TRANSFORMATION OF MANAGERIAL SKILLS OF ENGINEERS

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SUMMARY

Every year, more and more management positions are being filled by engineers and other technical personnel in spite of dual or parallel path systems for promotions in many companies. In spite of the centrality of engineers and management in industrial organizations and modern society, engineers are generally viewed to be unsuccessful in management roles due to the following shortcoming of skills: inadequate managerial education during engineering studies, administrative skills, interpersonal skills, personality and career orientation, management knowledge.

This research argues that there is a difference in leadership style between experienced and inexperienced engineers in South Africa. It was found that experienced engineers in Eskom are more transformational and more transactional compared to inexperienced post-graduated engineering students at the Rand Afrikaans University. To demonstrate this in the study, the researcher used the Multifactor Leadership Questionnaire to identify leadership style. The argument is substantiated by the results of a statistical analysis of leadership style for experienced and inexperienced engineers.

The findings of this research indicate the theory that successful managers tend to grow into their jobs over an extended period (Bennett, 1996 and Sedge, 1985). The findings also support the arguments of O'Connor (1994) and Badaway (1995) that engineers have no typical career path to prepare them for the management role. It is therefore imperative that inexperienced engineers prepares themselves for management and obtain knowledge about management and development management skills during their formal studies.

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CHAPTER 1

1. INTRODUCTION TO THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION AND PROBLEM STATEMENT

Chapter 1 includes an introduction to the research and provides background on the reason for the study.

Due to socio-political changes in 1991, South Africa moved from a paternalistic to a democratic society, which had an impact on employee-manager relations in organizations. South African organizations are in an era of rapid and spasmodic transformation as the current ambiguities result in the disillusionment of the workforce. Strong credible transformational leadership is needed to ensure focus and flexibility. Transformational leadership is a widespread phenomenon and an urgent requirement to optimize the resources of the country. While more of it occurs at the top than at the bottom of an organization, Bass & Stogdill (1990) state that it has also been observed by many employees in the first level supervisors and informal leaders.

Eskom (1999), where this study is undertaken, is the largest supplier of electric power in South Africa and the fourth largest power utility in the world. Eskom was established in 1920 and was chaired and managed by engineers until 1999. The engineer in Eskom operates within a matrix structure in which he is exposed to various levels of managerial skills requirements.

In the light of Eskom's overall transformation process, the Executive Director and his team have agreed to change some strategic priorities, providing people with transformation strategies, skills development, strategic alignment of Human Resources (HR) and stakeholder relationships. Toffler (1990-b) states that such changes imply a striking shift away from standard old-fashioned bureaucracy to Ad-hocracy and the emergence in management. Bennett (1996) believes that the transition process may be loosely defined as an exchange of mindsets, physical parameters and operational parameters from those operative as an engineer to those operative as a manager.

Based on an empirical study of engineers in Australia, the transition of engineers into management was generally viewed to be unsuccessful due to the influence of several factors. This statement was argued in a research survey carried out across the engineering population in Australia by Seethamraju & Agrawal (1999). The reviewed literature attributes these inadequacies to the engineering education, the status in organizations and society, the attitude of engineers towards management roles, management education, support and employers' attitude to engineers.

1.2 THE NATURE OF THE PROBLEM AND NEED FOR THE STUDY

Due to the acceleration of change, traditional bureaucracy can no longer keep up its pace Toffler (1990-a). As bureaucratic hierarchies decline and horizontally oriented teams and work units evolve, specialized management skills are needed. Babcock (1996) argues that one of the prime responsibilities of the project

manager is to build the project team. This involves a whole spectrum of management skills to identify, commit and integrate various project groups from traditional functional organizations into a single programme management system.

Toffler (1990-a) argues that while skills in human interaction will become more important, due to the growing need for collaboration in complex tasks, there will be a concomitant reduction in group cohesiveness. Toffler (1990-b) also states that in the new matrix organization, the workers have more than one boss at the same time. Members of different rank and skills meet in temporary 'ad-hocratic' groups. It will become the responsibility of these members to develop quick and intense relationships on the job. The assumption is that in a matrix organization, conflict can be healthy and differences are valued. People express their views even when they know that the other members may disagree. So across the board, there is a subtle but profound change in the personality traits rewarded by the economic system. This change cannot help but also shape the emerging social character of the manager and the engineer in the South African context considering the South African context, both as it stands today and the way in which it has emerged since April 1994, organizational transformation is vital in order to cope with the turbulent business environment.

Babcock (1978) and Badawy (1983) state that the engineer who becomes a manager faces a bewildering task as he must:

- re-orient his thinking from things to people,
- learn how to motivate others to get work done rather than do it himself, and

- develop a knack for playing the political game that is so much a part of the management scene.

Seethamraju & Agrawal (1999) indicated in their study that although large numbers of engineers are in management, it is generally believed that they still lack soft skills such as:

- communication,
- business management, and
- interpersonal skills to be successful in management positions.

Kemper (1975) emphasizes that engineers are expected to be experts in certain areas. Their education leads them to be observant of what they see. Engineers are concerned with the creation of devices, systems and structures for human use. Seethamraju & Agrawal (1999) postulate that the engineer is by implication, through his education, trained to be a scientist of things and not a motivator or counsellor of people. Lannes (2001) reports that engineers work mostly with objects and they usually identify with the technical aspects of organizations.

One of the most challenging jobs in the engineering industry today is project management, for two reasons. The first reason is that it requires management skills and abilities that are different from those required in a traditional functional, management position. The second reason is that there is very little training support available to those engineers moving into management positions. Thornberry (1987) identifies that the project managers are, however, expected to have a very broad perspective, be able to work mostly with people and primarily identify with

the project rather than their former function areas. Johnston (1987) reports that surveys have shown that the majority of professional engineers are required to assume a degree of management responsibility as they approach mid-career, and for some, the opportunity may come earlier. Badawy (1995) indicates that 63% of the engineers in the USA are employed as managers at the age of 65. This proves the need for generalists in today's business world.

The successful transition of engineers into management is due to three interrelated components: knowledge, skills and attitudes. A thorough knowledge of the principles and elements of administration is needed for managerial success. However, such knowledge by itself is not enough to ensure competency. Management theory is seen as a science, while management practice is seen as an art. An effective manager is thus a person who has developed a set of managerial skills. Kemper (1975) states, however, that there is sufficient similarity to give substance to the assertion that e ngineering is part of management.

Based on personal experience, the researcher believes that the engineer, after completion of his degree and training, is not equipped to undertake a managerial position. Management and project leaders in the engineering industry, however, require an aptitude for interpersonal relations and the willingness to make difficult decisions, which may affect other people. The theoretical and practical sides of educational knowledge required during the transition process from engineer to manager will be analyzed in this research study.

1.3 REVIEW OF THE RELATED LITERATURE

Babcock (1978) and Badawy (1983) argue that for a manager to develop and apply certain methods and techniques in his tasks, a certain number of technical skills is required. General familiarity with, and understanding of, the technical activities undertaken in his department and relation to other company divisions is also encompassed by the manager's technical skills. His technical competence, experience, background and formal education also help to form a strong foundation in the development of such technical skills.

As shown in Figure 1.1 Badawy (1995) indicates that engineering skills are inversely related to the management level. These are most important at lower management levels, but decrease as the manager/engineer advances to higher levels in the organization. The engineer is involved in a limited amount of managerial activity but as he advances to middle and upper management, the importance of administrative skills increases. When engineers are promoted to management level, it means moving away from the technical/engineering end of the operation, and moving closer to general management. His administrative and conceptual skills will become far more important. He will have to become accustomed to seeing the "big picture and the details".

According to Badawy, (1995) a manager's ability to manage relates directly to his administrative skills. These administrative skills are reflected in the ability to organize, plan, lead and control. It is the ability to build a workable group that will initiate a project, make decisions, control and evaluate performance, and direct

subordinates by motivating them through communication to lead them in a certain direction to help the organization to achieve its goals in the most effective way.

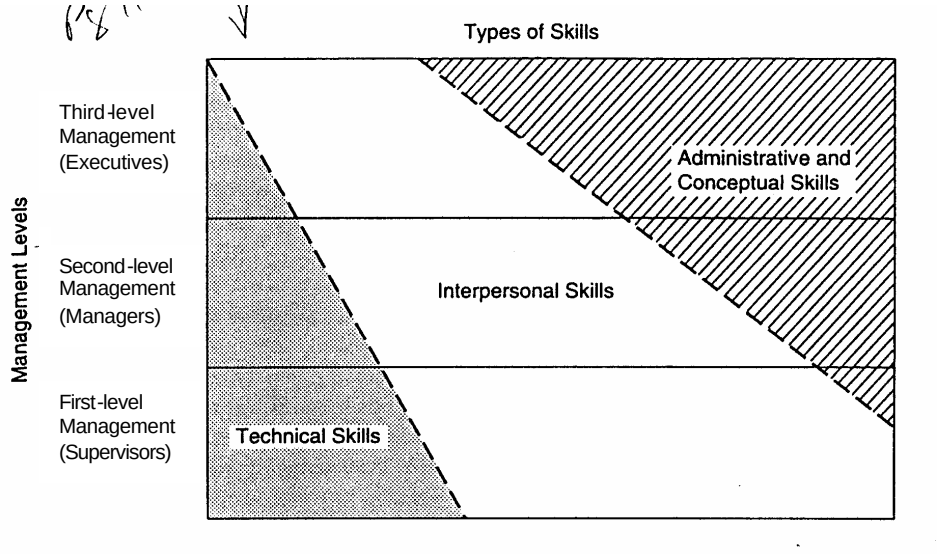

Figure 1.1. The Managerial Skill Mix (MSM)

Source: Badawy (1995).

Raudsepp (1983) refers to what is called the most important of all as, of course, interpersonal skills. To manage is a group effort. Therefore, to work with people requires a superior ability in managerial competency. An effective manager must interact, motivate, influence and communicate with people. The success of an organization is directly related to the people working in the organization. Therefore, the most intricate problem of the manager today is to manage people effectively. It appears from literature that Transformational leadership as conceptualized by Burns (1978) probably serves as the most appropriate leadership style in managing the contemporary changes taking place in South African organizations.

1.4 HYPOTHESIS

The purpose of this study is to assess and compare the skills and readiness of Eskom experienced engineers for adopting effective transformational leadership and appropriate managerial styles within the organization and the possible impact thereof on curriculum changes in the future of RAU engineering students in the South African context.

The nil hypothesis will not be formulated for this research. The researcher postulates that there is a difference in leadership style between inexperienced engineers, on the one hand, and those engineering managers who have work experience, on the other, in this specific sample.

1.5 DEFINITION OF TERMS

- **Management**

Bennett (1996) points out that, although some differences occur over the exact terminology, writers of textbooks are in agreement that the central activities of management are planning, organizing, leading and controlling.

- **Leadership**

Babcock (1996) defines leadership as an "interpersonal influence exercised in a situation, and directed through the communication process, toward the attainment of a specified goal or goals". The element of influencing others to the achievement of a specific objective is emphasized.

- **Transformational leadership**

Bass (1985,1994,1999) argues that transformational leadership consists of a range of leadership styles that contribute to generating outcomes of leadership. Some of these outcomes might be an extra effort from subordinates, individuals, groups and organizational effectiveness, and satisfaction with the leader. From least effective to most effective, these styles are:

a) Laissez-faire: the leader is not actively involved in the follower's work.

b) Transactional style: the leader permits followers to work on the task and does not intervene unless goals are not being accomplished in a reasonable time and at a reasonable cost.

1.6 ASSUMPTIONS

The assumption is that all the elements of the research process would have conformed to the necessary empirical principles, thereby rendering the findings of this research project a true reflection of the current situation.

1.7 METHODOLOGICAL APPROACH AND COMPOSITION OF THE STUDY

1.7.1 Research design

The topic of the leadership style of engineers is fairly new, challenging and exciting. In deciding on the research methodology to be pursued, it is important to distinguish between the quantitative or qualitative nature of the research process. Creswell (1994) defines quantitative study as "an inquiry into a social or human

problem, based on testing a theory composed of variables, measured with numbers and analysed with statistical procedures, in order to determine whether the predictive generalisations of the theory holds true". In contrast, he defines a qualitative study as "inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting". These two definitions highlight the distinguishing characteristics of each approach. The quantitative research process is applicable to this research. The research took place at Eskom and was case specific to Eskom engineers only.

1.7.2 Location of the data

Two independent samples are used. Firstly, the sample size for inexperienced engineers is 37 and the sample size for experienced managers is 48. The composition of the population is engineers.

According to Saunders *et al.* (2000), purposive, non-probability sampling is ideally suited to case studies. This is particularly so where the intention is to collect qualitative data. The validity and understanding that one will gain from the data will have more to do with data collection and analytical skills than the size of the sample Patton (1990).

1.7.3 Measuring instruments

Transformational leadership will be measured by the Multifactor Leadership Questionnaire (MLQ) developed by Bass & Avolio (1995). The MLQ measures

the broad range of leadership from laissez-fair to idealized influence. The MLQ consists of 45 items with four factors that represent the meaning of each construct of the Full Range Model.

1.7.4 Research procedure

The research procedure implemented the following steps:

- Respondents were told that confidentiality would be maintained.
- Respondents (i.e. the leaders) were asked to complete the MLQ leader answer sheet. It was be explained to the respondents that the questionnaire consisted of statements about typical leadership behaviour, and they were asked to indicated how often they behaved in a certain way. Some of the items required that the respondents should indicate how strongly they identified with the behaviour. Because of the fact that the questionnaire was self-explanatory, respondents did not have to provide their names. This would take 20 minutes.
- Respondents (i.e. three followers of the specific leader) were asked to complete the MLQ follower answer sheet. It was explained to the respondents that the questionnaire consisted of statements about typical leadership behaviour, and they were asked to indicate how often their managers behaved in a certain way. Because of the fact that the questionnaire was self-explanatory, respondents did not have to provide their names. This would take 20 minutes.
- All four sets of tests would be stapled together for each respondent.
- All the tests were be sent to the Statistical Consultation Service at RAU.

