UNIVERSITY OF KWAZULU-NATAL

The Transition from Engineer to Manager: Implications for the Effectiveness of the Engineer-in-Training Programme at Tongaat Hulett – Sugar

By

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List of Acronyms

AA	Affirmative Action
BBBEE	Broad Based Black Economic Empowerment
B.Sc. (Eng.)	Bachelor of Science in Engineering
B. Tech	Bachelor of Technology
DTI	Department of Trade and Industry
ECSA	Engineering Council of South Africa
EE	Employment Equity
EiT	Engineer in Training
EM	Engineering Manager
IEEE	Institute of Electrical and Electronics Engineers
KZN	KwaZulu Natal
NAE	National Academy of Engineering
SAICE	South African Institute of Chartered Engineers
THS	Tongaat Hulett Sugar

Abstract

It is generally accepted that employees are any organisation's greatest asset, so its success or failure is significantly linked to the contribution that they make. Engineers are one particular group of personnel, whose impact on sugar manufacturing operations cannot be overlooked. This study focusses on engineering career advancement, in the sugar industry, from primarily technical into managerial work. This transition is typically considered to be challenging, predominantly because the skill set required for one to be an effective engineer is dissimilar to that required for one to be an effective manager. The research investigates how well the Engineer in Training (EiT) programme prepares engineering candidates for managerial roles. Effort is directed towards understanding the transitional challenges from engineer to manager and how the EiT programme impacts this process. A quantitative research approach was used whereby; research data was collected through a self-administered structured questionnaire. Thirty invitations to were sent to potential respondents, with only 21 engineers ultimately selected to participate. The main findings of the study suggest the following: that the EiT programme did not sufficiently prepare candidates for managerial work and that the lack of leadership training in engineers made transition to management level very challenging. Other findings were that successful managers had to develop leadership skills on the job and that the EiT programme did empower candidates with sufficient communication and interpersonal skills. It is recommended that clear career paths be mapped out for engineers and a holistic approach be used to prepare them for managerial work. Tongaat Hulett-Sugar should be more sensitive to the challenges facing engineers in managerial positions, to the point of more actively supporting their career development. The EiT programme could be improved by including management development modules to address the leadership training needs of candidates. This may entail a programme extension from two years to about two years and six months.

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CHAPTER ONE

Introduction

1.1 Introduction

There is a general agreement that employees are the greatest asset in any organisation and contribute greatly to the success or failure of that organisation (Kumar 2013). The same mantra holds within Tongaat-Hulett, an organisation boasting of a long history in South Africa, a sustainable SADC wide footprint and its preferential market access. The business has run profitable operations in Botswana, Mozambique, Namibia, South Africa, Swaziland and Zimbabwe with a total production capacity of more than 2 million tons of sugar per annum, brought about by a multicultural workforce of greater than 25000 full time and fixed term contract employees.

To sustain its market positioning, Tongaat-Hulett has constituted its operational management team by an enthusiastic, talented and well-trained group of engineers and managers who lead the workforce in different functions at the various sites in realising the "Total Sweetening Solutions" for the Tongaat-Hulett brand and downstream operations. Within the SADC region, Tongaat-Hulett has operations that include cane farming, sugar milling, and refining, sugar repacking and animal feed operations, where sugar engineering professionals are responsible for nurturing the skills and talents of employees, while controlling the working life cycles through development and performance management (Tongaat Hulette Sugar 2012).

In this context, it is common for engineers, by virtue of their knowledge and experience, to reach a stage, where they are promoted from primarily technical jobs into managerial positions. While this move is generally considered a desirable promotion for most of them, the transition from engineer to manager is widely considered difficult, mainly because the essential skills set for a successful manager are not the same as the critical requirements for a successful engineer.

The engineering discipline has historically been considered a highly technical one, and this is particularly true in the sugar industry where heavy machinery and delicate processes are employed to extract the sweet juice from cane to produce high quality raw or refined sugar. This sugar industry environment requires that engineering professionals possess analytical and technical prowess, enabling them to survive the demands of this work. Therefore, it is understood that for the modern engineer, entering the sugar industry marks the beginning of a journey for not only the tech-savvy but also an experience where one is required to be the diplomatic, professional manager and / or businessperson (Knovel 2011). It is also true that the contemporary business environment demands adoptable individuals who can measure up to the dynamic challenges of the postmodern business environment in South Africa.

Thus said, engineers today have to lose the dogmas that they are accustomed to when transitioning to become managers (i.e. adopting the management culture) through a trial and error process, Parkinson, Balling and Hedengren (2013:7). A critical problem facing most organisations is how to make managers from technical specialists, because the use of technical skills as the basis of promotion does not always translate into managerial ability. Coupled with the forgoing challenge, the engineer's performance as a manager is also compromised by their natural proclivity towards technical work, which affects their time management for the new leadership roles and responsibilities, resulting in poor performance as expected within the rapidly changing business environment.

Engineering professionals within Tongaat-Hulett Sugar generally start off on the EiT program and after gaining sufficient experience, progress into managerial positions -a change that is not always easy. This section introduces the research by defining the research basis and emphasis of the study. Chapter one of this research explains the core of the problem setting a baseline, defines and outline the aims and limits of the report. The following chapters detail the literature that was studied in an effort to understand recorded research in the existing body of knowledge, the methodology used to conduct this research. The results obtained follow this section followed by discussion of the results and interpretation of their meaning and lastly conclusions and recommendations made for Tongaat-Hulett Sugar.

1.2 Motivation for the Study

This research investigated the experiences and challenges faced by engineers at Tongaat-Hulett Sugar when going through the transition period from engineer to manager (Tongaat Hulette 2016). In particular, the study evaluated the experiences of engineers who went through the organisation's Engineer-in-Training (EiT) Program.

The EiT program was designed to equip and prepare engineers for management positions. In order to understand the troubles relating to work transition, it was pertinent to gain an understanding of what these engineers had personally experienced during the change. What the engineers went through could, in turn offer important insights into the change process. Better understanding of the work change process and experiences could help in identifying ways to improve the efficacy of transition (Fisher 2012). This might provide an opportunity to facilitate ease of transition for future engineers, and will go a long way in enhancing the development programs directed towards the management and development for upcoming engineers.

The study was important in that it highlighted the challenges faced by engineers when they became managers, with practical lessons drawn from these challenges. The results from the study were able to elicit the experiences and challenges faced by engineers at Tongaat-Hulett Sugar as they developed from engineer to manager.

Stakeholders who stand to benefit from this study include:

- Tongaat-Hulett-Sugar

  The organisation stands to benefit from this research in that, it can establish whether the EiT programme is effective in developing the necessary skills required by management candidates. This study provides recommendations to Tongaat Hulett-Sugar on how to improve the Engineer-in-Training Programme. These recommendations, when implemented, can make the programme more effective, thus yielding successful managers with the capability to perform in this rapidly changing business environment.

  The EiT programme provides an opportunity for the organisation to instil a value driven and high performance culture.

Tongaat Hulett's organisational values determine the way in which the business as a whole interprets and responds to environmental challenges and opportunities. It is therefore important to ensure alignment of these corporate values with the skill set required by future leaders of the organisation in order to deliver sustainable results.

- Future Engineering Candidates to be trained.

The identification of the shortfalls in the Engineer-in-Training programme as well as the clarification of areas of improvement will benefit candidate Engineers who go through this programme.

This will greatly motivate them as the programme evolves into one that brings about their holistic development. Change that brings about a more appropriate and wholesome programme would be a welcome development for these beneficiaries. The recommendation presented would result in an increase in the success of engineer-cu-manager in their professions, while simultaneously reducing, if not eliminating the challenges encountered in the engineer to manager transition.

- Business Leaders and Managers

A well-structured, effective, EiT program eliminates the troubles faced by business leaders and senior managers who supervise upcoming engineer-cum-managers in the organisation. If EiT candidates came out of the program, ready to face management challenges, there would be less effort required for mentorship by the seniors, thereby freeing up the much-needed time to focus on strategic matters for growing the business and resolving major organisational challenges

- EiT Program Managers and Facilitators

Positive critique is always a welcome gesture for forward thinking program designers and facilitators. Therefore, feedback from research that is supported by data and objective feedback would be beneficial to the programme managers and facilitators because it gives an opportunity to review the training curriculum and improve where necessary to meet business requirements. Contemporary programme managers may benefit from this research since they are constantly looking out for opportunities to improve and this report is but one of them.

- Subordinate Employees and Staff

Another beneficiary of study, if recommendations were to bring about the changes desired in the EiT program, is the employee who serves under the well trained engineer cum manager. When engineers have gone through a thorough, focused and appropriate training programme, they come out well groomed and ready to deliver in a professional way. On the other hand, an engineer who was not trained well, struggles to cope in the manager's role, makes mistakes and blames the employees on the shop floor. An ill-informed engineer cum manager cannot build a cohesive team or effectively lead the team efficiently in problem solving, thereby causing frustration on the shop floor.

A leader who cannot communicate effectively, motivate or engage the workforce in a professional way, leads a non-cohesive, hopeless and potentially volatile staff that cannot reach its full potential. Employee safety is one example where Tongaat Hulett achieved a Lost Time Injury Frequency Rate (LTIFR) of 0,085 per 200 000 hours worked in 2014/15. This was the organisation's best safety performance since the formal introduction of SHE management systems (Tongaat Hulette 2016).

- Work Colleagues

Colleagues in the business may benefit significantly from the implementation of the improvements identified here because, when key decision makers in the business are well developed to make sound decisions this would take the organisation forward. Bringing about business growth, new work opportunities and job security

- The Community, Upstream and Downstream Business

Local communities and other support business in the supply chain are also major stakeholders to benefit from this study should it bring about the expected business growth that stems from sound decision making by well trained and well-rounded engineers and managers at Tongaat-Hulett. The growth of a business attributable to correct decision making by clear-minded engineer-manager undoubtedly benefits upstream and downstream businesses.

This study brings a unique contribution to human resource and training which includes,

a) an improved understanding of the effectiveness of the EiT programme from the engineer-cum-managers' perspective, b) related challenges as experienced by the candidates and the extent there of, c) recommendations on how this programme can be improved.

1.3 Focus of this Study

This research had emphasis on understanding the experiences and challenges faced by engineers at Tongaat Hulett-Sugar when going through the transition period from engineer to manager. Consideration is given to the methods of training and the relevance of the course material covered. In particular, the study evaluated the experiences of engineers who went through the organisation's Engineer-in-Training Program. It focused on ascertaining the development process into responsible engineer role, understanding the challenges confronted as engineers grow into managers.

The study also considered candidates' attitudes towards the effectiveness of the program in nurturing and developing the essential skills required by managers in order to be successful in their roles. The expected outcome of this review is valuable feedback from this research, which feeds back into the training and development programme to improve its scope, design and execution, resulting in improved program deliverables.

1.4 Problem Statement

The graduate training programme concept, if implemented correctly, has great potential to assist businesses in developing candidate engineers into competent professionals, and further into becoming successful managers. A possible strategy for implementing this concept is, implementing transitional models, for the creation of an environment that offers much needed managerial training, for upcoming engineers to succeed in management.

The lack of understanding and experience in execution of roles and accountabilities could result in engineers' failure in management duty (Chandra *et al*., 2006, Childs and Gibson, 2010). An engineer's success comes when one broadens themselves beyond merely technical work. A review of the literature revealed not many companies conduct research to understand and measure the effectiveness of their development programmes.

The main study focus of this research is to show, "Whether the EiT program prepare candidate engineers enough for career progression through engineers' to managerial positions?"

1.5 Objectives

The listed objectives were defined in an attempt to reveal the question above:

- To understand of the effectiveness of the EiT programme.
- To determine the transition challenges from engineers to manager.
- To determine ways to improve training for effective engineer to manager transition

1.6 Research Questions

The most significant question for this context sought to determine how effectively Tongaat Hulett EiT programme prepared candidates for possible transition when promoted from engineer to management position. The refinement of the above question formed an integral part of the study as it led to the following derived questions:

- How was the transition from engineer to manager role, for the candidates?
- What skills gained through the EiT program, if any, assisted in the transition?
- What can success in the management role be attributed to

1.7 Limitations of the Study

The study focus was on managers that went through the Engineer-in-Training programme at Tongaat Hulett in KwaZulu-Natal. This group of managers was a significant part of business leadership and the management workforce; however, the focus group was merely a subclass of the management complement for Tongaat Hulett, working in the KwaZulu Natal geographic location. The study is therefore not fully representative when considering the context of organisation, a SADC wide organisation, due to differences in demographic, cultural, economic and other influences.

The emphasis of this research question was limited to certain aspects of the transition experience due to time constraints over which the report was completed. Consequently, the results are not expected to precisely signify the general principle of the job change, but rather the element(s) that are the focus of the study questions, it however gives a sound basis for further study in this area.

Some assumptions made for the research to progress, in themselves, pose some limitations to applicability of some of the recommendations derived. These assumptions, without being exhaustive include but are not limited to:

- All engineers interviewed are committed to their work and to the success of the organisation
- The responses given in the questionnaire are accurate to the best of the respondent's knowledge
- The respondents went through similar standardized programs

1.8 Chapter Outline

This research consists of five chapters, which are summarised as follows:

Chapter 1 introduces the brief of the study on how the efficacy of the EiT program affects transition process as engineers' develop into managers' management.
The chapter gives a background to the study, explaining the motivation for the research before highlighting the focus area for the report. The problem statement was then defined and objectives set. In this chapter, limitations that confine the investigation are also emphasised.

Chapter 2 presents findings from the existing body of knowledge on the subject of engineering training, the specific context of the organisation in its South African setting. The roles of the engineer and manager are viewed in contrast and how the EiT programme can influence this relationship. This training and the processes of performance assessment and career development that could prepare the engineer to perform optimally is also discussed.

Chapter 3 is about the research methodology, addressing the selection of participants, location of study and data collection strategy. The research tool, questionnaire construction design and participant recruiting are main sections of this chapter. Data entry and the statistical tools used for date analysis gives the substance of this part of the report, which is followed by the listing of strengths and weaknesses of this stage. A summary concludes by encapsulating the work done in chapter 3.

Chapter 4 is about the discussion of results derived from analysis of questionnaire feedback. An attempt is made to show the relationship of the data received through the tool and the literature so that the main research question can be answered. This chapter discusses the development of possible recommendations discussed in the last chapter of the report.

Chapter 5 brings all learnings into perspective and shows how the research question is answered, considering the findings from this study. The implications of these findings are also discussed as well as opportunities for study in related areas.

CHAPTER TWO

Literature Review

2.1 Introduction

The engineering discipline has historically been considered a highly technical one, requiring that engineering professionals possess analytical and tech prowess. However, for the modern engineer, this marks the beginning of his / her journey. In addition to being tech-savvy, the modern engineer is also required to be the diplomatic manager and / or businessman. The challenge, however, is that many engineers do not possess the business skills required to become industry relevant. As such, they experience difficulties when assuming the management role. This study, explores the challenges faced by engineers who became managers at Tongaat Hulett in KwaZulu-Natal.

This section looks at the literature relating to experiences of engineers and the industry. It begins by giving a background on Tongaat Hulett and the Engineer-in-Training Programme, and then proceeds to discuss the question in the South African situation. Thereafter, it gives context on the engineering discipline and follows the career progression of a typical engineer, identifying the various obstacles that they encounter along the transition to management positions. This is followed by a discussion on management and the principles that govern it, and the future state of management. The possible challenges, and their causes, encountered by transitioning engineers are also identified.

2.2 The Scope of Tongaat Hulett

Tongaat Hulett Group Limited is a major agribusiness in South Africa, with three internationally competitive business units, namely sugar, starch and glucose. The company originated in the north coast of KwaZulu-Natal, specifically in the town of Tongaat. The company prides itself with the leading program for the development of young graduates into engineering professional, through the EiT Programme (Tongaat Hulette 2016).

2.2.1 The Engineering Training Program

The EiT programme is a flexible course that is generally meant to run over a 2-year period. This duration may be reduced if the trainee's previous experience covers some of the requirements of the programme. The programme covers four major knowledge areas, namely, technical knowledge, management knowledge, company procedures and methods; and supplementary courses. These areas are described briefly as:

i. Technical knowledge

This knowledge area is aimed at teaching the trainee all aspects of sugar processing industry and application of engineering principles to practical situations. It prepares the candidate to be able to complete complex task and improve his/her understanding of tools that can be applied to the problem solving process.

ii. Management knowledge

This knowledge area includes responsibility objectives covering different positions and functions in the organisation, which the trainee should fulfil in order to gain the required practical experience in operating the plant and leading people. It involves organisation and coordination of the activities of the business so that predetermined goals can be achieved.

iii. Company procedures and methods

This knowledge area aims to expose the trainee to the policies, procedures and methods employed within Tongaat Hulett, such as budgeting, cost control and purchasing. These documented processes, define the general acceptable norms and steps that are followed when organisational activities are carried out (Tongaat Hulette 2016).

iv. Supplementary Courses

These are study materials shared with the candidates who are seen fit, to prepare them for the workplace where their careers will be developed.

The entry requirement for the training programme is either a B.Sc. (Eng.) or a B. Tech. qualification.

The overall objectives of the programme are to:

- To ensure a supply of competent and high calibre of engineering managers within the sugar operations of Tongaat Hulett
- To provide a comprehensive training programme to accelerate the learning of sugar processing and to ensure coverage of all aspects of the process.
- To identify potential management material and
- To provide development opportunities whereby trainees can acquire management skills and experience (Tongaat Hulette 2016)

2.2.2 Suitable Candidates

Tongaat Hulett (2016) stated that the organisation seeks exceptionally capable candidates for the EiT program, candidates who are intelligent and eager to progress into employees that will grow and contribute to business development. It is Tongaat Hulett's priority to identify enthusiastic, committed and results orientated young people who are willing to take initiative. This is due to the fact that such candidates would be ready to accept greater responsibilities to challenge their capabilities in an ever-changing South African corporate environment. In addition to the foregoing Tongaat Hulett seeks supple personalities that are eager to embrace change and possessing utmost morality.

Farr and Brazil (2009) recorded that, forward thinking organisations need educational institutions to provide engineers who are skilled enough to lead cross functional groups, combining technical skill and business insight. Educational institutions should deliver to industry young professionals who are passionate about continuous professional development.

2.2.3 Shortage of Engineers

The shortage of technical skills in South Africa has been a topical issue in the recent past, where business has lobbied government and training institutions to realign their strategy to address this challenge.

Tongaat Hulett has not been spared of the challenges that come with skills shortage, with Ndimande, Chisoro and Karodia (2016:101) recording that, "the shortage of sugar engineers in Tongaat Hulett has resulted in the poor management of operations in the factories, and, subsequently, reduced outputs. This has raised concerns to management and stakeholders about the effectiveness of the training and the development programme designed for sugar engineers".

Maja (2007) recorded that the most noteworthy changes in the last 20 years have been the slowdown of immigration from the developed countries and a dramatic increase in the numbers of skilled migrants leaving South Africa for those destinations.

The Engineering Council of South Africa (ECSA) has also stated that the ratio in South Africa, of engineers to none engineers is 1 to 2 600 people, while international standards require one engineer for every 40 people (Pillay 2017). Pillay's statement focussed on institutions of higher learning's need to relax entry requirements for potential engineering candidates, to include a minimum B-symbol pass mark for matric maths and science. This is a debatable recommendation because industry needs to ensure that engineering competency and skill are of the highest possible order.

Pillay (2017:2) proceeded by quoting Dr Martin van Veelen, the preceding president of SAICE, saying, "South Africa is fortunate to have a competent and experienced corps of engineering practitioners and it is one of the few African countries that does not need consultants from overseas to solve the challenges that we face as a developing country. However, the centre of this accumulated wisdom lies in an ageing group of professionals and it is vital that this knowledge is passed down to our younger and inexperienced engineers."

Professional Provident Society (2015) conducted a survey where almost 500 engineering professionals participated. In this survey, 56% of the respondents indicated the scarcity of job opportunities for young engineering professionals in the sector. The same report also noted that when compared to the same period in 2014, only 46% of respondents indicated the scarcity of job opportunities for young engineers. "The figure has now increased by 10 percentage points, which indicates that this is a growing issue within the profession."

Statistics South Africa (2017), recorded a total of 92 612 people (including 20 038 with professional qualifications) emigrating from South Africa between 1989 and 2003 to the United Kingdom, Australia, New Zealand, Canada and the United States. However, destination-country statistics of immigrant arrivals from South Africa paint a different picture: they show 80 831 professionals and 368 829 total immigrants arriving from South Africa during the same period.

Stern and Szalontai (2006), state that official figures reporting on South African emigration under rated the loss by about 75% because the South African migration figures rely on self-declaration when the emigrants depart and this also does not account for those who do not declare their reason for leaving the country and those who change their reason for leaving to a point where they do not return. Hence, Mattes and Richmond (2000) affirm that, South Africa's skilled population was recently estimated as in the order of 1.6 million and skill losses tend to be concentrated in the sectors such as health, engineering, finance and IT.

2.2.4 Skills development initiatives

Tongaat Hulett has taken an objective to address the needs of its employees to ensure that their performance and skills are high enough to meet the requirements of an ever-changing business environment. This has motivated the development of the EiT programme, designed to feed the ever increasing need of the business for technical superiority.

Training and development programmes have been set up at all stages to include supervisors, managers and business leaders. There are also specific programmes to ensure development of shop floor employees as well. Tongaat Hulett has committed a focused mentoring program as well - when an employee performs well and can deliver desired results, they are rewarded with an opportunity to develop their skills and knowledge through the support of the organisation. (Tongaat Hulett 2016)

Therefore, there is a programme to periodically assess the employees' skills against work requirements to establish the skills gaps. Those who show the required competence and characteristics are identified and rewarded through promotions.

Tongaat Hulett (2016) records that occasionally, there is the urgent requirement to fill vacancies by hiring external candidates and then train them to meet the organisational requirements. This need has resulted in the need to implement targeted recruitment where market related remuneration practices are now part of standard practice.

