

A management framework for accelerated development and retention of young engineers: Eskom as a case study

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Dissertation submitted in partial fulfilment of the requirements for the degree *Magister* in **Development and Management Engineering** at the Potchefstroom Campus of the North-West University

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May 2016



Acknowledgements

I would like to thank my fiancé, LEEANNE, for her ongoing and unconditional love and support while I was compiling this research.

My gratitude also goes to my study leader Professor Stoker for his words of wisdom and guidance during the development of this dissertation.

To my research participants, I would like to share my appreciation for the time you all took to contribute to this academic work, and to Thabo Montja for taking the trouble to validate my research.

Thanks, also, to my sister, Noelda Pillay, for her support.

Finally, I would like to express gratitude to my parents, Gonaseelan and Nirmala Pillay, who have given me the opportunities that enabled me to study for a master's level degree.

Abbreviations

ASME – American Society of Mechanical Engineers

BS - British standards

CE – Chief Executive

COE – Centre of excellence

EIT – Engineer in training

EN – European standards

GCC – Government certificate of competency

GSDP – Graduate student development program

ISO – International Organisation of Standardisation

JIPSA – Joint initiative in priority skills acquisition

KPI – Key performance indicator

LTD – Limited

MYPD – Multi year price determination

OHS – Occupational health and safety

PEIC – Production integration engineering coal

Pr. – Professional

Pr. Cert. Eng – Professional Certificated Engineer

Pr. Eng. – Professional Engineer

Pr. Tech Eng – Professional Engineering Technologist

PSM – Power station manager

SADC – South African Development Community

SOC – State owned company

STEP –Station Thermal Efficiency Performance

TFR – Transnet Freight Rail

TPL – Transnet Pipe Lines

Abstract

Key terms and phrases: Young engineer development, young engineer retention, accelerated development, Eskom.

Eskom Holdings SOC Ltd was in need of a means to optimise their existing engineer training programme in order to accelerate the development of young engineers and improve the retention rate of young engineers in the organisation, thus retaining critical skills and receiving maximum return on the investment made (in the case of graduated bursars). This research sought to investigate the existence of a link between the quality of the training offered by the organisation and young engineer turnover. The research also sought to discover those factors that would increase the rate at which young engineers develop in terms of their ability to make technical decisions in situations characterised by high pressure and stress.

To achieve optimisation of Eskom's training program an experiment was conducted using quantitative data collection; this data collection took the form of two independent surveys issued to two predefined subsets of participants. The subsets, namely *trainee engineers* and *appointed engineers*, were further subdivided into those respondents employed by Eskom and those respondents employed by either Sasol, Transnet Pipelines, Transnet Freight rail or other non-Eskom affiliated entities. This was done in order to provide a basis for comparison, to find out the effects of the experiment on Eskom as opposed to non-Eskom employees. Each organisations' training regime was analysed as a back drop. The statistical analysis (where applicable) used in this research was based on a 90% confidence level, with a confidence interval of 6%.

The data collected from the experiment provided the basis upon which the proposed management framework was developed. The results of the experiment produced several key focal points which could be implemented to optimise Eskom's existing engineer training programme which based upon collected data and validation methodology, will improve young engineer retentions rate, improve the young engineers' readiness and sense of judgement in making technical decision under pressure, optimise the existing engineer training programme and propose changes in management approach that will foster an environment of improved development by applying statistically justified psychological factors that positively influence young engineer retention.

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Chapter 1: Introduction

1.1 Background

At the time of the compilation of this research, Eskom Holdings SOC Ltd was South Africa's largest power producer, contributing 95% of the country's electricity; this figure constitutes approximately 45% of the total electricity supplied on the continent (Eskom 2015b). Approximately 46 919 people, including fixed-term contractors, were employed by the Eskom group and its various divisions (Eskom 2014a: pg. 76). Members of the engineering profession are found in different divisions of the organisation, ranging from executive level down to power station level (system engineers). Depending on the development path followed, young engineers within the Generation Division can find themselves in consulting positions at head office or satellite offices (Megawatt Park, Eskom Centre of Excellence - CoE), as consultant engineers for one of the company's subsidiaries (e.g. Rotek SOC Ltd), in managerial positions at power stations, as specialist consultants with PEIC (Production Engineering Integration - Coal) or as system engineers at power station level.

