0.54132921	0.37574410
II-B	-0.435629	0.207779	-2.09660	0.041948	-0.854656	0.01660354	-0.85465616	-0.01660354
IC	0.464580	0.166760	2.78591	0.007909	0.128276	0.80088524	0.12827641	0.80088524
IM	0.202994	0.245959	0.82531	0.413748	-0.293031	0.69901987	-0.29303119	0.69901987
IS	0.230788	0.265860	0.86808	0.390169	-0.305370	0.76694792	-0.30537073	0.76694792
CR	0.365381	0.190960	1.91338	0.062371	-0.019727	0.75049086	-0.01972755	0.75049086
MBEA	0.275249	0.166462	1.65352	0.105507	-0.060453	0.61095233	-0.06045348	0.61095233
MBEP	-0.232612	0.171284	-1.35804	0.181531	-0.578041	0.11281522	-0.57804109	0.11281522
LZ	0.355089	0.202761	1.75126	0.087031	-0.053818	0.76399749	-0.05381896	0.76399749

Since the calculated F-value (113.51) is higher than the critical F-value (1.52E-26), the regression equation is statistically significant at a 0.05 significance level (95 per cent). This seems to indicate that the set of regression coefficients in total are statistically significant from zero. Therefore, the regression equation shows the relationship between satisfaction and the nine leadership style dimensions.

Individual consideration (IC), one of the transformational leadership dimensions, explains the dependent variable (satisfaction) much more than any of the other variables and would be regarded as the strongest predictor of the regression equation. From a practical point of view, if the raters were to score high on individual consideration (IC) it would have the greatest influence on the dependent variable (satisfaction) and, since there is relatively strong positive correlation (0.7) between individual consideration and satisfaction (Figure 4.20), it would result in the same trend for satisfaction. Idealised-influence attributed (II-A) would be regarded as the weakest predictor in terms of satisfaction.

From the regression model in Table 4.8, it is assumed that the coefficients for the nine leadership dimensions are standardised. Standardised coefficients are useful when variables

are measured on different scales. In this study, all the variables were measured on the same scale (0=not at all; 1=once in a while; 2=sometimes; 3=fairly often, and 4=frequently, if not always).

The  $t$ -value measures the statistical significance of each of the individual regression coefficients. Table E.5, Appendix E, lists the critical values of  $t$  for given probability levels (in this case at a probability of 0.5 on significance for a two-tailed test, with  $d.f \infty$ , the value is 1.960). Two coefficients are found to be significant, namely, in decreasing order: individual consideration (IC) and idealised-influence behaviour (II-B). The calculated  $t$ -values for individual consideration (2.79) and idealised-influence behaviour (2.10) are higher than the critical  $t$ -value (1.960) for the above-mentioned coefficients. Therefore, they are significantly different from zero.

If the  $t$ -value indicated that a coefficient is not significant, it could mean the following:

- There is a low correlation between the dependent variable and that specific independent variable.
- There might/might not be some correlation between the specific independent variable and the dependent variable, but the variance explained in the dependent variable is explained much more by another variable which is a stronger predictor (being statistically significant).

If the correlation matrix (Figure 4.20) is considered, it is noted that both individual consideration (IC) and idealised-influence behaviour have a high correlation (0.7) with satisfaction. The same is true for inspirational motivation (IM). These three dimensions explain satisfaction more than any of the other dimensions. Idealised-influence attributed (II-A), intellectual stimulation (IS) and contingent reward (CR) also display a strong positive correlation (0.6), and management-by-exception passive (MBEP) a strong negative correlation (-0.6) with satisfaction. Idealised-influence attributed (II-A), intellectual stimulation (IS), contingent reward (CR) and management-by-exception passive (MBEP) are found to be statistically not significant, even with a high correlation with satisfaction; this phenomenon can be explained by co-linearity or multi-co-linearity. This is a situation where two or more of the independent variables are highly correlated and it can have damaging effects on multiple regressions (i.e.  $IS=0.7=IC$ ;  $IM=0.8=II-B$  and  $IC=0.7=IB$ ). When this condition exists, the estimated regression coefficients can fluctuate widely from sample to sample, making it risky to interpret the coefficients as an indicator of the relevant importance of predictor variables. However, both individual

consideration (IC) and idealised-influence behaviour (II-B) are likely to have a lot in common and it would still make sense that if both these dimensions are high, satisfaction would also be high. From a practical point of view, these two dimensions could be used in the workplace to determine the satisfaction of people with their leaders.

# CHAPTER 5

## 5. CONCLUSION AND RECOMMENDATION

### 5.1. Conclusion

Males dominated the survey (60 per cent), with females in the minority (40 per cent). Whites were in the majority followed by Blacks, Asians and Coloureds. The demographic results indicate that the majority of the responses are from white male scientists.

The average scores of the MLQ questionnaire for the Council for Geoscience ranged from 2 to 3 (rating scale out of 4) on the transformational leadership factors, with leaders B, I, M and D as exceptions. Participants in general perceive scientists as unit leaders more as transformational leaders as opposed to transactional leaders. The 2.5 rating on transformational leadership indicates that the unit leaders are often influential in the awareness of what is important.

The transformational leadership style ratings of scientists as unit leaders were similar to the ratings of their peers and 'others'. Supervisors and subordinates, however, rated them lower. This indicates that the groups above and below the leaders in the hierarchy perceive them notably less inspirational, motivational and influential than do the scientists as unit leaders themselves. This is a matter for concern. These leaders are generally the revenue producers and their subordinates need to believe in them and must be satisfied with the way they are managed else inherent problems might not be identified soon enough. It is acknowledged that scientists as unit leaders are more perceived to be transformational leaders, than transactional leaders; however, the difference in the ratings of both supervisors and subordinates and the scientists as unit leaders' own ratings (self-ratings) on transformational leadership is a matter for concern.

Transactional leadership ratings for the majority of leaders were between 2.0–3.0 on CR, and MBEA and 1.0–2.0 on MBEP, except for leaders A, B, D, H, I, K, M, N and O. Transactional unit leaders regard objective setting, motivation and control measures fairly important in performing their day-to-day tasks. The ratings obtained, indicate that unit leaders would be seen as people who prefer to monitor and take action before failures occur, rather than intervene after a mistake or non-compliance has been identified. Supervisors, peers and others rated the scientists as unit leaders higher on transactional leadership, except for subordinates who rated them lower. The variation in ratings was very small, 2.0–2.3 (rating scale out of 4).

Leaders are rated 0–1 (out of 4) on laissez-faire leadership style. The low rating on the laissez-faire leadership style confirms that leaders do get involved in important issues and have a need to be involved in the decision-making process. Supervisors, peers and subordinates rated scientists as unit leaders higher on laissez-faire leadership style than the rating they gave themselves (self-rating). Therefore, scientists as unit leaders perceive themselves to be more involved than do supervisors and subordinates.

Attribution ratings (extra-effort, effectiveness and satisfaction) varied from 2.0–3.0 (out of 4), except for leaders A, B, C, D, E, I, M and O. This seems to indicate that the unit leaders of the Council for Geoscience are inducing others to do more than they are expected to and are effective in meeting organisational requirements. The satisfaction dimension indicates that unit leaders often work with others in a satisfactory way. For attribution dimensions, supervisors and subordinates rated the scientists as unit leaders lower on extra-effort, effectiveness and satisfaction, whereas peers rated them higher. Supervisors are less satisfied with the leaders than subordinates are.

There is a difference in the self-ratings of the different leaders with regard to transformational and transactional leadership style and attribution (extra-effort, effectiveness and satisfaction), but not on the laissez-faire leadership style.

The ratings of scientists as unit leaders indicated no correlation between the dimensions mentioned below, whereas all other raters indicated some correlation:

- Inspirational motivation and idealised influence behaviour (correlation of 0.8).
- Management-by-objective active and idealised influence behaviour (correlation of 0.4–0.6).
- Management-by-objective active and inspirational motivation (correlation of 0.1–0.4).
- Satisfaction and intellectual stimulation (correlation of 0.5–0.6).
- Satisfaction and laissez-faire leadership (correlation of -0.2 to 0.4).
- Satisfaction and effectiveness (correlation of 0.7).

The ratings of scientists as unit leaders indicated a positive correlation between the dimensions mentioned below, whereas all other ratings indicated a negative correlation between these dimensions:

- Management-by-exception passive and transformational leadership dimensions.
- Management-by-exception passive and both management-by-exception active and contingent reward.

- Laissez-faire and idealised-influence behaviour (-0.4 to -0.5).
- Extra-effort and management-by-exception passive (-0.5 to -0.6).
- Satisfaction and management-by-exception passive (-0.2 to -0.6).

Leaders' ratings indicated negative correlations between the dimensions mentioned below, whereas all the other raters indicated a positive correlation between these dimensions.

- Contingent reward and idealised-influence behaviour (0.7).
- Extra-effort and idealised-influence behaviour (0.7–0.8).
- Management-by-exception active and individual consideration (0.1–0.3).
- Laissez-faire leadership and management-by-exception passive (0.7–0.8).
- Satisfaction and idealised-influence behaviour (0.6–0.7).
- Satisfaction and inspirational motivation (0.7).<sup>6</sup>
- Satisfaction and individual consideration (0.6–0.7).

The ratings of supervisors indicated a very strong correlation between management-by-exception active and intellectual stimulation, compared with all other raters.

The ratings of scientists as unit leaders (self-ratings) indicate a very strong correlation between satisfaction and management-by-exception active, whereas all other ratings do not indicate the same strong correlation.

The results obtained from the MLQ questionnaire for the leadership style of scientists in the Council for Geoscience are slightly different from those of United States companies. The Council for Geoscience, compared with US (United States) companies, rated lower on both transformational leadership and attribution dimensions (extra-effort, effectiveness and satisfaction) and higher on both transactional and laissez-faire leadership styles. This seems to indicate that the Council for Geoscience tends to follow a less inspirational and influential leadership style with more objective setting and less satisfying methods of leadership, compared with US companies (N=27,285).

## **5.2. Recommendations**

The average transactional leadership style of scientists as unit leaders of the Council for Geoscience rated above the average rating (2.1) for US companies (1.9). As statistically tested, all raters agreed on the transactional leadership style of scientists as unit leaders, indicating that transactional leadership is well established in the Council for Geoscience. A further study



could be undertaken to determine if a strong transactional leadership style is characteristic of scientists as leaders, i.e. whether a correlation exists between transactional leadership and scientists as leaders.

Transformational leadership development is recommended for the scientists as unit leaders of the Council for Geoscience. Statistically, it was established that both supervisors and subordinates rated the scientists as unit leaders lower on this leadership dimension. The average transformational leadership rating for the Council for Geoscience is also lower (2.5) compared with US companies (2.9). This would further support the above-mentioned recommendation.