2.2.5 Performance Management

The capabilities of groups and individuals are periodically evaluated alongside the set capabilities and suitable measures are implemented to correct any inadequacies found. As a results programs like talent management, management development, training, external recruitment and succession planning ensure a constant supply of professionals who can perform at the organisation's level of requirements. (Tongaat Hulett 2016)

Tongaat Hulett has initiated programmes at its business units as part of the organisation's strategy to attract, develop and keep valued talents. Skills development processes including accountabilities, roles and responsibilities, performance assessments and reviews, evaluation of potential and action planning encourage heightened employee performance. Where there are capability lacks and it is observed that individuals need further training, appropriate actions are taken to provide the identified inadequacies. Sound training and guidance programs are required for career development of the employees. (Tongaat Hulett 2016)

2.3 Engineering Career in The South African Context

Inasmuch as the engineering discipline may be similar in many matured economies around the globe, there is always some uniqueness that comes with specific locations and South Africa is one that has such exceptionality that separates the workplace environment from what one would find in any other place.

The history of South Africa has a major influence to the dynamics of the workplace and some of the aspects are include the fact that after 1994, many technical professionals and engineers left the country due to uncertainty, leaving behind a big skills gap. Due to improved access to global information through the internet, the 1990's exodus was followed by a brain drain to first world countries as South African professionals accepted jobs in more developed countries. This left a huge skills gap.

2.3.1 Impact of Professionals' Immigration

Stats SA (2015), reports that safety and crime concerns are the main push factors for why South African leave their home country. Another leading factor is the state's high cost of living, and the economy, in addition to the employment market. There are pull factors that come into play including the benefits that the destination countries offer which attract South Africans to relocate. Such benefits comprise of the idea of adventure, an expectation for improved quality of life and better employment prospects. "South Africans are on average more compelled to move abroad for political, religious, or safety reasons, with 5% indicating this as their most important reason for moving abroad compared to a mere 1% of all respondents," Inter Nations recorded.

Stats SA's Midyear Report of 2015 the table below shows the migration patterns for the past 30 years

Table 2.0 Migration patterns in South Africa

	African	Indian / Asian	White
1986-2000	828 750	14 476	-304 112
2001-2006	561 398	23 335	-133 782
2006-2011	673 706	34 689	112 046
2011-2016	779 593	40 929	95 158

When considering the matters addressed in the report, South Africa only ranks highly on its leisure alternatives, because it positions at around 8th in the world. When considering the other factors, which include personal pleasure, security, healthcare, education standards and more affordable cost of living, South Africa does not score well.

In the month of July 2015, emigration was highly debated when professionals and specialists in the emigration sector recorded an acute increase in the number of South Africans intent to relocate overseas. Chris Watters (2016), an immigration attorney reported that inquiries for assistance to emigrate had gone up from about one to 10 every two weeks since January 2015.

2.3.2 Demographic Profile

Lehohla (2013) records that the gender equality in South Africa is central to the course of creating a non-discriminatory society where all human rights are upheld, regardless of their race, gender, age, disability or sexual preference. However, in practice, there is still work to be done by all parties to sensitise South African citizens on these matters.

2.3.3 Affirmative Action

South African history also has it that due to discrimination and other apartheid practices that have taken place in the workplace pre 1994, some sectors of society have been economically disenfranchised from affluent positions and salaries (Seekings and Nattrass 2005). As such, the government has sought to redress this inequality through the Employment Equity Act no. 55 of 1998.

Affirmative action requires that designated employers plan and introduce fairness in their organisations to ensure that all groups are represented in the workplace. The reason for such a programme is to enable employers "to achieve reasonable progress towards redressing the inequality, to help in the elimination of segregation in the organisation, and to develop a non-discriminatory and fair workplace where employees from selected groups can receive a fair chance at opportunities (Dawson 2014). This means that recruiting for positions such as those of engineers and managers, is influenced by this act and further that the manager’s job has to be carried out in a way that satisfies these requirements.

Employment Equity

Employment Equity is the legal instrument designed to redress the inequality of the past by allowing fair discrimination to promote the employment of designated groups to balance the ratios of employees at particular level in the organisational hierarchy.

SASA (2015) reported that all participants in the sugar industry promote compliance with the Employment Equity Act, and have combined Employment Equity and Skills Development Plans such that these can be monitored and updated periodically. Some targets have been set for recruiting, developing and promoting employees from designated groups.

SASA (2015) also reports that, "As at 31 March 2012, 57.4 percent of management and 82.4 percent of skilled and supervisory positions are filled by black employees. Women constitute 34.6 percent of the workforce across South African operations. Within the South African operations, 73.4 percent of the 587 graduates and diplomats employees are black, with women constituting 45.3 percent."

The employment Equity act entails that businesses must take some definite affirmative action actions to attain employment Equity.

- Companies must involve unions and workers when making the EE plan to ensure that they are acceptable to all, and should allow all stakeholders a chance to comment.
- It is necessary that companies analyse their policies and procedures of employment, to prepare a workforce profile that identifies employment equity problems.
- An Employment Equity plan should be prepared and implemented, defining affirmative action methods for achieving the employment Equity targets.
- Companies are required to report to the Department of Labour on the progress of the plan implementation for the department to check for compliance.
- Businesses must display the provisions of the act in all relevant languages at the workplace.

2.3.4 BBBEE - Retaining and Attracting Skills to Tongaat Hulett

Tongaat Hulett (2016) records that the organisation continues to progress by developing justifiable Broad Based Black Economic Empowerment (B-BBEE) programs that will benefit of all players in the industry.

Measures are continually being implemented to guarantee that organisational procedures are in harmony with pertinent legal requirements and the state (DTI) Codes of Good Practice. Here appropriate, business units are involved in the preparation of applicable segment records.

Tongaat Hulett as an organisation has established an Employee Share Ownership Plan (ESOP) coupled with a Management Share Ownership Plan (MSOP), these systems were designed so that the black South African workforce and management staff can benefit. This has placed a collective interest in the organisation, of 7 percent, under the ownership of these workers. These programs are meant to keep and draw talented black staff at all levels of the organisation, while creating shared ownership values among workers, while entrenching the culture of ownership within the workforce.

2.4 Engineering Education and Training

Farr and Brazil (2009) state that leadership is a critical element necessary for the advancement of engineering to keep the profession relevant in light of global competition and heightened outsourcing. Farr and Brazil (2009) go on further to say that businesses' resolve to remain profitable are placing pressure on institutions to produce engineers that are able to lead cross functional groups, to join technical creativity with business skills and to be entrepreneurial. Managers in commerce are also being urged to encourage management characteristics in junior engineers Farr and Brazil (2009).

2.4.1 Transformation of Engineering Education

According to Farr and Brazil (2009) there are three publications that have been printed within the past 50 years or so that are thought to have shaped the area of engineering training.

These include the Green Report (1994) and Educating the Engineer of 2020. Farr and Brazil (2009) attribute the footing of engineering education and its accreditation to the 60 year old Grinter Report.

This report recommends the strengthening of basic sciences subjects in academic institutions as this is key to developing technical thinking. Hence, the addition of engineering subjects (namely, fluid mechanics, mechanics of solids, thermodynamics, nature and properties of materials; and electrical theory) into all engineering curricula is necessary.

The Green Report, on the other hand, gave its emphasis to education that was relevant and connected. According to Farr and Brazil (2009) this report recommended that education transformation be sped up to include leadership, an appreciation of different cultures, business acumen, *inter alia* .

Table 2.1 Skills proposed for engineering curriculum

Team skills, including collaborative, active learning
Communication skills
Leadership
A systems perspective
An understanding and appreciation of the diversity of students, faculty and staff
An appreciation of different cultures and business practices, and the understanding that the practice of engineering is now global
Integration of knowledge throughout the curriculum
A multi-disciplinary perspective
A commitment to quality, timeliness and continuous improvement
Undergraduate research and engineering work experience
Understanding of the societal, economic and environmental impacts of engineering decisions
Ethics

Adapted from: Farr J.V. & Brazil, D.M. 2009. Leadership Skills Development for Engineers. *Engineering Management Journal*, 21(1), page 3.

2.4.2 Need for Evolution in Engineering Education

These skills have been imparted through senior design programme, and the engineering and basic science course, promoted by the Grinter Report, have literally remained untouched in the engineering syllabi since the report's inception (Farr and Brazil, 2009).

This has been somewhat confirmed by Childs and Gibson (2010) who noted that university education had not changed over the years and tended to continue relying on the knowledge of engineering technology experts, who had little leaning towards engineering business and the resulting business-related challenges of the 21st Century. This approach, according to Childs and Gibson (2010), has not encouraged students to become interested in the management aspects of their future occupation.

The failure of the NAE to exploit the apparent gaps in the engineering education curricular was a very unfortunate occurrence according to Farr and Brazil (2009). Farr and Brazil (2009) also noted that the NAE fell short of making detailed recommendations on curriculum transformation, thereby losing the platform to make meaningful contribution(s) in directing the course of engineering education. Nonetheless, the NAE recognised that the key to engineering's future lay within the context of the global marketplace. The report also stated that in addition to technical excellence, engineers should also possess team communication and ethical reasoning skills.

2.4.3 Engineering Training in South Africa

Martin, Maytham, Case and Fraser (2005) investigated the perceptions of chemical engineering graduates from the University of Cape Town towards their preparedness for working in the marketplace. Their study found that overall graduates were convinced that they were ready to work in industry. Graduates professed that their skills in problem solving, technical background, communication and professional development abilities were their major strengths. However, Martin *et al*. (2005) pin pointed, multi-disciplinary work, engineering in practice and organisational capabilities were the graduates' shortcomings.

Cross functional group work was noted to be an area of great concern to industry since industry relied strongly on teamwork between individuals with frequently divergent sets of expertise (Martin *et al*., 2005, Pasha-Zaidi, 2015). In addition, Martin *et al*. (2005) also mention the importance of communication in industry, as often technical information needed to be communicated to diverse audiences.

2.4.4 Managerial Course Options in Engineering Curricula

A further issue was that some engineering graduates had difficulties comprehending the significance of the business aspects of industry (Black, 1994, Holcombe, 2003). This view is supported by a study conducted by Moreno, Cascales, Solano and León (2002) in which they found that engineering students generally considered trade and economic knowledge as having low importance in the development on an actual engineer. This could in part be due to managerial skills' inclusion into engineering educational curricula being approached as a secondary issue to technical skills and not being properly integrated into curricular so as to have a positive impact on the grooming of market ready engineers (Childs and Gibson, 2010). This is supported by Pasha-Zaidi (2015) who stated that engineering students are themselves displeased with the soft skills that engineering programs are "imparting" to them at the university level.

In addition, Patil and Codner (2007) found upon analysis of the Asian Pacific, American and European engineering education accreditation, that engineering graduates lacked capabilities in the area of problem-solving, communication, decision-making, people management, and social skills. Students also lacked the aptitude to work in a multifunctional setting.

Borrego and Bernhard (2011) argued that these shortcomings arose from complaints from industry that engineering graduates fell short of the requisite skills needed in industry. This view was shared by Ramadi *et al*. (2016) who found that managers felt that recent engineering graduates showed low overall readiness for employment. Monitoring the progression of engineering education, not much seems to have happened in terms of shaping the modern engineer.

Nguyen (1998) for instance, observed as early as 1998 that engineering education was producing a different engineer to what industry actually desired.

2.4.5 Industry Expectations and Candidate Perceptions

According to Haris (2014) there are different views between academics, students and industry personnel on what they perceived as essential generic and specialist skills, and attributes needed in the makings of the modern engineer. These three groups were more or less of similar mind in terms of the generic skills and attributes required. However, there is variance in the relative importance that they placed on each quality. Industry for instance, placed highest importance on attitude, academics on technical knowledge and skills; and students' placed importance on both attitude and technical aspects. Another interesting observation made was the tendency for academics and students to be like-minded when compared to industry personnel. The conclusion reached was that engineering education was producing a different engineer to what industry actually desired and might be failing to satisfy market demand (Heywood 2016)

A study by Ramadi, Ramadi and Karim (2016), in which they investigated 36 skills relevant to engineers in the Middle East and North Africa (MENA) region, specifically exploring the gaps between industry expectations and perceptions of engineering graduates' skill, found that the areas in which managers felt that graduates needed the most improvement were communication, time management, and continuous learning.

2.5 The Engineering Career

Tongaat Hulett (2016) records that, various career prospects exist within the establishment, throughout the numerous operational business units in the SADC region, that is, South Africa, Swaziland, Mozambique and Zimbabwe.
Some typical engineering opportunities that one could pursue as a career covers the fields of Mechanical, Electrical, Chemical, and Process Engineering.

There are also apprenticeships programs offered in different disciplines which include Fitter and Turner, Millwright, Plater/Welder, Electrical, Instrumentation and Boiler Making, and after one has completed a diploma in a technical field, they can upgrade their

qualifications and be admitted into engineering training. (Tongaat Hulett 2016) There are limited offers for student sponsorship for degree studies at Universities or Colleges which fall in the fields of Chemical, Mechanical and Electrical Engineering. These initiatives show the commitment of Tongaat Hulett to skills development in the area of engineering.

2.5.1 The Engineering Disciplines

Moreno *et al*. (2002) described modern engineering as a "broad discipline that embraces knowledge and training in science and mathematics, business and management, social science and computer technology". Engineering applications are most often geared towards improving the human condition (i.e. improve the livelihood of mankind). According to Anderson, Courter, M^{c}Glamery, Nathans-Kelly and Nicometo (2010), engineering practice is continually advancing due to the development of new technologies and an ever changing world-wide environment.

Visser, Naudé and Schepers (2004) define an engineer as an individual who, through formal education and experience, is qualified to practice engineering. The engineer, according to Visser *et al*. (2004), essentially applies his knowledge, use of mathematical, physical, engineering sciences and the principles of engineering analysis and design, in his everyday life. Lannes (2001) reported that the engineering work is mainly defined by the engineers' interactions with machines and structures so they easily relate with the technical features of their workplace.

While engineers principally create devices and systems for human consumption or use, they are also involved in the design, implementation and management of processes and projects Moreno, Cascales, Solano and León (2002, 2).

2.5.2 Engineering Work and its Attributes

The work of an engineer does not emphasize only on the ability to deal with constraints, but it provides a picture of what the said constraints are as well (Anderson *et al*., 2010). Some of these constraints include the law of science, restrictive budgets, timeframes, performance targets, and product or process specifications. Consequently, it is important for engineers to develop competency in organising technical groups solving problems.

Similarly, de Graaff, Markkula, Demlová, Kuru, and Peltola (2007) state that today's engineers need to learn to communicate effectively, work together in different multifunctional teams and have the ability to cope with intercultural dynamics.

A key attribute of effective engineers, therefore, is the ability to work with and influence others to conscientiously perform essential work to a mutually agreed schedule (Anderson *et al*., 2010). To this end, prospective engineers should be educated (and trained) very early in their development, i.e. at the university level, integrating commerce and business aspects with the traditional scientific and technical aspects of engineering education (Childs and Gibson, 2010).

These views of the evolving engineer contrast with a description mentioned by Seethamraju and Agrawal (1999) of engineers as individuals, who through their education, are trained to be scientists of things and not as motivators or counsellors of people. In other words, traditionally engineers were trained to be strictly technical without the people and interpersonal skills. The modern engineer is thus required to be a well-rounded individual who is technically savvy, business savvy and gets along with people.

2.5.3 Changes in Work Responsibilities

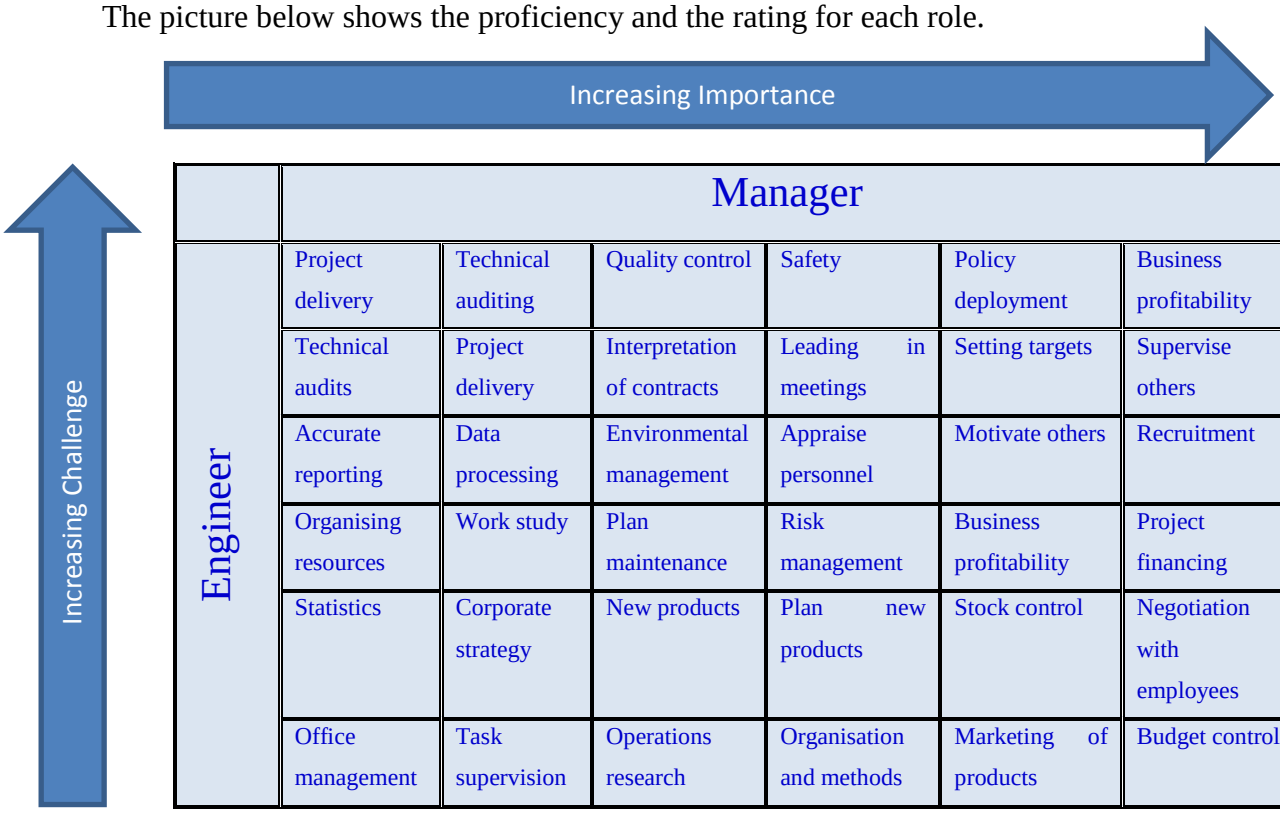
The traditional engineers worked in an environment where secretaries or clerks would do all the typing work for them but today, the engineer cum manager has to be self-sufficient. Economic pressures have forced most organisations to cut out "fat" and demand that contemporary managers be more adaptable to the requirements of the job.

This development has added pressure to the highly demanding job of engineering manager. The work of the modern engineer/ manager does not only emphasize the skill of dealing with limitations, but also delivers an image of what the limitations are (Anderson et al., 2010).

2.5.4 Similarities in Engineer / Manager Roles

The matrix below shows that while there are many similarities between these job types, there are also some skills that are more important for one to success in one role than the other.

The picture below shows the proficiency and the rating for each role.



	Manager					
Engineer	Project delivery	Technical auditing	Quality control	Safety	Policy deployment	Business profitability
	Technical audits	Project delivery	Interpretation of contracts	Leading in meetings	Setting targets	Supervise others
	Accurate reporting	Data processing	Environmental management	Appraise personnel	Motivate others	Recruitment
	Organising resources	Work study	Plan maintenance	Risk management	Business profitability	Project financing
	Statistics	Corporate strategy	New products	Plan new products	Stock control	Negotiation with employees
	Office management	Task supervision	Operations research	Organisation and methods	Marketing of products	Budget control

Figure 2.1 Professional Engineers Need management Skills

2.5.5 Engineering Problem Solving and Other Interactions

To adjust and to stay abreast of global technological advancement(s), Anderson *et al*. (2010) mention that the engineer has to problem solve amidst a plethora of uncertainty. The process of problem-solving is itself irrational and often lacks clear structure.
Arriving at solutions is often dependent on knowledge generated from practise, more than proper training (Kumar and Hsiao, 2007, Anderson *et al*., 2010). The work of an engineer also requires interdisciplinary coordination. It is a social process, where different disciplines are involved such as: executive mandate, laws of science, and marketplace needs and where the standards and practices of the organisation play a major role (Sonnenwald, 1996).

In addition, Sonnenwald (1996) states that in practice, engineering work emphasizes social interaction, with constant negotiation and complicated business logistics. The social processes of engineering work, however, often present greater complications, uncertainty, and subjectivity than expected (Korte *et al*., 2008).

2.6 Professional Growth and Transition

As a snapshot of the typical career progression of an engineer, Lannes (2001) proposed a 3 stage process that typically spans over the 30 years or so of an engineer's career. Lannes describes these stages / phases as engineering, engineering management and management of technology (see Figure 2.2).

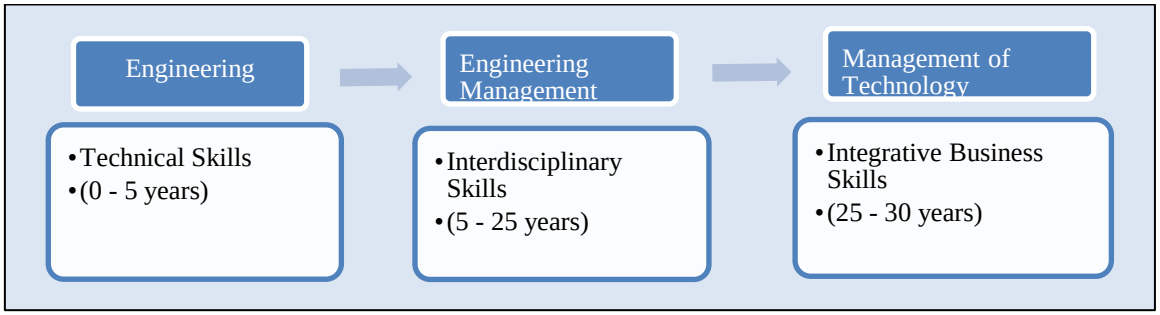


Figure 2.2 Typical engineering career path

Adapted from Lannes W.J. 2001. What is engineering management? IEEE Transactions on Engineering Management, 48(1), p109.