1.7.5 Statistical analysis

The 45 items of the MLQ were subjected to a Chi-square test in order to establish the frequency distributions of background variables from the two independent samples: the RAU sample (representing the young engineers), and the ESKOM engineers (representing the engineering manager).

In order to compare the leadership style of experienced and inexperienced engineers, the mean and standard deviations were computed.

Multivariate tests of significance were computed in order to determine whether equal results for the two independent samples were obtained.

1.7.6 Outline of the chapters of the study

Chapter 1 is an introduction to the research and provides a background on the reason for the study. A literature review on leadership styles is covered in Chapter 2. The literature review comprises two subsections: firstly, leadership with specific reference to transactional and transformational leadership styles and secondly, the skills that engineers need in today's business environment. Chapter 3 covers the research methodology and includes discussions on research design, the location of the data, measuring instruments and the research procedure. The results and findings of the research are presented in chapter 4. Finally, chapter 5 consists of conclusions and recommendations.

1.8 DELIMITATIONS OF THE STUDY

Leadership has been discussed extensively in literature. However, leadership styles of engineers do not boast an array of literature generated.

1.9 CONCLUSION

From the research of Seethamraju & Argawal (1999) and other literature that covers the problem statement, it becomes very clear that there is a need for identifying, evaluating and developing the engineer's knowledge and expertise in the managerial arena. Leading is seen as an element of managing in order to achieve organizational objectives.

Various factors affect the engineer's development that differs from other professions:

firstly, the scientific and specialized education and training of engineers; secondly, the individual personality and character (their lack of soft skills) and,

thirdly, the nature of the experience and training in the managerial arena affects their development as leaders/managers.

To be able to address the above issues, the following chapters will analyze the leadership behaviour of the engineer manager/leader. The MLQ measuring instrument will be used to identify the preferred leadership style between two groups of engineers, namely, those who do not have more than one year's work experience and those who have.

Chapter 2 will focus on a literature review.

CHAPTER 2

2. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter focuses on a literature review on engineers and engineering managers. Leadership and managerial requirements as well as a transition model for engineers are investigated.

2.2 DEFINITION OF THE TERM 'ENGINEER'

For the purposes of this study, the word or term “engineer” will be defined according to the description of Repic (1990) and Kemper (1975). The engineer is a person who, by reason of his:

- knowledge,
- use of mathematical,
- physical,
- engineering sciences, and
- the principles and methods of engineering analysis and design, which were acquired through engineering education and experience, is qualified to practise engineering. Engineering can be described as the application of scientific principles to the creation of products and systems that are useful to mankind. O’Connor (1994) argues that to create the product, engineers provide the imagination, inventiveness and other skills that are required to perceive the need and the opportunity to create the product.

2.3 TERTIARY EDUCATION OF ENGINEERS IN SOUTH AFRICA

The typical duration of the education of an engineer, practising as a professional engineer in South Africa, has been four years of undergraduate studies. This is in sharp contrast to education in other professions, which only begins after a bachelor's degree has been granted. Smith (1969) argues that the typical four-year engineering curriculum has gradually become the scientific and technical equivalent of a liberal science programme.

Engineering is based on mathematics and science, as confirmed by Bennett (1996), and therefore lacks the human side of business skills. Designs and processes involve:

- evaluation,
- optimisation, and
- measurement.

It is impossible to develop and produce control systems, communications, radar or even vehicle suspensions without the use of basic mathematics. Even more advanced methods such as differential calculus, Fourier analysis, the mathematics of mechanics, communications and control theory are needed. The scientific and mathematical principles that form the foundation of an engineer's work must be fully understood. These are taught to them as part of their basic and specialized education. "In truth what the engineer most properly deals with is that which can be measured, weighed and numbered; these are his conquests, these are the certainties of the engineer" (Beall & Bordin 1964).

However, O'Connor (1994) argues that engineers usually do not need to work with scientists and mathematicians. They have sufficient knowledge to deal with the problems themselves. A sufficient acquaintance with the *humanities and social sciences* will help an engineering student to understand the large social problems of his time. Kemper (1975) argues that the engineer should be able to understand and appreciate the importance of his role in solving these problems.

Babcock (1996) is of the opinion that the "Engineering curriculum should include specific engineering courses which incorporate written, oral, graphical and interpersonal communication skills, and these areas should be emphasised in the evaluation of the student performance. It would also be useful to consider the development and implementation of English proficiency criteria as part of the admission and graduation criteria".

The researcher agrees that the above quotation makes a strong case for universities to consider programmes in engineering management, as the present engineering curriculum does not make provision for any managerial education or training during students' training.

What else is required when an engineering education, which is at least as good as any preparation for someone who wants to be a company president, is completed? Finance and law seem to be closed routes for newly graduated engineers. However, they are classic routes to the top. Repic (1990) indicates in his study that sales and production are a better route to follow for the engineer. Approximately half of the executives have achieved their positions through the

sales and production routes. Kemper (1975) also reports that many graduates move directly into one of these fields because they are so open to exploration.

2.4 TYPICAL PERSONALITY PROFILES OF ENGINEERS

A typical engineer is a university graduate who is comfortable with science and mathematics.

A team of psychologists found, during a detailed analysis of about 100 mechanical engineers, that they are usually

- easygoing,
- without friction in personal relations,
- emotionally stable,
- active,
- energetic,
- direct,
- straightforward,
- very conscientious.

The engineer's characteristic activity is one of intellectual effort, which is basically directed towards creative design. Lumsdaine, Lumsdaine & Shelnutt (1999) argue that the personality profile of the engineer is to be factual, analytical, mathematical, technical, logical, rational and critical – the typical analyst.

Traits such as elitism, conceit and arrogance were almost non-existent.

Aggressiveness and natural curiosity can help an engineer to be successful. However, there is a limit. Some engineers tend to set high goals, which they cannot achieve individually, causing the teamwork to stifle. Sometimes, engineers think they can do everything and then try to take on a larger workload than they can effectively complete. The potential to find themselves in such a situation is always there, but with good supervision, this can be avoided. Bass & Stogdill (1990), confirm that role conflict and ambiguity could add role overload as a source of stress to managers and professionals trying to be very organized in remaining abreast of things. To avoid role overload, they set their own priorities based on what they like to do. One failed assignment, while trying to do more than he is able to, can harm an engineer's performance evaluation in the future. Engineers may become fixated on the technical aspects of the job and fail to see interrelationships and the greater whole in the process.

2.5 MOTIVATION OF ENGINEERS

Toffler (1990-a) states that professional specialists "seemingly derive their rewards from inward standards of excellence, from their professional societies and from the intrinsic satisfaction of their task. In fact, they are committed to the task, not the job; to their standards, not their boss. And because they have degrees, they travel. They are not good company men; they are uncommitted except to the challenging environments where they can play with problems".

Haug & Dofny (1997) state in their research that engineers are predominantly 'locals'. Their goals are directed primarily inward, at achieving the goals of the company and advancing within the company. In contrast, goals directed outward

towards establishing a reputation among fellow professionals through publication and participation in society meetings – 'the cosmopolitan' goals – are least important. Identification with the profession is much weaker than identification with the company.

2.6 THE CAREER PATH OF THE ENGINEER

Brown, Grant & Patton (1981) argue that engineers are specialists/technocrats and that managers are generalists. There has been a debate for many years over specialist versus generalist in management. The generalist is considered to be the better of the two to perceive more than detail, whereas the engineer is trained in orderly thinking. Engineering and engineering management is a complex activity in which uncertainty, intangibles and risk abound. Bennett (1996) confirms that successful managers tend to grow into their jobs over an extended period. Specialists become managerial generalists when they gain experience in their specialized fields. Specialists apply this knowledge to increasingly broader ranges of the organization's activities.

Kemper (1975) identifies that the typical engineer is ambitious and may vaguely resent the alleged 'fact' that the only way of improvement is going into management. Beall, & Bordin (1964) state that in the engineering role, the engineer concerns himself with the product and the processes. Engineers have no affiliation for the law; their interest is doing something constructive and dealing more directly with the forces of nature.

The engineer does not have a typical career path to prepare him for the management role. O'Connor (1994) supports this statement and postulates that only a few engineers receive training in new management principles. Another fact is that management training and literature are tinged with Taylorism, which emphasizes the 'command and control' role of management. The reason why engineers tend to gravitate towards the scientific approach to management is that they are usually rational, numerical and logical. Engineers are the application of science to the design, manufacture and support of useful products, and scientific education is rational, numerical and logical. Engineers, therefore, welcome the ideas of scientific management and have difficulty in giving them up in favour of methods that seem vague, subjective and not amenable to quantification and control.

In sharp contrast, engineering work today in general, and based on knowledge, teamwork and the application of certain skills. The manager's role is to concern himself with the people in his team. O'Connor (1994) states that these two roles are linked so closely together that separation will inevitably lead to bad engineering and bad management.

2.7 REQUIREMENTS FOR ENGINEERS TO BECOME SUCCESSFUL MANAGERS

According to Varley & Gray (1986), only a broad experience and understanding of the commercial, financial and accountancy aspects of organizations will ensure an engineer entering the industry, commerce or the government services of personal

and career advancement. Project managers are expected to have a broad cross-functional perspective, work mostly through and with people, and primarily identify with the project rather than their former functional area. The main problems faced by engineers are typical of the problems of any other businessman and can involve financial, managerial and legal responsibilities, and personnel. However, their position is different because of its unique responsibilities, which are coupled with personal responsibilities.

The ability to gain commercial education and experience that is necessary for promotion to higher levels of management becomes restricted by this belief. Varley & Gray (1986) agree that a good engineer is often held back by the idea that he cannot be replaced and he is, therefore, kept within his speciality to such an extent that he tends to become a narrow specialist. This can be seen clearly in the UK, as opposed to the rest of Europe.

2.7.1 Work experience as a requirement

A lack of experience and understanding can cause an engineer to fail in his duty as a manager. According to Thornberry (1987), for the engineer to be successful, he must broaden himself beyond purely technical matters. One of the most difficult areas for engineers to improve on is people skills, especially when they move into a project management position. These skills are not as highly valued or as critical in an individual contributor's role as they are in a project manager's job. The more experience he gains, the better his understanding will be of how he and his efforts fit into the organizational scheme of things, which will, in turn, improve his chances of success. To gain more experience, McAllister (1984) proposes that

the engineer can take on diverse assignments, participate in technical societies and committee work, and cultivate a natural curiosity to understand the overall context of his efforts. Bircumshaw (1980) indicates that the overall aim of project management development should be to optimize the career success of those employees who have the ability to take increasing responsibility.

2.7.2 Technical skills as requirement

Thamhain (1983) emphasizes the importance of technical expertise to include an understanding of the applications of markets and the business environment. To provide engineering personnel with the needed interdisciplinary expertise within their teams requires extensive technical skills and expertise on the part of the engineering manager who leads the overall effort.

Consultants who are likely to fail are more those who lack business ability, rather than those with a lack of technical ability. What really gives science and engineering the edge is the growing technical complexity of the industry. This does not, however, mean that the top-level manager must have extensive knowledge of detailed technical know-how. It rather means that the manager in a technically-based industry needs a technical background as part of his cultural understanding. Repic (1990) states that the term “cultural” refers to all the knowledge and experience anyone can posses, against which he compares his current situation, in order to make valued judgements. Some industries depend completely on rapid technological change for their well-being. Managers of these enterprises will inevitably possess considerable technical understanding and believe that this trend will increase.

2.7.3 Interpersonal skills as a requirement

Engineers tend to focus more on things than people, logic than emotion, and facts than feelings. Bircumshaw (1980) confirms that many engineers are not sensitive enough in the field of management. This can be emphasized by the practical, logical thinking engineer being irritated by the irrational, often inconsistent behaviour of those he manages. It is argued by Sedge (1985) that an engineer, who is used to working with 'things', may never have acquired the necessary interpersonal skills to operate in a 'people-oriented' role. He recommends that improved selection and training procedures are needed to smooth the transition process since most management training fails to meet the needs of those in transition. According to Thornberry (1987), many engineers take a somewhat cynical view of people management training. Perhaps an engineer's perspective and training work against an easy acceptance of this area. Since people management programmes usually deal with soft issues, wrong and right answers are not always forthcoming. Engineers are used to dealing with concrete and hard data and therefore resist soft skills training.

As engineers become involved in larger projects, they require interdisciplinary skills. Alternatively, the higher an engineer climbs the management ladder in an organization, the broader his contact base becomes.

Engineers then discover that success will depend not only on technical expertise, but also on other factors, such as organizational and people issues. Lannes (2001) states that the knowledge and skills required in the phase of development are primarily things such as project management, interpersonal and

communication skills, interdisciplinary skills in finance and marketing, and other organizational skills.

To work well with diverse groups of people is an ability that is sought after by company management when they want to appoint new supervisors. Engineers are usually assigned to teams. To accomplish their work in a way that will result in the achievement of a common goal, team members must work closely with their peers and supervisors. The performance of the entire team depends on the engineer and if he becomes too independent, the whole team suffers. In most job situations today, the engineer who tries to do a job by himself will be disappointed. McAllister (1984) also declares that teamwork is a catalyst for success, as is the recognition that part of an engineer's success is due to the efforts of his team.

Kerzner (1992) confirms that a manager should provide an effective atmosphere, which could be conducive to teamwork. A manager must nurture a climate with the following characteristics:

- The commitment of the team members.
- Team spirit and good interpersonal relations.
- The necessary expertise and resources.
- Goals and project objectives must be defined clearly.
- Top management must be involved and supportive.
- Good project leadership.
- Open communication among all team members and management.
- Interpersonal and inter-group conflict should be limited.

- Effective communications
- Interest should be shown in the professional growth of team members.
- Commitment to the project is essential.

Koontz, O'Donnell & Weihrich (1984) are of the opinion that poor communication skills can prevent an engineer from moving up. As stated by one executive who is responsible for 100 engineers, "We consider the ability to communicate to be as important as grade point average when we interview engineering graduates". Freston & Lease (1987) state that a new engineer may be average in technical ability, but how people perceive him in meetings and over the telephone is a key to his success. Bircumshaw (1980) states that once a new engineer has been recruited, he needs training. The new recruit seldom moves straight into a line job and contributes. The only advantage to an organization is that it obtained an individual with a trained brain and a personality, which might presage potential to manage others. Just because a person has high marks does not mean that he can function well in an environment of high personnel interaction. Engineers must often resolve complex problems over the telephone.