The typical progression for a young engineer in Eskom begins either through bursary contract obligation or direct employment at completion of tertiary study. The graduate engineer enters the organisation, as an Engineer In Training (EIT), at power station level or at head office. After a minimum period of 18 months and successful completion of three evaluations, the EIT is eligible to be appointed as a System Engineer. The System Engineer at power station level is appointed 'The custodian of the plant' or plant owner, for a section of the generating unit. He or she is held fully responsible for the function and performance of the equipment associated with his or her designated plant area. The System Engineer is answerable for any decline of station performance attributed to his or her plant components. Further progression thereafter is commonly to an advisory position within the organisation with PEIC or COE after sufficient experience has been attained, or into management, depending on the individual's chosen career path. The worst case scenario, for Eskom, is the career path of the engineer which sees the engineer exiting the organisation, taking with him or her the skills and knowledge attained as a result of Eskom's investment.

This research focussed on young engineers in Eskom. For the purpose of this research, *young engineers* were deemed to include EITs and system engineers with less than five years' post-qualification working experience and no professional registration or Government Certificate of Competency (GCC).

For the purpose of this research, *senior engineers* were deemed to be those with more than five years' working experience or those who held Professional status (Pr Eng, Pr Cert Eng or Pr

Tech Eng) and/or those in possession of GCC. Professional status was deemed to supersede working experience if the individual had less than five years' working experience. *Management* refers to, and includes, engineering line managers and middle managers.

1.2 Problem statement

Engineering was at the time classified as a 'critical skill' in the organisation itself and by the South African Department of Labour. The importance of the profession in contributing to South Africa's economic growth has been realised and emphasised for a number of years (Du Toit & Roodt 2008). Eskom's claimed commitment reads "*Eskom aims to grow human capital by retaining core, critical and scarce resources, and by effectively developing skills and talent*" (Eskom 2015a: pg 37). However, from 2012 to 2014, there has been a noticeable decline in the number of engineering learners (Eskom 2015a: pg. 37). Furthermore, the recruitment freeze in force since late 2013 (Eskom 2014a: pg. 76) as a result of financial constraints has meant a restriction in the young engineer intake into the organisation. This was evident at power station level, taking Grootvlei Power Station as an example, where the number of new EITs starting work declined from eight in 2013 to four in 2014 and three in 2015. Under such restrictive conditions it would have been prudent for the organisation to concentrate on employee retention. However, in 2013, Grootvlei lost 25% of its EITs within their first 12 months of employment (for various reasons). The research problem was therefore identified and stated as follows:

The effectiveness of the existing EIT training programme and implementation needed to be evaluated and a management framework developed to optimise the training of EITs and improve overall young engineer retention within the organisation.

This framework needed to be developed on the basis of information from current young engineers about their drivers for retention and an investigation into the causal factors behind the exit of young engineers from the organisation.

The implementation of a management framework of this nature would benefit the organisation in two ways. Firstly, it would improve the retention rate of young engineers in the organisation at minimal monetary cost. Secondly, it would improve engineers' preparedness for critical decision-making which, ultimately, means improved plant performance. For the company, this would mean an improvement in income and a better public image as the organisation does its part in 'keeping the lights on.'

1.3 Research objectives

Using Eskom as a case study, this dissertation aims to achieve the following:

- Improve young engineer retention rate, thus keeping knowledge and skills in the organisation.
- Improve young engineers' readiness and sense of judgement with regard to technical decisions. This ultimately influences the performance of the organisation as a whole and improves engineers' decision-making confidence.
- Optimise the current EIT training programme by taking into account the factors discovered through this research.
- Recommend changes that can be made to improve engineer development through an analysis of the current management approach that may be contributing negatively to employee retention.

The means to achieve the above objectives shall be presented in the form of a management framework derived from the data collected and analysed in the compilation of this dissertation.

1.4 Dissertation Overview

With the goals of this dissertation outlined in chapter 1, the chapter to follow provides an analysis of relevant supporting literature. The literature sources were Eskom specific in order to gauge the situation in which the organisation found itself at the time of this research. External (non-Eskom) sources were also used to provide a basis for comparison (i.e. to the situation in other industries). The literature reviewed also aimed to analyse past and current research that has been conducted into employee retention (including behavioural and psychological factors that needed to be considered in the structuring of the research design).

In chapter 3, the research design consisted of the process applied to construct two surveys which were administered to trainee engineers and appointed engineers. From these instruments, data was then collected and analysed. Statistical analysis was used to identify relevant trends, which were presented and discussed in chapter 4. The proposed management framework was developed (in chapter 5), (Appendix C1) along with conclusions and recommendations (also presented in chapter 5). Before being distributed, the questionnaires were subject to verification. Validation was conducted on the results through review and evaluation of the management framework (by an Eskom management team member).