It is important to note that false transformational leaders (seemingly transformational leaders with a self-absorbed tendency) should be distinguished from the genuine ones — those leaders interested in both themselves and others (Howell and Avolio, 1993; Bass and Steidlmeier, 1999). Gardner and Avolio (1988) state that, transformational leaders may impress their followers with the value of their capability and intentions, but to do so they must maintain their trustworthiness. Bass (1997) indicates that leaders who are not actually present as much may stretch the truth for a longer period of time before they lose the trust of their followers, but leaders close to their followers will spoil their trustworthy reputation with double standards and mistruths. Research by Barling, Slater and Kelloway (2000) showed that emotional intelligence is associated with three characteristics of transformational leadership (idealised influence, inspirational motivation and individualised consideration). It would be worthwhile to develop or improve the emotional intelligence of scientists as unit leaders in an effort to improve their transformational leadership style. Research by McColl-Kennedy and Anderson (2002) also indicate that transformational leadership is positively related to employees' feeling of optimism and negatively related to employees' frustration.

Optimism and employee frustration can be used in future surveys by the Council for Geoscience to determine the progress of transformational leadership development in the organisation. Empirical evidence links transformational leadership to followers' creativity and innovative ideas (Avolio and Bass, 2004). If the Council for Geoscience desires to improve creativity and the innovative ideas of personnel — which is likely like to give the organisation a competitive edge — it would be in their own interest to improve and develop transformational leadership styles in the organisation.

The leadership of an organisation influences the organisational culture. It is, however, important to note that leading is done from the top. Upper management is responsible for the implementation of the necessary changes to promote transformational leadership. At the same time, they need to guide and share a vision of the leadership style that should be emphasised in the organisation. Therefore, as an example, if upper management foresees a transactional leadership style for the organisation, it would be difficult for scientists as unit leaders to lead with a transformational leadership style. The leadership style of an organisation starts with upper management and is supported at each successive lower level. Therefore, the culture of an organisation is a reflection of upper management. Upper management with transformational tendencies will accommodate and support the creative input from their personnel. If upper management does not realise the importance of transformational leadership, the chances for the rest of the organisation to promote a transformational leadership culture in the organisation are not good.

Results indicated that there were differences between the self-rating correlations of the leaders and the ratings of all the other groups on the MLQ questionnaire dimensions, indicating that leaders perceive the influence of the different leadership dimensions differently than their followers (subordinates) and their supervisors (executive managers) do. This further indicates that leadership development is essential for scientists as unit leaders to help them in anticipating the needs of their supervisors and followers, and to assist them in dealing more effectively with these needs.

Supervisors' ratings indicated a very strong correlation between management-by-exception active and intellectual stimulation, whereas ratings of scientists as unit leaders indicated a very strong correlation between management-by-exception active and satisfaction. In both these cases, the ratings of the others indicated a much weaker correlation between these dimensions, indicating that supervisors anticipate that when scientists as unit leaders focus on monitoring the execution of tasks for problems that arise and then correct the problems to maintain current performance levels, it would result in the followers (subordinates) querying the proved and accurate ways of solving problems, which would then encourage them to query the techniques they use in order to improve upon them. The ratings of scientists as unit leaders, on the other hand, indicated that if they focus on monitoring the execution of tasks for problems that arise and then correcting those problems to maintain current performance levels, followers (subordinates) are then satisfied with their leadership because they follow leadership methods that are satisfying and, by doing so, they are working with others in a satisfactory way. These

above-mentioned correlation ratings of the supervisors and scientists as unit leaders are cause for concern as it indicates misperceptions of what satisfying leadership is and what is to be done to obtain satisfactory leadership. This finding indicates that leadership development for supervisors would also be recommended in order to get both upper management and middle management to “talk the same talk”, and “walk the same walk”.

One recommendation to consider is for the Council for Geoscience to employ people with adequate managerial skills in unit leader positions. These skills would include leadership traits, operational skills, financial skills, etc. The substantiation for this recommendation being that unit leaders have historically been promoted from the specialist science roles (either a master’s or doctorate qualification) based on previous successes in their science field.. However, this does not indicate that specialists cannot be good leaders (transformational) but, before their being employed in a leadership position, the question should be asked; “what are the leadership skills of this person?”

Staff is, after all, the most important asset of an organisation and scientists as unit leaders need to develop, satisfy, inspire and motivate staff while making a profit for (and giving valuable statutory input to) the organisation. The success of an organisation depends on its people and if they are not looked after, the organisation will pay the price. Therefore, a decision needs to be taken by the organisation (Council for Geoscience) that when scientists are employed as managers (unit leaders) or as members of the upper management cadre, they must have adequate managerial and leadership skills, and all parties have to agree with the competency and be satisfied with the management styles. A management -training programme should be completed by all the scientists as unit leaders, such as an MDP (management-development programme) that has already been initiated by the Council for Geoscience.

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# APPENDICES



# **APPENDIX A**

**Gantt chart: research timeline**



# **APPENDIX B**

**Permission letter and full-range leadership theory scales**



855 Oak Grove Avenue, Suite 215 Menlo Park, CA 94025  
650-322-6300 fax 650-322-6398 www.mindgarden.com

Date: June 22, 2006

To whom it may concern,

This letter is to grant permission for: Madelein von Wiellign  
to use the following copyright material;

Instrument: Multifactor Leadership Questionnaire 3<sup>rd</sup> Edition

Author: Bruce J. Avolio and Bernard M. Bass

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In addition, five (5) sample items from the instrument may be reproduced for inclusion in a proposal, thesis or dissertation.

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Sincerely,

Vickie Jaimez  
Director of Operations

Appendix B: Scales, consisting of the full-range leadership theory.

#### Transformational leadership

1. *Idealised influence (attribute)* refers to how idealised the leader is and whether the leader is perceived as confident and powerful in his or her abilities.
2. *Idealised influence (behaviour)* refers to actions centred on values, beliefs and sense of mission.
3. *Inspirational motivation* is about energising followers by viewing the future with optimism, stressing ambitious goals, and communicating that the vision is achievable.
4. *Intellectual stimulation* centres on appealing to followers' sense of logic and analysis, as well as challenging followers to think creatively and to look at problems differently.
5. *Individualised consideration* represents a considerate leader who advises supports and coaches others, paying attention to their individual needs and helping them to develop and to self-actualise.

#### Transactional leadership

1. *Contingent-reward leadership* refers to providing followers with material and psychological rewards contingent on the fulfilment of transactional obligations.
2. *Management-by-expectation active* is a corrective form of leadership, in which the leader is actively vigilant in ensuring that standards are met.
3. *Management-by-expectation passive* represents the reactive leader who intervenes only after failures have occurred.

#### Laissez-Faire leadership

1. *Laissez-faire leadership* refers to the avoidance of decision-making and the abdication of responsibility.

# **APPENDIX C**

**MLQ instrument**

Studies published which tested the factor structure of the MLQ instrument (after Antonakis *et al.*, 2002: 263).

Authors	Article title	Version	Country	Sample description	Number of factors comprising model
Hater & Bass (1988)	Superiors' evaluations and subordinates' perceptions of transformational and transactional leadership.	Form 5, 1985	USA	Delivery firm	6 (CH, IS, IC, CR, MBEA, MBEP)
Yammarino, Spangler & Bass (1993)	Transformational leadership and performance: a longitudinal investigation.	1985 modified	USA	Military	5 (CH/IM, CR/IC, MBEA, VBEP, LF)
Tepper & Percy (1994)	Structural validity of the Multifactor Leadership Questionnaire.	Form X, 1990	USA	Students, financial institution	2 (CH/IM, CR)
Druskat (1994)	Gender and leadership style: transformational and transactional leadership in the Roman Catholic Church	Form 8Y, 1990	USA	Church	5 (CH/IC, IS/IM, CR, MBEA, MBEP/LF)
Bycio <i>et al.</i> (1995)	Further assessment of Bass's (1985) conceptualisation of transactional and transformational leadership.	Form 1, 1985	Canada	Health services	5 (CH, IS, IC, CR, MBE)
Koh <i>et al.</i> (1995)	The effects of transformational leadership on teacher attitudes and student performance in Singapore.	Form 5S, 1985	Singapore	Educational institutions	5(CH, CR, MBEA, MBEP, LF)
Den Hartog <i>et al.</i> (1997)	Transactional versus transformational leadership: an analysis of the MLQ.	Form 8Y, 1989	Netherlands	Various private and public firms	3 (TF,TR, LF)
Lievens, Van Geit, & Coesier (1997)	Identification of transformational leadership qualities: an examination of potential biases.	Form 8Y, 1989	Netherlands	Various private and public firms	4 (IS/IC/IM, CR, MBEA)
Hinkin, Tracccy & Enz (1997)	Scale construction: developing reliable and valid measurement instruments.	Form 5X, 1990	USA	Students, hotels	3 (IM, IC, IS)
Tracey and Hinkin (1998)	Transformational leadership or effective managerial practices.	Form 5X, 1990	USA	Hotels	1 (IM, IC, IS)
Geyer & Steyrer (1998)	Transformational leadership and objective performance in banks.	Form 5R	Germany	Banks	4 (CH/IS/IM/IC, IC/CH, CR/IC, MBEP/LF)
Carless (1998a)	Assessing the discriminant validity of transformational leader behaviour as measured by the MLQ.	Form 5X	Australia	Banks	3 (CH, IS, IC)
Avolio <i>et al.</i> (1999)	Re-examining the components of transformational and transactional leadership using the Multifactor Leadership Questionnaire.	Form 5X	Primarily USA	Various business firms	6 (CH/IM, IS, IC, CR, MBEA, MBEP/LF)
Tejeda <i>et al.</i> (2001)	The MLQ revisited: psychometric properties and recommendations.	Form 5X, 1993	USA	Various business firms	9 (IIA, IIB, IM, IS, IC, CR, MBEA, MBEP, LF)

CH = charisma; IIA = idealised influence attributed; IIB = idealised influence behaviour; IM = inspirational motivation; IS = intellectual stimulation;  
 IC = individualised consideration; CR = contingent rewards; MBEA = management-by-exception active MBEP = management-by-exception passive;  
 MBE = management-by-exception; LF = laissez-faire leadership.

Fit indices of MLQ validation models (after Antonakis *et al.*, 2002: 287).