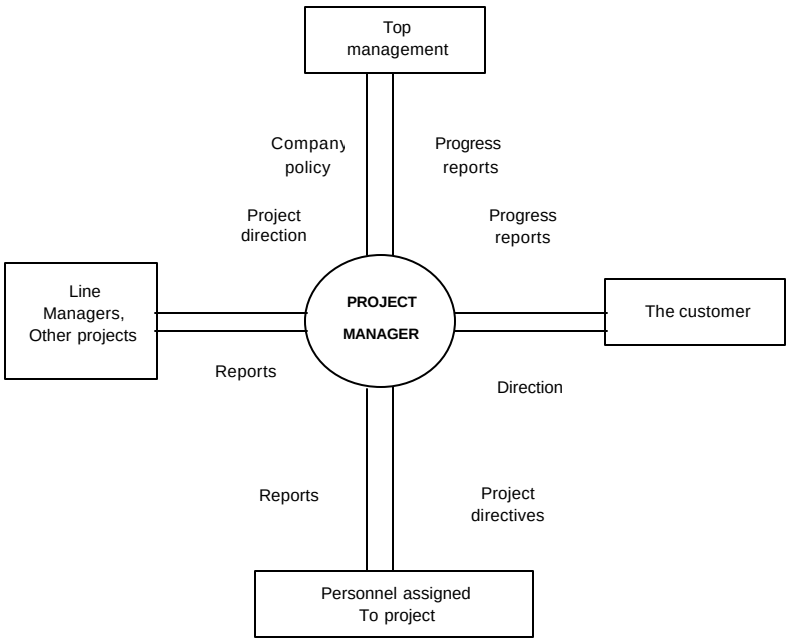

FIGURE 2.1 The Project Manager Skill Links
Source : Bennett (1996)

Good verbal communication skills are therefore of importance. Obviously, deficiencies in this area will limit opportunities.

Management must also be willing to accept variations between individuals and change with time. As indicated in Figure 2.1, when an engineer enters the managerial arena, he will also enter the arena of managerial skills mix, which indicates the various communication skills links.

Project managers in technical organizations are often required to communicate in an important fourth direction – outside the organization. This task will primarily involve the customer, although interfacing with the public at large through new

media, public testimony, addresses before citizen groups and the like may be part of the responsibility. Figure 2.1 shows the communication links important to an engineering project manager.

According to Sedge (1985), it is possible that an engineer, performing a role with a "thing" or "data" orientation, may never have acquired the necessary interpersonal skills to operate in a "people-oriented" role. Most management training fails to meet the needs of those in transition and Bayton & Chapman in Sedge (1985) recommend that improved selection and training procedures are required to smooth the transition process.

2.8 THE NEED FOR CONTINUING EDUCATION

An engineer's career can be viewed as a set of multiple phases. These phases influence the need for new knowledge and expertise. Badawy (1995) identifies four distinct stages through which engineering employees pass:

Stage one: A scientific or technical engineer usually works under the direction of others as a trainee or an apprentice, helping and learning from his superiors. This is the stage where he is probably assigned to a project directed by a senior engineer or supervisor.

Stage two: The primary prerequisite for this stage is independence. The transition to this stage is made by developing a reputation for being technically competent and by being able to produce significant results independently. To accomplish this, he has to become a specialist, even temporarily, within a certain

field of endeavour. Transition to the second career stage is never easy. Attitude and behavioural changes are essential. To adjust from dependence to independence requires originating and developing ideas and individual standards of performance. It is, however, important to note that some individuals can and should choose to rise to higher levels in what might be considered stage 2.

Stage three: In stage three, the engineer learns to take care of others, unlike stage two where he learned to take care of himself. In this stage, engineers assume some responsibility for directing and developing other people. A high degree of self-confidence, a willingness to assume responsibility for others' performance and the capacity for dealing with the tension that results from bridging the worlds of management and the engineering discipline are required to make a successful transition to this stage. This stage is very satisfying and rewarding in terms of money, status and growth. Many engineers remain in this stage until retirement where they play at least one of the following three roles: manager, internal entrepreneur or idea innovator.

Stage four: In this stage, upper level managers are usually, although not always, formulating policies, making decisions, and initiating and approving programmes. Entrepreneurs bring resources, money and people together to pursue new ideas and direct new ventures.

From the above four stages, stage two seems to be the most difficult stage for the engineer to transform into the management arena. Many companies who hire engineering graduates do not place them in engineering positions. The new hires

go through a period of being engineers-in-training so they can acquire tacit knowledge about engineering and about the company's culture. In a way, graduation is not the end but just the beginning of lifelong learning, which will be a balance of tacit and explicit knowledge acquisition.

Accordingly to Toffler (1990), education and training become central to economic effectiveness. According to Brush (1979), graduating scientists or engineers typically do not have any immediate interest in assuming a managerial role, and they do not understand what the job of a manager really involves. It is not always understood how the various technical and managerial skills should be combined or weighted in the selection process.

Kemper (1975) disagrees with Brush (1979) and argues that it is interesting to know that there are many engineering students who do not really want to be engineers: they want to be managers. Badaway (1995) agrees with Kemper and states that 80% of the engineers at the time of retirement had been involved in or transferred from, engineering into managerial functions.

Soon after an engineer has graduated, he usually begins to feel that his education was lacking in certain respects. Kemper (1975) indicates that University study shows that the kind of shortcoming that is sensed is fairly categorized by age groups, thus:

- Those who have been out for five years or less wish they had taken more courses of a practical nature.

- Those who have been out for five to fifteen years wish they had taken more mathematics and science.
- Those who have been out between fifteen and twenty-five years wish they had taken more courses in business and management.
- Those who have been out for more than twenty-five years wish they had taken more humanities and fine arts.

Kemper (1975) states that whatever the stimulus, there is a tremendous demand today for continuing education for engineers. Continuing education for engineers is predominately of three types:

1. Specific and detailed courses on computer programming.
2. Courses in new technology.
3. General upgrading of a higher technical level.

Thamhain (1983) believes that management education should be a major concern of the engineering manager and that it should reflect the needs of the managers of technology and engineering. He also emphasizes that most engineers with several years of work experience, after completion of their engineering qualifications, find that good management skills are important too. If they want to improve their job performance, job satisfaction and promotion prospects, they need superior management skills.

Badawy (1995) states that there is no concrete evidence that those with an MBA perform better than those without it, except for testimonial observations. Management education has been viewed by some as a myth. The researcher

believes however that the new engineer entering the work market will be unable to operate successfully or even to expect any promotion without a broad commercial education, which will have to include finance and managerial skills. Without this, it might seem that he is a narrow specialist and he may find it more difficult to participate in the essential economic decision-making processes.

2.9 THE TRANSITION FROM SCIENTIST TO ENGINEER

According to Badawy (1995), engineers have more in common with the manager than what scientists do, although many scientists also end up in managerial positions. The differences between engineers and scientists are not really determined by their occupational status – much more by their personality characteristics, management styles, value systems, type of position and management level involved. Scientists find the transition to management more difficult than engineers, since the management culture is much more compatible with the engineering culture. Thus, the values of management, i.e. profit making, efficiency and growth, are in line with those of engineering rather than those of science.

2.10 THE TRANSITION FROM ENGINEER TO MANAGER

Sarchet (1969) stated that by the year 2000, more than 50% of corporations would be headed by men with an engineering background. The bulk of the lower echelon decision-making and supervisory jobs would also be in their hands. A manager does not have any direct control over his employee's technical competence, but he can provide incentives that will allow the employee to bring his

talents to full potential. For a manager to be able to motivate his staff successfully, he will need to understand what people look for and aspire to in their work.

Managers generally focus on leadership, technical and administrative skills. In Table 2.1 below, the role differences between the engineers and the managers, as indicated by Bennett (1996), show the old and the new paradigm and that there is a lack of preparation and training for the new responsibilities.

Management skills are twofold: firstly, they offer insight into specific profile engineering management skills, which are needed for effective role performance. Secondly, they establish a possible future management research. Effective engineering leadership involves a whole spectrum of interpersonal skills and abilities.

It gives a clear direction and guidance, integrating multidisciplinary efforts, planning and eliciting commitments, communication skills, problem-solving assistance, collecting and filtering relevant data valid for decision-making, and integrating individual demands, requirements as well as limitations into decisions that can benefit the overall engineering task.

Table 2.1

Role differences between engineers and managers

Position	Engineer	Manager
Focus	More concerned with things technical/scientific	More concerned with people
Decision-making	Makes decisions with much information, under conditions of greater certainty	Often makes decisions with inadequate information, under conditions of greater uncertainty
Involvement	Works on tasks and problem-solving personally	Directs the work of others to goals
Process outcomes	Work based on facts with quantifiable outcomes	Work based on fewer facts, less measurable outcomes
Effectiveness	Depends on personal technical expertise, attention to detail, mathematical/technical problem solving, and designing	Depends on interpersonal skills in communication, conflict management, getting ideas across, negotiating and coaching
Dependency	Experiences role as autonomous	Experiences role as interdependent
Responsibility	Individual accomplishment in one project, task or problem at a time	Many objectives at once, requiring orchestrating a broad range of variables and organizational entities
Creativity	Creative with products, designs, materials	Creative with people and organizations
Bottom line	Will it work?	Will it make/save money for the organization?

Source : Bennett 1996

Quality leadership in the engineering field depends heavily on the manager's personal experience, credibility and understanding of the interaction of organizational and behavioural elements. In other words, the engineering manager must be a social architect!

People skills, management style, technological understanding and organizational culture are important components of leadership. This style must be conducive to

the innovative, high-performance demands of an engineering organization and an engineer must understand the dynamics of the organization so that he can diagnose potential problems and the need for change.

Engineers are facing many problems in switching to management due to the education they receive in engineering or at universities and technikons. The engineer today is bound to a four-year undergraduate curricula programme that focuses entirely on engineering/technical subjects, with a major concentration on conditioning and equipping the students with basic methods and attitudes. Little attention is paid to preparing them for careers in engineering management. The present education systems overdevelop their analytical skills, while their managerial skills remain highly underdeveloped.

From the above, O'Connor (1994) reached the following conclusion: Scientists primarily produce knowledge and engineers primarily produce things. Managers practise management, make decisions and solve problems. The manager is responsible for the work of at least one other individual reporting to him. His ultimate goal is to help the organization to achieve its objective in areas such as engineering, construction, marketing or manufacturing. In other words, managers must guide, coach and direct others. As a result, the skills required of an engineer (specialist) and a manager (generalist) are significantly different. Repic (1990) states that engineers confess in general that they are aware of the fact that they do a poor job in expressing themselves, either in writing or orally. In order to undergo the managerial transition successfully and succeed in the new position of engineering manager, an engineer must at least possess:

- a broad organizational outlook;
- an understanding of operations;
- people-rating skills;
- communication skills; and
- some knowledge of specific business areas such as marketing and finance.

Bass & Stogdill (1990) identify the three main functions that are important at all times in all aspects of the jobs held by managers as:

- The analysis of problems
- Decision-making
- Communication

Upon promotion to managerial positions, many engineers are left to their own ingenuities to determine what and how things should be done. Engineers flounder and become frustrated and they do not succeed in the new positions. This occurs to the detriment of the organization as well as the people.

Preparing for a transition requires a conscious effort and initiative by the engineer and the organization. Because most engineers are involved with mainly technical concerns, firstly, exposure to the overall organization and its workings is difficult to obtain. Secondly, technical projects have their own unique analytical methods, procedures and language. The ability to relate to, and communicate with, many other different types of people with diverse non-technical backgrounds is usually not an essential requirement. Thirdly, exposure to marketing and finance issues

does not really enter into the day of a typical engineer, and from his perspective, it has no direct bearing on his work.

It is confirmed by Thamhain (1983) that proper overall engineering leadership was ranked fourth in the list of most important needs. It is common to relate success to the quality of leadership obtained from management.

2.11 LEADERSHIP SKILLS

Bass & Stogdill (1990) identified four types of leaders:

1. The static leader

This is a professional or scientific person of distinction whose work influences the thoughts of others. These people are chosen on the strength of the Project Engineer, but are not necessarily qualified for the job, e.g. chairing meetings.

2. The executive leader

This leader exercises control through the authority and power of his position.

3. The professional leader

This leader stimulates followers to develop and use their own abilities. According to Miller (1986), the professional leader feels undervalued in pay, in facilities support and in top-management attention and interest. The feeling of being undervalued can be an important cause of dissatisfaction.

4. The group leader

This leader represents the interests of group members. The extent of an engineer's professionalism dictates his leadership style. Bennett (1996) states that he would look for new and better solutions to a given problem and allow subordinates to make mistakes. This is part of the engineer's risk-taking characteristics. According to Wysocki, Beck & Crane (2000), risk analysis is frequently used. The engineer, in his approach to business-decision models, depends on qualifying risks, expected loss if the risk materializes and the probability that the risk will occur.

2.11.1 Transformational leadership

Avolio, Waldman & Yarmmarino (1991) argues that transformational leadership does not simply happen by chance. Certain antecedent conditions set the stage for the development of transformational leadership. These conditions include the individual experiences that a leader has with early role models as well as current experience in the leader's work and non-work setting. According to Avolio (1991), research indicates that transformational leadership can develop as individuals at lower levels in the organization if those individuals have the opportunity to observe the behaviour of successful, appealing, higher level leaders. The aspiring transformational leader must be willing to re-examine his or her strengths and weaknesses as a leader. It is essential for the leader to know his or her strengths because from these strengths the leader will derive personal power. The individual's personal strengths that build personal power include technical expertise, the willingness to take intellectual risks, the concern he or she shows for other people's needs, his ability to communicate clearly and powerfully, particularly

when confronting a crisis, and the leader's record of previous accomplishments. Transformational leaders display four distinct characteristics that Avolio, Waldman & Yarmmarino (1991) labels the Four Is:

- **Individualized consideration**

Transformational leaders pay attention to the individual employee and his needs rather than treating all followers alike and having the same needs. Such leaders listen to and share an individual's concerns while simultaneously helping to build the individual's confidence. The leader removes 'roadblocks' in the system that inhibit both the development of the followers and their achieving optimum performance. The transformational leader must be able to diagnose and evaluate the needs of each follower and then elevate them as required for developing each follower to his optimum potential.