1.5 Summary of chapter 1

In chapter 2, factors that contribute to employee development and retention, and which are relevant to the development and retention of young engineers, were extracted from credible scholarly and industry-related literature sources. This information was analysed and presented

and linked to this research. In addition, existing Eskom training programmes, as well as training programmes from other organisations, were analysed, compared and discussed with a view to better understanding the training situation in Eskom at the time. This also allowed a generalised correlation to be formed between the nature of Eskom's training programme and the retention rate of young engineers in other, non-Eskom organisations; their preparedness for decision-making was also discussed. The literature based information presented in chapter 2 was then used as the basis for the development of questionnaires upon which this research was based.

Chapter 2: Literature Review

Chapter 2 serves to present an analysis of past research and trustworthy, relevant literature that is applicable to the development and retention of young engineers. This chapter includes the review of training programmes that, at the time of this research, existed in Eskom, Sasol and Transnet (in order to form a basis for comparison). The implementation of these programmes was evaluated and verified through the research experiment. One must bear in mind that the goal of this research was to design a management framework that supported young engineer development and retention by examining those management factors that inhibited both. The goal was not to rewrite existing training programmes.

2.1 Eskom SOC Ltd: A background into Africa's largest power producer

Eskom, a state-owned power producer based in South Africa, at the time produced approximately 95% of South Africa's electricity, and 45% of the total electricity on the continent. Based on the Electricity Supply Commission founded in 1923, the organisation was transformed into a fully government owned entity in 2002.

The company provides electricity to South Africa and buys and sells electricity to other African countries (i.e. those in the South African Development Community region). The purpose of cross-border dealings which, at time, had been controversial, was cited to be: "*The future involvement in African markets outside South Africa (that is the SADC countries connected to the South African grid and the rest of Africa) is limited to those projects that have a direct impact on ensuring security of supply to South Africa.*" (Eskom 2015b).

As at 11 April 2015, Eskom's 27 power stations held a nominal generating capacity of 41 995MW divided among five energy sources: 35 726 MW coal fired, 1860MW from nuclear energy, 2409 MW from Open Cycle Gas Turbines, 2000 MW from hydro-electric and pump storage schemes, and 3 MW from a wind farm. The electricity was distributed to its customers via approximately 359 337 km of power lines.

In recent years, the company has found itself in the media spotlight and under scrutiny, partially by the implementation of rolling blackouts (the first of these occurred in 2008). In 2014, Eskom began implementing load shedding again, which continued into 2015. This situation justified the need for the rolling blackouts; indeed, there is a possibility of a nationwide blackout if the load is not reduced at certain, critical times. The need for load shedding in 2015 was attributed to the periodic supply shortfalls. An event wherein the national electricity demand significantly

outweighs the company's ability to supply, calls for load to be shed thus ensuring that grid frequency was maintained within allowable tolerance, in the region of 50Hz, thus preventing a national blackout. The cause of the electricity 'crisis' has been attributed to a deferral of maintenance activities, leading to maintenance backlogs, and the delayed delivery of the Medupi and Kusile newly built power stations (which began construction in 2007 and 2008 respectively). Eskom has since taken action against the maintenance backlog in that the organisation's stance regarding the matter had shifted to: "*We cannot continue to defer maintenance and increase the backlog –that would be catastrophic for the country. We have decided to get down to maintenance and implement it properly; therefore we are likely to load shed on most days in the near future,*" in the words of the then Chief Executive, Tshediso Matona (Oosthuizen & Omarjee 2015).

This equated, at power station level, to increased leniency in the granting of units for opportunity maintenance (over weekends or as was necessary and justified by the power station in question). The result was that, on days when load shedding had to be implemented, the radio news report cited "Delays in bringing back generators" as the cause. This is why this research is especially relevant, since it has been established that maintenance backlogs were a reality and, as such, the organisation had to make certain, necessary sacrifices in order to conduct maintenance as quickly and effectively as possible. At the centre of the maintenance activities at power station level were the owners or custodians of each sub-plant, the system engineers, whose work scoping and decision making have the ability to heavily influence and, at times, be the deciding factor as far as the return of a generating unit was concerned.