- Technical- Junior Management

Generally, many engineers spend more than five years in the engineering phase with some never actually reaching the management of technology phase. According to Lannes (2001), the engineering phase is the most enjoyable for engineers as they put into practice their qualifications and is the phase that typifies the classical view of an engineer. The next phase, the engineering management phase, is typified by a change in thought processes and approaches to problem-solving.

- Interdisciplinary Middle Management

More specifically, it is marked by a transition from the reduction approach problem-solving to management problem-solving. This transition generally requires holistic and integrative knowledge, which many engineers find difficult to grasp (Lannes, 2001).

This is not ideal, but is somewhat expected, because the engineers' career progression pathway is indistinctive and does not really prepare them for the management role (Visser *et al*., 2004).

- Business Executive – Senior Management

The last phase is concerned more with the acquisition and use of executive management skills as the engineer concerns themselves more with organisational and industry wide applications of engineering. Kaiseer (2005) states that, it is at the point where managers transition to executive roles that most careers derail, because the transition to executive level is fraught with difficulty (Kaiseer 2005).

Although the 3 phases have been presented as discrete career landmarks, Lannes mentions that there is overlap between the different levels. Nonetheless, what is clear is that the first and last phases of engineering career progression are mutually exclusive. For the purposes of this study, it is the transition from the first to the second phase that is of most import.

To address this challenge, the following section will set the background on the management function, because high performance in this role is expected of many engineers as they progress in their careers. (Appelbaum L. n.d.)

2.6.1 Transitioning to Manager

Several authors have written on the challenges faced by engineers who became managers (Chandra et al., 2006, Kumar and Hsiao, 2007, Childs and Gibson, 2010, Panos and Gray, 2012, Srour et al., 2013). Chandra, Ptoe and Bocarnea (2006) state that engineers are by nature considered to be poor managers and administrators. This is partly due to engineers' resistance to acquiring management knowledge and skills as they generally tend to be uncomfortable with the management aspects of their profession (Childs and Gibson, 2010).

Traditionally, engineering professionals in technology-based companies are promoted to management level after gaining the relevant experience in their career paths and are usually expected to master the art of management "on the job".
According to Chandra *et al*. (2006), it is mainly through time spent within an organisation and the experience that they accumulate over the years that junior engineers are promoted to function essentially as managers.

This view is supported by Kumar and Hsiao (2007) who stated that engineers learn management and leadership skills while working. Within these working environments, for the modern day engineer to be relevant and successful, they are expected to be responsible for more complex roles that inevitably see them functioning as businesspeople. Chandra *et al*. (2006) also added that for these managers to function in a managerial capacity, they had to go through a process of trial and error and adapt to the new management culture.

Although learning on the job might be the common practice, Childs and Gibson (2010) argued that this is an ineffective and imperfect approach. In light of the critical need for managerial skills among engineers, their successful acquisition and / or development, therefore, cannot merely be "picked up" on the job (Childs and Gibson, 2010).

Transitioning from engineer to manager involves a degree of metamorphosing on the part of the engineer. Babcock (1978), for instance, stated that engineers who become managers face a perplexing task of growth and skills acquisition.

The typical engineer-manager has been known to:

- re-adjust his thinking from the inanimate (i.e. machines) to people,
- understand motivation and work delegation,
- to thrive as a manager within the multi-faceted, dynamic and unpredictable business ecosystem, which for the most part is a political game

The transition to manager, as put by Hsiao (2013), thus left new engineering managers feeling unprepared and lacking in training.

Perhaps one of the most comprehensive work done on the challenges faced by engineers-turned-managers was performed by Howard (2003). In his study, Howard explored the

experience and challenges encountered by engineers as they grew into manager. His study identified several challenges encountered by these new managers, three of which they described as the most difficult with their transition. The first related to the managers being overwhelmed with the multi-faceted workload, in what Howard termed as "so much going on". The second related to relationship dynamics and the third to delegation challenges.

2.6.2 Transition Models

Gallo 2013 states that for the aspiring engineer to prepare themselves for managerial responsibilities, they needed to attain skills on leadership and to master the art of management well before they are appointed to the position of manager. Gallo go on the quote Muriel Maignan Wilkins, "It's never foolish to begin preparing for a transition no matter how many years away it is or where you are in your career," These managerial skills, according include the ability to work with and to motivate subordinates.

Upcoming engineers are encouraged to be ambitious but not to overlook their current responsibilities. When one can do very well at their responsibilities and show initiative to learn managerial skills, practice good teamwork for example success is inevitable. Gallo recommends that young engineers should help their supervisors to succeed in the tasks at hand and seize opportunities to lead no matter how small. Those who are willing to take on challenges that others are not willing to tackle can easily be noticed as potential leaders of the future.

2.6.3 Challenges of Transition

Engineers form a significant part of the personnel who lead the organisation in a sugar industry set up but the transition of their career from being predominantly technical into managerial positions are characterised by the following challenges:

2.6.3.1 Attachment to Old Activities

After engineers have developed the skill and appreciation of their technical abilities in performing the tasks related to their jobs they develop confidence in execution of set tasks and this gives them purpose of exsistance. (Gostelow 2017:54)

In this environment habits form and routines make it easy to deliver desirable results, but when the engineer is promoted to take a new position with new responsibilities they unconsciously try to deliver the job using the old methods and hold on to the old procedure that gave results (Oravets A. 2004).

Many engineers who are promoted to managers are unhappy about their promotion when it fails to deliver the same level of satisfaction as the engineer's job. They soon learn that executing in the the managers 'role is time-consuming and that the work must now be done through other people. Engineers here try to hold on to the familiar while trying to take on a the new challange. As a result they work long hours, worry a lot, and may even neglect their management responsibilities. (Gostelow 2017:58)

2.6.3.2 Performance Pressure

When engineers are promoted into a "bigger" responsibility because they were good at the engineering job a new set of responsibilities is given to them but, in the same organsation recipients of the engineeers services still expect the same work to continue yet the responsibility scope has changed. (Oravets A. 2004). This appreciation from other departments puts pressure on the new manager to serve and satisfy and this leaves the engineer with insufficient hours in the day. One needs to be able to adjust quickly and learn that they cannot do it all themselves. (Chan 2007:194)

2.6.4 Four stages of change

Panos and Gray (2012) identified four stages that a good engineer turned-recent-manager typically encounters. These they described as "early days", "reality", "pressure" and "dealing with issues".

- In the early day's stage, when the new manager assumes the role, he immediately becomes overloaded and has to learn to rely on others to help him fulfil his duties.
- During the reality stage, the engineering manager spends much of his time putting out fires, has less direct contact with engineers, has longer work days and experiences increased stress levels.

- During the pressure stage, the manager has to cope with disgruntled staff, is more office bound and challenges keep mounting.
- The final stage (i.e. dealing with issues) the manager finds that they are falling behind on projects, staff complacency increases and they find themselves spending more time hiring staff either in response to staff attrition or to fill in certain roles.

2.6.5 Enabling the Transition Process

For the most part, new engineering managers feel alone trying to juggle the wide spectrum of responsibilities accompanying the new position (Panos and Gray, 2012). In an attempt to help ease the transition from engineer to manager, Panos and Gray (2012) propose several recommendations that could assist. These include:

- Working with Human Resources to create a development plan for engineers transitioning to management positions
- Provide opportunities for engineers to exercise leadership in committees, project work etc.
- Meet with the newly promoted managers to track progress and to discuss the challenges that they are encountering
- Make time available for the new manager to attend conferences, training, and receive coaching
- Provide administrative and technical support to new managers
- Create opportunities for new managers to interact with each other and with seasoned managers
- Review management span of control

2.7 Interventions to Ease Transition Process

The organisation can do a lot to make life easier for the engineer-cum-manager. The following points summarise some effective interventions (Hutchinson 2007:8)

- Job Rotation can expose the engineer to other functions of the business before they are promoted to the level of manager. Much exposure to the management of different teams would prepare one to even lead the same teams combined. Organisations that have a deliberate policy on job rotation for engineers would have a better engineer-cum-manager transition success rate

- Coaching and Mentoring is a proven method of exposing younger professionals to greater responsibilities. In the process of coaching, a senior member of staff needs to be trained on the couching or mentoring process. How to engage and challenge the trainee to enable them to develop their skills in a non-threatening environment. (Hutchinson 2007:8)

- Orientation programs would give the new appointee a clear scope of the job at hand. A specific programme to introduce the employee into a new space of work allows one to understand the objectives and target they should focus on. This process eliminates time wastage and minimises the chance of mistakes.

- Conferences and seminars give professional an opportunity to meet fellow colleagues from other organisations and share learnings. In such meetings professional make invaluable contacts that they can consult with when faced with challenges

- Employee Performance Assessment is a process where periodic evaluation of an employee's performance is done by a supervisor. In such processes, assessment of one's potential is objectively conducted and feedback is given both ways. In some organisations, 360 degree assessments are done where such feedback is sought from direct and indirect supervisors, colleagues and subordinates.
  This gives opportunities for self-evaluation, after which further developments are identified and action plans address deficiencies are set. (Hutchinson 2007:8)

2.7.1 Change focus

Engineers are motivated when then they see the results of their efforts translate into the desired results, but focus change is necessary to enable one to derive satisfaction from seeing the success of the team. It is important for the engineer-cum- manager to learn to appreciate their input in the team's activities through leadership.

2.7.2 Self-Assessment

The new manager should understand themselves and which of their personal traits can be applied in each situation. Such self-assessment reveals to one their strengths and weaknesses which enables interventions where necessary, to facilitate effective management. There are various methods of assessment that include goal setting, delegating, communication, leading meetings, couching, and projects management and budgeting. (Musselwhite 2007)

2.7.3 Consultation

Consultation is often an underestimated method for self-development. In this process, the engineer-cum –manager can consult with colleagues, subordinates and superiors to get honest feedback on areas of potential development. It is important to seek the help of manager and peers, learn and adapt positive behaviours of successful managers and capitalise on such interaction for self-professional development (Ashford 2003:778)

2.7.4 Continued Professional Development

Childs and Gibson (2010) placed the ill-preparedness of engineers to assume managerial roles on the formal engineering education mechanism. They argued that the education mechanism failed to familiarize engineering graduates with essential skills necessary for meaningful contribution towards business outcomes in many engineering and industrial organisations.

Consequently, engineers were not adequately equipped with the leadership skills (over and above their technical skills) that are essential to organisational and industrial productivity and longevity.

In anticipation of assuming management roles, some engineers actively prepared themselves for these roles by pursuing independent business studies. These included postgraduate studies in management e.g. Master's in Business Administration (MBA) and Masters in Engineering Management (MEM) degrees. Srour et al (2013) for instance, did a study on the career progression of 58 such engineers. These engineers had completed their Masters in Engineering Management (MEM) degrees at a prominent university from 1992 to 2009. Engineering Management, as described by Hsiao (2013) combines the application of management skills and practice to engineering-based industries.

> " It focuses on the technological problem-solving ability learned from an Engineering discipline and the organisational, administrative, and planning abilities of management in order to oversee complex enterprises from conception to completion" (Hsiao, 2013, p108).

Srour *et al*. (2013) specifically explored the decision(s) of these engineers to pursue advanced degrees in management as opposed to doing technical graduate studies. Most of these engineers' careers followed a path that typically led to managerial positions. This was in part due to the demands of industry, especially to meet technological advancements that required managers with technical acumen to both manage and overlook the development and implementation process of new technologies (Kotnour and Farr (2005) and Kocaoglu (2009).

Srour *et al*. (2013) found that approximately 50% of the participating engineers opted to pursue an MEM degree since they believed that the course gave them an edge in the job market. Competitive advantage translated to career flexibility and progression in the form of status and on-the-job independence. Srour *et al*. (2013) also observed that engineers who completed a MEM degree progressed much faster to becoming managers and were less likely to experience derailment when compared to their non-EM counterparts.

Failure to meet the challenges when transitioning from engineer to manager sometimes leads to derailment (Visser, 2007, Wilde, 2009). Derailment, as described by Shipper and Dillard (2000), makes references to a case where candidate failed to achieve their organisation's performance targets upon becoming managers due to their deficiency in much needed management abilities. Howard (2003) postulated several reasons for the challenges faced by transitioning engineers leading to derailment. These include balancing the multi-faceted requirements of being a manager, relationship challenges, stress, delegating, *inter alia*. These are tabulated in table 2.3.

Visser et al. (2004) state that successfully transitioning from being an engineer into management is due to three interconnected components. These they identify as knowledge, skills and attitudes. Additionally, Visser et al. (2004) also mention that a good grounding and understanding of administrative principles are required for success in management. Nevertheless, they caution that this knowledge is by itself insufficient to guarantee effectiveness.

Table 2.3: Challenges leading to engineer managers' derailment (Howard 2003)

Challenge	Description
So much going on	The engineering manager role involves balancing many more responsibilities, tasks, and priorities than the engineering role
Relationship changes	Personal relationships, interaction, dynamics, and engineer perceptions change due to the transition.
Delegation	This career progression presents the challenge of leaving the hands-on technical behind and learning to work through others.
More stress	Promoted engineers face increased stress and pressure associated with increased responsibility
Developing new skills	Different skills are associated with a managerial transition; engineers need to capture a new set of skills (managerial skills) as they become managers
Resources and getting the work done	Engineering managers have to find the time, the staff, and other resources to get the work done efficiently and effectively

Further, they add that management theory though seen as a science, its practice, on the other hand, is considered an art. In concluding, Visser *et al*. (2004) describe a successful manager in one who has mastered managerial skills. Table 2.3 depicts the role differences between engineers and managers as indicated by Visser *et al*.

As evidenced in the 2.4 table below, a huge disparity exists between the role of an engineer *vis-à-vis* that of a manger. Generally, engineers tend to work more in silos, are more self-dependent and are more uncertainty averse. Managers, on the other hand, are more open minded and face uncertainty with "cautious" confidence. This highlights the huge chasm that the engineer has to traverse in assuming the managerial role and reinforces the views of authors such as (Seethamraju and Agrawal, 1999, Lannes, 2001)

2.8 Management in Practice

According to Carpenter, Bauer and Erdogan (2012), a manager's primary challenge is to creatively solve problems and management, therefore, should be seen as "the art of getting things done through the efforts of other people"

Carpenter, Bauer and Erdogan (2012, 11). Expanding more on this, management can be considered as the mechanism through which things get done through others (i.e. either individually, in groups, or in organisations). Stated formally, (Carpenter et al., 2012) define the principles that govern management as the collective activities that

> "plan, organize, and control the operations of the basic elements of [people], materials, machines, methods, money and markets, providing direction and coordination, and giving leadership to human efforts, so as to achieve the sought objectives of the enterprise." Carpenter et al (2012, 11)

2.8.1 Professional Skills

According to Hsiao (2013) engineering managers typically manage engineers who are technically inclined and do not think entrepreneurially. They, therefore, require the necessary professional skills to coach, mentor and motivate fellow engineers (Hsiao, 2013).

Although a large number of engineers are in management, Seethamraju and Agrawal (1999) found in their study that, generally, engineer-managers lacked soft skills, such as communication and interpersonal skills, as well as business management skills needed to be successful in management positions.

Table 2.4: Role Differences between Engineers and Managers

Position	Engineer	Manager
Focus	Things (technical/scientific)	People-orientated
Decision Making	Need much information	Often based on inadequate information
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 roles as autonomous	Experiences roles 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 organisational entities
Creativity	Creative with products, designs and materials	Creative with people and organisations
Bottom Line	Will it work?	Will it make / save money for the organisation?

Adapted from Visser, H., Naude', L. & Schepers, J. 2004. Transformation of Managerial Skills of Engineers. *SA Journal of Human Resource Management,* 2(2)**,** p18.

Secondly, engineers moving into management positions have very little training support available to them. People skills are not as highly appreciated or as essential in an individual contributor's role as they are in a project leader's role. Project leaders are also expected to have extensive appreciation and to engage regularly with people (Thornberry, 1987).

2.8.2 Working with People

It happens that engineers lack the necessary sensitivity required in leadership. Such an argument could be rationalised as the applied, systems thinking engineer acting intolerant towards the inconsistent conduct of his subordinates. Sedge (2005) argues that engineers, accustomed to working with 'machines', may never have developed the required people skills required to function in a 'people-focused' position. However, as they, engineers, get more exposure in bigger ventures, they definitely need multi-disciplinary capabilities.

Custovic and Insaurralde (2015) state that as the career of an engineer progresses, they often find themselves in management roles and soon come to realise that the role required a set of skills which they had not yet sufficiently developed. Restated, engineers often discover that career success depends not only on technical expertise, but also on other factors such as organisational and people issues (Seethamraju and Agrawal, 1999). According to Lannes (2001), the knowledge and skills required in the build up towards the management level primarily included project management, interpersonal relations and communication skills, multifunctional leadership skills in administration and sales, and other organisational abilities. In addition to these, Childs and Gibson (2010) include people management skills and teamwork.

2.8.3 Principles of Management

Historically, the fundamental idea of the principles of management was the brainchild of the French management theorist, Henri Fayol (Carpenter et al., 2012), who was subsequently also credited for the original POLC framework (i.e. planning-organizing-leading-controlling).

Despite the many important amendments and "tweaking" that the POLC framework has undergone since its inception, it still remains the classical (or dominant) management

framework in the world (Carpenter et al., 2012). The planning, organising, leading and controlling management functions form the key managerial functions with which managers get to reach organisational goals, primarily through the organisation's labour force.

2.8.4 Traditional and Contemporary Management

Carpenter et al. (2012) split management in two general categories, namely the traditional and contemporary views. These are arranged into pyramidal structures. The traditional view has top management at the top of the apex with lower management and staff forming the base of the pyramid. The second, contemporary view flips the pyramid upside down, with the broader / base of the pyramid at the top and top management at the bottom. In this structure, "on the ground" staff feed into the lower levels of management, ultimately impacting (or feeding into) the decisions of top management.

Figure 2.3 The changing roles of management and managers
Source: CARPENTER, M., BAUER, T. & ERDOGAN, B. 2012. Introduction to Principles of Management. Principles of Management. Saylor Academy. p14

Nonetheless, in both the traditional and contemporary views of management, according to Carpenter et al. (2012), the need for different types of managers still remains. These different management types are tabulated in the following table.

Table 2.5 Different management types

Management Type / Level	**Description**
Top managers	develop the organisation's strategy and are stewards for its vision and mission
Functional managers	are responsible for the efficiency and effectiveness of an area, such as accounting or marketing
Supervisory* or *team managers	are responsible for coordinating a subgroup of a particular function or a team composed of members from different parts of the organisation
Line managers (as known as service / product managers)	lead a function that contributes directly to the products or services the organisation creates
Staff managers	lead a function that creates indirect inputs i.e. that provide a supporting role
Project managers	Are responsible for the planning, execution, and closing of any project. Are often found in construction, architecture, consulting, computer networking, telecommunications, or software development
General managers	Are responsible for managing a clearly identifiable revenue-producing unit, such as a store, business unit, or product line. Typically make decisions across different functions and have rewards tied to the performance of the entire unit (i.e., store, business unit, product line, etc.). General managers take direction from their top executives

Adapted from: CARPENTER, M., BAUER, T. & ERDOGAN, B. 2012. Introduction to Principles of Management. *Principles of Management.* Saylor Academy. P13-14

2.8.5 Managerial Information Role

Mintzberg has been credited as the main author of the role(s) that managers actually play. According to Carpenter et al. (2012), Mintzberg's work in the 1970s set the foundation for what managers actually did, a role that has changed very little since then, apart from a few exceptions. These exceptions include "the shift to an empowered relationship between top managers and other managers and employees, and obvious changes in technology, and the exponential increase in information overload." (Carpenter et al, 2012, 15)

2.8.6 Interpersonal, Informational and Decisional role of Managers

Mintzberg, it is reported, followed managers around for several weeks leading him to conclude that managers, in meeting the demands of the function that they performed, had to take on a variety of roles (i.e. an organised set of behaviours). He identified ten roles common to the work all managers. These have been subsequently divided into 3 groups, namely interpersonal, informational, and decisional (Mintzberg in Carpenter et al, 2012)). These are depicted in Figure 2.3.