- **Intellectual stimulation**

To serve in a transformational leadership role, Avolio (1991) argues that a leader should be concerned with providing ways and reasons for people to change the way they think about technical problems, human relations problems, and even their own personal attitudes and values that have developed over the individual's life span. An intellectually stimulating leader helps people to think about 'old' problems in new ways and to use reasoning and evidence to solve problems. Intellectual stimulation is also helpful when the leader is attempting to maintain excitement and a high level of motivation among an educated workforce that prefers to have their opinions at least considered by the leader.

- **Inspirational motivation**

Avolio, Waldman & Yarmmarino (1991) postulates that antecedents such as past personal accomplishments, the development of communication skills, and the role modelling of other leaders create the potential to inspire others. This potential is realized in part by the interplay with individualized consideration and intellectual stimulation when the person is in a leadership role. Such behaviour strengthens the leader's inspirational appeal because it makes followers feel valued, self-confident and assured that their leader can overcome obstacles and help the group to meet new challenges and opportunities. A leader's level of inspirational motivation is further strengthened if a vision of where the group is heading, is shared by co-workers. As other means of generating excitement and confidence, inspirational leaders often set an example of hard work, remain optimistic in times of crises, and search to reduce an employee's duties and workloads by using creative work methods.

- **Idealized influence**

Avolio, Waldman & Yarmmarino (1991) believes that by showing respect for others and by building their confidence and trust in the overall mission, transformational leaders are able to develop much referent power and influence over others. When followers observe their leader achieving desired results, the followers are more likely to want to emulate the leader, i.e. to be like the leader in terms of the leader's behaviours, attitudes and values. The transformational leader convinces his followers that by achieving their full potential all concerned will benefit. Idealized influence is to a large extent a culmination of the other three is coupled

with an emotional attachment to identification with the leader. Such leaders are emulated by followers and often labelled charismatic.

2.11.2 Transactional leadership

The transactional leadership style focuses on the interpersonal transactions between managers and employees. Leaders are seen as engaging in behaviours that maintain a quality interaction between themselves and their followers Kreitner & Kinicki (2001). The leader helps the follower identify what must be done to accomplish the desired results: better quality output, more sales or services and reduced cost of production. In helping the follower to identify what must be done, the leader takes into consideration the person's self-concept and esteem needs. The focus is therefore on how leaders influence the follower's expectations.

House (1974) sees the leader's main job as helping employees remain on the right track to challenging goals and valued rewards. Gibson, Ivancevich & Donnelly (1997) states that a natural outflow of this is therefore that the transactional leader relies on contingent reward and on management by exception. Contingent reward is then defined by Gibson (1997) as 'the leader informs followers about what must be done to receive the rewards they prefer' and management by exception is defined as 'the leader permits followers to work on the task and doesn't intervene unless goals aren't being accomplished in a reasonable time and at a reasonable cost'. Bass (1985) states that transactional leadership depends on contingent reinforcement and this could be either a positive contingent reward (CR) or the more negative active or passive forms of management-by-exception (MBE-A or MBE-P). In MBE-A the leader arranges to monitor deviances from standards

actively and taking corrective action if necessary. MBE-P implies waiting positively for deviances and taking corrective actions as necessary.

2.11.3 Leadership development

Bass (1991) states that despite conventional wisdom to the contrary, leadership is a widespread phenomenon…."it can be learned and it should be the subject of management training and development". Research has shown that leaders at all levels can be trained to be charismatic in both verbal and non-verbal aspects of leadership. The subject of transformational leadership is also part of leadership courses in the Unites States air force academy and transformational leaders serve as role models to cadets. Bass (1991) states that leadership development has for too long been seen mainly as a matter of skills development, but lately it is widely regarded as an art and a science, which can be taught effectively.

Bass (1991) asserts that candidates showing the promise of transforming leaders will be attracted to an organization whose chief executive officer is charismatic and enjoys a public image as confident, successful and dynamic. An organization with a large group of transformational leaders conveys to its stakeholders an image that is forward looking and planning the future.

A large-scale evaluation of training was completed by Avolio & Bass (1996). Results showed that immediately following the Advanced Full Range of Leadership training programme for 115 leaders, who were rated before the training by their followers back at work, there were significant increases in inspirational

motivation and intellectual stimulation, and a significant decrease in Management-By-Exception.

2.12 JOB SATISFACTION NEEDS OF ENGINEERS/SUBORDINATES OF ENGINEERING MANAGERS

The principal motivator for an engineer is to have an interesting job and a feeling of personal and professional growth. He may be able to handle many shortcomings in the work situation if the work itself is challenging. If the job is not challenging, he may become more interested in other factors such as company policies, administrative procedures, interpersonal relations and even status symbols. Although these factors are also important to boost morale, they cannot always compensate for the lack of a job challenge. Raudsepp (1977) argues that the engineer's attitude towards his job is self-directing and he is normally quite happy when given limited supervision. He knows he will often be part of a team, but he still wants his company to have confidence in his responsibility so that he can earn greater independence. As factors in job satisfaction, opportunities for responsibility rate high among experienced engineers.

Engineering management studies done by Thamhain (1983) clearly show a significant correlation between the level of professional satisfaction perceived by technical personnel and managerial effectiveness as perceived by upper management. These studies specifically indicate that engineering managers who foster a work environment that is professionally challenging, stimulating and leads to recognition of engineering achievement is an environment conducive to effective engineering teamwork and performance.

For effective engineering teamwork and performance, it is crucial to recognize the professional needs and to build a work environment that is conducive to the employees' fulfilment.

The factors making up the work situation can be divided into those that are extrinsic to the job and those that are intrinsic. Satisfactory extrinsic factors are for a healthy, productive work environment. These include company policies on administration and supervision, physical working conditions, interpersonal relations, salary status symbols and job security. Once these have been provided for adequately, the intrinsic factors become important. Intrinsic factors are not peripheral to the job, but inherent in the job itself. Intrinsic factors are effective motivators, and include a sense of achievement, recognition after successful completion of a job, authority and accountability as well as opportunities for professional advancement and growth.

Thamhain (1983) refers to what is called the intrinsic factors, forming an interesting relationship with Maslow's hierarchy of needs. Four of the five needs in the hierarchy are called deficit needs. These are survival, security, acceptance and self-esteem. Their fulfilment is stimulated by an absence, which is the lack of food, shelter, safety, acceptance or self-esteem. Such deficit needs could be satisfied only by the extrinsic elements of the work environment. A total of 65% of engineering professionals pointed out that a stimulating work environment is very important for professional involvement, creativity and interdisciplinary support. After follow-up interviews, it was established that a stimulating work environment fosters team building, motivates people and an interest in the work itself, and

makes staff result-oriented. They communicate effectively and have the capacity for conflict resolution. They are committed to established organization goals.

2.13 A TRANSITION MANAGEMENT MODEL

The big question is: What can management do to help the engineer make the transition from the technical to the managerial role successfully?

The term "management" refers to those who are responsible for the organization, planning and direction of career planning and employee "development activities" of professional engineers. These include technical managers, directors and engineering executives in charge of the corporate engineering functions. Included are technical development programme managers and executives and, more specifically, a manager or supervisor representing "management" to the engineer.

To make the transition from engineering positions to management easier, one must realize that this is a joint responsibility. Organizational climate, support and development programmes that ease the transition and problems are the responsibility of management. However, it is the responsibility of the engineer to develop managerial knowledge and skills and therefore seek the necessary support for a successful and smooth transition. Cummings & Worley (1997) state that to manage a smooth transition involves creating a plan for the change activities as well as planning special management structures for operating organization during the transition. They also state that implementing the organizational change involves moving from the existing state to the desired future state. Although the transitional state does not occur immediately, this period is

necessary because it allows the organization to learn how to implement the conditions, which are needed to reach the desired future.

2.13.1 A framework for easing the transition to management

The following list of seven identities as described by Flamholtz & Randle (1998) is modified and presented as a base model to ease the transition from an engineering to a managerial role.

The seven identities are:

1. Identify managerial potential.
2. Employ better selection methods.
3. Make the dual ladder work.
4. Provide appropriate support, orientation and coaching.
5. Reward managers for subordinates' development.
6. Provide training in the functions and skills of management.
7. Provide opportunities for management internships.

- **Managerial potential**

Managerial skills are manifested in potential and performance. However, potential must be identified. According to Kerzner (1992), it is difficult to identify the manager with the right qualifications due to the selection of managers on personal characteristics rather than a job description. This may involve the ability to integrate individual demands, requirements and limitations into decisions that can benefit the manager's performance. Kerzner (1992) is also of the opinion that

because of the high cost of executive failure, potential must be identified, since management cannot afford an ad hoc approach to staffing managerial positions. Poor decisions are usually the result of a random approach to managerial positions.

Hallows (1998) concludes that the identification of the managerial potential of engineers should be approached carefully as one must separate the variables leading to high potential from those leading to low potential. It should also be pointed out to managers that performance should be based on results, not process. The fact of the matter is, however, that there is no single "ideal" style of managing – rather more than one effective style. It must be realized that different managers using different behavioural avenues can achieve similar results. What needs to be identified, then, is not a set of personal traits – but rather a sample of behaviours. In the identification of the potential of management candidates, the critical variable is not his traits - but rather his behaviour in certain situations. Fitzgerald & Carlson (1972) state that it is important to “let go” of the technical work and derive satisfaction from managing the work of others.

The engineer must learn to manage the need to be liked in order to deal with conflict and direct others in order to accomplish goals. Given the contextual nature of management (being situation oriented), Fitzgerald & Carlson (1972) claim that this approach is realistic because it shifts the focus away from the individual traits and places it on individual behavioural patterns. Cummings & Worley (1997) are of the opinion that, due to the fact that organizational changes demand new knowledge, skills and behaviours from the organization members, in most cases,

the changes cannot be implemented unless these members gain new competencies. It is therefore easier to look under the skin and deeper to sample job-typical behaviours expected of successful managers.

Woodall & Winstanely (1998) confirm that for engineers to enter management, they need to develop interpersonal skills because they are incapable of dealing with people.

According to them, another problem for engineers incorporating into management is professional independence because they value their independence.

There is no single uniform pattern for the identification of managerial potential, training, selection or development of managers, as stated by Flamholtz & Randle (1998). The employee must also have the ability to do what he is motivated to do and his performance depends on his ability. Selection and assessment processes are imprecise. There are various scales, measures, inventories, instruments, indicators and projective materials available, which range from the insignificant and superficial to the solemnly clinical.

According to Dipboye, Smith & Howell (1994), a needs assessment sets the stage for specifying the objectives of the training programme. The following four major tools have been identified by Woodall & Winstanely (1998) for assessing the potential of management candidates:

1. Personal interview
2. Performance evaluation
3. Evaluation of experience and seniority
4. Assessment centre

The most widely used tool is the personal interview. Research has shown that the above tools are generally insufficient and only serve to meet the needs of the interviewer rather than to serve as a reliable selection device. Dipboye, Smith & Howell (1994) argue that the assessment of trainability could be used to indicate different types of training for different types of trainees or whether intervention will be needed prior to the training to prepare the trainee for the programme. In the case of poor or low motivation, the question could arise as to whether intervention should be attempted at all.

Performance management evaluation and assessment of experience are proven to be unsystematic. Supervisors' ratings can be highly biased. One of the most promising aids in the identification of managerial potential is the assessment centre. According to Flamholtz & Randle (1998), this has a high potential value, because it lets us see *what* is going to be measured, *how* it works, whether it will be completed, and *how* it compares to other techniques.

The importance of an assessment centre depends on the nature of the goals that have been set. Flamholtz & Randle (1998) confirm that an assessment centre is used to measure the reactions of candidates when they are faced with different managerial situations. The assessors then make an aggregate assessment,

identifying the candidate's strengths and weaknesses. The candidate then undertakes a series of tests and exercises, both individually and in group situations, which are designed to extract key forms of behaviour that serve as indications of managerial success. These dimensions to be assessed include leadership, organizing and planning, decision-making, oral and written communication skills, initiative, energy, resistance to stress, delegation, self-direction and overall potential.

An 'in-basket' exercise is used by Grote (1996) to tape these dimensions, including simulated accumulation of memorandum, reports, notes of incoming telephone calls, letters and other material. The candidate is asked to dispose of these materials in the most appropriate manner by writing letters, notes, self-reminders, agendas for meetings, leaderless group discussions, management games, individual presentations, interviews and projective tests.

The assessment centre is a vehicle for assessing the person in relation to the competencies of his performance on the job and his aim to obtain the best possible indication of the person's actual competence to perform at the job level. According to Woodall & Winstanely (1998), an assessment centre is almost certainly more valid than any other means of identifying and analyzing a candidate's management potential. Organizations are more inclined to use structured career development tools like assessment centres, workshops and psychometric testing to assess and develop the competencies of employees. Although there is no proof, it seems that the use of an assessment centre for identifying management potential is a sounder method than those traditionally

used by management. Through research, it has also been established that assessment centre evaluations seem sufficiently high to support their further use. Assessment centres have been found to be effective and to contribute positively to the selection process.

The purpose of an assessment centre is to evaluate candidates. Two interviews are then scheduled: one oriented to technical competence and the other to managerial knowledge. Team skills could also be assessed as well as their decision-making capabilities. Cummings & Worley (1997) conclude that the responses will enable the interviewers to assess technical depth, the ability to learn and the desire to be cross-functional.

The strengths of such an assessment centre can be summarised as follows:

1. In typical performance evaluation systems, the use of several assessors is superior to the single boss's appraisal.
2. Several yardsticks, which are common to all assessors, are used in evaluating potential.
3. The training assessors receive help to sharpen their observation and interviewing skills.
4. Training exercises are given to candidates participating in the assessment centre – (in-basket, group presentation and problem-solving exercises) that will eventually be regarded as management training experiences.
5. The assessment centre experience has a positive influence on the morale and job expectations of the candidates. It provides

candidates with the opportunity to show their managerial abilities in fairly realistic situations. It also helps to understand the requirements for the positions for which they are considered.