Models	$\chi^2$	df	$\chi^2/df$	RMSEA	CFI	AIC
<i>Pooled data (N= 3368)</i>						
Null model	50,360.45	630				
Model 1: One factor	14,947.60	595	25.12	.085	.711	15,161.60
Model 2: Two factors	11,865.93	594	19.98	.075	.773	12,081.93
Model 3: Three factors	12,930.97	591	21.88	0.79	.752	13,152.97
Model 4: Four factors	10,722.73	591	18.14	.071	.796	13,152.97
Model 5: Five factors	6767.46	579	11.69	.056	.876	7013.46
Model 6: Six factors	6482.60	573	11.31	.055	.881	6740.60
Model 7: Seven factors	5965.54	566	10.54	.053	.891	6237.54
Model 8: Eight factors	5622.47	566	9.93	.052	.898	5894.47
Model 9: Full nine factors	5306.32	558	9.51	.050	.905	5594.32
<i>Multi-sample data (males = 2289; females = 1079)</i>						
Null model	51,121.01	1260				
Model 1: One factor	15,694.10	1190	13.19	.060	.709	16,122.10
Model 2: Two factors	12,663.76	1188	10.66	.054	.770	13,095.76
Model 3: Three factors	13,687.41	1182	11.58	.056	.749	14,131.41
Model 4: Four factors	11,526.49	1182	9.75	.051	.793	11,970.49
Model 5: Five factors	7555.71	1158	6.52	.041	.872	8047.71
Model 6: Six factors	7267.61	1146	6.34	.040	.877	7783.61
Model 7: Seven factors	6715.95	1132	5.93	.038	.888	7259.95
Model 8: Eight factors	6369.42	1132	5.63	.037	.95	6913.42
Model 9: Full nine factors	6047.39	1116	5.42	.036	.901	5188.03

CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike information criteria. All  $\chi^2$  results were significant at  $p < .001$ . Model 1 = one general first-order factor; Model 2 = two correlated first-order factors of passive and active leadership; Model 3 = three correlated first-order factors of transformational, transactional, and laissez-faire; Model 4 = three correlated first-order factors of transformational, transactional, and passive leadership; Model 5 = six correlated first-order factors of idealised influence/idealised influence behaviour/inspirational motivation, intellectual stimulation, individualised consideration, contingent reward, active management-by-exception, and passive leadership; Model 6 = seven correlated first-order factors of idealised influence attributed/idealised influence behaviour/inspirational motivation, intellectual stimulation, individualised consideration, contingent reward, active management-by-exception, passive management-by-exception, and laissez-faire leadership; Model 7 = eight correlated first-order factors of idealised influence attributed/idealised influence behaviour, inspirational motivation, intellectual stimulation, individualised consideration, contingent reward, active management-by-exception, passive management-by-exception, and laissez-faire leadership; Model 8 = eight correlated first-order factors of idealised influence attributed, idealised influence behaviour, inspirational motivation, intellectual stimulation, individualised consideration, contingent reward, active management-by-exception, and passive leadership; Model 9 = full nine-factor model.



Invariance of the nine-factor MLQ model: males versus females (after Antonakis *et al.*, 2002: 288).

Testing conditions for nine-factor model	$\chi^2$	df	$\Delta\chi^2$	$\Delta df$
Condition: 1 Factor loading pattern same for the two groups	6047.39	1116		
Condition: 2 Factor loadings identical	6090.87	1143	43.48*	27
Condition: 3 Factor loadings identical (except items 20 & 33)	6078.12	1141	30.73	25
Condition: 4 Factor loadings and construct co-variances identical	6198.53	1179	151.14***	63
Condition: 5 Factor loadings (except item 20 & 33) and construct co-variances identical	6170.18	1177	122.79***	61
Condition: 6 Factor co-variances identical	6125.04	1152	77.65***	36
Condition: 7 Factor loadings and error variances identical	6166.00	1179	118.61***	63
Condition: 8 Factor loading and error variances (except items 20 & 33) identical	6135.51	1175	88.12*	59
Condition: 9 Factor loadings, error variances, and construct co- identical	6266.93	1214	219.54***	98
Condition: 10 Factor loadings and error variances (except items 20 & 33), and factor co-variances identical	6220.96	1210	173.57***	94
Condition: 11 Factor loadings, manifest intercepts, and latent means identical	6134.94	1169	87.55***	53
Condition: 12 Factor loadings and manifest intercepts (except items 20 & 33) and latent means are identical	6121.95	1165	74.55*	49

\* $p < 0.5$ .

\*\*\*  $p < .001$ .

$\Delta\chi^2$  was calculated by subtracting model  $\chi^2$  from that of the baseline model (Model 1).  $NF = 1079$ ;  $NM = 2289$ .

The goodness-of-fit results for contextual conditions (Antonakis *et al.*, 2002: 289).

Model	N	$\chi^2$	df	$\chi^2/df$	CFI	RMSEA	AIC
<i>Competing model results for high-risk conditions</i>							
Model 1: One factor	502	847.67	62	13.67	.830	.159	903.667
Model 2: Two factors	502	443.20	60	7.39	.917	.113	503.197
Model 3: Three factors	502	799.09	59	13.54	.839	.158	861.088
Model 4: Four factors	502	259.53	57	4.55	.956	.084	325.530
Model 5: Five factors	502	154.90	50	3.10	.977	.065	234.895
Model 6: Six factors	502	146.54	47	3.12	.978	.065	232.535
Model 7: Seven factors	502	118.47	41	2.89	.983	.061	216.466
Model 8: Eight factors	502	93.85	41	2.29	.989	.051	191.847
Model 9: Full nine factors	502	72.24	36	2.09	.991	.047	183.242
<i>Nine-factor model results for all conditions<sup>4.38</sup></i>							
1. High risk	502	75.24	36	2.09	.991	.047	183.242
2. Stable business	1240	473.27	108	4.38	.963	.052	617.268
3. Majority males	906	485.74	108	4.50	.957	.062	629.740
4. Majority females	481	69.89	36	1.94	.984	.044	177.893
5. Low-level leaders	1887	479.77	72	6.66	.959	.067	605.772

CFI = Comparative Fit Index; RMSEA = Root Square Error of Approximation; AIC = Akaike information criteria. All  $\chi^2$  results were significant at  $p < .01$ . A brief description of the samples included in each condition was as follows: "high risk" (military platoon, fire departments); "stable business" (various business firms); "majority males" (military platoon, gas exploration, fire departments, military recruiting unit); "majority females" (nurse educators, nurse educator executives); "low-level leaders" (military platoon, gas exploration, period-operative nurses, hospitality/retail).

# **APPENDIX D**

**Raw data**

Raters	Leader	Questions answered by participants																			
		Transformational leadership																			
		II-A	II-A	II-A	II-A	II-B	II-B	II-B	II-B	IM	IM	IM	IM	IS	IS	IS	IS	IC	IC	IC	IC
0	A		3	3	3	1	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
0	B		3			2	2	3	0	4	3	1	3	3	2	3	3	2	3	3	3
0	C	3	3	4	3	3	3	4	4	4	4	3	3	4	3	3	4	3	4	3	4
0	D	3	3	3	3	3	3	4	3	4	3	3	3	4	3	3	3	4	3	4	3
0	F	2	3	2	3	0	2	3	2	2	3	3	3	3	3	2	2	1	3	4	2
0	G	3	3		3	3	3	4	4	2	2	2	2	3	1	3	2	3	2	3	2
0	H	4	3	3	3	3	4	4	3	4	4	3	3	4	3	3	3	3	4	2	3
0	I	3	3	4	3	3	3	3	1	3	3	2	2	3	3	3	3	3	3	3	3
0	K	3	4	3	2	3	2	4	3	3	3	3	3	3	4	3	3	4	4	4	4
0	L	3	4	4	4	3	4	4	3	3	3	3	3	4	4	4	4	3	4	4	4
0	M	4	3	3	3	3	2	3	2	4	4	4	4	2	4	4	4	4	3	4	4
0	N	2	4	2	2	4	2	4	4	1	3	2	2	2	3	3	2	4	2	2	3
0	O		4	3	2	2	3	4	3	3	3	2	3	3	3	1	1	4	2	4	4
1	A	1	1	1	1	1	0	1	1	0	0	0	2	1	1	2		2	2		
1	B	2	2	2	3	2	3	3	3	3	3	2	4	2	3	2	2	1	3	3	1
1	C	1	2	2	3	3	3	2	4	2	3	3	2	3	4	2	4	1	3		
1	D	1	2		2	2	2	3	1	2	2	1	2	3	2			2	1	1	
1	E	3	0	2	1	2	2	2	1	2	3	0	4	1	1	1		3	1		
1	F	1	3	1	1	3	2	2	2	2	1	1	2	3	3	2	1	1	3		
1	G	1	4	4	4	4	4	0	1	0	4	1	0	3	1	3	4	1	2	1	2
1	H	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
1	I	3	3	4	3	4	4	3	3	3	4	3	4	4	3	4	2	4	2	4	3
1	J	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1	K	1	2		1	0	0	2	1	0	1	0	1	2	1		1	1	3		
1	L	2	3		3	3	1	2	0	1	2	1	1	3	2	1	2	2	1		
1	M	3	3	3	3	3	2	1	2	4	4	3	4	2	3	2	3	4	3	2	
1	N	1	0	3	1	4	3	2	3	1	3	1	0	3	3	4	1	1	2	3	1
1	N	1	2		0	2	0	2	0	0	0	0	1	1	3		2	2	3		
1	O	1	3		4	1	3	1	1	2	2	3	3	2	1		1	0	2		
2	C	3	3	4	3	2	3	4	3	3	3	3	3	3	3	4	4	3	3	4	4
2	D	2	2	0	3	2	2	3	3	2	3	3	3	4	0	2	3	2	2	2	2
2	D	3	3	3	2		3	3	3	3	3	3	3	3	3	3	3	3	3	2	3
2	D	3	3	4	3	2	3	3	3	3	3	3	3	3	2	3	3		3	3	
2	F	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3
2	F	3	3	3	3	3	2	2	2	2	2	2	3	3	3	2	2	4	3	3	3
2	H	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2	3	1	3	2	3
2	H	3	3	3	3	4	3	3	3	2	2	3	3	3	4	2	2		3	3	1
2	I	4	4	4	4		3	3	3	4	4	4	4	3	3	3	3	3	4	4	3
2	I		3	3										2							
2	L	4	4	3	3	1	3	3	3	3	3	3	3	3	2	2	3	2	2	3	3
2	M	3	3	4	3	4	4	3	4	4	4	4	4	4	3	3	2	3	3	3	2
2	N	0	1	1	1	1	0	3	1				2	2	3	1		0		1	0
2	N		2	4	2	3	2	4	4	2	4	2	3	4	3	3	4	3	3	2	3
3	A	4	4	4	4	1	4	4	4	4	4	4	4	3	3	1	3	2	4	4	4
3	A	3	0	4	4	0	3	0	3	3	4	3	4	2	3	2	3	2	0	2	3
3	A	1	3	2	1	1	2	4	1	1		1		2		1		3	2		
3	A	0	0	2	3	0	0	1	0	0	0	0	3	3	2	0		0	1	0	1
3	A	3	4	4	2	2	2	3	4	2	1	2	4	3	4	3	2	2	4	4	2
3	A		4	4		0	4	4	4	4	4	3	4		4			2	4	4	
3	A	1	3	2	1	1	2	3	1	4	3	2	2	3	3	1	2	0	3	3	0
3	A	4	4	4	4	2	3	4	3	2	3	3	4	0	2	4	4	2	4	4	4
3	A	3	4	4	3	4	3	4	4	3	3	3	2	2		2	2	2	4	3	3
3	A	2	3	3	0	1	1	3	1	3	2	1	2	1	3	2	1	1	4	3	2
3	A	3	3	3	3	3	3	4	3	3	3	3	3	4	0	3	3	3	2	4	3
3	A	3	4	4	3	3	1	4	1	3	3	2	2	3	3	1	2	0	4	2	1
3	A	4	3	4	4	0	3	4	2	2	3	4	4	3	4	4	2	2	4	4	3
3	B	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	B	1	2	2	4	3	2	2	1	4	3	4	3	2	1	1	1	1	2	2	1
3	B	2	4	3	3	2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2
3	B	2	2	3	3	3	4	3	2	2	4	4	3	2	3	4	4	3	3	3	3