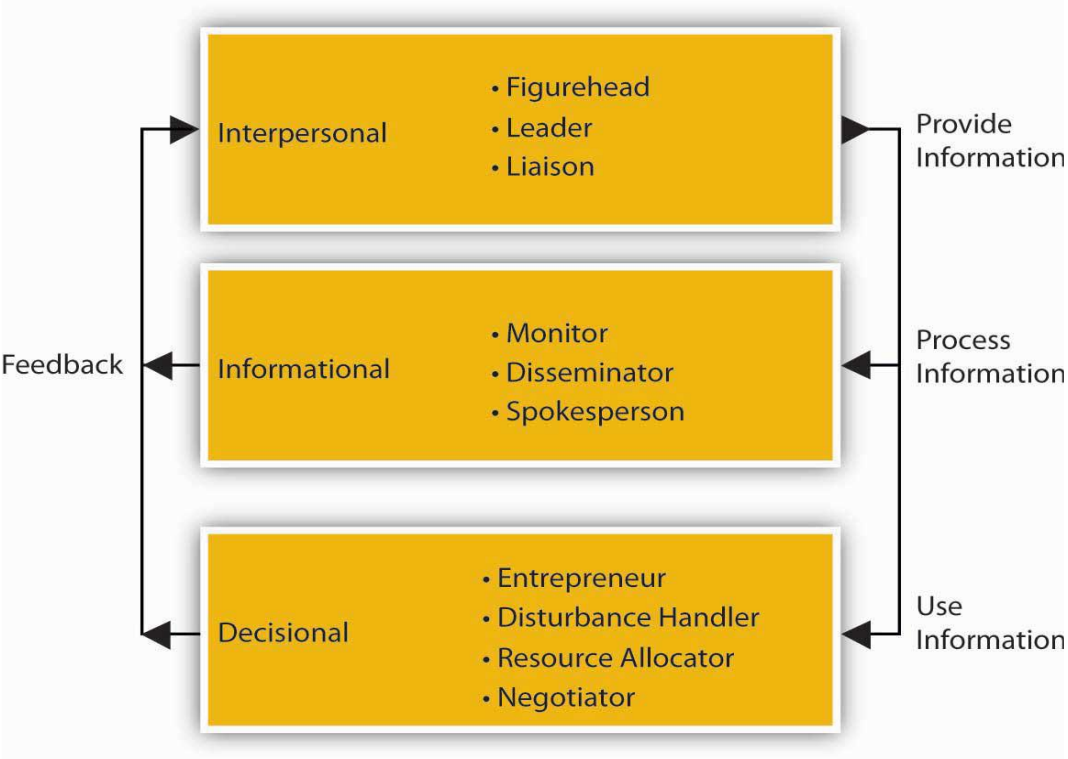


Figure 2.4: The ten managerial roles

Source: CARPENTER, M., BAUER, T. & ERDOGAN, B. 2012. Introduction to Principles of Management. Principles of Management. Saylor Academy. p16

All the managerial roles are connected by the informational roles. The interpersonal role ensures that information is provided, while the decisional roles make important use of the information. According to Carpenter et al. (2012), the performance of managerial roles can often be executed at different times by the same manager and to varying degrees (depending on the level and function of management).

Described individually, the ten roles form an integrated whole. By virtue of the direct relationship / interaction with people, the interpersonal roles place the manager in an ideal and / or unique position to get information. Therefore, the three informational roles chiefly focus on the information aspects of managerial work.

As the organisation's figureheads and leaders, the informational role makes managers the vanguard of the organisations decision-making. According to Carpenter et al. (2012), there are four decisional roles that managers play. As an entrepreneur role, the manager stimulates or initiates change. As a disturbance handler, the manager handles both internal and external threats to the organisation. In the resource allocator role, the manager decides where to best use the organisation's efforts and resources. As negotiator role, the manager is responsible for negotiating on behalf of the organisation. Typically, top-level manager make organisational-wide decisions, while lower level mangers usually make decisions pertaining to their particular unit.

2.8.7 Managers of the future

There are some authors that see the role of managers evolving towards a futuristic and more relevant role. Morgan (2015), for instance, calls these managers "managers of the future". He argues that future managers will challenge conservative management dogma replacing it with more contemporary practices that are relevant and in tandem with global advancements. This view of managers should not be confused with the contemporary view of management mentioned earlier by Carpenter and company, although some aspects do coincide. Rather, this view could be considered as an expansion of the contemporary view. Morgan (2015) proposes 10 principle areas that traditional managers have to traverse in order to adapt to the future manager state.

These are shown in Figure 2.4, the first seven will be briefly discussed in the upcoming paragraphs.

Figure 2.5: Ten principles of a future manager

Source: MORGAN, J. 2015. Book Highlight-Ten Principles of the Future Manager. Global Business & Organisational Excellence, 34, p80.

2.9 Leadership

Morgan (2015) mentions that managers typically focus on enforcing control. This generally encompasses organising, overseeing, supervising, delegating, and making sure that things get done properly and on time. However cautions this view may be, that managers may not often be the best at thinking outside of the box, inspiring or engaging employees, challenging assumptions and building trust. Many of these qualities, according to, are characteristically associated with leadership. Future managers, therefore, must possess influence and they must earn followers (Suda 2013). In concluding this argument, Morgan states that the manager of the future must be able to inspire, engage, challenge, and lead people; as opposed to merely exerting control over subordinates.

Therefore, future managers must be comfortable with and / or embrace the leadership aspects that are steadily rising within the function or role of the manager.

2.9.1 Following from the Front

Moore (2012) discusses how managers alter their mind-set from "How can I get the most out of my employees" to "What can I do to help employees be most effective and engaged?" Admittedly, Morgan acknowledges that this is somewhat a foreign concept as managers are used to leading while subordinates merely follow. The proposition is that that managers of the future focus on develop their employees by removing "roadblocks from the paths of employees in order to help them succeed while empowering them to work in a way that makes them engaged and effective." This aspect seems to be more in sync with the contemporary view described by Carpenter et al (2012) as it focuses more on empowering employees.

2.9.2 Understanding Technology and How Employees Work

The future manager needs to keep abreast of the technological world this does not necessarily mean that the manager has to be very tech-savvy Morgan (2015). Instead, it is vital for managers to be able to stay on top of trends, the technology landscape, and how this landscape might impact the world of work. This concept is a new one and breaks away from technologically-related "tasks" being the traditional or sole domain of the IT department. Staying on top of trends, the technology landscape, *inter alia* has been made feasible to non-tech-savvy persons through cloud-based technologies. These technologies can be leveraged to meet organisational needs whilst empowering employees to heighten and / or improve their performance.

2.9.3 Leading by Example

Traditionally executives and management have used "impersonal" means of showing their support for a project to employees. For example, stating their support normally took the form of budget approval, or communication via a newsletter or video recording.

Executive team support should be more profound as discussed by Wheatman (2016). By this he meant that the executive team should actively participate with employees in the initial adoption of initiatives (e.g. adoption of new technology). This support could take the form of actively engaging with employees, sharing content, listening to what is going on within the organisation, and being present. This need not be a mammoth of a task and could be facilitated with a simple internet connection that a manager or executive could use to easily be in touch with employees through their mobile devices in real time.

2.9.4 Embracing vulnerability

Lapidot., Kark, Shamir (2007) stated that management cannot have meaningful, real relationships with employees and customers if they were afraid to be vulnerable or to show emotion. They defended his statement, arguing that "leaders' behaviours manifesting ability, integrity and benevolence play a central role in enhancing followers' trust in the leader". In concluding, however they stated, "Greater subordinate vulnerability increased the importance of behaviours reflecting leader integrity or ability compared to behaviours reflecting the leader's benevolence, and vulnerability increased the likelihood that trust would be eroded.

2.9.5 Sharing and Collective Intelligence

By tradition, managers have always sat at the top of the organisational hierarchy and been privy to all the information needed to make decisions, decisions which are subsequently dished out to employees to action. According to Morgan (2015), this is somewhat ironic because executives and managers are often the furthest removed from the "ground" and are not hands on in production or the provision of services. This mentality, is ineffective and harmful to the organisation. Future managers, therefore, must embrace collective intelligence (i.e. tap into the experience, wisdom, ideas and knowledge of their teams or the company).

2.9.6 Be a Fire Starter

Morgan mentions that traditionally managers followed a template or formula on how to act, supervise, how to discipline employees, and generally how to get the job done, he believes this, has remained virtually unchanged over the years. This view of management's resilience to change is somewhat supported by Carpenter et al (2015) when referring to Fayol's POLC model which still remains the dominant management approach. Future managers challenge the conventional ideas about management, must have enquiring minds and not take things at face-value. In other words, they must get rid of the traditional "management template". Rather, they should consider using virtual offices for employees, get rid of the formal review process and invite employees to management meetings to get their input and feedback. (Timmons 2008)

The remaining three principles revolve around changing the way that management assesses performance and how they give recognition to their employees. They also give direction to management to adapt to the needs of the evolving employee and to harness employees' potential to benefit both the employees and the organisation.

In summary, the main purpose of this section was to give a background on what is generally expected of any person taking on the role of a manager. It is within these "expectations" that engineering managers are expected to perform. The next section discusses the challenges and what is needed to shape the engineer into a capable manager.

2.10 Summary

This chapter described the background on which the research was done by defining Tongaat Hulett as a business and how the EiT program fits in the bigger scheme of things. An outline of how candidates are recruited into the program was also given before the training program structure and framework was shared. The skills development objectives were also discussed. The chapter went on to lay out the South African context in which the EiT program is set, where the legal framework addressing BBBEE, EE and Skills development requirements were discussed. The Engineering education and training and literary information on such programs was discussed.

This chapter proceeded to explore the various challenges faced by engineers as they transitioned to management roles. It described what engineering work entails, career progression of an engineer was also discussed. Career progression was described as not very clear cut, requiring a new set of skills necessary for the engineer to progress in an industry relevant path. Most of the skills identified that were needed by the progressing engineer related to business management skills and interpersonal skills. Engineers were often found lacking in these, much of this shortcoming was attributed to the almost exclusive technical focus of tertiary institutions in training of the "modern" engineer.

Literature is, however, very scant on the actual challenges that these new engineering managers encountered upon assuming their management roles, through the lens of these managers. There is also very little or no academic literature on in-house training programmes that prepared engineers for management roles, nor is there any literature investigating the success rate of such programmes. This study, therefore, aims to bridge this gap by exploring the challenges faced by South African engineering managers upon completion of an in-house training programme designed to prepare them for management positions. It is through their experiences that both the challenges that they faced and the success of the training programme can be gauged. The next chapter describes the methodology and logic that was followed in the execution of this study.

CHAPTER THREE

Research Methodology

3.1 Introduction

Research methodology, as stated by Mouton (2011), centres around the process(es) behind or involved in conducting a particular research. It, therefore, focuses on the research procedures used, the types of tools employed and the procedures used. This chapter describes the how the present research was conducted. At the onset, the aims and objectives that guided the research process are stated. Thereafter, the location of the study, the population of interest and the general design of the study are described.

3.2 Aims and Objectives

This study aims to gain an understanding the relevance of the EiT program, the experiences and challenges faced by engineers during the transition period when they become managers and how the two correlate. By increased understanding of the transition and experiences of engineering managers, it could help in identifying ways to reduce the difficulties encountered by new engineering managers during the transition. The specific study objectives and questions to assist in addressing these objectives follow.

3.3 Objectives of the study

The objectives of the study are:

- To understand of the relevance of the EiT program.
- To determine the transition challenges from engineers to manager.
- To determine ways to improve training for effective engineer to manager transition

3.4 Questions to be answered in the research

In addressing the study's objectives, the study aims at answering the following questions:

- The nature of the EiT program and its relevance to the sugar engineering manager?
- What experiences define the engineer to manager transition?

- How can the transitional challenges be overcome?

3.5 Participants and Study Location

The targeted participants of the study were engineer-managers at Tongaat Hulett in KwaZulu-Natal. The study specifically aimed to gain an understanding of the challenges encountered by engineers who went through Tongaat Hulett' s Engineer-in-Training (EiT) programme when transitioning into the management role. The EiT programme, as described in Chapter 2, is a learner controlled learning programme which focuses on four major knowledge areas. These areas include technical knowledge, management knowledge, company procedures and methods; and supplementary courses.

The overall objectives of the programme are to ensure that the company has a steady supply of competent, high calibre of engineering managers by grooming them for the management role. 30 such managers who went through the EiT programme formed the population of interest for this study.

3.6 Data Collection Strategy

For this study judgment purposive sampling was used. According to Sekaran and Bougie (2010, 277), this technique is best suited for extracting data from a specific group of people. This method allowed for a homogenous participant pool. In this case, engineering managers who went through the EiT programme were the best suited experts at addressing the aim and objectives of the study. This necessarily means that the findings might not be generalizable to the entire Tongaat Hulett management structure, nor be generalizable to other engineering managers who did not go through the EiT programme (or received similar training from other organisations).

Nonetheless, this technique was the most appropriate for the purposes of this study. A total of 30 engineer managers were identified for the study. As the quantitative research approach was used, research data was collected by means of a self-administered structured questionnaire.

3.7 Research design and methods

This study is descriptive in nature, making use of the quantitative research approach. Data used here was collected through a structured questionnaire, and the responses were coded for ease of statistical analysis.

Therefore the study results were intended to be generalizable in the case of the engineering management community at Hulett Tongaat. It was also envisioned that this study would serve as template to guide further study on the design of programmes targeted at gearing engineers for management.

The questionnaire was designed using similar questions from previous studies identified in the review of the literature. In addition, specific questions that the researcher aimed to address were also included. The questions, therefore, were designed with the specific intent of extracting engineer managers' (who went through the EiT programme at Tongaat Hulett) feedback and perception of the EiT programme, its ability to prepare them for management, and the challenges that they encountered upon becoming managers.

3.8 Questionnaire Construction

Adobe Frame Maker software was used in the design of the questionnaire. Several versions of the questionnaire were constructed prior the final version which was administered to participants. Construction of the questionnaire involved several steps leading to the final version. These are described below:

- **Step 1: Design**

The first step of the design used questions and statements obtained from the review of literature that aligned with the objectives of the present study. Then informal pre-test interviews were conducted with random engineer managers to get a feel of some of the challenges that they experienced. The feedback received from them helped to better inform the design of the questionnaire. The design process involved continuous consultation between the researcher and research professionals. This resulted in a few design revisions. Apart from the content, the revisions also concentrated on the general questionnaire layout, the choice of assessment tools and the ease of comprehension.

The layout was intended to make it easy for the participants to respond. It began by first gathering demographic data about the managers (see general overview of questionnaire in Table 3.1). Obtaining this data first, served to allow for meaningful descriptive statistics and was intended to help ease study participants into the questionnaire.

Table 3.1: Overview of sections in questionnaire

Section	Questions	Description
A	1 - 11	Demographics
B	12 - 17	The EiT programme
C	18 - 23	Management specific challenges

The second section of the questionnaire included 6 questions (please note that sub-questions are not accounted for here). These pertained specifically to the EiT programme and evaluated whether participants' perceptions of the benefits of the programme and its shortcomings, among other things. The third section (section C) evaluated the specific challenges that engineering managers faced upon becoming managers and how they overcame some of these.

During the design process, numerous scaling methods were used to capture responses. A scale, according Sekaran and Bougie (2010), is a tool used in research to differentiate persons, groups, or events on variables of interest in a meaningful way. The scaling used in this research included nominal, ordinal and interval scales. The level and degree of scrutiny that can be done on the data obtained using the diverse types of scales increases from nominal through to interval (Sekaran and Bougie, 2010). In addition, free text boxes were also made available for participants to expand on their thoughts or to express additional concerns or comments that the data collection tool did not incorporate. This was necessary because, in spite of all efforts made to make the questionnaire as comprehensive as possible, it was impossible to fully comprehend or cater for all possible responses and to supply those as options for participants to make their selections.

- **Step 2: Pre-testing**

In the following step of the assessment process, a designed questionnaire was first piloted to 4 engineer managers who had volunteered to assist the researcher to test the research collection tool. This task involved the investigator sitting with managers while they populated the questionnaire, whilst observing their body language and facial expression during the procedure. On this basis the researcher was able to probe deeper on specific parts to elicit the manager's feedback. Volunteers were also encouraged to ask the researcher questions on areas that were unclear, ambiguous, among other things. The feedback received was used to further refine the questionnaire.

The final version of the questionnaire was then administered to 3 individuals who were neither managers nor engineers to review it for the ease of reading, the ease of completion and for general presentation. Further adjustments were then made based on the feedback received from these volunteers, resulting in the final version of the questionnaire that was administered to the study participants.

3.9 Participant Recruitment

Prior the recruitment of study participants, permission was obtained from both the University of KwaZulu-Natal (UKZN) and Hulett Tongaat. In respect of the latter, formal application and several meetings were conducted to address the organisation's concerns and to fine-tune the project to add maximum value to the organisation. The researcher attended to all relevant concerns that were within his power to address. Upon successful resolution of raised concerns, formal consent was given for the research to be conducted at the organisation. This consent was then presented as part of the application process to get ethical clearance from UKZN's Humanities and Social Science Research Ethics Committee. Once ethical clearance was obtained, active participant recruitment began.

Participant recruitment was facilitated through the support of Senior and Executive Management at Hulett Tongaat. Potential participants were identified with the help of Human Resources. These participants were sent an email by the organisation informing them of the research to be conducted and for them to offer the researcher their support. A follow-up email was then sent by the researcher explaining the research to be conducted and emphasising that the research was voluntary. They were also asked to indicate their show of interest in participating. Upon receipt of intentions to participate, the researcher then informed participants of when to expect questionnaires to be hand delivered to them by the researcher.

Prior to commencing participation, each participant was given a verbal description of the purpose of the research and the importance of their participation. It was then explained to them that their participation was voluntary and that they could refuse to participate or could choose to discontinue their participation at any point during the study. Their confidentiality was also assured. They were then asked to complete an informed consent form indicating that they understood the purpose of the study, that their participation was

voluntary; and that they understood their roles and rights in participating. The researcher also availed himself to the participants while they were completing the questionnaire to clarify any areas of the questionnaire that were unclear to them.

3.10 Data Analysis

The data obtained from questionnaires were captured manually into a Microsoft Excel spreadsheet. Each cell was pre-loaded with drop down lists to prevent inappropriate data being captured. The drop down lists also served to reduce data capturing errors as restrictions were placed on the data that cold entered into each cell. In so doing, data integrity was maintained. Each questionnaire collected was given a unique identifier on the questionnaire and in the database. This ensured that participant identities could not be captured into the database. It also provided for the ease with which one could locate particular questionnaires if need should arise due to data queries and also to assist in data verification purposes.

3.11 Research Methodology

Research as a systematic enquiry aimed at providing information to unpack the identified challenges. Furthermore business research is defined as an examination in order to discover facts which provide information to guide the business decisions. Bhattacharyya (2006:387) writes that the research methodology describes the way in which data is collected for a study. (Saunders, Lewis and Thornhill, 2007:602) Research methodology refers to the theory which describes how research should be done, including assumptions on which the study is based. This chapter presents the rationale of the study, research design, sampling and target population, research instrument, pilot study and research process.

3.12 Reliability and Validity

A measuring instrument can be assessed by two critical features which are “Validity and Reliability” (Tavakol and Dennick, 2011). Reliability assesses the consistency of a measuring instrument’s ability to determine a particular area of interest, while validity measures how well the instrument can measure what it is supposed to measure (Sekaran and Bougie, 2010; Tavakol and Dennick, 2011). The validity of the questionnaire was evaluated during the pre-testing phase in the questionnaire’s design described earlier in section 3.5.1.2.

In constructing the measuring tool for this study, Cronbach's Alpha statistic was used to evaluate the consistency of the test questions. Researchers believe Cronbach's Alpha is possibly one of the most objective tools for testing the reliability or consistency of a measuring instrument (Coakes and Ong, 2011).

3.12 Cronbach's Alpha

At its conception, Cronbach's alpha was intended to provide some sort of standard measure of the internal constancy of a test. It is shown as a number between 0 and 1, where numbers nearer to 1 representing higher degrees of consistency. General, alpha readings that fall below 0.6 can be considered poor, but those between 0.6 while less than 0.8 are generally taken as acceptable, while readings greater than 0.8 are normally presumed to be good (Sekaran and Bougie, 2010). According to Tavakol and Dennick (2011). Table 3.2 contains the Cronbach alpha's for the main composite for measuring the perceptions of engineering-managers with respect to the effectiveness of the EiT programme in equipping them for management.

Based on the Cronbach alpha statistic in the table above, the internal consistency of measures used to test respondents' perceptions on the effectiveness of the EiT programme are at the least acceptable (alpha > 0.6). This indicated that the reliability of the measures (individually and as part of a composite) used to test this concept were at an acceptable level.

Table 3.2: Cronbach's Alphas - Effectiveness of the EiT programme

Question / Statement No.	Description	Cronbach's Alpha if Item Deleted	Total Cronbach's Alpha (n=9)
14	14. The programme equipped me for my present position?	0.735	0.735
15	15. The programme met with my expectations of it?	0.732	
17i	17i. The programme adequately prepared me for management:	0.714	
17ii	17ii. The programme equipped me with leadership skills	0.680	
17iii	17iii. The programme helped develop my interpersonal skills:	0.708	
17iv	17iv. The programme developed my communication skills:	0.698	
17v	17v. The programme taught me to delegate and to motivate others:	0.690	
17vi	17vi. The programme re-orientated my thinking from things to people:	0.663	
17vii	17vii. The programme equipped me with the necessary business management skills needed to perform my management duties effectively	0.764	

3.13 Data Analysis

After all of the raw data had been entered, random checks of the data were performed by comparing captured data with data on specific questionnaires. In addition to the preloaded spreadsheet (i.e. drop down lists), this step further contributed towards maintaining data integrity. Before data was coded and prepared for further analysis, an independent data capturer was asked to give the spreadsheet data a final sweep through.

Data was then exported to Statistical Packages for the Social Sciences (SPSS) software. In SPSS, the data responses were coded where necessary and the data analysed. The variables that were analysed were prearranged by the researcher in constructs that related to the aim and objectives of the present study.

Tests for significant differences between categorised responses were performed using the Kruskal-Wallis hypothesis test. This test is a non-parametric test that is an analogue of the one-way between groups analysis of variance i.e. ANOVA (McDonald, 2009; Coakes and Ong, 2011). It allows for the examining of any possible differences that might exist between two or more groups (Coakes and Ong, 2011). The analysed data were then exported to MS Excel for further handling, specifically for the purpose of presenting the information contained.

Data was summarised and presented frequency distribution table formats and relevant graphs. Presentation of collected data was structured to simplify analysis and interpretation results.

3.14 Strengths and limitations

The study focus was on managers that went through the Engineer in Training programme at Tongaat Hulett in KwaZulu-Natal. This group of managers was a significant part of business leadership and management workforce; however, the focus group was merely a subclass of the management complement for Tongaat Hulett, working in the KwaZulu Natal geographic location. The study is therefore not fully representative when considering the context of organisation, a SADC wide organisation, due to differences in demographic, cultural, economic and other influences.

The focus of the research questions was limited to certain aspects of the transition experience due to time constraints over which the report was completed. Consequently, the results are not expected to accurately signify the complete principle of the transition, but more of the element(s) which the study questions focused on, it however gives a sound basis for further study in this area.