Assessment centres and limitations thereof:

1. The candidates who perform well become "crown princes" and their future success may become a self-fulfilling prophecy.
2 Candidates who perform poorly in assessment centres may feel inadequate and find that their jobs are on the line with the company they represent. This may cause some undesirable job turnover.
3. Candidates who have not been nominated for participation might develop an unfounded high degree of anxiety.
4. The organization might create a feeling that only candidates high on conformity and low on independence are nominated for assessment centres. Therefore, it could eliminate the unusual or imaginative candidates for management. To avoid this, nominations could be supplemented by self-nominations, peer nominations or the assessment of everyone at a job level for possible selection to managerial positions.
5. Stressful situations may occur for the candidate since he might feel his entire career depends on his performance of a few days. Stress is part of a manager's world, but in this scenario, a candidate could feel the stress more acutely since he is subjected to a more intensive dose, knowing his performance could determine his future.

The assessment centre is a promising concept. Although it is far from perfect, it is still superior to other traditional approaches to the identification of managerial potential. This is the reason why this technique could be used in identifying an engineer's potential for management. In this sense, the technique becomes an ongoing assessment procedure of the potential of many management candidates.

From the above discussion, it is clear that the transition of engineers to management depends on the proper identification and assessment of the candidate's potential. Since the best way of appraising and developing managerial capability is in the context of the job, candidates should be given the kind of responsibility that will help identify their potential and contribute to their development.

A supervisory job should be a testing period during which the new manager is offered the opportunity to try out the role before committing himself to management. This is the only way he will realize what management is all about.

- **Selection methods**

It often happens that the wrong engineers are promoted into managerial positions without adequate preparation to overcome the difficulties involved in this troublesome transition. There must be a willingness to listen to negative messages and to encourage a high freedom of choice and risk-taking. According to Woodall & Winstanely (1998), teaching the correct skills to inadequate managers cannot make component managers. The key point is that managers are learning all the time and this can give them the opportunity to be innovative or

to take risks in the day-to-day practice. Another way to ease the transition from engineer to manager is via better selection.

Several problems can occur when a manager selects the “right” people for managerial positions. Moffatt (1978) indicates that the most visible aspect of the engineering performance is his technical competence, which is hardly a sufficient prerequisite for effective managerial performance. It is safe to say that competent engineers do not necessarily make competent managers. It is found that technical competence is erroneously the most widely used criterion in selecting engineers for supervisory or managerial positions. The assumption that the individual who is best at doing the work will be best at supervising it is clearly inappropriate.

A problem related to selecting people with the "right" motivations for management can also surface. Since a large part of the manager’s job is getting things done through people, it is essential to try to understand people’s motivation. Stewart (1997) is of the opinion that the real purpose of management is motivation of the group to use its energy to achieve objectives. This would be a commendable way to do the task as long as your perceptions of the "right motivations" and those of your subordinates aspiring to management are the same. The fact of the matter is that they are usually not. Stewart (1997) also states that a useful guide for managers trying to improve on motivation comes from what is called the “expectancy theory”, which argues that employees perform well when they see a link between effort, performance and rewards. One of the most critical problems in selecting engineers to become managers is motivation. Cummings & Worley (1997) are of the opinion that motivation starts when organizational change

involves moving from the known to the unknown. People must feel the need for change, thus making them dissatisfied with the status quo and desiring to try new things and ways of behaving.

Differences may arise from the difference in hierarchical perspectives and expectations as well as understanding by the superior about the motivational problems facing the subordinate in transition. For these reasons, the wrong individuals might often be selected for managerial positions. Therefore, the transition to management might turn out to be quite problematic for an engineer with a superb technical competence, simply because managerial motivation has little appeal for him.

Another problem in the selection process relates to the underdeveloped state of psychological selection technology. None of the measuring devices are perfect. No perfect model exists as a substitute for the subjective judgement of the superior. The basis for promoting the engineer to management should be clear. The selection of managers on the basis of a set of identifiable traits, such as empathy and intelligence, would be inappropriate and has therefore been rejected. Success in management can only be achieved through the possession of different sets of traits as long as they happen to fit the demands or requirements of a particular situation. The essence of this approach is: "it all depends".

The effectiveness of a particular set of skills or managerial style will simply depend on the nature and characteristics of the situation. A managerial style could be effective only if it is suitable to the requirements of the situation.

Aids in managerial selection have several implications. These can be summarized as follows:

1. It is the opinion of Woodal & Winstanely (1998) that engineering managers should not become trapped in the traits or attributes of the individual, as they are intangible variables, difficult to operationalize and link to managerial behaviour. Traits and abilities needed to lead people tend to vary from one situation to another, and for this reason the selection of managers is so difficult. Stewart (1997) argues that a match between the manager, the staff and the situation is needed to make the "right" selection.

2. Furthermore, Stewart (1997) states that behaviour can be used as a measurement tool by seeking to identify managerial skills, which will result in effective performance. How managers manage is only partly due to the kind of people they are, for their behaviour is also affected by the position in which they are placed.

3. The use of a conceptual scheme developed for the ingredients of managerial competency as a basis for assessing the candidate's knowledge, skills and attitudes is stated by Kerzner (1992) and confirmed by Flamholtz & Randle (1998). It is also stated that the skills tend to be focused on more interpersonal and administrative skills, versus the skills needed to perform technical tasks. Table 2.2 depicts a checklist that may help with the managerial selection process. This could be used as a guide to identify major dimensions and the strengths and weaknesses of proposed candidates. The

checklist may be adapted to fit any given situation. By using this table, it is obvious that in the selection of managers, one should look beyond the candidate's technical background and ability. The real concern should be the extent to which the ingredients of managerial competence are present in the candidate translated in the form of identifiable skills. In assessment, the main question that will always remain is: Does he have what it takes to succeed in management? This question will revolve mainly around his skills and, thereafter, his knowledge and attitudes.

- **The dual ladder leader**

Another mechanism that management can adopt is the establishment of equally attractive reward systems for both engineering and managerial career paths. These organizational rewards are powerful incentives to improve the employee's performance. Cummings & Worley (1997) confirm that through this measure, engineers will be encouraged to choose their career directions on the basis of their background, interests and skills, and not so much on the basis of economic and non-economic rewards given.

Both the individual and the organization will benefit from this. For the individual, it means better use and development of his professional assets, and for the organization, a better management and technical capability. Woodall & Winstanely (1998) describe that effective implementation is the key to making the dual ladder work.

The following suggestions are made for consideration:

1. A committee should be established to devise and administer the appropriate ladder to meet the organization's particular needs. According to Cummings & Worley (1997), skill variety is important and increased by moving the employee from one job to another, which is a form of job enrichment. Furthermore, skill variety can be defined as the degree to which a job requires a range of activities and abilities to perform the work.

2. The engineering ladder must go as high as the management ladder, with salary parity at each level.

3. The ladder must be designed for free movement between engineering support groups and management. This avoids the all-too-common isolation of the two groups and is an important aid to the career development of young engineering people.

4. Flexibility is essential, allowing engineers to report to managers on the same level where necessary to form project teams.

5. Non-degree people should be accommodated. Make opportunities for advancement by providing rungs on the ladder for them as well.

Table 2.2 represents the guidelines by Kerzner (1992) and Cummings & Worley (1997) to ensure that engineers, in their move into management, respond to motives and career objectives other than just economic incentives.

TABLE 2.2

Guidelines to ease the transition from engineers to manager

FACTORS INFLUENCING THE TRANSITION	IDENTIFYING THE FACTORS
SKILLS **Administrative skills**	Some questions that could be asked regarding administrative skills: What kind of administrative experience does he have? Has he been involved with management, projects and task forces? To what extent does he understand the way the organization operates? Does he like to make decisions or solve problems? Is he capable of taking risks? How does he relate to authority, power, and responsibility? What type of skills does he have in the area of organizational structure and design? Is he effective in appraising the performance of others? Would he be comfortable working against deadlines? Is he good at getting things done through others, at follow-ups and feedback? Would he delegate authority to others? (Kerzner, 1992)
Interpersonal skills	Is he good at working with people? Is he a team player or a loner? Would he be effective in motivating and inducing others to work hard? Is he good at "sizing up" people? Is he a good communicator? Does he maintain healthy relations with his associates and superiors? Does he take initiative and exhibit leadership qualities in working with others? How does he handle conflict? How does he relate to power? Would he use it wisely? Would he appreciate subjective things like emotions, feelings and values, and their place in management? (Cummings & Worley ,1997)
Technical skills	The following questions could be asked: Does he have the professional respect of his peers? Can he identify with people who are part of the technical community? What is his understanding of product applications? Where will his loyalties lie? Any knowledge about technological trends and evolutions? Can he identify with the big picture? Can he play the dual role of professional administrator as a professional and a manager of engineering activities? (Kerzner, 1992)
PERSONALITY AND CAREER ORIENTATION	What are his personal motives? Why does he want to become an engineering manager? Why is he working for this particular organi zation? What are his career objectives? Would he be preoccupied with getting the job done - as a potential manager - or with maintaining the "nice guy" image? How strong (or dominant) are his needs for achievement and power? Is he capable of interacting, relating to, and empathising with, others? (Kerzner,1992)
KNOWLEDGE	How much management knowledge does the engineer have? Experience? Does he have enough respect for managerial work? How much value does he attach to managerial as opposed to engineering work? Would he be willing and able to upgrade his management knowledge through education and training? (Kerzner, 1992)

- **Appropriate support, orientation and coaching**

Broad (1982) is of the opinion that a newly appointed manager whose task may seem overwhelming will need training to cover both the immediate and long-range aspects of his job**.** It may include workshops and training materials oriented to human relations, communications, active listening and mentoring. According to Cummings & Worley (1997), this could enhance the organizational capability to implement personal and organizational strategies. On taking up his duties, the young manager might find himself confronted with a mountain of paperwork. Many administrative problems may occur. The following questions could arise: "How do I get a raise from someone? What rights do I have regarding discipline in this case? Where do I sign this time card?" He needs training to cover the immediate and long-range aspects of his new job.

Steps should initially be taken to ensure that the manager is given (1) adequate instruction and coaching in handling the request administration. Thereafter, he needs (2) an intelligent insight into company policy, management systems and procedures. Management supervision involves more than the mere mechanical application or rules and regulations. The manager also needs (3) insight into the difficulties he will encounter in making the transition from engineer to manager, and requires help and guidance in overcoming them.

The question, "What does it mean for me to be a manager?" needs to be answered, and he will need help in doing so. This kind of orientation should start as soon as the new manager has grasped the administrative details of his new job.

But how? There are various ways in which this aid could be provided. Firstly, the new manager's superior is best equipped to give him the necessary council. However, sometimes the superior himself may be less wise in these matters than the subordinate. In such a case, a personnel specialist might undertake the counselling. Either the training department or an outside consultant could conduct some form of in-company training programme or even ensure the attendance of outside seminars whereby the prospective manager would help, especially meeting people from other specialities who nevertheless have the same needs he has. The perfect solution is for the training to be done within the plant of the organization unit to which the man is assigned, in collaboration with an outside management consultant. A management consultant with a solid background in applied behavioural sciences could be very helpful. His knowledge in designing and implementing the necessary training for those prospective managers and possibly their new superiors could help them to make a smoother transition from engineering to management.

- **Rewarding managers for subordinates' development**

Engineers as managers have many responsibilities and are very busy people. The emphasis on short-range results, immediate payoffs and the continuing pressures to perform focuses their attention on functional activities that will enhance divisional efficiency. This means spending most of their time doing the activities that will actually appear on the balance sheet or the profit/loss statement - in the short term. The bottom line is all that counts in the short term!

A high priority for the manager personally might be the development of employees, but will probably be pushed aside since more compelling pressures may be competing for your time. One way to help your subordinates in the transition to management would be through supervisory counselling, coaching and support. Cummings & Worley (1997) conclude that the most useful way to help employees advance in their careers is sponsorship. To achieve this end, four avenues must be pursued:

- The development of subordinates must become a viable criterion in evaluating supervisory performance.
- Appropriate rewards and incentives should be employed to induce supervisors to meet subordinates' development needs.
- Supervisors should be provided with appropriate means (including education and training) to develop employees' skills in the transition to management.
- Upper-level managers should take a long-range view of human resources development rather than expecting a short-range and quick pay-off. To develop a competent manager is one of the best investments of an organization.

- **Providing training and skills to management**

Appropriate management training and development is the next mechanism for easing the transition to management. Flamholtz & Randle (1998) argue that an organization should evaluate the extent to which its training processes support its new transition. The following areas, as indicated by Dipboye, Smith & Howell

(1994) for the training and development of engineers in transition, have been identified:

- The management functions to be performed.
- The personal skills needed for the performance of these functions.
- Motivational value - patterns to be satisfied.

It is also important to know how to maximize performance in the training itself, which requires the knowledge of research on motivation and learning, followed by how to facilitate the transfer of training to the work environment.

Basic management functions such as basic grounding in the principles and techniques of supervising, planning, organizing, evaluating and programme assessment will be included in the training. From research, it is known that engineers do not experience a great deal of difficulty in learning and handling these functions.

The second area where training and development are needed relates to the personal skills of the newly appointed manager. Three types of skills are necessary for managerial competency, i.e. technical, administrative and interpersonal.

Table 2.3 depicts some examples of topics that should be covered in each of the three skills training areas. The skills area has the greatest potential as a source of tensions and frustrations for the engineers in transition. It also shows that the

administrative and interpersonal skills are usually “the most problematic” in the transition to management. Technical skills will not cause major problems. Training and development needs in the motivation and rewards area will depend on the type of orientation, values and career objectives the engineer has.