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

II-A – Idealised influence (attributed)  
II-B – Idealised influence (behaviour)  
IM – Idealised motivation  
IS – Intellectual stimulation  
IC – Individual consideration

Raters	Leader	Questions answered by participants																				
		Transformational leadership																				
		II-A	II-A	II-A	II-A	II-B	II-B	II-B	II-B	IM	IM	IM	IM	IS	IS	IS	IS	IC	IC	IC	IC	
3	B		3	3	3	2		3	3	3	3	3	3	3	3	3	3	3	0	2	3	
3	B	3	3	3	4	0	3	3	3	4	4	4	4	3	4	4	3	4		2	4	
3	C	2	3	3	4	3	4	3	4	3	4	4	4	2	3	3	2	3	4	4	3	
3	C	3	2	3	3	1	3	2	2	4	3	3	2	2	2	2	1	2	3	3		
3	C	1	1	2	4	3	4	3		4	4	1	2	4	0	0	0	4	2		1	
3	C			2	0	2				0	0			0	1						0	
3	C	0	0	0	3	4	2	2	2	4	2	2	2	4	1	2	0	2	2	0	0	
3	C	2		2	2		3		2		3	3	3	3	2	3	3	3	0	3	2	
3	C		4	4	4		4	3	3		3	2	4	3	0	4	4	4	4	4	4	
3	C	0	2	3	1	0				4			0	2		2		0	0	1		
3	D	0		0	4	0	3	1	4	2	1	0	2	2	1	2	1	2	4	0	2	
3	D	1	0	1	3	1	0	1	2	2	2	2		2	0	2		2		1	1	
3	D	0	0	0	3	2	1	0	3	1	1	1	1	1	0	1	0	1	0	1	0	
3	D	1	0	1	3	2	1	0	2	2	1	2	1	1	0	2	1	0	0	1	1	
3	D	2	3	3	2	3	3	3	4	3	3	3	3	3	3	3	3	4	3	3	3	
3	D	3	0	0	3	0	3	1	3	1		3	1	4	0	0	2	2	0	0	0	
3	D	2	1	1	1	2	2	3	1	3	3	1	3	3	2	1	2	3	2	1	3	
3	D	0	0	0	1	2	0	1	2	2	2	0	1	0	1	0	1	0	1	0	0	
3	D	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	D	0	0	0	4	4	0	1	4	0	0	4	4	0	0	4	4	0	0	0	0	
3	D	3	4	1	2		4	2	1	3	4	1	0	2	1	1	0	2	4	0	0	
3	D	0	0	0	1	2	1	0	3	4	2	0	2	0	0	1	1	1	2	0	0	
3	D	2	0	0	4	2	1	0	1		1		0	0	0	0	0	1	0	0	0	
3	D	2	2	2	3		3			3		3	3			3						
3	E	3	4	4	2	2	2	4	3	4	4	4	4	4	3	4	3	4	4	4	4	
3	E		2	1	2	1	1	3	2	2	3	1	1	3	3	2	2		2	0	0	
3	E		2	3	2	2	3	3	3	4	2	1	3	3	3	3	2	1	0	3	2	
3	E	2		2	2	3	2	2		2	2	2	2		2	1	1	1		2	1	
3	E	4	4	3	4	2	4	4	4	4	4	4	4	3	4	4		4	4	4	4	
3	F	2	1	1	2	1	1	2	2	2	1	1	2	2	3	3	2	0	0	3	3	
3	F	4	4	4	4	2	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	
3	F	4	3	3	0		3	4	2	3	4		3		3	3	0	1	4	2	4	
3	F	4	3	2	3	4	4	3	4	4	4	4	4	3	4	2	2	3	3	4	4	
3	F	1	0	1	3	2	2	1	2	2	3	2	2	3	3	2	0	0	0	2	1	
3	F			4	3			4	2	3	2	4	3	3						3	3	
3	F	2	2	1	4	1	3	1	3	2	2	2	2	2	3	3	3	1	4	3	3	
3	F	2	4	4	3	2	3	1	3	4	3	2	4	4	3	3	1	3	4	4	3	
3	F	2		2	3	3	2	3	2	4	3	3	3	3	3	3		3	3	3	3	
3	F	0	0	0	2	0	0	0	2	0	1	1	1	1	0	0	0	0	4	0	0	
3	F	1	2	1	2	1	0	3	0	1	1		2	1	2	1	0		2	2	2	
3	F	4	4	4	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
3	G	4	3	3	4	3	4	4	4	3	3	3	2	4	3	3	3	4	3	2	3	
3	G	3	3	2	3	3	3	3	4	0	0	0	0	4	2	3	2	3	3	3	3	
3	G	2	1	3	3	1	3	4	3	1	2	1	3	4	3	3	3	1	3	2	3	
3	G		2	3	2	3	4	4	4	1	4	2	4	3	3	4	4	4	2	2	4	
3	G				1	0		3		1	2	1						0	4	0	0	
3	H	3	2	3	4	3	4	3	4	4	4	4	3	3	3	3	3	3	2	3	3	
3	H	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4		3	4	3	
3	H	0	0	0	2	4		0	2	0	1	0	0	0	0	0	0	0	4	0	0	
3	H	4		4	4		4	4		3	4	4	3	4		4	4	3	4	4	4	
3	H	0	0	0	4	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	
3	H	0	0	0	2	1	0	0	2	2	2	2	2	0	0	0	0	0	0	0	0	
3	H	0	0	0	3	3	2	1	1	1	3	2	1	0	0	0	0	0	1	0	0	
3	H	2	2	3	3	1	3	4		3	3	3		2	3	1	2		4	1	2	
3	H		3	1	4	2			1	3	2	2	2	3	0	2	2	2		1	2	
3	H	2	3	3	4	2	4	3	3	3	3	3	3	3	3	3	2	3	3	3	3	
3	H	2	2	2	4	0	3	3	0	3	4	3	3	1	0	0	2	1	1	1	2	
3	H	1	0	1	2	3	2	2	1	3	2	3	1	2	0	1	1	0		0	1	
3	H	2	3	2	4	2	4	2	3	4	4	4	4	4	2	2	2	0	3	2	3	
3	I																					

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

II-A – Idealised influence (Attributed)  
II-B – Idealised influence (Behaviour)  
IM – Idealised motivation  
IS – Intellectual stimulation  
IC – Individual consideration

Raters	Leader	Questions answered by participants																			
		Transformational leadership																			
		II-A	II-A	II-A	II-A	II-B	II-B	II-B	II-B	IM	IM	IM	IM	IS	IS	IS	IS	IC	IC	IC	IC
3	I	4	4	4	4	3	4	4	4	4	4	4	4	3		4	4	3	4	3	4
3	I	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	I	0	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	4	0	4
3	I	1		4	3		4	4	2	2	4	3	3		3	2	3	1	3	3	3
3	I	4	4	4	3	0	4	3	2	4	4	3	3	2	4	4	3	2	4	3	3
3	I		3	2	4		3		4	3	2	3	4	4			3		3	3	
3	I	4	4	4	3	2	4	4	4	4	4	4	4	3	3	3	3	3	3	4	4
3	J	2	3	3	4	1	4	4	3	3	4	4	3	4	4	4	1	2	4	2	3
3	J	4	4	3	4	2	3	4	3	3	3	3	3	3	3	3	3	3	2	3	4
3	J	2	3	3	4	1	3	3	3	3	3	3	4	3	2	2	2	2	4	3	3
3	J	4	2	3	2	2	3	2	1	4	3	2	2	3	4	2	1	2	3	3	3
3	J		1	2	1	0	1	3	1	1	1	1	2	3	1	2	2	2	2	2	1
3	J	0	1	0	0	0	1	3	0	0	1	0	0	0	0	1	2	1	1	0	0
3	J	4	4	4	4	0	4	3	3	4	4	4	4	3	3	4	4	3	4	4	4
3	J	2	2	1	1	2	1	2	1	2	2	2	1	3	3	2	1	1	2	1	1
3	K	2	3	3			2	3	3	4	2	2	3	3	4	4	4	4	4	4	4
3	K	3	4	4	3	3	3	4	2	4	3	4	3	4	3	4	4	4	4	3	4
3	K	3	4	4	4	2	4	4		3	4	4	4	4	4	4	4			3	4
3	K		0	4	0	0	4	0	4	4	4		4		0	4	4	4	0	4	4
3	K	4	3	3	4	2	3	2	4	3	4	3	3	3	4	3	4	3	4	4	2
3	K	4	4	4	4	0			2	4	3	4	4		3	3	3	4	4	4	
3	K	3		3	3					3	3		3	3				3	3		2
3	L			2		2				3	3	2						3	3	4	4
3	L	0	1	1	3	2	1		0	0	1	0	2	4	2	0		1	1	3	2
3	L	0	0	0		0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0
3	L		3	3	3	2	3	3	3	2	3	3	3	0	2	3	4				3
3	L	1	1	2	3	1	2	3		1	1	1	2		2	2	2	1	3	1	2
3	L	2	3	1	1	1	1	3	0	0	1	0	3	3	1	1	1	0	3	1	1
3	L	2	2	2	3				2	2	3		3				2	2	2		2
3	L	2	3	2	3	4	4		3	4	4	4	3		4	2	3	1	3	3	
3	M	3	3	3	3	1	4	4	4	4	4	4	3	4	1	3	4	2	3	3	4
3	M	4	4	3	3	0	4	3	3	4	4	3	3	2	3	3	3	2	4	3	3
3	M	4	4	3	4	2	4	2	4	4	4	4	4	3	3	4	4	3	4	4	4
3	M	2	2	3	2	3	4	4		3	4	3	3	3	2	2	2	2	2	2	3
3	M	3	3	4	4	0	2	4	2	4	4	4	4		3	3	1	3	4	3	4
3	M	4	4	3	1	2	2	1	3	4	4	4	4	3	4	4	4	4	3	4	4
3	M	4	3	4	3	4	4	3	3	4	4	4	4	2	4	4	4	4	3	4	4
3	M	2	3	3	4	3	3	3	4	4	4	4	3	3	2	2	3	3	4	2	
3	M	0	3	1	1	3	4	3	3	4	4	2	4	3	4	3	2	0	3	4	2
3	M	3	3	4	3	1	4	3	4	3	4	4	4	2	3	1	1	4	4	3	3
3	M	4	4	3	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
3	M		2	4	3	1		3		3	4	3	2	1		1	2	1	3	2	
3	M	3	3	3	3	3	3	3	4	4	3	3	3		3	3	3	3	3	3	4
3	M	0	1	1	1	2	3	2	0	3	3	2	1	2	2	2	0		3	2	2
3	M	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	N	4	4	4	4	2	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4
3	N	1	4	2	1	4	2	4	1	1	3	1	1	4	3	3	3	2	3	3	3
3	N		2	4		3		4		3	4	4	4		3	4	3	4		4	4
3	N	1	2	1	0	0	0	2	0	0	0	0	0			1		0		1	1
3	N	4	4	4	4	4	4	4		4	4	4	4	4	4	4	4	4	1	4	4
3	O	4	3	4	4	3	4	4	4	3	4	4	4	2	2	3	3	2	4	3	3
3	O	2	2	4	2		2	4	2		3	2	2			2	2	3	2	3	
3	O	4		4	4		4	4	4	4	4	4	4	4	3				4		4
3	O	3	3	4	3	1	3	3	4	4	3	4	3	2	2	1	2		3	3	3
3	O	4	3	4	3	1	1	3	1	4	2	1	3	3	3	2	3	1	4	3	3
3	O	0	4	4	3	0	3	4	4	3	3	4	3	3	4	3	3		3	4	
3	O	0	0	1	4	0	0		1	0	2		1	1	1	1	0	3	2	1	0
3	O		4	4	3	2	4	4	3	3	4	3	4	4	3	4	4	4	4	4	4
4	F	2	3	3	2	2	3	3	3	3	3	2	3	3	3	3	2	2	2	3	3
4	H	3	3	3	3	2	3	4	3	3	4	3	4	4	4			2	4		