Load shedding carries with it negative impacts; these range from a disgruntled public to a very real negative impact on the national economy and growth. As investor confidence declined, the negative impact on the energy intensive mining sector, which South Africa depended on to aid in curbing budget deficits, compounded the overall feeling of hostility towards the organisation. Furthermore, the company was thrown into management turmoil with the appointment of a new CE (Chief Executive) on 1 October 2014 who, within 6 months, was suspended (along with three other group executives) for the duration of an inquiry into the organisation's financial practices. This was followed by the appointment of acting CE Brian Molefe, who was seconded from Transnet, as well as the resignation of the chairman of the board of directors (Zola Tsotsi), and the reshuffle of the remaining group executives. All this is an indication of the instability that was evident in Eskom's upper management. At the power station level there has been increased pressure on middle, line and power station managers alike. At the time of writing (May 2015), it was clear that the company was under serious pressure. Taking into account the financial constraints that it had admitted to by requesting a further electricity tariff in 2015 (over

and above that expected from Multi Year Price Determination (MYPD) 3), the organisation needed to make full use of its resources, including its human resources.

The sub-chapter to follow discusses the criticality of the development of engineers in the country's and organisation's growth. However, before this, a brief description of Eskom's organisational structure is necessary to provide clarity regarding the management levels referred to later in this dissertation. Figure 2-1 and figure 2-2 describe the management structure that existed in Eskom Holdings SOC Ltd at the time of writing, and shows the path that is relevant to this research.

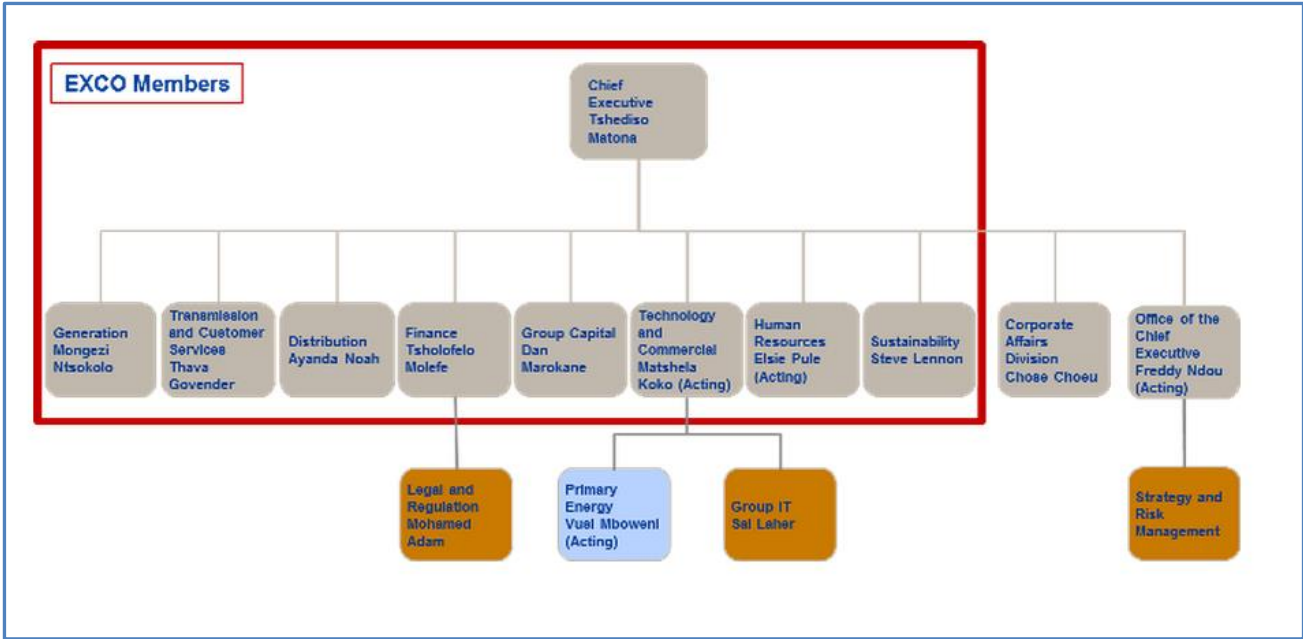


Figure 2-1: Eskom executive committee structure (Eskom: 2015c)

The leader of the executive committee, the Chief Executive, was the only member of the executive committee who also was a part of the 12 member board of directors chaired by Acting Chairman, at the time, Dr Baldwin Siphon Ngubane.

The link to the System Engineer was through the Group Executive for Generation, as shown in Figure 2-2. The focal point of this research, the young engineer, falls into the System Engineer or EIT blocks outlined in yellow. Their development was mainly influenced by the parties outlined in red in figure 2-2. However, their development could also be influenced by a dedicated Power Station Manager (PSM), as was the case at Grootvlei Power Station from 2004 to 2010; during his tenure, the PSM (Jason Hector) conducted monthly development meetings with EITs.