Table 2.3

Training and Development Needs in Management Skills

ADMINISTRATIVE	INTERPERSONAL	TECHNICAL
Job descriptions	Handling people	Knowledge of fundamental technology
Understanding the organi-zational systems	Coordination	Application of technology
Organizational relationships	Leadership	State of the art
Problem-solving techniques	Motivational techniques	
Managerial decision-making	Effective communication	
Programme evaluation	Forming and managing effective teams	
Coping with organizational constraints (budgets, resource allocation, personnel policies, etc.)	Managing innovation and creativity	
Coping with environmental factors		

Source: Dipboye, Smith & Howell (1994)

Stewart (1997) states that a useful guide for managers trying to improve motivation comes from what is called “expectancy theory”, which argues that employees will perform well if they see a link between effort, performance and rewards. It is important to provide rewards on an individual basis, tied to performance. Three types of orientations and career choices could exist: firstly, the engineer in transition to management with a strong loyalty to the organization and strong managerial motivation orientation. Secondly, the undecided engineer who enjoys working in his field but finds a career in management appealing, yet is somewhat reluctant to move into management. Thirdly, the professionally loyal engineer with a strong loyalty to his profession, for whom managerial motivation definitely has a negative appeal. Considerable research evidence shows that the first orientation will be more typical among engineers than scientists. Conversely, the professionally loyal orientation will be the other way round. Managerial motivations could clearly have a negative appeal for more scientists than engineers. It is possible that the three types of orientations could be found within both engineering and science populations.

Training and development needs would depend on the type of orientation the engineer has during the transition. The stronger managerial orientation would ensure easier and less intensive training. Individuals with a strong specialist motivation would experience the most frustration in the transition. With an undecided engineer, the intensity of the training and the extent of the frustrations would largely depend on how motivated they are to become a manager, their degree of loyalty to both the profession and the organization, and their long-range career objectives.

- **Providing opportunities for management internships**

This is the final mechanism that could be employed to ease the transition from engineer to manager.

Training and development programmes based on intellectualised and cognitive approaches such as lectures, discussions, cases and readings will not be sufficient. Another approach to ease the transition to management is by providing opportunities for engineers to test management waters before making a final commitment to management as a career. It could be quite beneficial to give them "hands on" opportunities, in the light of their management knowledge and background, not only to learn about management but also to do some actual managing. Dipboye, Smith & Howell (1994) state that most organizations never carefully evaluate the costs and benefits of on-the-job training. This type of training offers many advantages. Project assignments are one way of doing this, with significant managerial responsibilities, venture teams, rotational assignments and task leadership groups. These are a few examples of "learning by doing" in actual management situations. A similar practice is to have management candidates go through an internship programme as a testing period.

This is an excellent arrangement for them to learn and practise the skills of their "new" possible position. Dipboye, Smith & Howell (1994) is further of the opinion that some personal assessment of the managers could be undertaken to see and evaluate them in action. This testing period approach should be part of a comprehensive career development programme at an appropriated organization. For this procedure to work, two criteria must be met effectively. Both the engineer

and management must agree so it becomes part of the culture of the organization. Both must also have the right to call it off should things not work out. In this way, there will be no stigma implying managerial failure.

Bennett (1996) states that these various management internship programmes would provide engineers with the opportunity to assess the type of satisfaction they will obtain by performing the managerial role. This point relates closely to the question of their motivation. The amount of satisfaction derived will depend on several variables, including their career objectives, their values and the extent of their professional and organizational orientations at that point.

2.14 CONCLUSION

It is the opinion of the researcher that (1) the engineer in the matrix environment is not equipped during his formal educational and training years with the necessary skills needed for future managerial positions. For the engineer to prepare himself for management, he will need to (2) obtain knowledge about management and develop management skills. Because of the inadequate preparation of engineers and technologists for careers in management at undergraduate schools, they (3) tend to experience several difficulties in their new careers, which often makes the transition to management far from smooth. It is suggested that (4) a broad organization outlook, an understanding of its operations, people-relating skills, communication skills and some knowledge of specific business areas such as interpersonal skills and finance be included in engineering education and training. The engineer, as a manager, needs (5) political, interpersonal and technical

sensitivity. These could aid in recognizing the early stages of conflict between individuals and organizations. Managing today's engineering function requires specific skills in leadership as well as a technical, interpersonal and administrative area. These skills requirements became more complex and more crucial to effective role performance as bureaucratic hierarchies declined and multi-disciplinary work groups evolved. Today's managers have expressed (6) concern about, and interest in, the identification and development of engineering management skills. Every manager has his own set of skills, though, which seem to be particularly crucial for effective role performance.

The (7) MLQ can be used successfully to investigate the leadership style of engineers and engineering managers.

Management (8) has a key role in initiating and implementing a transition model or programme to ensure that an environment is put in place that will provide the necessary training for the engineer to become a manager. Transition is a multiphase evolutionary process over time. It can be a fairly difficult process for the engineer, and to ease it, a (9) well-thought-out and intensive strategy would have to be developed by management. Lastly, (10) the engineer who wants to become a manager must therefore make a quality decision and be able to commit to challenging transition to management.

CHAPTER 3

3. RESEARCH METHODOLOGY

3.1 INTRODUCTION

Whenever research is conducted, it is for a specific reason, i.e. to answer a specific question or to solve a particular controversy or issue. Research is such an interesting phenomenon as it can be challenging on the one hand, yet frustrating on the other. It can be exhilarating and very stimulating. However, it can also be time consuming and tedious (De Poy & Gitlin, 1994).

As mentioned previously, the purpose of this study is to assess and compare the skills and readiness of Eskom experienced engineers for adopting effective transformational leadership and appropriate managerial styles within the organization and the possible impact thereof on curriculum changes in the future of RAU engineering students in the South African context.

This chapter describes the method that was employed in the study, including a description of the target population, the measuring instrument and the data analysis.

3.2 PURPOSE OF THE RESEARCH

Kemper (1975) emphasizes that engineers are expected to be experts in certain areas. Their education leads them to be observant of what they see. Engineers are concerned with the creation of devices, systems and structures for human use.

Seethamraju & Agrawal (1999) postulate that the engineer is by implication, through his education, trained to be a scientist of things and not a motivator or counsellor of people. Lannes (2001) reports that engineers work mostly with objects and they usually identify with the technical aspects of organizations. Based on personal experience, the researcher believes that the engineer, after completion of his degree and training, is not equipped to undertake a managerial position. Management and project leaders in the engineering industry, however, require an aptitude for interpersonal relations and the willingness to make difficult decisions, which may affect other people.

In establishing whether the leadership style of the engineering manager with work experience and the engineer without work experience differs, it would aid organizations to:

- provide focused, purposeful training in order to develop specific leadership skills, and
- enhance a performance culture in organizations.

3.3 THE RESEARCH PROCESS

The research process consists of eight phases and is summarized by way of a diagram as seen in figure 3.1 (Van der Colff, 1999). Phase 1 is the input to the research. It covers the choice of the research topic and the need to formulate and clarify the topic. The topic must have issues that have a clear link to theory.

Phase 2 deals with the literature review and focuses on the generation of the initial research concepts. Concepts are the building blocks of theories and

hypotheses in that they are “abstract ideas which are used to classify together things sharing one or more common properties” (Krausz and Miller in Gill & Johnson, 1991).

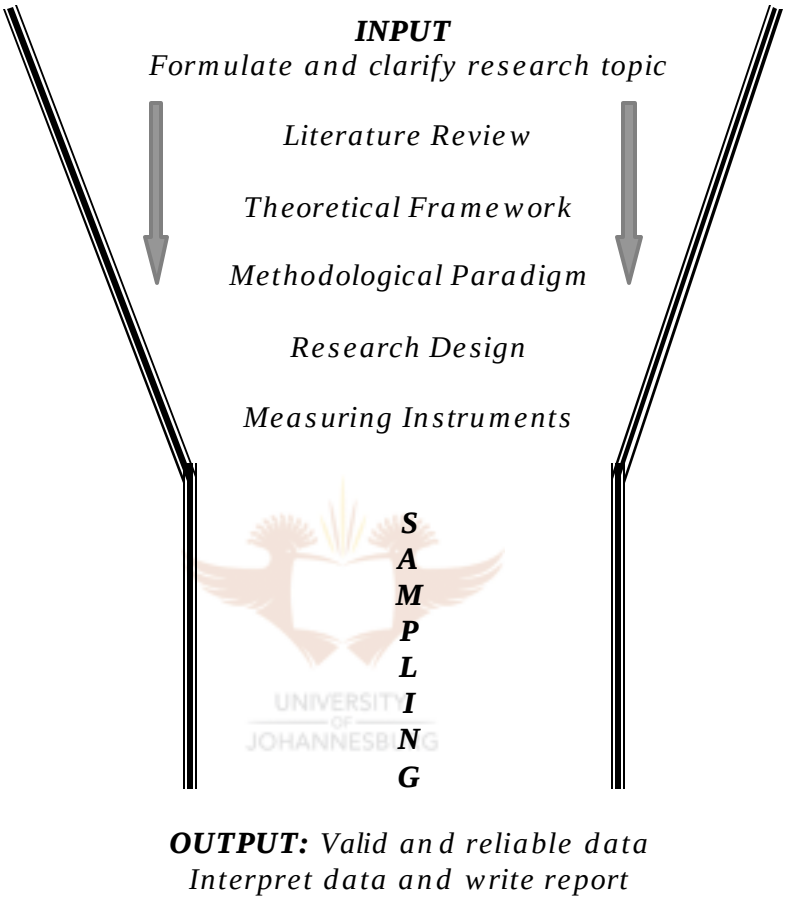

Figure 3.1: The Research Process

Source: Van der Colff, L. (1999): *Consultancy Dissertation,* Johannesburg, Milpark Business School.

A literature review, according to Van der Colff (1999), forms the foundation on which research is built. It is a description and critical analysis of what other authors have written about a particular topic Jankowitz, (1991). Friedman in Gill *& Johnson* (1991) refers to theories gathered as ‘filing systems’, which allow

observations to be used for predicting and explaining events. They create expectations. According to Gill *et al.* (1991), theories influence what people see and what people take to be factual observations. This means that the nature of the observation is theory-laden and that there is no actual separation between theory interpretation and data. The literature review discussed (chapter 2) in this research focuses on leadership style, education and skills needed by the engineering manager as well as a transitional model.

Phase 3, as seen in figure 3.1 deals with the theoretical framework, as discussed in chapter two of this report. Phases 4 and 5 as seen in figure 3.1 deal with the methodological paradigm and research design respectively Van der Colff, (1999). The methodological paradigm, which includes the research design, will deal with the choice between the qualitative and quantitative paradigms. The application to this research is discussed in the next section.

3.4 RESEARCH DESIGN

The purpose of the study is to compare the leadership style of inexperienced engineers and experienced engineers. Creswell (1994) defines quantitative study as "an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers and analysed with statistical procedures, in order to determine whether the predictive generalisations of the theory holds true". The quantitative research process is applicable to this research.

Phase 6, according to figure 3.1, constitutes the measuring instruments.

3.5 MEASURING INSTRUMENTS

There are many different measuring instruments that can be used, each with its own advantages and disadvantages. They are used to quantify the variables and indicators that are being researched.

Leadership style was measured by the Multifactor-leadership-Questionnaire (MLQ) developed by Bass & Avolio (1995). The MLQ measures the broad range of leadership from laissez-fair to idealized influence. The MLQ consists of 45 items with four factors that represent the meaning of each construct of the Full Range Model.

3.6 RESEARCH PROCEDURE

The research procedure implemented the following steps:

- The researcher administered the questionnaire in person.
- Respondents were told that confidentiality would be kept.
- Respondents were asked to complete the MLQ leader answer sheet. It was explained to the respondents that the questionnaire consisted of statements about typical leadership behaviour and they were asked to indicate how often they behaved in a certain way. The items required that the respondents should indicate how strongly they identified with the behaviour. Because of the fact that the questionnaire is self-explanatory, respondents did not have to provide their names. This took 20 minutes.
- All the tests were sent to the Statistical Consultation Service at RAU.

3.7 STATISTICAL ANALYSIS

In order to compare the leadership style of experienced and inexperienced engineers, the mean, standard deviation was computed.

Multivariate tests of significance were computed in order to determine whether equal results for the two independent samples were obtained.

The SPSS Windows programme was utilized. The statistical information is available from the Statistical Department of the Rand Afrikaans University.

Phase 7, as seen in Figure 3.1, deals with the sampling process.

3.8 THE TARGET POPULATION AND STUDY SUBJECTS

Sampling is the technique of observing a portion of some total set of events or phenomena Oswald *et al.,* (1997). It is used where the researcher wishes to make assertions about a total population, but is unable to survey the entire population: "A good sampling procedure fulfils two basic criteria, the first one being that the sample should be representative Goode & Hatt in Boon (1996)". This means that the total population, the observations and the significant relationships between them should be carefully defined. The second one is that the sample should be adequate (Goode & Hatt in Boon, 1996) so that sufficient confidence exists in the stability of its characteristics. The designs that describe sampling procedures are probability sampling and non-probability sampling (Van der Colff ,1999).

The respondents constituted of two independent samples

Firstly, all the students currently enrolled for their engineering degrees composed a population of interest. "The unit of study (Cooper 1998) was engineering" students working on their degrees at the Rand Afrikaans University in South Africa. The sampling method used is non-probability sampling as defined by Cooper (1998). Cooper (1998) states that the population can be divided into groups purposively selected for the study. For the purpose of this research, judgement sampling was used as a type of purposive sampling method. The researcher selected sample members to conform to some criteria. The most common attributes of engineering students is their type of education and lack of managerial experience. The researcher believes that although the use of students may imply homogeneous groups, this sample is more heterogeneous due to the fact that the respondents do not have managerial experience in the corporate environment as a common attribute. The sample variance is therefore greater. The sample size (N) is 37.

Secondly, engineering managers at Eskom composed a population of interest. The non-probability sampling method was used. The most common attributes of engineering managers is their managerial experience. The researcher believes that although the use of engineering managers may imply homogeneous groups, this sample is more heterogeneous due to the fact that the respondents have managerial experience in the corporate environment as a common attribute. The sample variance is therefore greater. The samples size (N) is 48.