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

II-A – Idealised influence (Attributed)  
II-B – Idealised influence (behaviour)  
IM – Idealised motivation  
IS – Intellectual stimulation  
IC – Individual consideration

Raters	Leader	Questions answered by participants												Questions answered by participants Laissez-faire leadership			
		Transactional leadership												Laissez-faire leadership			
		CR	CR	CR	CR	MBEA	MBEA	MBEA	MBEA	MBEP	MBEP	MBEP	MBEP	LF	LF	LF	LF
0	A	0	3	3	3	1	2	1	1	3	0	3	0	0	2	0	0
0	B	3	3	3	3	3	2	2	1	1	1	3	0	0	0	0	2
0	C	0	3	3	4	1	3	1	1	0	0	3	0	1	0	1	1
0	D	0	3	3	4	1	1	1	1	0	0	1	0	0	0	0	0
0	F	3	3	4	3	3	4	3	3	1	1	3	3	0	0	0	1
0	G	3	1		3		2	3	0	2	1	2	0	1	2	0	1
0	H	3	4	3	3	3	3	3	4	3	0	3	0	0	1	0	0
0	I	3	3		2	2	3	1		0	0	0	0	0	0	1	1
0	K	4	3	3	3	2	2	3	2	1	2	2	1	0	0	1	1
0	L		3	3	4	4	4	2	4	3	1	3	0	0	1	0	0
0	M	4	3	3	4	0	3	1	2	1	1		4	0	0	0	1
0	N	3	3	2	4	2	3	1	1	0	1	1	0	0	1	1	1
0	O	3	4	2	4	2	4	4	2	0	0	3	0	0	0	0	0
1	A	4	2			1	2	2	2	3	4	2	2	3	2	3	0
1	B	4	3		4	1	3	3	2	1	1	1	2	2	0	2	2
1	C	4	3			4	3	3	2	0	1	1	2	0	1	0	1
1	D		1			3	3	2		0	0	1	3	0	0	2	0
1	E	3	1			1	1	0	2	3	3	3	3	2	2	2	2
1	F	4	3			3	2	3	2	2	2	2	2	1	0	2	1
1	G	3	4	3	0	4	3	4	4	2	0	4	0	0	0	0	0
1	H	4	4	4	4	4	4	4	4	0	0	4	0	0	0	0	0
1	I		4	4	4	4	3		3	0	0	3	0	0	0	0	0
1	J	4	4	4	4	4	4	4	4	0	0	4	0	2	0	0	0
1	K		2	1	1	2	2	2		1	1	2	1	1	0	2	1
1	L		3	3		2	3	3		1	0			1	0	0	
1	M		2	3	3	1	3	0	1	3	1	3	2	0	1		1
1	N	3		0	1	1	3	3	3	1	1		1	1	2	0	3
1	N		1	1	2	0	1	0		3	3	3	4	3	2	4	4
1	O		3	1		3	3	4		0	0	3	1	0	0	1	0
2	C		3	3	4	2	4	3	3	2	0	1	0	0	0	0	0
2	D	2	2	3	3	4	3	3	2	3	3	2	0	2	0	2	3
2	D	3	3	2	3	3	3	3	2	0	0	3	1	0	0	0	2
2	D	0	3			3			2	0	0	2	0	0	0	4	0
2	F	3	3	3	3	3	2	3	3	3	0	3		0	0	0	0
2	F	1		4	3	1	1	2	1	0	1	1	1	1	0	1	1
2	H	3	2	2	2	3	3	3	3	2		3	2	1	0	3	2
2	H	4	3		3	3	2		1	0	0	1	0	0	1	0	1
2	I	4	4		4	2	2	3	3	3	0	3		0	0	0	1
2	I														1	2	
2	L	3	3	2	3	3	2	2	3	2	0	3	1	0	0	2	2
2	M	4	4	3	4	1	3	1	2	0	0	1	0	0	1	0	1
2	N			0	2	2			0	4	3		3	3	2	3	2
2	N	4	2	2	4	2	4	4	2	0	0	0	0	0	1	0	0
3	A	4	3	4	4	3	3		1	0	0	3	0	0	0	0	0
3	A	3	3	4	3	0	0	2	2	0	0		3	0	0	3	0
3	A	2			1						0		0	0			
3	A	3	0	0	4	1	2	0	1	2	2	1	0	2	1	0	0
3	A	2	2	2	4	0	3	0	0	4	1	0	0	1	3	3	3
3	A	0	4	4	4	3	4	3		0	0	0	0	0	0	0	0
3	A	3	0	0	3	0	2	0	1	3	2	0	1	3	1	3	3
3	A	4	3	1	4	3	4	3	2	3	0	0	0	0	2	0	0
3	A	3	4	3	3	4			4	2	0	4	0	0	2	0	0
3	A	4	3	0	3		0	1	0	2	1	3	2	1	1	2	2
3	A	4	0	3	3	0	4	1	0	0	0	0	0	0	2	0	0
3	A	4	4	2	2	0	4	1	2	2	0	1	1	1	2	2	
3	A	4	3	3	4	2	0	0	0	1	0	0	0	0	0	0	0
3	B	4	4	4	4	4	4	2	0	0	0	3	0	0	0	2	0
3	B	3	3	1	3	2	2	3	1	2	2	3	1	3	1	2	2
3	B	4	3	3	4	4	4	3	3	0	0	2	0	0	0	0	0
3	B	3	2	3	3	3	3	1	3	1	0	3	0	1	0	2	1

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

CR – Contingent reward  
MBEA – Management-by-exception: attributed  
MBEP – Management-by-exception: passive  
LZ – Laissez-faire leadership

Raters	Leader	Questions answered by participants												Questions answered by participants Laissez-faire leadership				
		Transactional leadership												Laissez-faire leadership				
		CR	CR	CR	CR	MBEA	MBEA	MBEA	MBEA	MBEP	MBEP	MBEP	MBEP	LF	LF	LF	LF	
3	B	3		3	3	3		2	3	2	0	0	3	0	0	0	3	0
3	B	4		4	4	0				2	0	0		0		0	0	1
3	C	3	3	3	4	2	3		3	2	3	1	3	1	0	1	0	1
3	C	2	3	1	2	0	1	1	0	2	2		1	1	0	0	2	1
3	C	3	0	0	1	1	3	2	2	2	0			2	2	1	0	
3	C		0	0														
3	C	1	0	0	1	2				0	2	2		2	2	1	2	2
3	C	2	3		3		2			0	2	0		0	2	0	0	0
3	C	4	4	4	4	2	4	4	4	4	0	4	4	0	0	1	0	
3	C	4	0		0	3	2		3	3	1	0	4	3	0	1	2	
3	D	3	2	0	1	2	1	0		4	3	2	3	3	1	3	2	
3	D	0	0	0	1	0	0	0		4	3	0	4	2	2			
3	D	1	0	0	1	1	1	0	1	3	3	4	3	4	3	3	3	3
3	D	1	0	0	0	2	0	0	1	3	4	3	4	1	2	3	3	
3	D	4	3		3		2	2	1	1	2	2		2	1	0	1	
3	D	1	3	0	0	0	0		3	4	4	3	4	3	3	3	3	3
3	D	3	3	2	3	4	3	2	1	2	0	1	0	0	1	1	1	2
3	D	1	1	0	0	3	3	1	2	3	4	1	4	2	3	3	2	
3	D	0	0	0	0	4	0	4	4		4	3	0	3	1	4	4	
3	D	1	0	4	0	4	1	0	0	4	4	4	4	4	2	1	3	
3	D	0	4	4	0	3	4	4	4	4	4	0	4	2	2	4	4	
3	D	1	2	3	2	4	1	4	3	4	4	4	4	3	2	1	2	
3	D	2	0	0	1	0	0	4	4	0	2			3	2	3	1	3
3	D	3	3		3		3	4		0	0			0	0	0	0	
3	E	4	2	4	4	4	4	1	4		0	0	2	0	0	0	0	
3	E		4	2	1	0	2			0		0	0	0	0	1	2	
3	E	3	0	1	3	0	2	0	0	0	0	1	0	0	0	0	0	
3	E	2	1	3			1	2	1	1		1	0	0	1	0		
3	E	3	3	4	4	0	3	2	3	0	0	0	0	0	0	0	0	
3	F	3	1	2	3	2	3	0	2	1	3	1	2	0	2	1	2	
3	F	4	4	4	4	4	3	4	3	0	0	4	0	0	0	0	0	
3	F	4	3	2	3	0	3			0				1	1	0		
3	F	4	4	4	4	4	3	4	1	0	1	3	0	0	1	0	0	
3	F	2	4	4	3	4	1	3	3	1	1	4	2	1	2	1	1	
3	F	4	3		0	2	0			0				0	2		0	
3	F	1	2	1	1	3	1	4	4	2	0	1	0	0	0	0	1	
3	F	3	3	2	3	3	3	3	1	2	0	1	1	1	1	0	0	
3	F	3	3	3	2	3	2	3	2	0	2	0	2	0	0	0		
3	F	0	4	0	1	1	1	2	1	2	3	0	3	3	3	1	3	
3	F	1	0	1	3	3	2	2	3	3	3	2	3	2	1	1	2	
3	F	4	3		4	4	4	4	4	4	0		0	0	0	0	0	
3	G	3	4	4	3	4	4	3	3	1	0	3	2	1	1	0	3	
3	G	3	1	1	4	4	2	3	4	3	3		3	3	2	3	0	1
3	G	4	3	2	3	1	1	1	1	2	0	2	0	0	2	0	0	
3	G	3	4	3	4	2	3	2	4	1	0	1	0	0	0	2	2	
3	G	0			0	2	1				2	3			3	2		
3	H	3	4	3	4	2	2	3	3	2	1	2	0	1	1	0	1	
3	H	4	4	4	3	4	4	4	4	0	0	4	4	0	0	0	0	
3	H	0	0	0	0	4	4	4		4	4	0	4	4	2	4	4	
3	H	3		3	4	3	3	3		0	0			0	0	0	0	
3	H	0	2	0	0	4	4	4	0	4	4		4	4	4	4	4	
3	H	0	0	1	0	0	0	0	0	1	3	1	1	3	3	2	1	
3	H	0	1	1	0	3	2	3	0	3	3		1	2	3	4	4	
3	H		4		1	3	4	3	3	0	0	0	0	0	1	0		
3	H	3	2	2		3	0		1	2	0	3	3		1	1	2	
3	H	3	2	2	4	3	3	2	3	0	0	2	2	1	2	0	1	
3	H	2	3	3	3	3	3	2	3	0	2	0	0	0	2	2	0	
3	H		1	0	1	3	3	3	3	2		2		1	2	1	1	
3	H	3	3	2	4	4	2	4	4	2	2	1	2	1	1	0	2	
3	I																	