Some assumptions made for the research to progress, in themselves, pose some limitations to applicability of some of the recommendations derived.

These assumptions without being exhaustive include but are not limited to:

- All engineers interviewed are committed to their work and to the success of the organisation
- The responses given in the questionnaire are accurate to the best of the respondent's knowledge
- The respondents went through similar standardized programs

3.15 Ethical considerations

Ethical considerations made on this research included the following:

1. The data collection process did not include potentially damaging information
2. The responses of the participants were to be handled with confidentiality
3. Participants were not required to do anything which might diminish self-respect or cause them to experience shame, embarrassment or regret.
4. Participants were not exposed to questions which may be experienced as stressful or upsetting.
5. The autonomy of participants was protected through the use of an informed consent form, which respondents understood
6. The identity and institutional association of the researcher and supervisor/ project leader and their contact details was shared
7. That anonymity would be ensured where appropriate [e.g. coded/ disguised names of participants/ respondents/ institutions
8. The company participating in the research, was well informed of the scope and intent of the research

3.16 Summary

The foregoing chapter gave a summary of the quantitative research method used in the research. It started by listing the aims and objectives of the study, while detailing the process followed used in conducting the study. This procedure included the research approach used, the data collection techniques used and the research design procedure followed. The data collected in the research using the methods discussed here are presented and discussed in the next chapter.

CHAPTER FOUR

Results and Discussion

4.1 Introduction

This chapter presents the findings of the study. It also discusses these findings within the context of engineering managers' work experiences as well as their experiences with the Engineer-in-Training programme. The chapter gives an explanation of the findings in conjunction with information drawn from the literature review in chapter two. The main aim of to draw from past literature is to either concur with or disprove the work of past research in order to make a significant contribution to the study. Furthermore, this chapter focusses on the objectives of the research and highlights how the statistical figures gathered either support or negate the constructs in the study. The chapter begins by presenting the demographic profile of the participating EMS. It then looks into their perceptions of the Engineer-in-Training programme. Thereafter, the challenges faced by EMs both as new managers and as experienced managers are presented and discussed.

4.2 Demographics

Demographic information includes personal data for the respondents such as age, race service period. In research, the use of demographic variable is common because there is usually some similarities that can be drawn through demographic analysis of data, which allows it to be used as control data. Although 30 invitations were sent out to participants, only 21 respondents indicated interest to participate, where they would complete the questionnaires on their own. The total of 21 questionnaires sent out were received back, having been duly completed. Participants had responded to all questions on the survey. The demographics are presented in the upcoming tables, which often have more than one aspect of participants' demographics tabulated.

4.2.1 Age Profile and its Impact

The data extracted from the results show that 57.14% of the sample falls below the youthful age of 35 years.

The other age categories are the 35-50 and the above 50 category with proportions of 38.10% and 4.76% respectively. The respective head counts of these age groups are 12, 8 and 1 respectively.

This statistical result shows that Tongaat Hulett has good prospects for the future because younger employees usually show enthusiasm towards their jobs and are more likely to adhere to company policies and are more sincere at the workplace. It is more likely for an organisation to come up with more innovative solutions for the challenges that they will face in a sugar manufacturing environment. An organisation with a young management team is more likely to utilize updated knowledge to inform their decisions.

4.2.1.1 Advantages of a Young Workforce

As the organisation looks into the future with a versatile team of engineers they have an opportunity to recreate the workplace environment in a refreshing and inspiring way as required by today's competitive business space. Other benefits of a young workforce include, low cost to company because the expectation of younger employees is less than that of experienced employees with significant family responsibilities (Rothschild 2014)

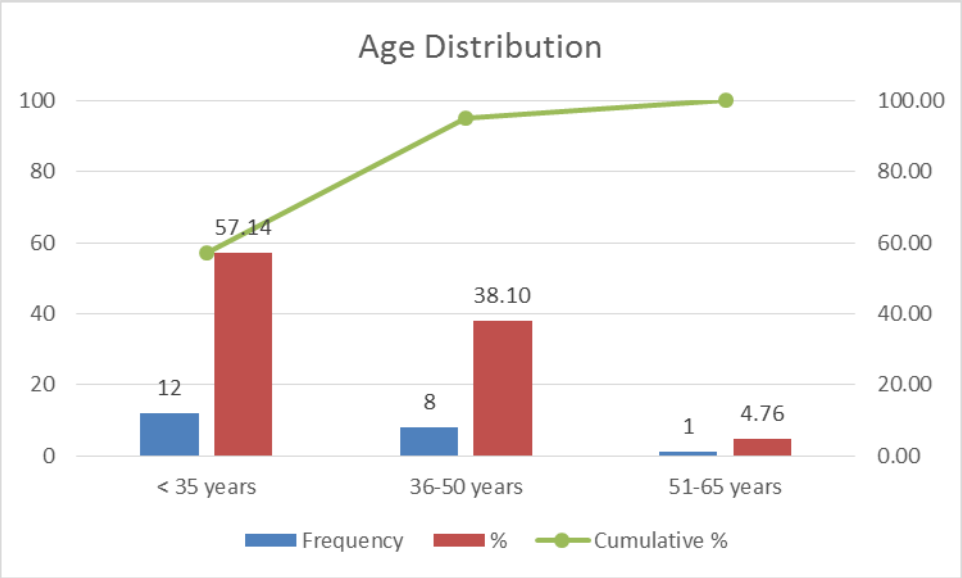


Figure 4.1 Age Distribution

When one looks at the age group <35 and considering the research question, it can be assumed that the respondents in this category could have given more accurate responses relating to the content of the EiT program since they would have completed training more

recently that the other segments of respondents. However <35 group's responses to the questions assessing the relevance of the EiT program to the transition process, from engineer to manager, this group's responses would be subjective because not many of its members would have gone through the transition. The opposite of this assertion would however be true as well.

4.2.1.2 Disadvantages of a Young Workforce

There are disadvantages that can be highlighted of having a young team of employees and these include:

- **Lack of stability** as young employees have no clear vision of what they want to pursue in their careers. This results in young employees pursuing different opportunities simultaneously, such a changing jobs thereby costing the organisation badly (Reddy 2017)

- **Lack of skills** in young employees requires that organisations spend much in the space of training and development. Critical positions require staff who can handle tasks in a professional manner and some mistakes can cost the business irreparable damages.

- **Discipline issues** can haunt young employees because of their ignorance on work culture and the work environment. The failure of young employees to handle pressure can cause them to get frustrated. (Lies 2010)

- **Dealing with socio economic problems,** .cannot be missed when one looks at the demographics above. When one considers the socio economic challenges that are prevalent in modern day South African society, which range from alcoholism, HIV and Aids, financial and family challenges and how these affect the workplace it is clear that the manager needs more than technical skills.

A manager or team leader is expected to play the role of a guide when the workforce is experiencing such problems.

They are expected to have the heart to deal with these matters with maturity and in confidence, yet these skills are not easily acquired.

This dilemma emphasises the need for modern engineers to be adaptable as stated by de Graaff, Markkula, Demlová, Kuru, and Peltola (2007) that today's engineers need to be able to communicate effectively, work together in multidisciplinary teams and have the ability to cope with intercultural dynamics. The social processes of engineering work, however, often present greater complications, uncertainty, and subjectivity than expected (Korte *et al*., 2008).

4.2.2 Gender Distribution

The gender distribution shown by the results reveal a 2 to 1 ratio of males to females in the sample group, varies significantly with the respective 48.2% to 51.7% ratio as represented in the general South African population. However Lehohla (2017) recorded that female workers constituted 31% of the labour force in the manufacturing sector. The portion of females workers in the industry fluctuated from 17% in 'metal products, machinery and equipment' to 71% in 'fabrics, fashion, and footwear industries. It should be noted though that since the sample size (n<30) the distribution is not normal so a t-test is suitable to test if the ratio of Tongaat Hulett' gender distribution is less than the country's ratio.

Table 4.1 Gender distribution

	Research Respondents	
Gender	n	%
Female	7	33.3
Male	14	66.7

4.2.2.1 Women Advocacy Organisations

In South Africa there are numerous organisations advocating for business and government to support women's efforts in penetrating the engineering sector.

(WIE) Women in engineering South Africa, is one affinity group of the IEEE that has taken on a mission to facilitate the recruitment of women in engineering disciplines. (Panetta 2010)

In the Mail and Guardian of 21 August 2015 Thompson reported that, in 2013 ECSA recorded almost 11% of registered engineers as female but that professional engineers totalled only 4%. This was a comment on an article titled "Women engineers quit over men's attitudes' where Thompson went on to report that, "70% of women who graduated with engineering qualifications had left the sector after starting the career because they felt isolated in their jobs.".

While one could argue that females are generally inclined to pursue the "softer" professions the foregoing articles are a cause of concern such that global organisations like WomEng have been formed to attract and develop female engineering leaders. Considering the forgoing statements Tongaat Hulett can be complemented as be leading the noble effort but there is still a long way to go. (Moosajee n.d.)

The South African government has laid down some legal structure in the Employment Equity Act that organisations should comply with. This framework has given the gender question the seriousness that it deserves when considering the empowerment of previously disadvantaged communities.

4.2.2.2 Age across gender

A review of the statistics to understand age distribution across gender has revealed the facts illustrated below.

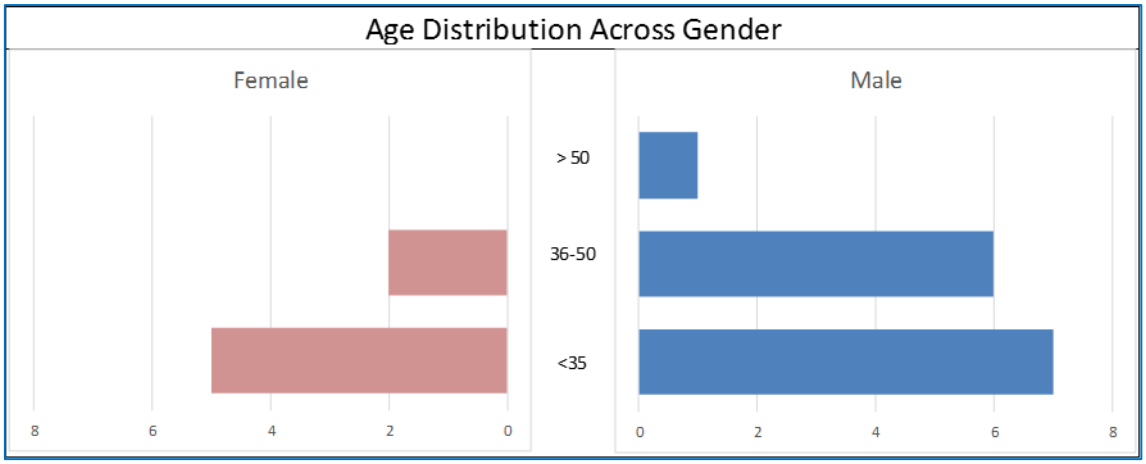


Figure 4.2 Age Distribution across Gender

The data shows 73.43% of females falling under the age of 35 years and the remaining 28.57% falling under the 36 to 50 years range. It can be observed that there are no female engineers above the age of 50 years, which suggests that the drive to recruit female engineers may have come into effect in the recent past as there are not as many female engineers as there are males. This however, is a good indication in response to the gender balance question.

Table 4.2 Age Distribution by Gender

	Female	Range	Male	
71.43%	5	<35	7	50.00%
28.57%	2	36-50	6	42.86%
0.00%	0	>50	1	7.14%

When analysing the classification of male respondents by age, one can observe that there are 50% of engineers under the age of 35 years and 42.86% falling between the age of 36 to 50 years and 7.14% older than 50 years. The trend shows that as age increases, the number of candidates reduces.

4.2.2.3 Possible Causes for such an Age Profile

The reasons for this may be a combination of the following;

- **Attrition,** the unpredictable but normal cases where employees leave the organisation due to causes such as resignations, retirement, sickness or death. In this case, the replacement of staff that will have left the organisation is sought from younger engineers who would have been developed within the EiT system. This trend could also confirm the skills shortage in the country, which gives rise to movements as engineers seek better opportunities.

- **Increased skill requirements**, is the case based on the assumption that today, there is a greater need for qualified engineers to effectively run the sugar manufacturing operations. This may be due to the complexity of the operations brought about by technological advancement or due to more stringent compliance requirements since the industry has become increasingly regulated from an environmental to quality and safety perspective.

- **Older engineers did not participate**, this would be the case if the respondents who declined the request to participate in the survey were predominantly the older employees. If this were the case, it would be interesting to know why.

4.2.3 Population Data

The figure below tabulates the age and race of the respondents for ease of comparisons of the numbers and percentiles that characterise the different sub groups. Further discussion on the race distribution follows in the next section

Table 4.3: Participants' age, race and gender profile

Age			Race		
Range	n	%	Race	N	%
< 35 years	12	57.1	Black	15	71.4
36-50 years	8	38.1	Coloured	1	4.8
51-65 years	1	4.8	Indian	5	23.8
Total	21	100.0	-	21	100.0

4.2.4 Race Distribution

Since South Africa is a multicultural country, the same is shown in the distribution of the engineering staff at Tongaat Hulett. The figure below shows the spread of respondents into different racial groups.

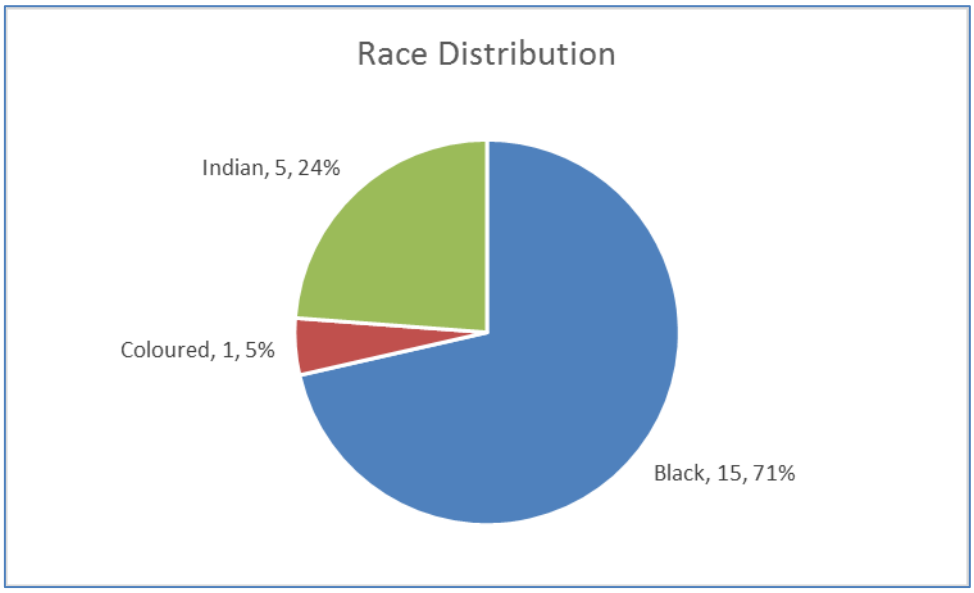


Figure 4.3 Racial Distribution

It can be observed that there are greater numbers of particular race groups in different geographical locations in South Africa and according to Stats SA's report for 2016, the population estimates for the country were in the ratio shown.

Table 4.4 South African Population estimates by race group and gender

Race	Male	Percentage
African	80.6	80.4
Coloured	8.7	8.8
Indian	2.6	2.5
White	8.2	8.3

The Employment Equity act requires that the demographic ratios of regional economically active population be represented throughout the management structure of designated businesses, of which Tongaat Hulett is one. The response to this question would be illustrated in the Employment equity plans of the organisation.

A closer look at the ratios of racial distribution across male and female respondents is shown in the graph below.

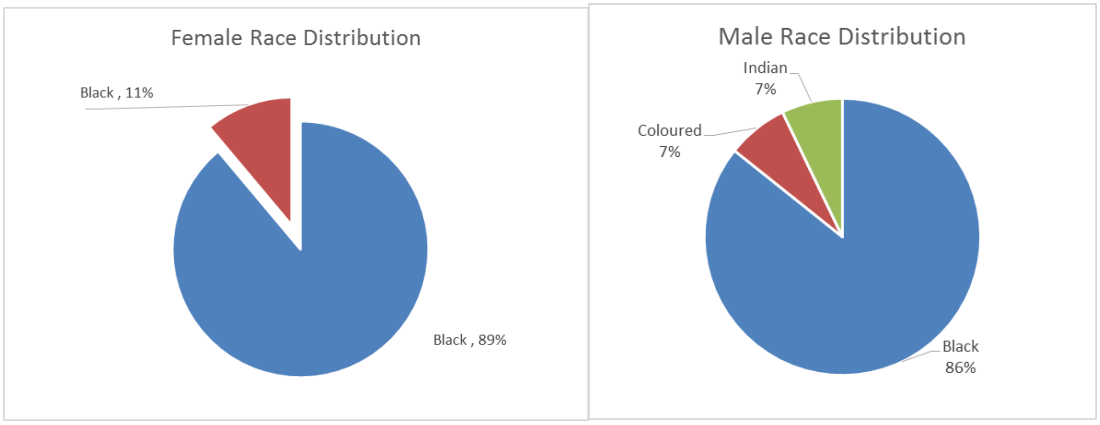


Figure 4.4 Race distribution by Gender

It can be observed that there is no white race representation as part of this team of engineers, it would be interesting to determine what the reason is.

4.2.4.1 Language

With the majority of the population in KZN being Zulu speaking it is not surprising that the Pareto diagram shows a 57.1% representation being of the same race. This majority is as followed in language popularity by the English speaking group which constitutes 28.6% of the population. This group is made up if the Indian and Coloured population of South Africa. These are followed by S. Sotho, Setswana and Swati speaking groups who constitute 4.8% each.

This ratio shows that there is likely to be effective communications with shop floor employees who would be predominantly Zulu speaking in the KZN region. However when one considers that the main language of instruction for the EiT program would be English it would be interesting to see how possible language barriers could have influenced the understanding of course content for the candidates.

Consideration should be taken though, that the official language of instruction in preparatory and high school in the KZN region is English as well.

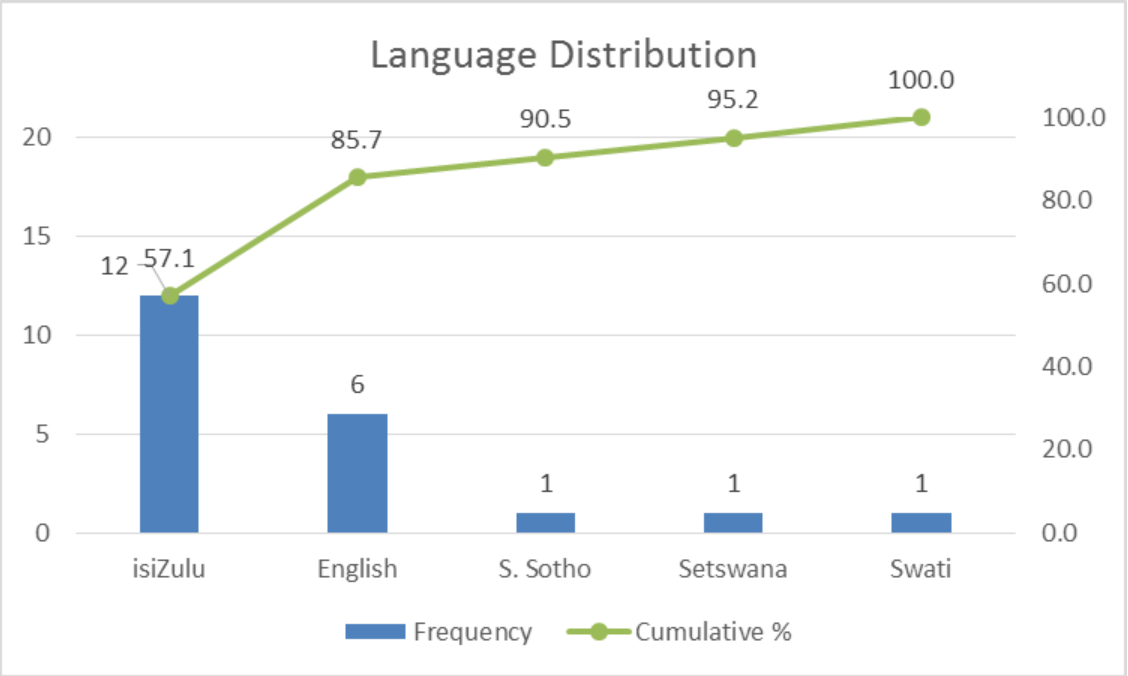


Figure 4.5 Language distribution

The statistical results shows that only 16.7% of the English speakers found the transition from engineer to manager being smooth to easy when the rest found it to be challenging/difficult.

4.2.5 Engineering field of Speciality

The pie chart below shows that 63% of the respondents specialised in Chemical engineering while the remaining 32% and 5% specialised in Mechanical and Electrical engineering.

The graph below shows career progression of the different engineering disciplines in which case 28% of the respondents were mechanical engineers, 66.67% were Chemical

engineers and 4.77% were electrical Engineers. Looking at the organisational hierarchy this data showed that 83% of the mechanical engineers were middle managers and the remainder senior managers. 71.41% of the Chemical engineers were employed as middle managers and 14.29% were employed as senior and junior managers respectively.