3.9 VALIDITY AND RELIABILITY

Phase 8 according to figure 3.1, is the output, which tests the validity and reliability of data, and then interprets and writes the report. Criteria to be used in the evaluation are internal validity, external validity and reliability (Gill *et al.,* 1991). External validity refers to how far generalization can apply beyond the immediate research sample. External validity is subdivided into population validity and ecological validity. Population validity refers to generalization to a wider population and ecological validity extends to other social contexts and settings beyond the research. The researcher believes that due to the heterogeneity of the sample, the findings of this research could be generalized to a wider population. Reliability refers to the consistency of results obtained in the research. The reliabilities, according to Cronbach's alpha coefficient (Cooper, 1998) of the transformational leadership style subscale (for both the independent samples), was higher than 0,7. The reliabilities, "according to Cronbach's alpha coefficient Cooper, (1998)" of the transactional leadership style subscale (for both independent samples), was 0,478 and 0,667 for the RAU and Eskom groups respectively.

3.10 SUMMARY

This chapter dealt with the research methodology that was employed in this research. To explain this, the research process in Figure 3.1 was followed. The results obtained from this research will be presented and discussed in the next chapter and based on these results the researcher will make certain recommendations.

CHAPTER 4

4. FINDINGS AND INTERPRETATIONS

4.1 INTRODUCTION

In the previous chapter, the research design and methodology were presented. In this chapter, the results of the data analysis are presented.

The purpose of the study was to determine whether there is a difference in leadership style between experienced and inexperienced engineers. In order to identify this, the MLQ was used to determine the leadership style between RAU engineers (who represent inexperienced engineers) and Eskom engineers (who represent experienced engineers or engineering managers).

4.2 MEASURING INSTRUMENT : THE MULTI-LEADERSHIP QUESTIONNAIRE

As seen in Table 4.1, 9 items were rejected and the remaining 36 items of the MLQ provided a measurement of leadership style. Three corresponding scales were formed, which represent the transformational leadership style, the transactional leadership style and the non-leadership style for inexperienced engineers and engineering managers. Although some of the reliability coefficients are very low for this research, the measuring instrument has been tested in different research projects and is seen as sufficient for this research.

Table 4.1

Measuring instrument: the multi-leadership questionnaire

	Cronbach Alpha	Number of items
1. RAU participants		
Transformational leadership	0,8622	20
Transactional leadership	0,4782	12
Non-leadership	0,6983	4
Total		36
2. ESKOM participants		
Transformational leadership	0,8653	20
Transactional leadership	0,6675	12
Non-leadership	0,3202	4
Total		36

4.3 COMPARISON OF RAU AND ESKOM DATA SETS IN TERMS OF BACKGROUND VARIABLES

Tables 4.2 and 4.3 represent the distribution of the biographical variables of the Eskom and RAU respondents.

Table 4.2

Distribution of Eskom respondents according to biographical variables

Demographic variable	N	%
Formal education		
Commercial	18	38,3
Bachelor's	23	48,9
Master's	4	8,5
Doctoral	0	0,00
Other	2	4,3
Total	47	100
Number of employees reporting directly to participants		
1-5	19	54,3
5-10	11	31,4
10-20	1	2,9
20-50	3	8,6
50 or more	1	2,9
Total	35	100
Number of employees reporting indirectly to participants		
1-5	8	30,8
5-10	1	3,8
10-20	5	19,2
20-50	5	19,2
50 or more	7	26,9
Total	26	100
Number of completed years in the organization		
1-5	11	24,4
5-10	13	28,9
10 or more	21	46,7
Total	45	100
Number of completed years in management		
1-5	23	62,2
5-10	9	24,3
10 or more	5	13,5
Total	37	100

Table 4.3

Distribution of RAU respondents according to biographical variables

Demographic variable	N	%
Formal education		
Commercial	3	8,8
Bachelor's	19	55,9
Master's	9	26,5
Doctoral	2	5,9
Other	1	2,9
Total	34	100
Number of employees reporting directly to participants		
1-5	22	91,7
5-10	0	0
10-20	0	0
20-50	0	0
50 or more	2	8,3
Total	24	100
Number of employees reporting indirectly to participants		
1-5	11	64,7
5-10	3	17,6
10-20	1	5,9
20-50	1	5,9
50 or more	1	5,9
Total	17	100
Number of completed years in the organization		
1-5	18	66,7
5-10	8	29,6
10 or more	1	3,7
Total	27	100
Number of completed years in management		
1-5	19	95,0
5-10	1	5,0
10 or more	0	0
Total	20	100

As seen in Tables 4.2 and 4.3, more Eskom participants indicated that they had been exposed to a management position. It is indicated that more Eskom respondents have more work experience in category 10 or more years than the RAU participants. This is in sharp contrast to the one RAU respondent who has more than 10 years of work experience. As seen in Tables 4.2 and 4.3, the total

number of employees reporting to the Eskom group is more than the total for the RAU group. More employees report indirectly to the Eskom group than to the RAU group. The high count for employees reporting to the RAU group in the first category (1-5 years) is due to the fact that one employee at RAU runs a business on a part-time basis in Africa. More employees report directly to the Eskom participants compared to the RAU participants. Tables 4.2 and 4.3 show the difference in the number of years of formal education between the two independent groups. A total of 47 participants (of the possible 81 participants) of the two independent groups are from Eskom, and they indicated formal education at different levels. It is clear that the group representing the Eskom group has more years of formal education than the RAU group.

The 45 items of the MLQ could not be subjected to Chi-square tests in order to establish if there was a relationship between the biographical variables from the two independent samples: the RAU sample (who represent young engineers) and the ESKOM engineers (who represent engineering managers). The number of respondents per cell for the different background variables was too small (20% of the cells have expected frequencies smaller than 5).

4.4 LEADERSHIP STYLES

From Table 4.4, it is clear that significant differences were found in the mean scores of the transformational and transactional leadership styles when the experienced engineers (Eskom) and the inexperienced engineers (RAU) were compared. The assumption is that the dimensions or scales of the MLQ are correct. From Table 4.4, it is clear that the RAU engineers are less

transformational and transactional than the Eskom engineers. On average, the two groups do not differ in terms of the non-leadership style.

The probability value for the transformational leader is 0,00 and it is smaller than 0.05, which means that there is a statistically significant relationship between the transformational leadership style and the Eskom (experienced) engineers. The assumption is made that Eskom engineers are representative of experienced engineers. The probability value for transactional leaders is 0.002 and it is smaller than 0.05, which means that there is a statistically significant relationship between the transformational leadership style and RAU engineers. The assumption is made that RAU engineers are representative of inexperienced engineers. This supports the assumption that the two groups differ in terms of leadership style.

Table 4.4

Descriptive statistics: Independent samples t -test for leadership styles in respect of experience of engineers.

GROUP		N	MEAN	STD DEVIATION
Transformational Leadership style	Eskom	48	3,1064	0,4110
Transformational Leadership style	RAU	37	2,8054	0,4857
Transactional Leadership style	Eskom	48	2,2751	0,4272
Transactional Leadership style	RAU	37	1,9865	0,3926
Non-leadershipl Style	Eskom	48	0,5729	0,4464

Levene's test for equality of variance		T-test for equality of means			95% Confidence interval of the Difference			
Independent Samples test above	**f**	**SIG**	**T**	**DF**	**SIG**	**MEAN difference**	**STD error difference**	LOWER	UPPER
Transformational Leadership style Eskom Equal variances assumed	0,136	0,714	3,645	83	0,000	0,3550	0,9739	0,1613	0,5487
RAU Equal variances assumed			3,567	70,345	0,001	0,3550	0,0995	0,1565	0,5534
Transactional Leadership style Eskom Equal variances assumed	0,001	0,973	3,197	83	0,002	0,2886	0,0902	0,1090	0,4681
RAU Equal variances assumed			3,233	80,408	0,002	0,2886	0,0892	0,1109	0,4662
Non-leadership style Eskom Equal variances assumed	5,852	0,018	-1,696	83	0,094	-0,2221	0,1309	-0,4825	0,0383
RAU Equal variances assumed			-1,593	55,097	0,117	-0,2221	0,1394	-0,5015	0,0573

As seen in Table 4.5, a test of equality (Hotelling T ²) of means considered the three dependent variables (Transformational leadership style, Transactional leadership style and the Non-leadership style) for experienced (Eskom) and inexperienced (RAU) leaders. Since the significance level (0.00) is less than 0.05 for the T ²- test, it is clear that the two groups provide different results with respect to leadership style; (0,246) is statistically significant.

Table 4.5

Multivariate test: Hotellings T ²

Manova: Comparison of the vectors of means of experienced and inexperienced engineers in respect of the chronometric measures.

Effect	Value	F	Hypothesis DF	Error DF	Sig. Of F	Partial Eta squared
Intercept						
Pillai's Trace	0,988	2172,174	3	81	0	0,988
Wilk's Lambada	0,012	2172,174	3	81	0	0,988
Hotelling's Trace	**80,451**	**2172,17**	**3**	**81**	**0**	**0,988**
Roy's Largest Root	80,451	2172,174	3	81	0	0,988
Groups						
Pillai's Trace	0,197	6,636	3	81	0	0,197
Wilk's Lambada	0,803	6,636	3	81	0	0,197
Hotelling's Trace	**0,246**	**6,636**	**3**	**81**	**0**	**0,197**
Roy's Largest Root	0,246	6,636	3	81	0	0,197

P < 0,05

From an inspection of Table 4.6, it is clear that transformational leadership, transactional leadership and non-leadership differ significantly between experienced and inexperienced engineers. This supports the assumption that leadership style differs between experienced and inexperienced engineers.

Table 4.6

Comparisons of the means of experienced and inexperienced engineers in respect of the psychometric measures

Source	Dependent variable (Y)	Sum of squares	Df	Mean square	F	p
Group	Transformational leadership style	2,633	1	2,633	13,288	0,00
	Transformational leadership style	1,740	1	1,740	10,223	0,002
	Non-leadership style	1,031	1	1,031	2,877	0,094
	Error	60,318	83	0,726		

$P < 0,05$ ($F_{0,05}(1,83)=3,9$

Table 4.7 and 4.8 below indicate the comparisons of the minimum and maximum values, which could also be calculated mathematically by the following formula :

If x_1 ……. X_n are observations on variable x and n in the sample size, then Max_x is that value which is large or equal (≥) to all x_i for all i = 1, ……, n and Min_x is that value which is smaller or equal (≤) to all x_i for all i = 1, ……, n. hence

$Max_x \geq x_i$ V i = 1, ……., n

$Min_x \leq x_i$ V i = 1, ……., n

Table 4.7

Comparison of minimum and maximum values of experienced and inexperienced engineers in respect of the leaders measurements

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
TRANSFORMATIONAL LEADERSHIP STYLE - leader	Eskom	48	3,1604	,41140	,05938	3,0410	3,2799	2,20	3,90
	RAU	37	2,8054	,48574	,07985	2,6435	2,9674	1,30	3,60
	Total	85	3,0059	,47662	,05170	2,9031	3,1087	1,30	3,90
TRANSACTIONAL LEADERSHIP STYLE - leader	Eskom	48	2,2751	,42729	,06167	2,1510	2,3992	1,25	3,08
	RAU	37	1,9865	,39260	,06454	1,8556	2,1174	1,33	2,75
	Total	85	2,1495	,43466	,04715	2,0557	2,2432	1,25	3,08
NON-LEADERSHIP STYLE - leader	Eskom	48	,5729	,44649	,06445	,4433	,7026	,00	1,75
	RAU	37	,7950	,75221	,12366	,5442	1,0458	,00	3,25
	Total	85	,6696	,60524	,06565	,5391	,8002	,00	3,25

Table 4.8

Comparison of minimum and maximum values of experienced and inexperienced engineers in respect of the raters measurements

Descriptives								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		

TRANSFORMATIONAL LEADERSHIP STYLE - rater	**Eskom**	45	2.6316	,74052	,11039	2,4091	2,8541	,50	3,62
TRANSACTIONAL LEADERSHIP STYLE - rater	**Eskom**	45	2.0198	,38228	,05699	1,9050	2,1347	,50	2,61
NON-LEADERSHIP STYLE - rater	**Eskom**	45	.8535	,61949	,09235	,6674	1,0396	,00	3,25

4.5 SUMMARY AND CONCLUSION

It is clear from the research results that (1) the inexperienced engineers as well as the experienced engineers have leadership styles and therefore managerial skills. (2) Three leadership styles were identified: the Transformational Leadership style, the Transactional Leadership style and the Non-leadership style for each of the two groups. (3) The two groups provided different results with respect to leadership style. There is a statistically significant relationship between transformational leadership style and RAU/inexperienced engineers. There is a statistically significant relationship between the transformational leadership style and Eskom engineers/engineering managers. RAU engineers are (4) less transformational and well as transactional than the Eskom engineers. On average, the two groups do not differ in terms of the non-leadership style.

It is clear from the research results that the Eskom group representing the experienced engineers has (5) more years of formal education than the RAU group. The Eskom group has also been (6) exposed more to managerial positions than the RAU group. This supports the findings that (7) more people report directly and indirectly to the Eskom engineers compared to the RAU engineers. The results also indicate that the Eskom engineers have more (8) work experience in the category 10 or more years compared to the RAU engineers.

The findings of this research confirm the theory that successful managers tend to grow into their jobs over an extended period Bennett, (1996) and Sedge, (1985). The findings also support the arguments of O'Connor (1994) and Badaway (1995) that engineers have no typical career path to prepare them for the management role. If Transformational and Transactional leadership styles enable managers to lead and manage people more effectively, it becomes necessary for engineers to broaden themselves beyond technical matters, as argued by Thornberry (1987) and Thamhain (1983).

For inexperienced engineers to prepare themselves for management, they will need to obtain knowledge about management and develop management skills during their formal studies. These managerial skills include the ability to work with and motivate subordinates. Management of business organizations has a key role to play in initiating and implementing a transition model or programme to ensure that an environment is established that will provide the necessary managerial training for the inexperienced engineer to become a successful manager. It can be a fairly difficult process for the engineer, and to ease it and overcome resistance, a well-thought-out and intensive strategy would have to be developed by management. This process begins with the selection of inexperienced engineers and the MLQ can be used as a selection tool in order to identify leadership style.