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CR – Contingent reward  
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LZ – Laissez-faire leadership

Raters	Leader	Questions answered by participants												Questions answered by participants Laissez-faire leadership			
		Transactional leadership												Laissez-faire leadership			
		CR	CR	CR	CR	MBEA	MBEA	MBEA	MBEA	MBEP	MBEP	MBEP	MBEP	LF	LF	LF	LF
3	I	4	4	4	4	0	0	1	0	0	0	4	0	0	0	3	0
3	I	4	4		4	4	4		3	0	0	0	0	0	0	0	0
3	I	4	4	2	4	0	2			0	0	3	0	0	0	0	4
3	I	3	2		3	2	3	1		0	0		0	0	0	0	0
3	I	4	2	3	2	1	4	2	2	1	0	0	0	0	0	1	1
3	I	3		2	4	2		3						0		0	
3	I	4	4	3	4	1	4	3	0	0	0	2	0	0	0	0	0
3	J	3	4	1	3		3			0	0		0	0	0	0	0
3	J	4	4	4	4	3	3	3	3	0	0	0	0	0	0	0	0
3	J	4	4	4	4	3	1	3	3	1	0		0	0	2	1	1
3	J	4	1	3	2	2	3	0	2	1	1	1	0	1	1	2	2
3	J	0	2	1	2	2	2	1	0	2	2		3	2	1	2	2
3	J	1	0	0	1		3	3	3	4	4	4	4	4	4	4	4
3	J	4	4	4	4	0	1		0	0	0	3	0	0	2	0	0
3	J	2	2	1	2	2	1	2	1			2	0	1	1	2	2
3	K	4	4	3	3	3	3	3	3	0	0		0	0	0	0	0
3	K	4			3	2	1	2		1	0	1	0	0	0	0	0
3	K		4	0	4		2		0	0	0	4	0	0	0	0	0
3	K	4	4	4	3	0	0	0	0				0		0	0	0
3	K	4	3	3	4	4	4	4	3	0	0		0	0	0	0	0
3	K	3	0		3	0		0		0	0	0	0	0	1	0	0
3	K	3	3	2	3		3							2	0		
3	L	3	4	2					4								1
3	L		3	1	2	4	4	3	2	2	3	3	1	1	1	1	1
3	L		1	0	1	4	1	4	4	4	3		4	3	4	2	1
3	L	3	2	3	3	0	3		3	0				2			
3	L	2	4	1	3	3	2		2		0	4	1	0	0	0	0
3	L	1	1	0	4	2	0	4	0	3	3	2	3	0	0	1	1
3	L	3	2	3	3	2	2	3	0	0				0	0	0	0
3	L	3	4	4	4	3	4	3	3	0	0	1	0	0	0	0	0
3	M	4	4	2	4	4	3	2	1	2	0	3	1	0	0	0	0
3	M	1	4	4	3	0	3	3	1	2	1	1	1	0	0	1	2
3	M	4	4	4	3	0	0	0	0	0	0	3	0	0	0	0	0
3	M	3	3	2	3	2	3	3	3	1	0	2	0	0	1	0	0
3	M	4	0	3	4		3			0	0	0	0	0	1	0	1
3	M	4	2	3	4	0	2	0	3	0	1	3	0	0	1	1	3
3	M	4	4	3	4	4	3	4	3	0	0	4	0	0	1	1	0
3	M	3	3	3	4	2	2	2	2	3	2	2	2	1	2	1	2
3	M	1	4	3	4	3	2	1	3	4	2	4	3	2	3	2	3
3	M	4	2	2	4	1	3	1	2	1	3	3	1	2	1	2	2
3	M	4	4	3	4	4	3	3	4	4	0	0	0	0	0	0	1
3	M	3	3	2		2	2	2	1	3	3	4	2	1	3	2	2
3	M	3	3	2	3	2	3	2	2	2	2	3	2	4	1	1	1
3	M	1	1	0	1	0	1	0	0	3	3		3	3	3	2	0
3	M	4	4	4	4	4	3	3	3	1	0	0	1	0	0	0	0
3	N	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0
3	N	3	2	1	1	0	1	2	2	3	2	2	2	2	3	2	3
3	N	4		1	4	0	0			2	0		0	2	1	1	0
3	N	0	0	0	1	2	2	2	2					2	1	2	1
3	N	4	4		4	0	0	4		0	0		0	0	0	0	0
3	O	4	4	1	4	4	4	4	1	0	0	3	0	0	0	0	0
3	O	3	2	3	2	0	4		1	0	0	3		0	2	0	
3	O	4	4		4	0	2			0	0		0	0	0	0	0
3	O	1	3	3	4	3	4			0	0	0	0	0	1	0	0
3	O	3	3	3	4	1	3	0	2	1	0	3	1	0	0	1	1
3	O	0	4	3	4	3	3		0	0				0	0	0	0
3	O	1	2	0	1	1	3	0	0	3	0	0	0	2	3	3	0
3	O		4	4	4	3	1	0	0	0	0	2	0	0	0	0	0
4	F	2	3	2	3	3	3	2	1	3	0	2	0	0	0	0	0
4	H	3	4		4	4	3			0	0		0	0	0	0	0

0 – Self-rating

1 – Supervisor

2 – Peer

3 – Subordinate

4 – Other

CR – Contingent reward

MBEA – Management-by-exception: attributed

MBEP – Management-by-exception: passive

LZ – Laissez-faire leadership



Raters	Leader	Questions answered by participants								
		Extra-effort	Extra-effort	Extra-effort	Extra-effort	Effectiveness	Effectiveness	Effectiveness	Satisfaction	Satisfaction
0	A	3	3	2	2	3	3	4	2	3
0	B					3	3	3		3
0	C	2	3	3	3	3	4	3	1	3
0	D	3	3	3	3	4	4	3	0	3
0	F	3	4	3	2	3	3	2	3	4
0	G			2			2	2		
0	H	3	3	3	3	3	3	3	3	3
0	I	3	3	3	3	3	3	3	3	3
0	K	2	3	3	3	4	4	3	3	4
0	L	3	4	4	4	4	4	4	3	4
0	M	3	2	3	1	4	3	3	3	2
0	N	1	2	2	2	4	3	2	2	3
0	O	2	3	3	3	3	3	4		3
1	A		2	2		1	3	3	1	4
1	B		3	3		4	4	3	2	4
1	C		3	3		3	4	0	1	3
1	D				1	3	3	2	2	
1	E	3	3			2	2	3	0	3
1	F			2		3	3	3	1	4
1	G	1	1	2	1	4	4	3	1	1
1	H	4	4	4	4	4	4	4	3	4
1	I	3	4	4	4	4	4	4	3	3
1	J	4	4	4	4	4	4	4	3	4
1	K					1	2	2	1	
1	L				3	3	3	3	1	3
1	M	2	3	2	3	3	3	3	2	3
1	N	1	2	1	2	3	2	3	2	3
1	N					2	1	1	1	
1	O		2			3	3	3	3	
2	C	3	3	4	3	4	4	3	4	4
2	D	2	3	2	3	2	3	2	2	3
2	D	3	4	4	2	4	4	3	3	4
2	D		3	3	3	3	3	3	3	4
2	F	3	3	3		3	2	3	3	3
2	F	3	3	3	3	3	4	4	3	4
2	H	2	4	3	2	3	4	2	2	4
2	H	0	3	3	1	3	3	3	2	4
2	I	3	4	4	3	4	4	3	4	4
2	I									2
2	L	3	3	3	2	3	4	3	3	3
2	M	3	3	3	3	3	4	4	4	4
2	N				0	0			1	4
2	N	2	4	3	4	4	3	4	4	4
3	A	2	4	4	4	4	4	4	4	4
3	A	4	3	3	3	4	4	3	4	2
3	A	0	1	1	3	2	4	4		
3	A	1	3	2	1	0	2	3	1	3
3	A	2	3	3	2	1	3	4	2	3
3	A	4	4	4	4		4	4	4	4
3	A	1	2	2	1	1	2	3	1	3
3	A	4	4	4	4	4	4	4	4	4
3	A	3	3	3	2	3	4	4	4	4
3	A	2	2	2	2	0	3	3	2	3
3	A	3	3	2	3	3	3	4	3	3
3	A	2	3	3	2	3	3	3	2	3
3	A	4	4	4	3	4	4	4	3	4
3	B	4	4	4	3	4	3	3	3	4
3	B	1	2	1	1	2	3	3	3	3
3	B	2	3	3	3	4	3	3	3	4
3	B	3	3	2	3	4	3	3	2	4