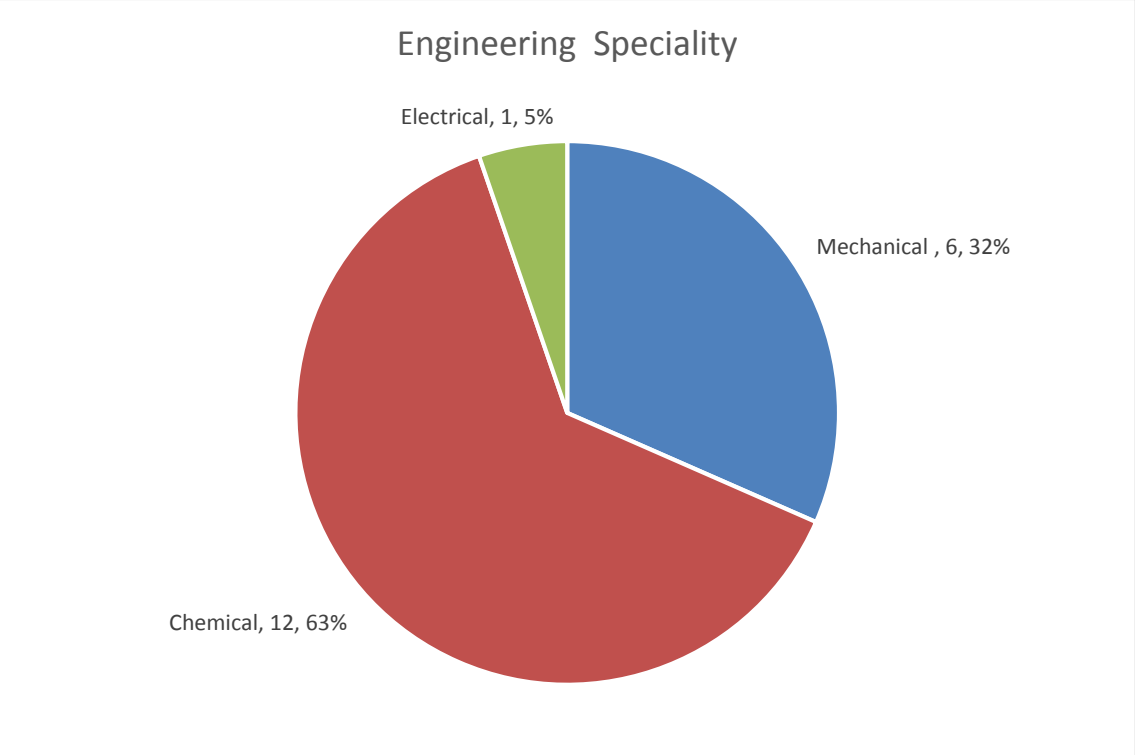


Figure 4.6 Area of Engineering Specialization

The only electrical engineer respondent was in middle management position. The fact that there is only one electrical engineer in the group of respondents made it difficult to make any conclusions in this regard.

Collaboration of candidates with similar backgrounds would make on the job development easier because there is common ground to start from. This would mean if everything were equal, the electrical engineer would need to make a special effort to find his place within the group.

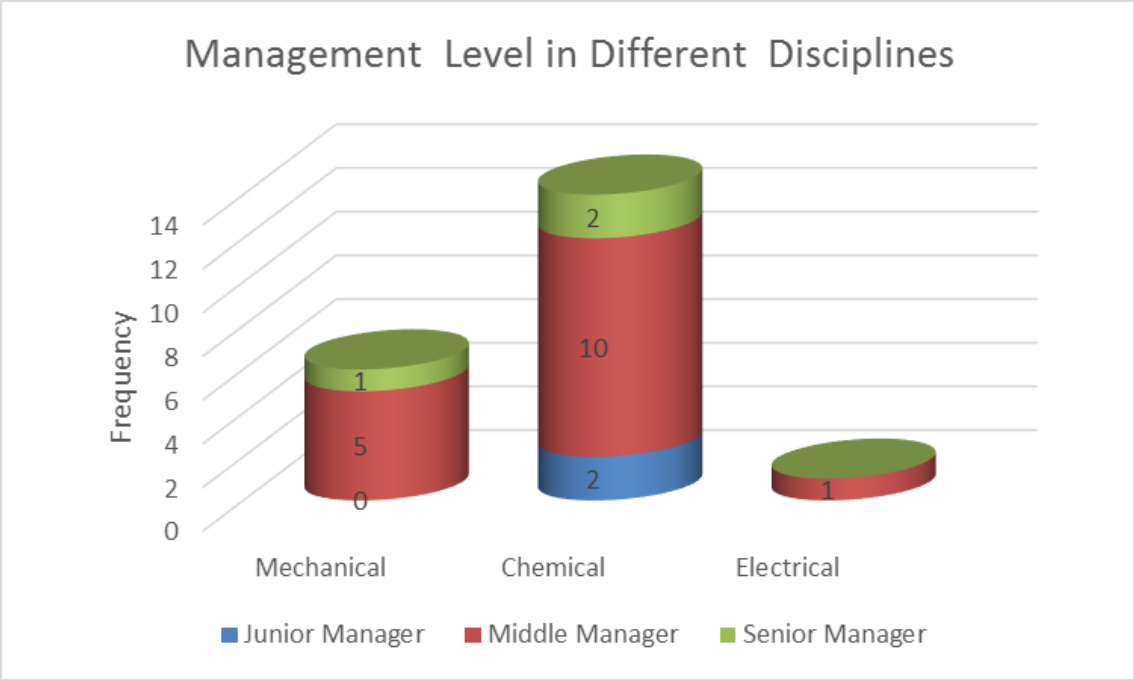


Figure 4.7 Engineering Discipline vs Position of in Organisational Hierarchy

The number of respondents in management level did not appear to have been influenced by the engineering discipline that the respondents had specialised in.

4.2.6 Education level

It is interesting to see that the younger respondents proved to be keen in improving their education level because 83.33% of the respondents had completed a degree in engineering compared to 50% of the 35-50 age group and the respondent above 50years old had not completed a degree level qualification. 8.33% of these young people had completed a postgraduate diploma and degree respectively. The education level of the 35-50year old age group was distributed such that 50% had completed a degree furthermore 12.5% and 37.5% of this group had completed a post graduate diploma and postgraduate degree respectively.

Table 4.5 Education Level vs Age

	<35		35-50		>50	
Diploma	0	0.00%	0	0.00%	1	100.00%
Degree	10	83.33%	4	50.00%	0	0.00%
Post Grad/ Diploma	1	8.33%	1	12.50%	0	0.00%
Post Grad/ Degree	1	8.33%	3	37.50%	0	0.00%
Total	12	100.00%	8	100.00%	1	100.00%

This is consistent with Tongaat Hulett' commitment to continued professional development of its employees because the organisation seeks exceptionally capable candidates for the EiT program, candidates who are intelligent and eager to progress into employees that will grow and contribute to business development. The organisation is determined to show that when an employee performs well and can deliver desired results they are rewarded with an opportunity to develop their skills and knowledge through the support of the organisation.

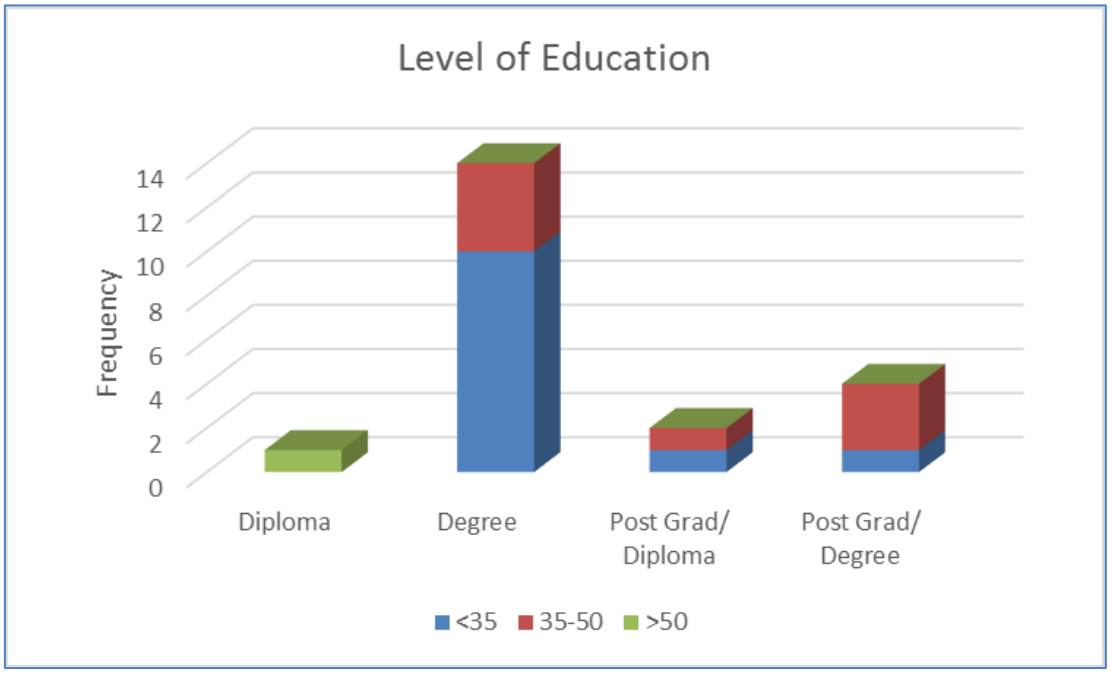


Figure 4.8 Highest Educational Level Attained

4.2.6.1 Age Profile and Education level

Dissecting the statistical data to show how age profile varies with education level confirms the hypothesis that younger generations are more enthusiastic with furthering education. This could be attributed to the ambition to develop one's career.

This analysis shows a different perspective when the same criteria is analysed from different positions

Table 4.6 Age vs Highest Educational level Attained

	Diploma	Degree	Post Grad/ Diploma	Post Grad/ Degree	
<35	0	10	1	1	
35-50	0	4	1	3	
>50	1	0	0	0	

Eleven of the EMs indicated that they had received formal business qualifications of some sort. To be successful in the role as EM, authors have suggested that engineers acquire some form of business training during their formal education and development as engineers (Seethamraju and Agrawal, 1999, Childs and Gibson, 2010, Srour et al., 2013). It may be inferred from the findings that the present EMs had not received business and or management training during their formal engineering studies (i.e. by virtue of the slight majority of them having business degrees in addition to their engineering degrees). Childs and Gibson (2010) argue that the education mechanism failed to familiarize engineering graduates with the essential skills necessary for meaningful contribution towards business outcomes in many engineering and organisations.

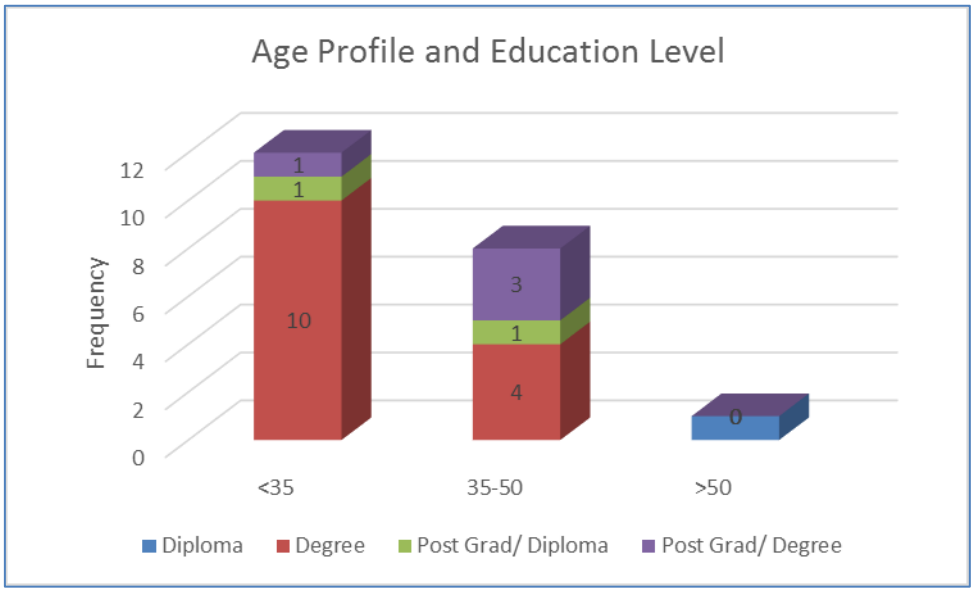


Figure 4.9 Age Profile and educational Level

These 11 EMs with business qualifications are in keeping with a study by Srour et al. (2013) in which they found that many engineers, in anticipation of assuming management roles, sort other commercial qualifications to both supplement and compliment their engineering degrees. This made them better packaged to meeting the demands of industry for well-rounded, business-savvy engineers, thereby reducing their chances of the derailment described by Shipper and Dillard (2000), Visser (2007) and Wilde (2009).

Cross-tabulating business qualifications by management levels revealed that 7 EMs were in middle management, one junior manager and all 3 senior managers had business qualifications (results not shown). By virtue of all 3 senior managers having formal business qualifications, it may explain why these engineers have been successful as managers (NB: this is being based purely on the years of uninterrupted service).

4.2.7 Tenure at Tongaat Hulett

The 21 respondents to the research tool used fell into different categories of length of service and their distribution was such that 28.6% had served between 1 and 5 years, the biggest group is that of persons with between 6 and 10 years of service with 38.1% share. The 3 smaller groups were constituted by 19.0%, a group with service between 11 and 15 years, 9.50% for service greater than 20 years and the smallest group was for persons with service falling between 16 and 20 years (one person belonged to this category).

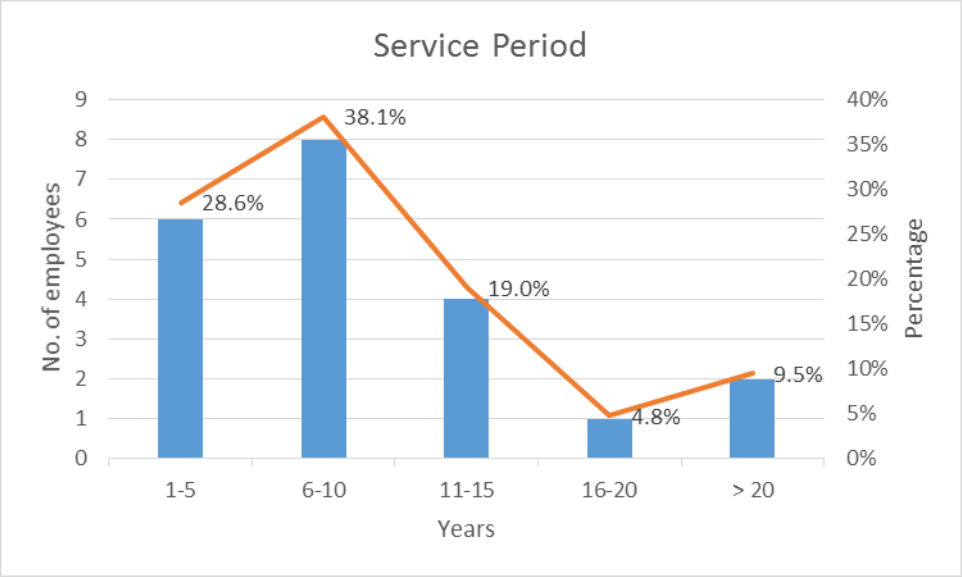


Figure 4.10 Tenure of service with Tongaat Hulett

The persons with a service period of longer than 10 years would be in a more informed position to comment on whether their career progress has been influenced by the learnings gained through the EiT program due to the time served within the organisation. This group would have gone through some significant transition over the time they served in different positions. The challenge with the foregoing statement is that this group of persons constitutes only less that 40% of the target group.

It is interesting to notice that the group of persons who have served Tongaat Hulett for between 6 and 10 years is greater than the number with service less than 5 years. More interestingly, 75% of this group is younger than 35 years of age, which one would assume to be the most unstable group. It can also be observed that 62.5% of this group have specialised in chemical engineering, which may be a possible factor that bonded their work relations. The actual cause of this phenomena needs to be investigated further.

4.2.8 Years in current position

The greater the number of years that one takes in a position gives them more experience of what the position entails. As much as there are misconceptions caused by excitement and the recency syndrome, lack of experience in a position could cause one to give an opinion that is not objective because of temporary excitement or frustrations that they would experience on starting in the new position.

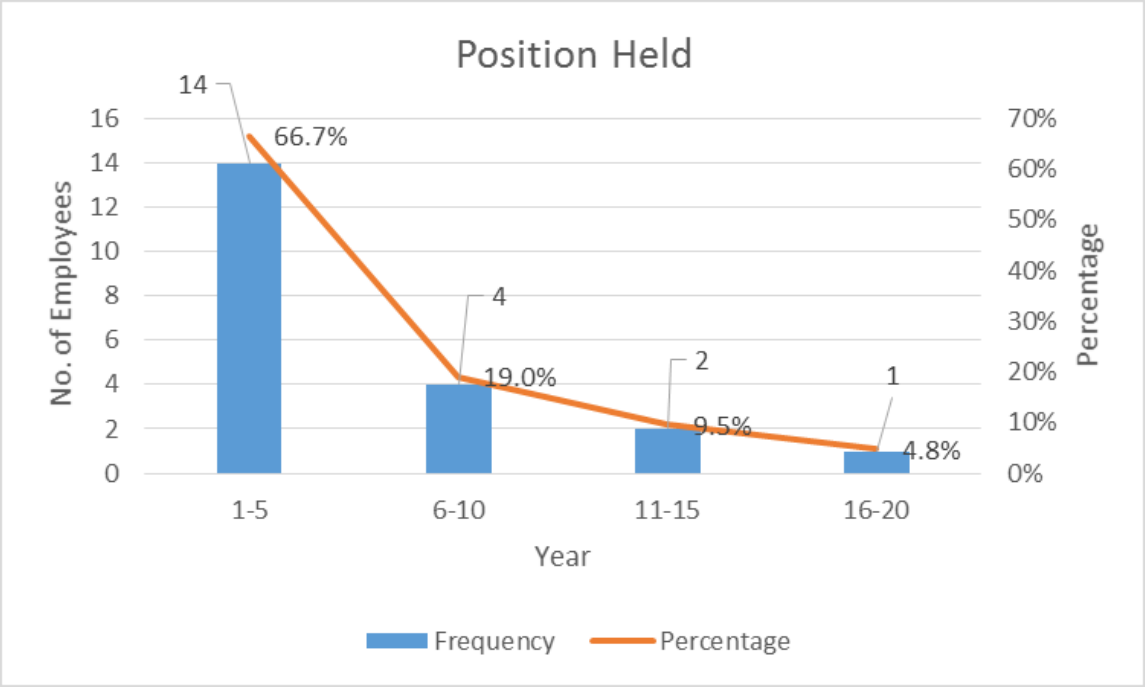


Figure 4.11 Length of service in current position

The data collected in this part of the research shows that 66% of the respondents had only been in the position for less than 5 years. 19% of the respondents had served in the current position between 6 and 10 years and 9.5% and 4.5% had served in their position for 11-15 years and 16 to 20 years respectively. The average calculated service length in the current position is 5.12 years

4.2.9 Management level and work experience

Figure 4.10 shows that 66.7% of the EMs had less than 11 years of work experience at Tongaat Hulett with 2 EMs having in excess of 20 years working at the company. The majority of the EMs that participated were in Middle Management (76.2%), three EMs were in Senior Management and two were Junior Managers.

Table 4.7: Management Level, Service Tenure at Tongaat Hulett

Years at Hulett Tongaat			Management Level			Years position held		
Year Ranges	n	%	Level	N	%	Year ranges	n	%
1 – 5	6	28.6	Junior Manager	2	9.5	1 - 5	14	66.7
6 – 10	8	38.1	Middle Manager	16	76.2	6 - 10	4	19.0
11 – 15	4	19.0	Senior Manager	3	14.3	11 - 15	2	9.5
16 – 20	1	4.8	-	-	-	16 - 20	1	4.8
> 20	2	9.5	-	-	-	-	-	-
Total	21	100.0	Total	21	100.0	Total	21	100.0

In addition, 66.7% of the EMs had held their positions for 5 years at the most. Only one EM had held their position from anywhere between 16 to 20 years [inclusive].

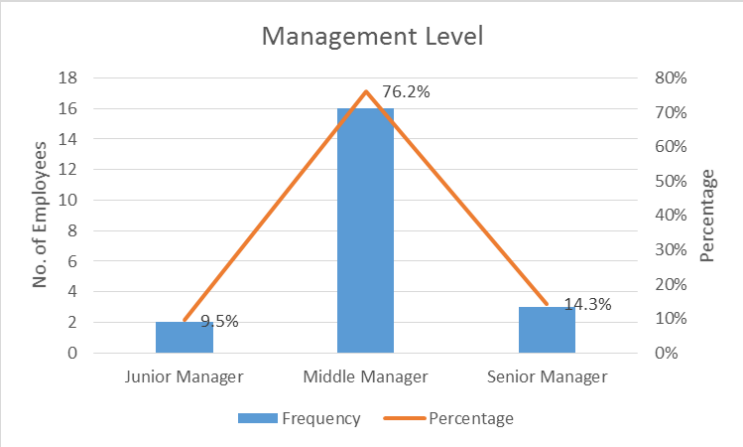


Figure 4.12 Distribution across management levels

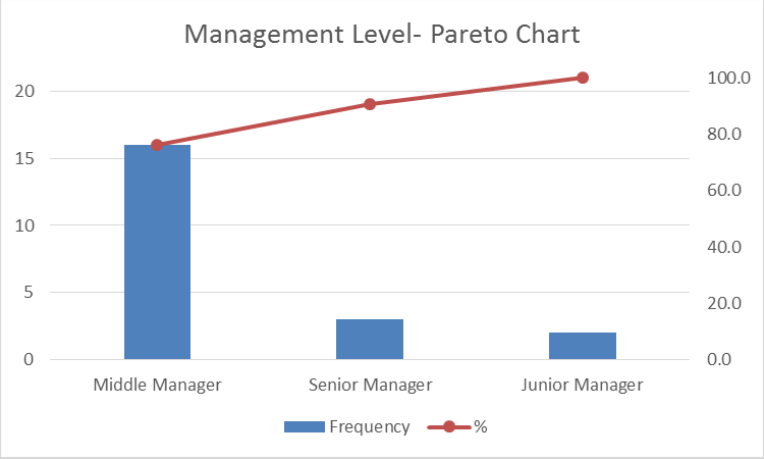


Figure 4.13 Population distribution across organisational hierarchy

The outlook of this graph strongly suggests that the middle management role is where most candidates who complete the EiT program starts.