CHAPTER 5

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

Some conclusions and recommendations with regard to the measuring instrument are discussed in this chapter. Finally, the researcher draws a conclusion on the outcome and the value of this research.

5.2 CONCLUSIONS AND RECOMMENDATIONS ON THE MULTIVARIATE QUESTIONNAIRE

As leadership style could be identified by the MLQ, this measuring instrument could be recommended as a test during the selection process of inexperienced engineers. The MLQ could also be used as a measurement of the progress of the transformational and the transactional leadership styles after training. For the purposes of this investigation, respondents were asked to rate themselves according to the items of the MLQ. It is recommended that if similar research where conducted in future, that at least three subordinates or colleagues could also complete the instrument and rate the person from their perspective. This might provide a clearer picture of the person's leadership style. It is also recommended that the sample size increase for future research. It would also be worthwhile pursuing means of improving the MLQ as some of the items were rejected and did not contribute to identify the three leadership styles but focused more on the problem-solving ability of the respondent.

CONCLUSION AND RECOMMENDATIONS OF THE RESEARCH

CONCLUSION 1

The research indicates that although large numbers of engineers are in management, they still lack soft skills such as interpersonal skills to be successful in management positions. The two groups provided different results with respect to leadership style. RAU inexperienced engineers are less transformational and transactional than the Eskom engineers. On average, the two groups do not differ in terms of the non-leadership style. If Transformational and Transactional leadership styles enable managers to lead and manage people more effectively, it becomes necessary for engineers to broaden themselves beyond technical matters as argued by Thornberry (1987) and Thamhain (1983).

Research indicates that Transformational leadership can develop in individuals at lower levels in the organization if those individuals have the opportunity to observe the behaviour of successful, appealing, higher level leaders. This emphasizes the point that management should model the transformational leadership style to their subordinates, in this case the engineers. Furthermore, the aspiring Transformational leader must be willing to re-examine his or her strengths and weaknesses as a leader. It becomes vital to develop the individual's personal strengths that build personal power, including technical expertise, the willingness to take intellectual risks, the concern he or she shows for other people's needs, his or her ability to communicate clearly and powerfully, particularly when confronting a crises, and the leader's record of previous accomplishments.

CONCLUSION 2

The Eskom group also has more years of formal education and has been exposed more to managerial positions than the RAU group. The findings of this research confirm the theory that successful managers tend to grow into their jobs over an extended period (Bennett, 1996, Sedge, 1985). The findings also support the arguments of O'Connor (1994) and Badaway (1995) that engineers have no typical career path to prepare them for the management role. Management can establish any attractive reward system for both engineering and managerial career paths. These organizational rewards are powerful incentives to improve the employee's performance. Cummings and Worley (1997) confirm that through this measure, engineers will be encouraged to choose their career directions on the basis of their background, interests and skills, and not so much on the basis of the economic and non-economic rewards given.

Both the individual and the organization will benefit from this. For the individual, it means better use and development of his or her professional assets, and for the organization, a better management and technical capability. The researcher agrees with Woodall & Winstanly (1997) and the following suggestions are made for consideration:

- A committee should be established to devise and administer the appropriate career path to meet the organization's particular needs. According to Cummings and Worley (1997), skill variety is important and increased by moving the employee from one job to another, which is a form of job enrichment. Furthermore, skill variety can be defined as the degree

to which a job requires a range of activities and abilities to perform the work.

- Ensure that the engineering career path goes as high as the management career path, with salary parity at each level.
- The career path must be designed for free movement between engineering support groups and management. This avoids the all-too-common isolation of the two groups and is an important aid to the career development of young engineering people.
- Flexibility is essential, allowing engineers to report to managers on the same level where necessary to form project teams.
- Accommodate non-degree people. Make opportunities for advancement by providing rungs on the ladder for them as well.

CONCLUSION 3

For inexperienced engineers to prepare themselves for management, they will need to obtain knowledge about management and develop management skills during their formal studies. This initiative could be a partnership agreement between organizations and tertiary institutions. Managers in organizations could provide company-specific examples to write training material in order to develop the managerial skills of the student engineer and the lecturers of tertiary institutions could in turn provide the industry with better, more skilled students. These managerial skills include the ability to work with and motivate subordinates.

Management of business organizations has a key role in initiating and implementing a transition model or programme to ensue that an environment is

put in place that will provide the necessary managerial training for the inexperienced engineer to become a successful manager. In order to cultivate an environment conducive to the development of engineers into managers, the researcher believes the following guidelines could be followed:

- Firstly, the manager should establish the administrative competency of engineers. This phase includes ensuring an understanding of organizational policies and procedures. Personal preferences for risk taking, power perceptions and accepting responsibility should also be identified.

- Secondly, the manager should establish the competency of the interpersonal skills of the engineer. These interpersonal skills include communication and conflict handling.

- Thirdly, the manager should establish the technical skills of the engineer. This phase includes an understanding of product applications and knowledge about technological trends.

- Fourthly, the manager should understand the person himself. This understanding includes persona motives, career objectives and the capability of interacting, relating to, and empathizing with other people working with the engineer.

- Fifthly, the manager should establish preference for engineering work opposed to managerial work. This phase would include identifying knowledge of managerial work and updating this knowledge through education and training. It may include workshops and training materials oriented to human relations, communications, active listening and mentoring. This could enhance the organizational capability to implement personal and organizational strategies.

The transition from engineer to manager can be a difficult process for the engineer, and to ease it and overcome resistance, a well-though-out and intensive strategy would have to be developed by management. This process begins with the selection of inexperienced engineers and the MLQ can be used as a selection tool in order to identify leadership style.

5.3 CONCLUSION

The purpose of the study was to establish whether there is a statistically significant difference in the leadership styles of inexperienced and experienced engineers. The researcher concludes that there is a statistically significant difference in the leadership styles between the two groups.

The finding of this research is valuable because of a lack of previous research on the leadership styles and managerial skills of inexperienced and experienced engineers in the South African context.

The purpose of this study is to assess and compare the skills and readiness of Eskom experienced engineers for adopting effective transformational leadership and appropriate managerial styles within the organization and the possible impact thereof on curriculum changes in the future of the RAU engineering students in the South African context.

The researcher concludes that there is a statistically significant difference in the leadership styles between the two groups.

The finding of this research is valuable because of a lack of previous research on the leadership styles and managerial skills of inexperienced and experienced engineers in the South African context.

W*e have much to do together.* ***L****et us do it in wisdom, love and joy.*

L*et us make this the human experience.*

- Gary Zukav -

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LIST OF TABLES

LIST OF FIGURES

APPENDIXES

Appendix A : Section E : Demographic Information

Appendix B : Leader Booklet

Rater Booklet

SECTION E : DEMOGRAPHIC INFORMATION : ESKOM / RAU

For research purposes please complete the following section. Mark your answers with a X (eg. ☒)

SEX : Male Female **AGE :** _____ Years

ETHNICITY : ASIAN/INDIAN BLACK COLOURED WHITE OTHER (Please specify) _____

FORMAL EDUCATION : (Choose highest only) and 'Other' specify.

Technical
Bachelors
Masters
Doctoral
Other _____

Technical Management
Bachelors Management
MBA / MBL
Other _____

NUMBER OF EMPLOYEES REPORTING TO YOU : choose the work. If are a Administration)

DIRECTLY :	***INDIRECTLY :***
1 – 5	1 - 5
5 – 10	5 - 10
10 – 20	10 – 20
20 – 50	20 – 50
50 or more	50 or more

YOUR FUNCTION: (Please function most closely related to your your job spans several because you VP or CEO, please choose

Administration
Credit / Financial
Education
Engineering/Technical
Education
Human Resources
Information Services
Manufacturing
Marketing
Material Management
Operations
Product Development
Quality Control
Research & Development
Sales
Security
Social Science

BACKGROUND :
Management
Number of completed years in :

Organisation :
1 – 5 5 – 10 10 or more

Current position :
1 – 5 5 – 10 10 or more

Management :
1 – 5 5 – 10 10 or more

Technical / Engineering : Other (Please specify) :

1 – 5 5 – 10 10 or more

_____

ORGANISATIONAL LEVEL :
(Choose one – Presently)

C Band M Band S Band
E Band

_____
_____
_____

Multifactor Leadership Questionnaire

Leader Booklet (MLQM)

by Bernard M. Bass and Bruce J. Avolio

DIRECTIONS: This questionnaire is designed to help you describe your leadership style as you perceive it. Please answer all items on the separate Leader Answer sheet. Be sure the answer sheet has your name on it. Judge how frequently each statement fits you. The word "others" may mean your peers, clients, direct reports, supervisors, and/or all of these individuals. If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.

Use the following rating scale:

0	1	2	3	4
Not al all	Once in a while	Sometimes	Fairly often	Frequently if not always

NUMBER

1. I provide others with assistance in exchange for their efforts	
2. I re-examine critical assumptions to question whether they are appropriate	
3. I fail to interfere until problems become serious -	
4. I focus attention on irregularities, mistakes, exceptions, and deviations from standards	
5. I avoid getting involved when important issues arise	
6. I talk about my most important values and beliefs	
7. I am absent when needed	
8. I seek differing perspectives when solving problems	
9. I talk optimistically about the future	
10. I instill pride in others for being associated with me	
11. I discuss in specific terms who is responsible for achieving performance targets	
12. I wait for things to go wrong before taking action	
13. I talk enthusiastically about what needs to be accomplished	
14. I specify the importance of having a strong sense of purpose	
15. I spend time teaching and coaching	
16. I make clear what one can expect to receive when performance goals are achieved	

17. I show that I am a firm believer in 'If it ain't broke, don't fix it."
18. I go beyond self-interest for the good of the group
19. I treat others as individuals rather than just as a member of a group
20. I demonstrate that problems must become chronic before I take action
21. I act in ways that build others' respect for me
22. I concentrate my full attention on dealing with mistakes, complaints, and failures
23. I consider the moral and ethical consequences of decisions
24. I keep track of all mistakes
25. I display a sense of power and confidence
26. I articulate a compelling vision of the future
27. I direct my attention toward failures to meet standards
28. I avoid making decisions
29. I consider an individual as having different needs, abilities, and aspirations from others
30. I get others to look at problems from many different angles
31. I help others to develop their strengths
32. I suggest new ways of looking at how to complete assignments
33. I delay responding to urgent questions
34. I emphasize the importance of having a collective sense of mission
35. I express satisfaction when others meet expectations
36. I express confidence that goals will be achieved
37. I am effective in meeting others' job-related needs
38. I use methods of leadership that are satisfying
39. I get others to do more than they expected to do
40. I am effective in representing others to higher authority
41. I work with others in a satisfactory way
42. I heighten others' desire to succeed
43. I am effective in meeting organizational requirements
44. I increase others' willingness to try harder
45. I lead a group that is effective

Multifactor Leadership Questionnaire Rater No.

Rater	No.

Rater Booklet (MLQM)

by Bernard M. Bass and Bruce J. Avolio

DIRECTIONS: THIS QUESTIONNAIRE IS TO DESCRIBE THE LEADERSHIP STYLE OF THE PERSON NAMED ON THE ANSWER SHEET. DESCRIBE THE LEADERSHIP STYLE AS YOU PERCEIVE IT. PLEASE ANSWER ALL ITEMS ON THIS ANSWER SHEET. IF AN ITEM IS IRRELEVANT, OR IF YOU ARE UNSURE OR DO NOT KNOW THE ANSWER, LEAVE THE ANSWER BLANK. PLEASE ANSWER THIS QUESTIONNAIRE ANONYMOUSLY.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits the person you are describing.

Use the following rating scale:

0	1	2	3	4
Not al all	Once in a while	Sometimes	Fairly often	Frequently if not always

THE PERSON I AM *RATING...*

NUMBER	
1. Provides me with assistance in exchange for my efforts	
2. Re-examines critical assumptions to question whether they are appropriate	
3. Fails to interfere until problems become serious	
4. Focuses attention on irregularities, mistakes, exceptions, and deviations from standards	
5. Avoids getting involved when important issues arise	
6. Talks about their most important values and beliefs	
7. Is absent when needed	
8. Seeks differing perspectives when solving problems	
9. Talks optimistically about the future	
10. Instills pride in me for being associated with him/her	
11. Discusses in specific terms who is responsible for achieving performance targets	
12. Waits for things to go wrong before taking action	
13. Talks enthusiastically about what needs to be accomplished	
14. Specifies the importance of having a strong sense of purpose	
15. Spends time teaching and coaching	
16. Makes clear what one can expect to receive when performance goals are achieved	

17. Shows that he/she is a firm believer in 'if it ain't broke, don't fix it:'	
18. Goes beyond self-interest for the good of the group	
19. Treats me as an individual rather than just as a member of a group	
20. Demonstrates that problems must become chronic before taking action	
21. Acts in ways that builds my respect	
22. Concentrates his/her full attention on dealing with mistakes, complaints, and failures	
23. Considers the moral and ethical consequences of decisions	
24. Keeps track of all mistakes	
25. Displays a sense of power and confidence	
26. Articulates a compelling vision of the future	
27. Directs my attention toward failures to meet standards	
28. Avoids making decisions	
29. Considers me as having different needs, abilities, and aspirations from others	
30. Gets me to look at problems from many different angles	
31. Helps me to develop my strengths	
32. Suggests new ways of looking at how to complete assignments	
33. Delays responding to urgent questions 34. Emphasizes the importance of having a collective sense of mission	
35. Expresses satisfaction when I meet expectations	
36. Expresses confidence that goals will be achieved	
37. Is effective in meeting my job-related needs	
38. Uses methods of leadership that are satisfying	
39. Gets me to do more than I expected to do 40. Is effective in representing me to higher authority	
41. Works with me in a satisfactory way	
42. Heightens my desire to succeed	
43. Is effective in meeting organizational requirements	
44. Increases my willingness to try harder	
45. Leads a group that is effective	

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What shall I render to the **Lord**

For all **His** benefits towards me?

Ps. 116: 12

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*"**E**verything should be made as simple as possible, but not simpler".*

Albert Einstein. 1879 - 1955

THANK YOU