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

Raters	Leader	Questions answered by participants									
		Extra-effort	Extra-effort	Extra-effort	Extra-effort	Effectiveness	Effectiveness	Effectiveness	Satisfaction	Satisfaction	
3	B	3	4	4	3	3	3	4	3	4	
3	B	2	4	3	3	4	4	4	4	3	
3	C	3	4	3	3	3	3	3	3	4	
3	C	1	3	3	2	3	3	1	3	4	
3	C	3	2	2	2		3		2	2	
3	C								2	2	
3	C	1	0	1	2	0	2		0	2	
3	C	0	2	3	3		4	3	1	4	
3	C	4	4	4	4	4	4	4		4	
3	C	1	4	4	1	2	3	4		4	
3	D	2	0	0	2		2	1	0	3	
3	D	0	0	0	1	1		0	0	2	
3	D	0	0	0	1	0	1	0	0	0	
3	D	0	1	0	1	0	1	0	1	2	
3	D	4	3	3	3	3	3	2	3	4	
3	D	4	0	0	0	0	4	0	0	2	
3	D	2	2	2	2		3	1	2	3	
3	D	1	0	0	1	2	1	2	0	1	
3	D	4	0	0	0	0	2	0	0	0	
3	D	2	0	0	0	0	1	0	0	0	
3	D	1	1	2	0		3	0	0	0	
3	D	0	1	0	0	0	2	2	0	1	
3	D	0	0	0	1	0	0	0	0	0	
3	D	2		2			3			2	
3	E	4	4	4	4	4	3	4		4	
3	E	0		0	1	0		1			
3	E	1	3	3	2	3	3	2	2	3	
3	E	2	2	2	2	2	2	2	2	3	
3	E	4	4	4	4	4	3	4	4	3	
3	F	2	2	2	2	2	3	2	2	3	
3	F	4	4	4	4			4	4	4	
3	F	0	4	4	3		3	4	3	4	
3	F	3	4	4	4	3	4	2	2	4	
3	F	3	3	2	1	4	4	1	1	3	
3	F		2					2	2	3	
3	F	2	2	3	1	3	3	3	2	2	
3	F	3	3	3	3	1	4	2	3	4	
3	F		3	3		3	3	3	2	3	
3	F	1	0	0	1	1	1	1	1	0	
3	F	1	2	2	2	1	2	1	1	3	
3	F	4	4	4	4	4	4	4	4	4	
3	G	3	3	4	3	3	3	4	3	3	
3	G	3	3	3	3	3	3	0	2	3	
3	G	3	3	2	2	3	0	1	1	3	
3	G	4	4	4	4	4	3	3	4	4	
3	G	1		1			3			2	
3	H	3	3	3	2	4	3	2	2	3	
3	H	4	4	4	4	4	4	4	4	3	
3	H		0	0	0	0	4	4	0	0	
3	H	0	4	4	3	4	4	4	4	4	
3	H	0	0	0	0	0	0	0	0	0	
3	H	0	0	0	0	1	0	0	0	0	
3	H	0	0	0	0	0	3	0	0	1	
3	H	2	3	2	3	3		3	3	3	
3	H	2		2	2				1	2	
3	H	3	4	4	3	3	4	3	3	4	
3	H	3	3	3	2	3	2	2	1	3	
3	H	0	0	1	0	1	2	3	0	0	
3	H	1	2	1	2	4	3	3	3	3	
3	I										

0 – Self-rating  
1 – Supervisor  
2 – Peer  
3 – Subordinate  
4 – Other

Raters	Leader	Questions answered by participants									
		Extra-effort	Extra-effort	Extra-effort	Extra-effort	Effectiveness	Effectiveness	Effectiveness	Satisfaction	Satisfaction	
3	I	4	4	4	4	4		4	4	4	
3	I	4	4	4	4	4	4	4	4	4	
3	I	4	4	4	4	4	4	4	4	4	
3	I		3	3	3	3	3	2	3	2	
3	I	3	4	3	3	4	3	3	3	3	
3	I	4	3	4	3		4	4	3	3	
3	I	3	4	4	4	4	4	4	4	3	
3	J	2	3	2	4	3	3	4	3	3	
3	J	3	4	4	4	4	4	4	4	4	
3	J	3	2	2	4	4	3	4	3	3	
3	J	1	3	2	1	1	4	2	1	3	
3	J	1	2	1	2	2	3	3	2	4	
3	J	0	1	1	0	0	0	0	0	0	
3	J	0	4	4	4	4	4	4	4	4	
3	J	1	2	1	1	1	1	2	1	2	
3	K		3	3	4	4	4	3	2	4	
3	K	3	4	3	3	4	3	3	4	4	
3	K	4	4	4	4	4	4	0	2	3	
3	K	0	4	4	4	4	3	2	4	4	
3	K	4	4	4	4		3		2	4	
3	K	3	4	4	4				4	4	
3	K	3	2	3	3		3	3	3	4	
3	L				2				2	3	
3	L	1	1	1	1	1		0	1	1	
3	L	0	0	0	0	1	1	1	0	0	
3	L	4	3	3	3	3	3	3	3	3	
3	L				3	4	4	3	2	3	
3	L	1	0	1	2	3	1	2	0	2	
3	L	2	2	2	2		3	3	2	3	
3	L	1	3	3	3	3	4	4	3	3	
3	M	3	4	4	4	4	3	4	3	4	
3	M	3	3	3	3	3	3	3	3	3	
3	M	3	3	3	4	4	4	3	3	4	
3	M	3	3	3	2	3	3	3	3	3	
3	M	4	4	4	3	3		4	4	4	
3	M	4	3	3	4	4	4	3	3	4	
3	M	4	3	4	3	4	4	4	3	2	
3	M	2	3	2	2	3	2	3	2	4	
3	M	2	2	2	2	3	4	1	1	3	
3	M	2	4	4	3	4	4	4	3	4	
3	M	4	4	4	4	4	3	4	4	4	
3	M	2	2	1	0	3	1	1		3	
3	M	3	4	3	2	2	2	3	3	4	
3	M	0	2	0	1	1	1	2	0	2	
3	M	4	4	4	4	4	4	4	4	4	
3	N	4	4	4	4	4	4	4	4	4	
3	N	1	1	1	2	2	2	2	1	3	
3	N	0	4	4		4	3	4	4	4	
3	N	2	0	0	0	2	2	0	0	2	
3	N	0	4	4	4	4	4	4	4	4	
3	O	3	4	4	2	2	4	4	3	3	
3	O	2	3	3	1	1	3	3	3	4	
3	O	0	4	4	4	4	4	4	4	4	
3	O	3	3	4	3	4	4	4	4	4	
3	O	3	3	3	3	4	3	4	3	4	
3	O	0	4	4	4	4	4	4	4	4	
3	O	1	1	1	1	2	2	2	1	2	
3	O	4	4	4	4	4	4	4	4	4	
4	F	2	4	4	3	2	3	2	3	4	
4	H						4	3	3	3	

- 0 – Self-rating
- 1 – Supervisor
- 2 – Peer
- 3 – Subordinate
- 4 – Other

# **APPENDIX E**

**Statistics: t-tests and ANOVA**

**Table E.1: Statistical t-test results.**

Hypothesis 1-1. Scientific unit leaders perceive themselves to be more transformational leaders than what their supervisors rate them to be.

t-Test: Two-Sample Assuming Equal Variances

	Leader	Supervisor
Mean	2.980769231	2.285555556
Variance	0.012573964	0.009905093
Observations	5	5
Hypothesized Mean Difference	0	
df	8	
t Stat	10.36846016	
P(T<=t) one-tail	3.23733E-06	
t Critical one-tail	1.859548033	
P(T<=t) two-tail	6.47465E-06	
t Critical two-tail	2.306004133	

Hypothesis 1-2. Scientific unit leaders perceive themselves to be more transformational leaders than what their peers rate them to be.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	2.980769231	2.889583333
Variance	0.012573964	0.017949761
Observations	5	5
Hypothesized Mean Difference	0	
df	8	
t Stat	1.167061943	
P(T<=t) one-tail	0.138396063	
t Critical one-tail	1.859548033	
P(T<=t) two-tail	0.276792126	
t Critical two-tail	2.306004133	

Hypothesis 1-3. Scientific unit leaders perceive themselves to be more transformational leaders than what their subordinates rate them to be.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	2.980769231	2.578415103
Variance	0.012573964	0.00925839
Observations	5	5
Hypothesized Mean Difference	0	
df	8	
t Stat	6.088960788	
P(T<=t) one-tail	0.000146508	
t Critical one-tail	1.859548033	
P(T<=t) two-tail	0.000293016	
t Critical two-tail	2.306004133	

Hypothesis 2-1. Scientific unit leaders rate themselves lower on transactional leadership than what their supervisors rate them to be.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Supervisor
Mean	2.076923077	2.300925926
Variance	0.791954306	0.477641461
Observations	3	3
Hypothesized Mean Difference	0	
df	4	
t Stat	-0.344335212	
P(T<=t) one-tail	0.373967666	
t Critical one-tail	2.131846782	
P(T<=t) two-tail	0.747935331	
t Critical two-tail	2.776445105	

Hypothesis 2-2. Scientific unit leaders rate themselves lower on transactional leadership than what their peers rate them to be.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	2.076923077	2.185019841
Variance	0.791954306	1.084657745
Observations	3	3
Hypothesized Mean Difference	0	
df	4	
t Stat	-0.136674052	
P(T<=t) one-tail	0.448945714	
t Critical one-tail	2.131846782	
P(T<=t) two-tail	0.897891427	
t Critical two-tail	2.776445105	

Hypothesis 2-3. Scientific unit leaders rate themselves lower on transactional leadership than what their subordinates rate them to be.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	2.076923077	1.96850691
Variance	0.791954306	0.483041597
Observations	3	3
Hypothesized Mean Difference	0	
df	4	
t Stat	0.166303076	
P(T<=t) one-tail	0.437993085	
t Critical one-tail	2.131846782	
P(T<=t) two-tail	0.87598617	
t Critical two-tail	2.776445105	

Hypothesis 3-1. Scientific unit leaders rate themselves lower on laissez-faire leadership than what their supervisors do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Supervisor
Mean	0.423076923	0.841666667
Variance	0.087339744	0.616617063
Observations	13	15
Hypothesized Mean Difference	0	
df	18	
t Stat	-1.914059509	
P(T<=t) one-tail	0.035824206	
t Critical one-tail	1.734063592	
P(T<=t) two-tail	0.071648412	
t Critical two-tail	2.100922037	