Although the 2 candidates who are in junior management level have served Tongaat Hulett for 1 to 5 years and 6 to 10 years respectively, they have both been in the current role for a period between 1 and 5 years. They both possess degree level qualifications in chemical engineering, are under 35 years of age and found the transition from Engineer to manager challenging to difficult.

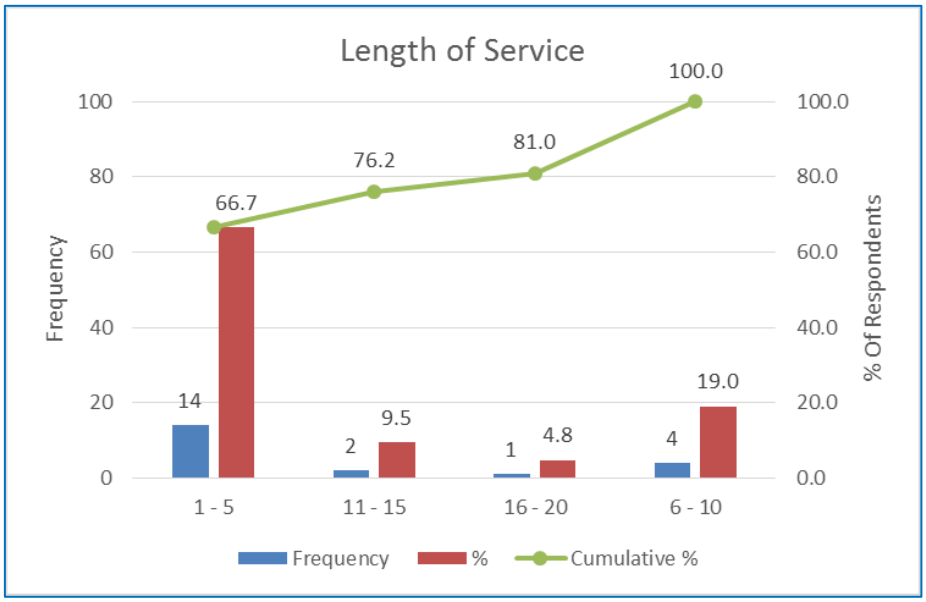


Figure 4.14 Length of service

The Stats SA (2016:73) state that a survey revealed that one in three companies considered emigration post-1994 to have had a significant skills impact on their operations. And that the most affected sector was that of high-tech with (33%) impact followed by manufacturing with (11%), education or health with (10%), and finally business services with (9%).

4.2.10 Further Education

The Pareto graph shows how much the respondents have taken further education to equip themselves for greater work responsibilities. Almost 40% of the participants have acquired a further qualification over and above the engineering degree which is the basis to be admitted for the engineer in training program.

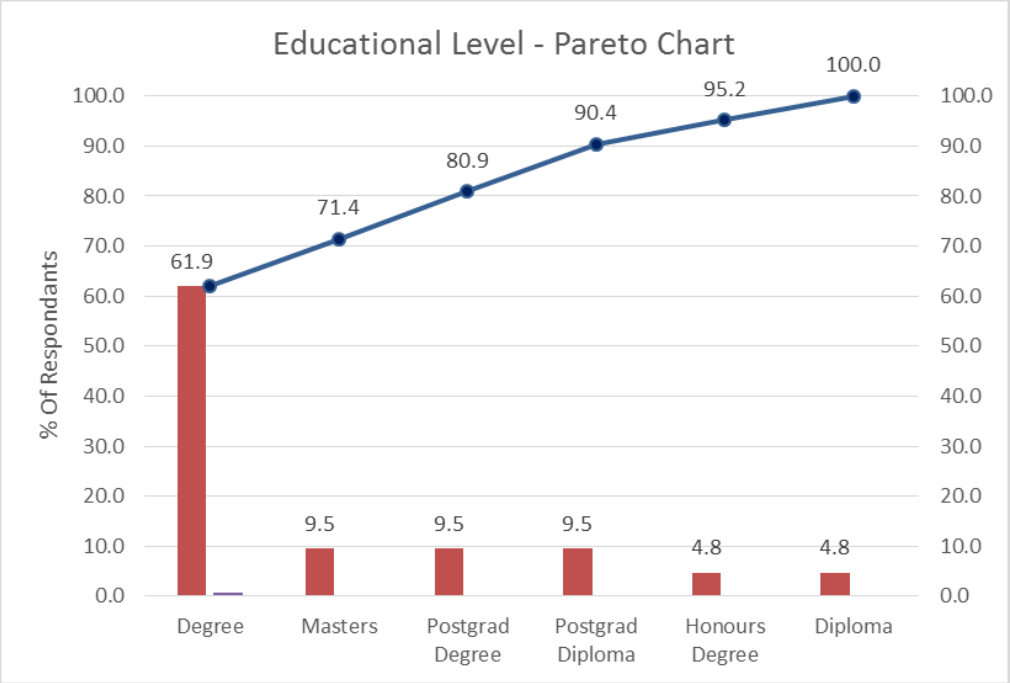


Figure 4.15 Educational Level (Pareto chart)

4.3 Engineer-in-Training Programme

The following section pertains specifically to the EiT programme and the EMs' experiences post EiT programme. It begins by establishing how long ago the EMs completed the EiT programme. It then extracts from the EMs their sentiments on whether the EiT equipped them for their present positions, whether it met with their expectations of it, the skills and abilities that they derived from the programme, among other things.

Table 4.8 Duration of EiT Programme vs Management Role

	Management Level				
Years since completing participation in EiT programme	Year Ranges	Junior Manager	Middle Manager	Senior Manager	Total (n)	%
	1 – 5	2	7	0	9	42.9
	6 – 10	0	6	0	6	28.6
	11 – 15	0	2	2	4	19.0
	16 – 20	0	1	1	2	9.5
	Total	2	16	3	21	100.0

As seen in the above Table 4.8, almost 43% (9 EMs) of the EMs had completed the EiT programme between 1 – 5 years ago. This included both junior managers as well as 7 of the 16 middle managers who had recently completed the programme.

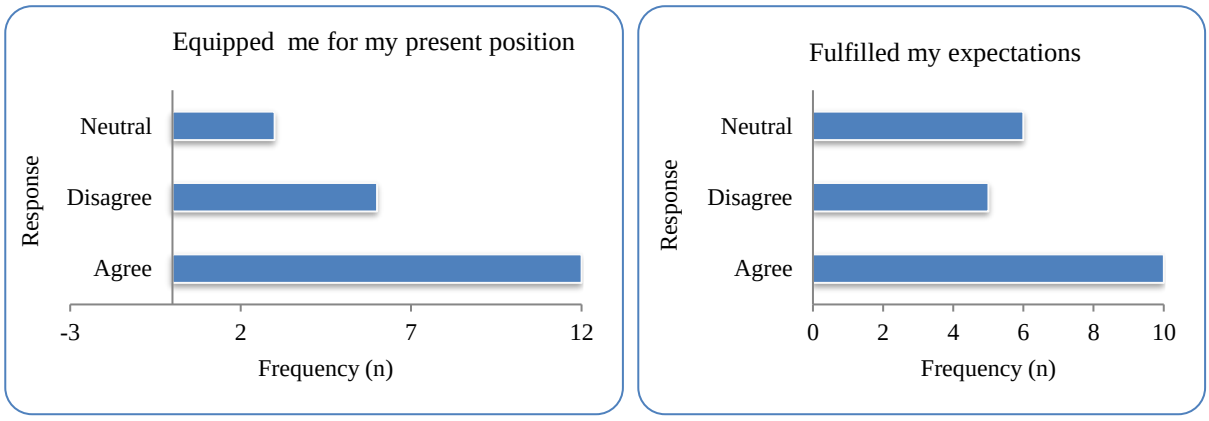


Figure 4.16: Perceptions about the EiT programme

Six middle managers had completed the programme 6 – 10 years ago. The senior managers had completed the programme at least 11 years ago, with one of these having done so more than 15 years ago.

4.3.1 Interpretation of graphical profile

Based on the above figure, the majority (57%) of EMs believed that the EiT programme prepared them for their management roles. Further analysis revealed that this percentage consisted of 10 middle managers and 2 senior managers (results not shown). Twenty-eight percent of them disagreed that the programme prepared them for management. This was comprised of 4 middle managers, 1 senior manager and 1 junior manager (result not shown).

Almost 48% of the EMs felt that the EiT programme met with their expectations of it. Seven of these EMs were middle managers, 2 senior managers and 1 a junior manager (result not shown). Five EMs (4 middle managers and 1 senior manager) disagreed, feeling that the EiT programme did not fulfil their expectations of it.

When engineering managers were asked whether they found the transition from engineer to manager as either easy to smooth or difficult to challenging, 19 of the 21 EMs said that they found this transition difficult or challenging.

This supports the views held by Shipper and Dillard (2000), Howard (2003), Visser et al. (2004), Visser (2007) and Wilde (2009) which held that engineers generally found it difficult transitioning into managers. The transition, therefore, left EMs feeling unprepared and lacking in training. This is in agreement with a similar view held by Hsiao (2013). Finally, only one senior manager and one middle manager found the transition easy / smooth.

4.3.2 Skills Attributable to the EiT Program

Table 4.10 below tabulates the responses to 7 statements regarding the perceived skills and abilities that EMs derived from the EiT programme. The responses are colour coded from most frequent response (i.e. highest) to least selected response (i.e. lowest) per statement. The key to the table is located at the bottom.

As can be seen in table 4.9 participating EMs most often disagreed with the statements regarding the perceived skills and abilities that were derived from the EiT programme. What emerged was that the majority felt strongly that the EiT programme helped them to develop their communication skills. This is evidenced by 62% of them agreeing to this statement. A little more than 52% (i.e. 47.6% agreed and 4.8% strongly agreed) felt that the programme helped to develop their interpersonal skills.

Table 4.9: Perceived skills and abilities derived from the EiT Programme

The EiT program...	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	n	%	n	%	n	%	n	%	n	%
i. adequately prepared me for management:	0	0	1	4.8	5	23.8	15	71.4	0	0
ii. equipped me with leadership skills:	0	0	1	4.8	3	14.3	15	71.4	2	9.5
iii. helped develop my interpersonal skills:	1	4.8	10	47.6	4	19.0	6	28.6	0	0
iv. developed my communication skills:	0	0	13	61.9	4	19.0	4	19.0	0	0
v. taught me to delegate and to motivate others:	0	0	3	14.3	5	23.8	11	52.4	2	9.5
vi. re-orientated my thinking from things to people:	2	9.5	4	19.0	5	23.8	10	47.6	0	0
vii. equipped me with the necessary business management skills needed to perform my management duties effectively:	1	4.8	0	0	3	14.3	16	76.2	1	4.8
Key	Highest		2nd Highest		3rd Highest		Lowest			

4.3.3 The Lack of Business Focus

The most selected skill or ability that EMs felt was lacking from the EiT programme was its failure to equip them with the necessary business management skills with which to execute their management duties efficiently. This is evidenced by 81% of them either disagreeing (76.2%) or strongly disagreeing (4.8%) with this derived benefit. Equally important was the EiT programme's inability to confer leadership skills to the EMs. Here 80.9% of them either disagreed (71.4%) with this statement or strongly disagreed with it (9.5%).

This deviated from the proposals of the Green Report (1994) at the close of the twentieth century which suggested that engineering curricula (i.e. formal training) include leadership as part of the development of engineers.

In addition, the EMs generally felt that the EiT programme failed to prepare them for management as the majority (71.4%) of the EMs disagreed with this statement. The programme also failed to teach EMs how to delegate and to motivate others. These findings support the view held by Kumar and Hsiao (2007) who stated that engineers learn management and leadership skills while working.

4.3.4 Technical to oriented Thinking

Less popular was the programmes ability to shift EMs thinking from technical thinking to people orientated thinking. Most often, EMs felt that the programme fell short in this regard as well (i.e. 47.6%). This is particularly unnerving as many authors had previously noted this is an obstacle in the engineering mind-set that needed to change for the engineer to be relevant and equipped for the future.

In summary, the EiT programme was only credited for the soft skills (i.e. interpersonal and communication skills) that it equipped the EMs with. Other than that, the EiT programme had several shortcomings, especially those that related to fulfilling their management roles effectively and efficiently.

4.4 Challenges experienced by Engineering Managers

This section assesses the challenges that EMs faced at the onset of assuming their management roles. It also identifies the subsequent challenges that they encountered as more experienced engineers. In the process, what EMs perceived as contributing to their success is also evaluated as well as the level of support and training received from their organisation in executing their roles. Each of these is presented and discussed below.

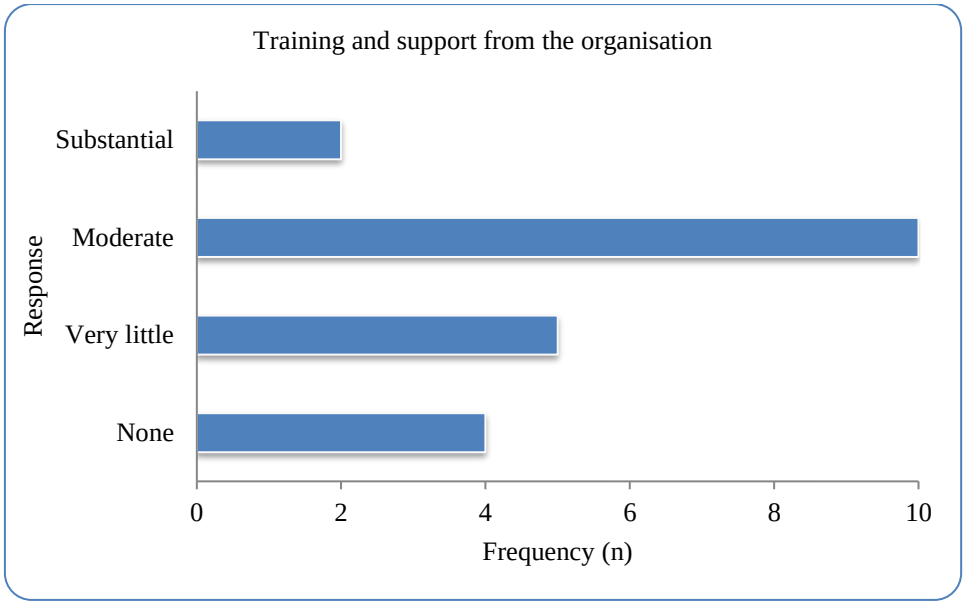


Figure 4.17: Organisational support and training during transition to management

As evidenced in Figure 4.17, the EMs most often felt the company was moderately supportive in helping them during their transition to managers. This included training them when necessary. This is evidenced by 47.6% selecting this option. A further 9.5% felt that the organisation supported them substantially in this regard. The remaining EMs felt that organisational support was negligible (23.8%) to non-existent (19%). This finding postulates that Tongaat Hulett has not done enough to support engineers during their transition period.

The transition from engineer to manager is typified by a change in thought process and approach to problem solving. Lannes (2001), for instance, states that many engineers find this transition difficult to grasp, the lack of support from the organisation during this period suggests that for the transitioning managers to function in managerial capacity, have to go through a process of trial and error and adapt to the new management culture. Childs and Gibson (2010) argued that this approach was ineffective and imperfect as the critical need for managerial skills among engineers cannot be merely "picked up". O'Connor (1999) therefore suggests that to ease of the transition, management need to develop and implement transitional models or programmes to ensure that the environment is put in place that will offer the required management training for engineers to become successful managers.

The EiT programme, therefore, is an ideal platform to breach the gap that is suggested to exist by Childs and Gibson (2010), the programme can familiarize the engineering graduates with essential skills required in order to be successful as managers. In addition, the EiT programme provides an opportunity for the organisation to instil a value driven and high performance culture.

The company values determine the way in which the organisation interprets and responds to business challenges and opportunities. It is therefore important to ensure alignment of these corporate values with the skill set required by future leaders of the organisation in order to deliver sustainable results. With this rapidly changing economic environment, it is therefore crucial for an organisation to be able to adapt to change. This adaption requires sound managerial skills that can drive the organisation through periods of transformation.

Table 4.10: Attribution of management success

Management success attributed to...	Substantial		Moderate		Very little		None	
	n	%	N	%	n	%	N	%
i. The programme	2	9.5	10	47.6	9	42.9	0	0
ii. Your personal ingenuity	9	42.9	8	38.1	4	19.0	0	0
iii. Learning as you go along	14	66.7	6	28.6	1	4.8	0	0
iv. Assistance and / or guidance from work colleagues	10	47.6	7	33.3	3	14.3	1	4.8
Key:	Highest		2nd Highest		3rd Highest		Lowest	

EMs mostly attributed their management success to learning how to manage while on the job. In other words, they attributed their management success to the process of trial and error. This is reflected by 66.7% of them indicating that this process had substantial bearing on their management success. Receiving help from work colleagues and personal ingenuity were also highlighted as substantial contributory factors to their success as managers.

This supports the finding by Chandra et al. (2006) that the transitioning managers go through a process of trial and error and adapt to the management culture. Childs and Gibson (2010) argue that the learning on the job practice is an ineffective approach.

The successful acquisition of critical managerial skills among engineers cannot be picked up on the job as this approach may not yield the skill required to compete in this rapidly changing environment. Engineering talent is crucial to the survival and growth of the business. Failure to nurture and develop qualities and skills required by managers may also result in the engineers taking too long to acclimatize and fit in perfectly into the new managerial role, depending on the individual's experience and ability to adapt quickly.

The programme itself had at best a moderate impact on their management success with 47.6% of the EMs rating it as such. However, almost as many EMs felt that the programme had very little impact on their success as managers, differing by only one EM (i.e. 42.9% of them).

In addition, when asked whether they considered the programme as having an overall positive impact on their abilities to perform their management duties effectively and efficiently, only 23.8% of the EMs agreed that it did (results not shown). Most often they disagreed (42.9%). The remaining 33.3% were unsure whether it did or did not and therefore chose to abstain from taking a bold stand. This draws into question the relevance of the programme, since for all in intents and purposes it was meant to equip engineers to becoming high performance managers as well. It also suggests that the programme needs to be reviewed and adjusted to add meaningful value to the development of EMs.

4.4.1 Challenges of being a new manager

To assess the challenges that EMs faced upon becoming new managers, a list of challenges extracted from literature and from initial feedback received from some EMs during the construction of the survey tool was presented to the participants.
From the list, they had to select as many challenges as possible that they encountered as new managers. These are depicted below.

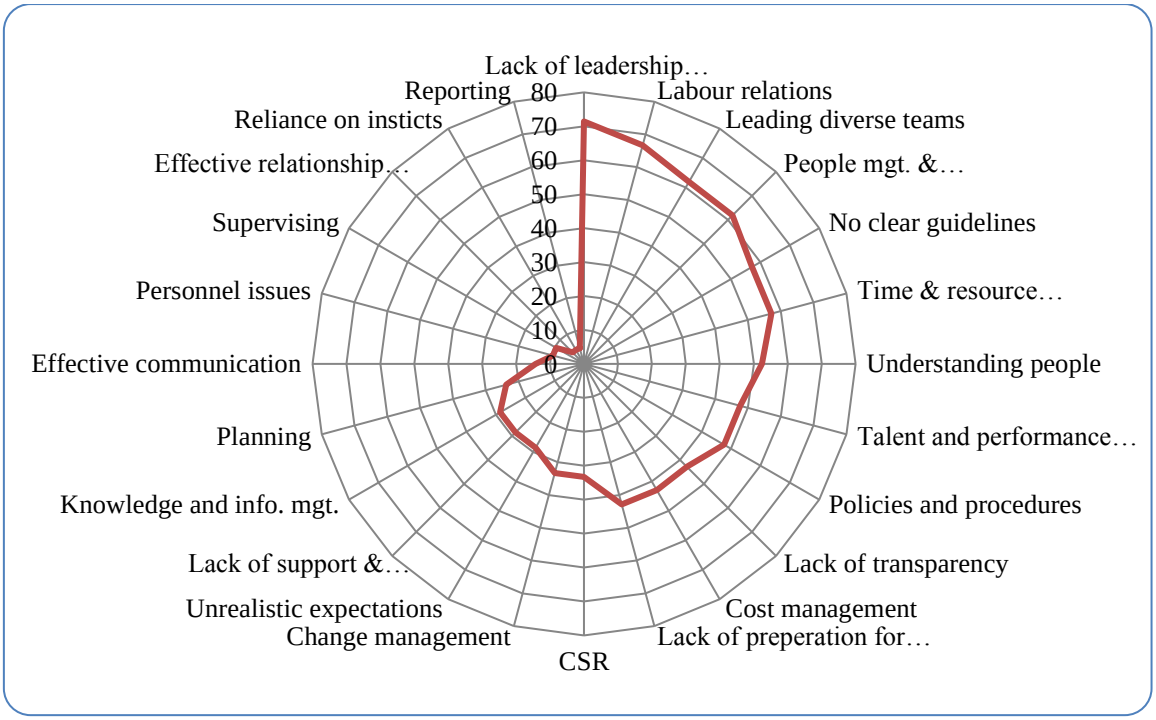


Figure 4.18: Challenges faced as new managers

As depicted from Figure 4.18, the majority of EMs felt that the lack of leadership training was their greatest challenge as new managers. This is reflected in 71% of them selecting this as a hurdle that they encountered. Labour relations (67%), leading diverse teams (62%) and people management and development (62%) also featured among the most difficult challenges that the EMs faced when they became managers. In addition, the majority of the EMs also felt that the lack of clear guidelines (57%), time and resource budgeting (57%) and understanding people were also teething problems that they had to overcome.

Featuring much lower on the challenge scale were unrealistic expectations of the EMs, the lack of support and supervision; and knowledge and information management, each with 29% of the EMs selecting these.

This indicates that the majority of EMs did not perceive or encounter these as challenges when they assumed their managerial roles. The least challenging aspects of assuming the management role were effective relationship management, reliance on instincts and reporting. Each of these was selected by only 1 (5%) participant.