Hypothesis 3-2. Scientific unit leaders rate themselves lower on Laissez-faire leadership than what their peers do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	0.423076923	0.744791667
Variance	0.087339744	0.201109871
Observations	13	8
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.802467028	
P(T<=t) one-tail	0.049453908	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	0.098907817	
t Critical two-tail	2.200985159	

Hypothesis 3-3. Scientific unit leaders rate themselves lower on laissez-faire leadership than their subordinates do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	0.423076923	0.898851565
Variance	0.087339744	0.277411262
Observations	13	15
Hypothesized Mean Difference	0	
df	23	
t Stat	-2.996353938	
P(T<=t) one-tail	0.003222628	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	0.006445255	
t Critical two-tail	2.068657599	

Hypothesis 4-1. Scientific unit leaders rate themselves higher on extra-effort than what their supervisors do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Supervisor
Mean	2.75	0.883928571
Variance	0.285353535	0.635197268
Observations	12	14
Hypothesized Mean Difference	0	
df	23	
t Stat	7.096267687	
P(T<=t) one-tail	1.57283E-07	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	3.14566E-07	
t Critical two-tail	2.068657599	

**Table E.2. Statistical t-test results continues.**

Hypothesis 4-2. Scientific unit leaders rate themselves higher on extra-effort than what their subordinates do

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	2.75	2.518397528
Variance	0.285353535	0.5102912
Observations	12	15
Hypothesized Mean Difference	0	
df	25	
t Stat	0.963348662	
P(T<=t) one-tail	0.172299497	
t Critical one-tail	1.708140745	
P(T<=t) two-tail	0.344598994	
t Critical two-tail	2.059538536	

Hypothesis 4-3. Scientific unit leaders rate themselves higher on extra-effort than what their peers do

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	2.75	3.055555556
Variance	0.285353535	0.111992945
Observations	12	8
Hypothesized Mean Difference	0	
df	18	
t Stat	-1.572053684	
P(T<=t) one-tail	0.066675097	
t Critical one-tail	1.734063592	
P(T<=t) two-tail	0.133350195	
t Critical two-tail	2.100922037	

Hypothesis 5-1. Scientific unit leaders rate themselves higher on effectiveness than what their supervisors do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	3.041666667	2.946428571
Variance	0.270833333	0.587187118
Observations	12	14
Hypothesized Mean Difference	0	
df	23	
t Stat	0.374966553	
P(T<=t) one-tail	0.355560388	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	0.711120777	
t Critical two-tail	2.068657599	

Hypothesis 5-2. Scientific unit leaders rate themselves higher on effectiveness than what their peers do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	3.041666667	3.015873016
Variance	0.270833333	0.115961199
Observations	12	7
Hypothesized Mean Difference	0	
df	17	
t Stat	0.130385205	
P(T<=t) one-tail	0.448896057	
t Critical one-tail	1.739606716	
P(T<=t) two-tail	0.897792114	
t Critical two-tail	2.109815559	

Hypothesis 5-3. Scientific unit leaders rate themselves higher on effectiveness than what their subordinates do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinate
Mean	3.041666667	2.730682215
Variance	0.270833333	0.387690215
Observations	12	14
Hypothesized Mean Difference	0	
df	24	
t Stat	1.387140687	
P(T<=t) one-tail	0.089073638	
t Critical one-tail	1.710882067	
P(T<=t) two-tail	0.178147275	
t Critical two-tail	2.063898547	

Hypothesis 6-1. Scientific unit leaders rate themselves higher on satisfaction than what their supervisors do

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Supervisor
Mean	2.818181818	2.339285714
Variance	0.413636364	0.669299451
Observations	11	14
Hypothesized Mean Difference	0	
df	23	
t Stat	1.638648867	
P(T<=t) one-tail	0.057447705	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	0.114895411	
t Critical two-tail	2.068657599	

Hypothesis 6-2. Scientific unit leaders rate themselves higher on satisfaction than what their peers do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Peer
Mean	2.818181818	3.30952381
Variance	0.413636364	0.12202381
Observations	11	7
Hypothesized Mean Difference	0	
df	16	
t Stat	-2.094417689	
P(T<=t) one-tail	0.026248524	
t Critical one-tail	1.745883669	
P(T<=t) two-tail	0.052497048	
t Critical two-tail	2.119905285	

Hypothesis 6-3. Scientific unit leaders rate themselves higher on satisfaction than what their subordinates do.

t-Test: Two-Sample Assuming Unequal Variances

	Leader	Subordinates
Mean	2.818181818	2.709350471
Variance	0.413636364	0.507765892
Observations	11	14
Hypothesized Mean Difference	0	
df	22	
t Stat	0.400417639	
P(T<=t) one-tail	0.346355381	
t Critical one-tail	1.717144335	
P(T<=t) two-tail	0.692710762	
t Critical two-tail	2.073873058	

**Table E.3: Statistical ANOVA single factor results.**

ANOVAS: SINGLE FACTOR

Hypothesis 7-1 There is a difference in transformational leadership style ratings between the different leaders.

Anova: Single

Factor

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>			
Leader A	5	13	2.6	0.20625			
Leader B	5	13	2.6	0.2375			
Leader C	5	17	3.4	0.01875			
Leader D	5	16.25	3.25	0.03125			
Leader F	5	12	2.4	0.14375			
Leader G	5	13.25	2.65	0.3625			
Leader H	5	16.5	3.3	0.04375			
Leader I	5	14.25	2.85	0.1125			
Leader K	5	16.25	3.25	0.1875			
Leader L	5	18	3.6	0.14375			
Leader M	5	17	3.4	0.33125			
Leader N	5	13.25	2.65	0.3			
Leader O	5	14	2.8	0.04375			
<b>ANOVA</b>							
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>	
Between							
Groups	9.3884615	12	0.782371795	4.70327553	3.89874E-05	1.943616952	
Within Groups	8.65	52	0.166346154				
Total	18.038462	64					

Hypothesis 7-2 There is a difference in transactional leadership style ratings between the different leaders.

Anova: Single

Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>			
Leader A	3	5	1.666666667	0.270833333			
Leader B	3	6.25	2.083333333	0.770833333			
Leader C	3	4.75	1.583333333	0.770833333			
Leader D	3	3.75	1.25	1.3125			
Leader F	3	8.5	2.833333333	0.520833333			
Leader G	3	5.25	1.75	0.298611111			
Leader H	3	8	2.666666667	1.020833333			
Leader I	3	4.666667	1.555555556	1.925925926			
Leader K	3	7	2.333333333	0.770833333			
Leader L	3	8.583333	2.861111111	0.93287037			
Leader M	3	7	2.333333333	1.083333333			
Leader N	3	5.25	1.75	1.5625			
Leader O	3	7	2.333333333	1.895833333			
<b>ANOVA</b>							
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>	
Between							
Groups	9.9405271	12	0.828377255	0.819765051	0.629655806	2.147926228	
Within Groups	26.273148	26	1.010505698				
Total	36.213675	38					

**Table E.4: Statistical ANOVA single factor results continues.**

Hypothesis 7-3 There is a difference in laissez-faire leadership style ratings between the different leaders.

Anova: Single

Factor

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Leader A	4	2	0.5	1
Leader B	4	2	0.5	1
Leader C	4	3	0.75	0.25
Leader D	4	0	0	0
Leader F	4	1	0.25	0.25
Leader G	4	4	1	0.66666667
Leader H	4	1	0.25	0.25
Leader I	4	2	0.5	0.33333333
Leader K	4	2	0.5	0.33333333
Leader L	4	1	0.25	0.25
Leader M	4	1	0.25	0.25
Leader N	4	3	0.75	0.25
Leader O	4	0	0	0

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	4.1923077	12	0.349358974	0.939655172	0.519197062	2.01018266
Within Groups	14.5	39	0.371794872			
Total	18.692308	51				

Hypothesis 7-4 There is a difference in extra-effort, effectiveness and satisfaction ratings between the different leaders.

Anova: Single

Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Leader A	3	8.166667	2.722222222	0.064814815
Leader B	2	6	3	0
Leader C	3	7.916667	2.638888889	0.391203704
Leader D	3	8	2.666666667	1.083333333
Leader F	3	9.333333	3.111111111	0.287037037
Leader G	2	4	2	0
Leader H	3	9	3	0
Leader I	3	9	3	0
Leader K	3	9.666667	3.222222222	0.231481481
Leader L	3	11.16667	3.722222222	0.064814815
Leader M	3	7.916667	2.638888889	0.016203704
Leader N	3	6.916667	2.305555556	0.321759259
Leader O	3	8.916667	2.972222222	0.085648148

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	5.8706206	12	0.489218385	2.305552826	0.039385216	2.183380082
Within Groups	5.0925926	24	0.212191358			
Total	10.963213	36				



**Table E.5:** Significant values of the correlation coefficient (Bajpai, Calus & Fairley, 1979:441).

Two-Tailed Tests				
<i>d.f.</i>	$p = .10$	$p = .05$	$p = .01$	$p = .001$
3	0.805	0.878	0.959	0.991
4	0.729	0.811	0.917	0.974
5	0.669	0.755	0.875	0.951
6	0.622	0.707	0.834	0.925
7	0.582	0.666	0.798	0.898
8	0.549	0.632	0.765	0.872
9	0.521	0.602	0.735	0.847
10	0.498	0.576	0.708	0.823
11	0.476	0.553	0.684	0.801
12	0.458	0.533	0.588	0.780
13	0.441	0.514	0.641	0.760
14	0.426	0.497	0.623	0.742
15	0.412	0.482	0.605	0.725
16	0.400	0.468	0.590	0.708
17	0.389	0.455	0.575	0.693
18	0.379	0.444	0.562	0.679
19	0.369	0.433	0.549	0.665
20	0.360	0.423	0.537	0.652
25	0.323	0.381	0.487	0.465
30	0.296	0.349	0.449	0.338
35	0.275	0.325	0.418	0.519
40	0.257	0.304	0.393	0.490
45	0.243	0.288	0.372	0.465
50	0.231	0.273	0.354	0.443
60	0.211	0.250	0.325	0.408
70	0.195	0.232	0.302	0.380
80	0.183	0.217	0.283	0.357
90	0.173	0.205	0.267	0.338
100	0.164	0.195	0.254	0.321

Source: Bajpai AC, Calus IM & Fairley JA. 1979: *Statistical Methods for Engineers and Scientists*. Loughborough University of Technology. Great Britain. John Wiley & Sons.

**Table E.6: Critical Values of  $t$  for Given Probability Levels (Cooper & Schindler, 2003:820).**

d.f.	Level of significance for One-Tailed Test					
	.10	.05	.025	.01	.005	.0005
	Level of significance for Two-Tailed Test					
	.20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.859	2.365	2.998	3.449	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.497	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
$\infty$	1.282	1.645	1.960	2.326	2.576	3.291

Source: Cooper DR. & Schindler PS. 2003: *Business Research Methods*. New York. Brent Gordon.