4.4.2 Challenges currently faced as a manager

Similar to the section above, respondents were asked to indicate the challenges that they presently experienced as managers. It should be noted that this question focused only on experiences as managers in higher leadership roles. As shown in the figure 4.19, the top three challenges that EMs experienced in their leadership roles were 1) being micro-managed 2) having limited team skills and 3) the lack of leadership training. These challenges were prominent with 57% of the participants.

Micromanagement is referred by White (2010) as a disease that affects many leaders who unnecessarily over manage, over scrutinize and over frustrate employees. This pointless oversight on minute details of what engineering managers have to do, does not only cause anxiety on the EM but dumbs down the organisation as good workers loose creativity and start behaving like drones who always wait for instructions. White (2010).

The lack of requisite professional skills to coach, mentor and motivate upcoming engineers as reported by Hsiao (2013) is confirmed by the skills limitation challenge raised by EMs. This is a major problem for any organisation appointing engineers to leadership roles because the same professionals are expected to make critical decisions for the business.

The third challenge, "lack of leadership training", may be the most significant on business impact according Farr and Brazil (2009), who state that leadership is a critical element necessary for the advancement of engineering to keep the profession relevant in light of global competition and heightened outsourcing.

The other challenges considered to have less weighting included according to figure 4.19 included, cost management (42.9%), policies and procedures (42.9%); and talent and performance management (38.1%) to name a few.

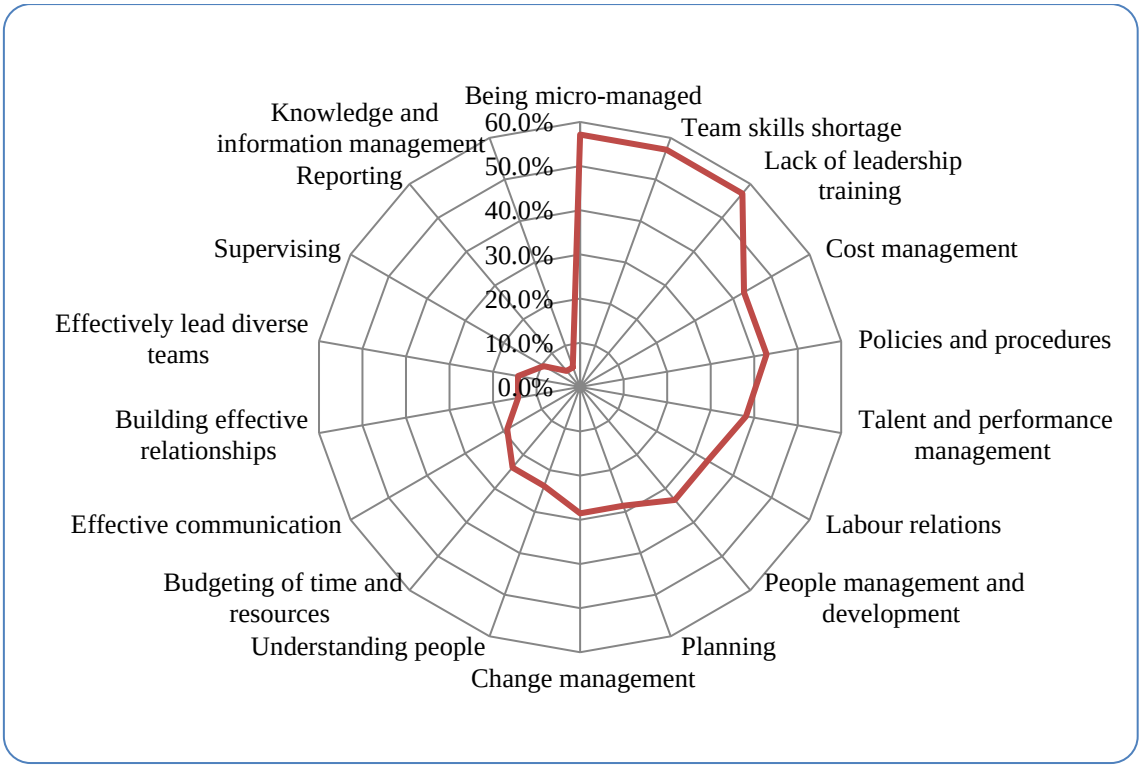


Figure 4.19: Challenges currently faced as a manager

The least challenging aspects of management were supervising (9.5%), knowledge and information management (4.8%) and reporting (4.8%).

What is interesting to note was that the lack of leadership training still posed a significant challenge to EMs, despite having had at least a year in the management role. This implies that the organisation is not really being proactive in training their managers to lead. In contrast, EMs had learnt to lead diverse teams since taking on the management role. This featured as a major challenge to new managers.

4.5 Response Exploration

To better understand the responses in depth, further analysis is done he so that conclusion can be drawn from the statistical data extracted from SPSS. This examination encompassed reliability analysis, to

4.5.1 Reliability Analysis

The Chronbach alpha statistic is an assessment technique designed to measure the level of internal consistency of research questions. The biographic data was not tested for reliability because this data is mostly qualitative yet internal consistence assesse is the components of each construct concur with the measurement of the construct. Chronbach Alpha values of at least 0.700 shows that the construct or research instrument (whole questionnaire) is reliable. The seven elements of the construct on "Efficacy of the Engineer in Training Program", in developing the candidate engineer for future work growth showed a highly positive Chronbach alpha statistic. This affirmed the assertion that this section of the questionnaire was reliable.

The table also shows the individual Chronbach alpha values if each item were removed from the list and the recorded results showed that there was no single question that was out weighing the other to give this positive result. The total Chronbach alpha value n=7.

Table 4.11 Chrobach Alpha - Test 1

Statement	Cronbach's Alpha if Item Deleted	Total Cronbach's Alpha (n=7)
17i. The programme adequately prepared me for management:	0.735	0.741
17ii. The programme equipped me with leadership skills	0.686	
17iii.The programme helped develop my interpersonal skills:	0.700	
17iv. The programme developed my communication skills:	0.698	
17v. The programme taught me to delegate and to motivate others:	0.695	
17vi. The programme re-orientated my thinking from things to people:	0.670	
17vii. The programme equipped me with the necessary business management skills needed to perform my management duties effectively	0.770	

The Chronbach alpha test was extended to evaluate the interaction of questions 14 and 15 on all elements of question 17. This was to determine if these questions were in tandem with questions 17i to 17vii. The result also showed a large and positive coefficient of 7.35 which proved that these questions were consistent and reliable.

Table 4.12 Chronbach Alpha – Test 2

Statement	Cronbach's Alpha of Item Deleted	Total Cronbach's Alpha (n=9)
14. The programme equipped me for my present position?	0.735	0.735
15. Program met my expectations of it?	0.732	
17i. The programme adequately prepared me for management:	0.714	
17ii. The programme equipped me with leadership skills	0.680	
17iii.The programme helped develop my interpersonal skills:	0.708	
17iv. The programme developed my communication skills:	0.698	
17v. The programme taught me to delegate and to motivate others:	0.690	
17vi. The programme re-orientated my thinking from things to people:	0.663	
17vii. The programme equipped me with the necessary business management skills needed to perform my management duties effectively	0.764	

4.5.2 Period after completion of train

According to the table below it can be seen that the number participants varies inversely proportionally to the years of service, which can explain the growing focus on the need of engineering professional in the sugar manufacturing process but simultaneously addressing the challenge that comes with natural attrition. The opportunity to serve in senior management is seen to naturally come with the length of service and experience, while the chance for one to lend a middle management position is almost certain as can be seen by the small percentage (<10%) of respondents in junior management. Conversely, 7 out of 9, i.e. 77% of the respondents with less than 5 years' service were already holding middle management positions.

Table 4.13 Training Duration

	Years	Management Level			Total
		Junior Manager	Middle Manager	Senior Manager	
How many years ago did you complete your participation?	1 - 5	2	7	0	9
	6 - 10	0	6	0	6
	11 - 15	0	2	2	4
	16 - 20	0	1	1	2
Total		2	16	3	21

4.5.3 EiT Program Effectiveness

This question was designed to directly test the relevance of the training received in the EiT program to present day work challenges. The responses are classified to evaluate the similarities between the Junior, Middle and Senior Managers, against the options of Agree, Neutral and Disagree. While 14.28% had a neutral opinion twice as much respondents confirmed than those who disagree with the statement i.e. 63.5% and 21.25% respectively.

Table 4.14 EiT Program Effectiveness

	Response	Management Level			Total
		Junior Manager	Middle Manager	Senior Manager	
The programme equipped me for my present position?	Agree	0	10	2	12
	Neutral	1	2	0	3
	Disagree	1	4	1	6
Total		2	16	3	21

4.5.4 Ease or Challenge of Work Transition

Statistical results derived from the research have shown that the change in work responsibility has in the main been a challenge for most respondents.

Table 4.15 Engineer to Manager Transition

How would you describe your transition from engineer to manager?	Response	Management Level			Total
		Junior Manager	Middle Manager	Senior Manager	
	Smooth / Easy	0	1	1	2
	Challenging/ Difficult	2	15	2	19
Total		2	16	3	21

4.5.5 Testing on the Likert Scale

The questionnaire circulated was constituted by mainly two constructs that addressed the main objectives of the research. These constructs referred to the relevance of the EiT program in preparing the engineers for the challenges that were experienced when they were promoted to manager positions. The other sought to determine the troubles that the engineers experienced in the transition from engineer to manager at Tongaat Hulett.

The questions that were recoded are presented in Table 4.17 below.

Table 4.16 The Likert Scale Responses

Q17	Response	Management Level			Total
		Junior Manager	Middle Manager	Senior Manager	
		n	N	n	n
17i. The programme adequately prepared me for management:	Strongly agree	0	0	0	0
	Agree	0	1	0	1
	Neutral	0	4	1	5
	Disagree	2	11	2	15
	Strongly disagree	0	0	0	0
17ii. The programme equipped me with leadership skills	Strongly agree	0	0	0	0
	Agree	0	1	0	1
	Neutral	1	2	0	3
	Disagree	1	12	2	15
	Strongly disagree	0	1	1	2
17iii.The programme helped develop my interpersonal skills:	Strongly agree	1	0	0	1
	Agree	1	6	3	10
	Neutral	0	4	0	4
	Disagree	0	6	0	6
	Strongly disagree	0	0	0	0
17iv. The programme developed my communication skills:	Strongly agree	0	0	0	0
	Agree	1	9	3	13
	Neutral	0	4	0	4
	Disagree	1	3	0	4
	Strongly disagree	0	0	0	0
17v. The programme taught me to delegate and to motivate others:	Strongly agree	0	0	0	0
	Agree	1	2	0	3
	Neutral	0	4	1	5
	Disagree	1	9	1	11
	Strongly disagree	0	1	1	2
17vi. The programme re-orientated my thinking from things to people:	Strongly agree	1	1	0	2
	Agree	0	4	0	4
	Neutral	0	4	1	5
	Disagree	1	7	2	10
	Strongly disagree	0	0	0	0
17vii. The programme equipped me with the necessary business management skills needed to perform my management duties effectively	Strongly agree	0	1	0	1
	Agree	0	0	0	0
	Neutral	1	2	0	3
	Disagree	1	12	3	16
	Strongly disagree	0	1	0	1

4.6 Hypothesis testing

To assess whether there were any significant differences between the EMs' responses from different engineering background as well as by management level, two sets of hypothesis tests were performed. The first compared responses across management levels, while the second compared the responses by engineering background or specialty. The results are shown in Appendix 1 and Appendix 2 respectively.

APPENDIX 1: Hypothesis Test Summary across Management Levels

Null Hypothesis	Sig.
The distribution of the programme equipped me for my present position is the same across categories of Mgt. Level.	0.3667
The distribution of the programme met with my expectations of it? It is the same across categories of Mgt. Level.	0.8627
The distribution of transition from engineer to manager? It is the same across categories of Mgt. Level.	0.3215
The distribution of the programme adequately prepared me for management: is the same across categories of Mgt. Level.	0.6607
The distribution of the programme equipped me with leadership skills is the same across categories of Mgt. Level.	0.2386
The distribution of the programme helped develop my interpersonal is the same across categories of Mgt. Level.	0.0395
The distribution of the programme developed my communication skills: is the same across categories of Mgt. Level.	0.3442
The distribution of the programme taught me to delegate and to motivate others: is the same across categories of Mgt. Level.	0.5657
The distribution of the programme re-orientated my thinking from things to people is the same for all across categories of Mgt. Level.	0.5804
The distribution of the programme equipped me with the necessary business management skills needed to perform my management duties effectively is the same across categories of Mgt. Level.	0.5183
The distribution of how much training and support received from organisation when transitioning from engineer to manager? It is the same across categories of Mgt. Level.	0.2704
The distribution of the programme: is the same across categories of Mgt. Level.	0.1421
The distribution of your personal ingenuity: is the same across categories of Mgt. Level.	0.4939
The distribution of learning as you go along: is the same across categories of Mgt. Level.	0.4263
The distribution of 19iv. Assistance and / or guidance from work colleagues is the same across categories of Mgt. Level.	0.8110
The distribution of do you consider the programme as having a positive impact on your ability to perform your management duties effectively and efficiently? It is the same across categories of Mgt. Level.	0.8671

Asymptotic significances are displayed. The significance level is 0.050.

APPENDIX 2: Hypothesis Test Summary across Engineering Background

Null Hypothesis	Sig.
The distribution of the programme equipped me for my present position is the same across categories of Eng. Background.	0.3774
The distribution of the programme met with my expectations of it? It is the same across categories of Engineering Background.	0.1231
The distribution of transition from engineer to manager? It is the same across categories of Engineering Background.	0.5908
The distribution of the programme adequately prepared me for management: is the same across categories of Engineering Background.	0.7556
The distribution of the programme equipped me with leadership skills is the same across categories of Engineering Background.	0.8304
The distribution of the programme helped develop my interpersonal skills: is the same across categories of Engineering Background.	0.4106
The distribution of the programme developed my communication skills: is the same across categories of Engineering Background.	0.7476
The distribution of the programme taught me to delegate and to motivate others: is the same across categories of Engineering Background.	0.2657
The distribution of the programme re-orientated my thinking from things to people is the same across categories of Engineering Background.	0.3214
The distribution of the programme equipped me with the necessary business management skills needed to perform my management duties effectively is the same across categories of Engineering Background.	0.9244
The distribution of how much training and support received from organisation when transitioning from engineer to manager? It is the same across categories of Engineering Background.	0.6766
The distribution of the programme: is the same across categories of Engineering Background.	0.5968
The distribution of your personal ingenuity: is the same across categories of Engineering Background.	0.2538
The distribution of learning as you go along: is the same across categories of Engineering Background.	0.2963
The distribution of 19iv. Assistance and / or guidance from work colleagues is the same across categories of Engineering Background.	0.7397
The distribution of do you consider the programme as having a positive impact on your ability to perform your management duties effectively and efficiently? It is the same across categories of Engineering Background.	0.2353

Asymptotic significances are displayed. The significance level is 0.050.

4.6.1 Significance of results

The hypothesis tests for differences in responses across engineering backgrounds did not detect any significant differences in EMs' responses at the 95% confidence level. This suggests that respondents were more or less in agreement in their expressed views across the different engineering specialties. Similarly, when comparing differences across management levels.

However, there was a significant difference ($p = 0.0395$) between the 3 management levels when it came to the programme having helped them develop their interpersonal skills.

This result shows that respondent at different management level felt differently about the impact of the program on the development of their interpersonal skills. It can be inferred that this view could have been formed due to the different periods over which the respondents went through the training program. This is because interpersonal skills are influenced by personalities according to Saunders et al (2007:204), who records that communication is one of the core dimensions associated with interpersonal relationships. Due to differences in personalities one group candidate engineers could have a different experience from another.

4.6.2 Deduction from Outcome

A closer investigation revealed that both junior managers and the 3 senior managers agreed (i.e. this includes agreed and / or strongly agreed) that the programme aided in developing their interpersonal skills. The variability, however, arose within the ranks of middle management, which found 6 of its members agreeing, 6 disagreeing and 4 opting for neutrality.

This variability in results may be due to a number of reasons, which may include the positivity that comes when one has been appointed into a position of responsibility or leadership. The balance of opinions between those who agree and those who disagree is a possible cause for further investigation or better refinement of the research tool to better extract information around the influence of the engineer in training program on the interpersonal skills of candidates.

4.7 Summary

This chapter presented and discussed the findings of the conducted research. The main findings were that the engineers found transitioning to management quite challenging. The EiT programme, which was meant to ease the transition to management, was perceived to have fallen short of its intended purpose as most EMs felt that they lacked leadership skills and had to learn most of their management skills while on the job and through the help of colleagues. The programme, however, did empower the EMs with much needed communication and interpersonal skills, which are often described as lacking in engineers.

CHAPTER FIVE

Recommendations and Conclusions

5.1 Introduction

This chapter presents a summary of the study's findings. Conclusions are drawn from the findings in alignment with the research's aim and objectives. Additionally, the study benefits, limitations and recommendations are also presented.

5.2 Research outcomes

This research investigated the experiences and challenges faced by engineers at Tongaat Hulett when going through the transition period from engineer to manager. In particular, the study evaluated the experiences of engineers who went through the organisation's Engineer-in-Training Programme. This programme was designed to equip and prepare engineers for management positions. The study outcomes were to gain understanding of the challenges that these engineers faced when transitioning to management and to learn practical lessons from these challenges.

5.3 Implications of this Research

This study contributes to the body of literature on the challenges faced by engineers when transitioning into managers. There is limited information in this area of research and this study will contribute to the scholarly evidence in this area, mainly in South Africa.
This study was able to highlight the challenges faced by engineers when transitioning to management and practical lessons from these challenges were drawn.

The following stakeholders stand to benefit from this study:

- Tongaat Hulett could benefit in that it will be able establish whether the programme is effective in developing the necessary skill required by the management candidates. This study further provides recommendations to Tongaat Hulett on how to improve the Engineer-in-Training Programme. These recommendations have the potential to make the programme more effective thus yielding the skill required for successful

managers with the capability to compete in this rapidly changing business environment.

- The EiT programme provides an opportunity for the organisation to instil a value driven and high performance culture. The company values determine the way in which the organisation interprets and responds to business challenges and opportunities. It is important to ensure alignment of these corporate values with the skill set required by future leaders of the organisation in order to deliver sustainable results.
- The engineers from Tongaat Hulett could benefit from this study in that it might highlight the shortfalls of the Engineer-in-training programme. It will also highlight what needs to improve in the programme for successful development engineering candidates who one day may become managers.

The unique contribution that this study will make to human resource management includes a better understanding of how effective the EiT programme works. It provides information on how the current programme can be amended in order to be more effective. In addition, this study provides insight into the engineers' perceptions of the EiT programme.

5.4 Recommendations to solve the research problem

In light of the research findings, the following recommendations are proposed to solve the research problem:

- Exposure to leadership and the understanding of the business should be emphasized at engineer level. This could be done through academic, by introducing supervisory and leadership modules to the program, and practical interventions by way of EiT mentorship by more experienced staff. This experience would have an enabling effect whereby the engineer as manager can in turn mentor upcoming engineers.
- Clear career paths should be developed for EiT's. These should be documented and reviewed to ensure consistent development and traceability of the progress trail, as a result a continuously self-improving system guarantees progression of the program.
- While the EiT program is designed to run between 18-24 months, it would be beneficial for the candidates and the business to extend it to 36 months to allow room for management development modules to be integrated within the course. This change would complement the technical knowledge gained. It is recommended that

these modules be introduced from the second year of training so that practical experiences from the work place can add value to the process.

- The organisation should give new engineering managers sufficient support to ease them into their positions. This could be achieved by means of an induction programme that will inform and equip them for what lay ahead.
- The organisation should put in place a voluntary guide which shows the requirements for continuous professional development for engineers who aspire to take management position. This guide would challenge individuals to study and develop themselves before they are considered for greater responsibility in management.

5.5 Recommendations for Future Studies

The study focus was on managers that went through the Engineer-in-Training programme at Tongaat Hulett in KwaZulu-Natal. This group of managers, however, were a small subclass of a much larger general population of engineers turned managers and were also limited by geographic location. The study may therefore not be accurate for other locations. Additionally, the focus of the research questions was on a certain aspect of the transition experience. Consequently, the results may accurately represent the overall principle of the transition, but rather the element(s) which the research questions focused on.

These are among the main limitations of the study. These limitations, together with strategies to overcome them in future research, will be discussed briefly below. The limitations of this study were:

This study has revealed that there is need for future research to address the issues that could not be covered in the time frame available. More conclusive information could be established if the research was to cover all sites of the business. This would allow for the usage of more conclusive statistical tools where more inferences could be derived. Research into other staff development programs would also shed some light on the effectiveness of other interventions aimed at developing employee capability.

5.5.1 Study sample

This research would have had greater impact if there was full participation from the management team with engineering backgrounds, in addition to those who went through the

EiT programme. This would have allowed for comparisons to see whether there were any significant differences or similarities between the challenges experienced by the two groups. To overcome this, the following should be taken into account:

1. For greater generalizability, the study should be extended to engineering managers who went through the EiT programme nationally.
2. For comparisons, other engineers who also went through the transition to management, but not through the EiT programme, could also participate and serve as a standard with which to compare the effectiveness of the EiT programme.

5.5.2 Research focus

The focus of the research questions was on a certain aspect of the transition experience. It is suggested that future research have a broader focus, looking at other aspects of the engineer to manager transitioning process.

5.6 Summary

This research investigated the experiences and challenges faced by engineers at Tongaat Hulett during their transition from engineer to manager. In particular, the study evaluated the experiences of engineers who went through the organisation's Engineer-in-Training Programme. The study sort to gain an understanding of challenges faced by engineers when transitioning into managers; to determine the common experiences for engineers transitioning into management; and to determine ways to reduce the difficulties faced during the engineer to manager transition period.

In light of the above, this research was successful in identifying the challenges that new engineering managers faced upon assuming their roles. It also highlighted the shortcomings of the EiT programme. In the process, recommendations were proposed on how to reduce the difficulties experienced by transitioning engineers, including improvements to the EiT programme.

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