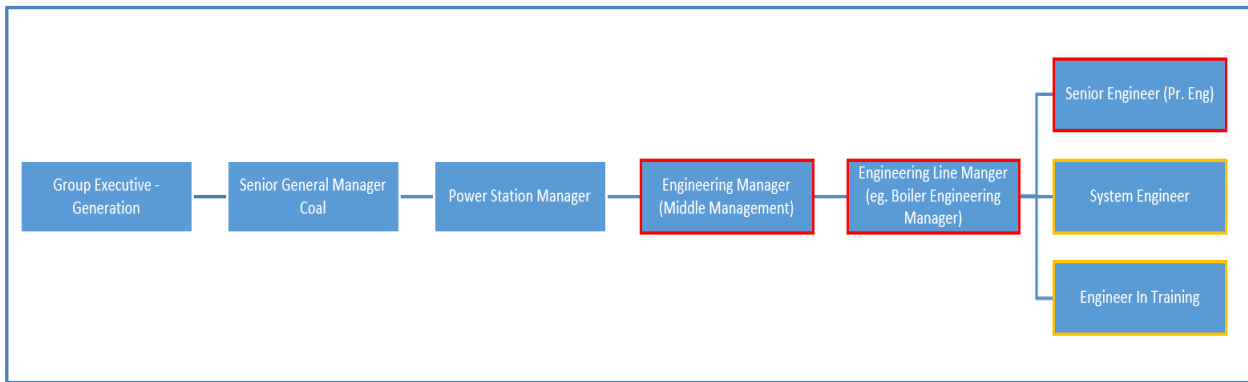


Figure 2-2: The Eskom management structure as it impacts on the young engineer

2.2 Engineering, a critical skill

In a notice published in 2014 by the Department of Higher Education and Training (Nzimande 2014a), 15 out of the top 20 in a list of South Africa’s 100 most in-demand scarce skills were from engineering related occupations. This is supported by the later published *List of occupations in high demand: 2014* (Nzimande 2014b), which reflected the same emphasis on the engineering sector as an area of high priority in terms of skills development. (Nzimande 2014a, pg.8), cites ‘scarce skills’ to refer to “*Those occupations in which there is a scarcity of qualified and experienced people...*”, a statement which does well to emphasise that the engineering skills shortage is twofold. This statement emphasises the fact that experience in a given profession is as critical as the formal qualification itself. Unfortunately, experience, by its very nature, operates under time constraints, and time is something that cannot be manipulated by human beings. This leaves the young engineer and his or her managers with one option, namely, to transfer information that can be used in decision-making in the shortest time feasible.

The critical nature of the engineering profession was further emphasised by the key finding made by the Joint Initiative on Priority Skills Acquisition (JIPSA) in their list of five priority skills areas requiring immediate attention. These skills included, “*High level, world-class engineering and planning skills for network industries, namely transport, communications, water and energy,*” (Tancott 2014) the latter being particularly relevant for Eskom.

Media releases and articles reporting on the matter tended to discuss the number of engineering graduates versus engineering enrolments at tertiary level. However, they failed to acknowledge the fact that a qualified (post-graduate) engineer is not ready to make production and safety-related decisions in large industry; he or she needs to gain experience in the particular industry.

Media articles dating back to 2006 had discussed the extent to which South Africa would need engineers in the coming years if the country was to be sure of sustained, economic growth. Given this, Eskom embarked on a skills growth campaign, focussing on technical fields of expertise (including engineering) through initiatives such as bursary schemes. Figure 2-3 reflects the investment made by the organisation into engineering learners and learners in other technical fields. The quoted target for 2017/18 (which appears to deviate significantly from previous years) was due to the decision taken by the organisation to realign learner numbers from 14% to 6.5% of its total staff compliment over five years as a more sustainable target. It is arguable, however, that this reduction could also be attributed to the financial constraints experienced by the organisation (although this argument is as yet unsubstantiated). If this were to be proven to be the case, then this was a short-sighted move by a company which for the sake of the nation’s growth had no choice but to find a means to regroup and recover. Figure 2-3 reflects the fact that the company has taken measures to bring engineering skills into the organisation through the number of learners it has taken into its development system.

Indicator and unit	Target 2017/18	Target 2013/14	Actual 2013/14	Actual 2012/13	Actual 2011/12	Target achieved?
Training spend as % of gross employee benefit costs, % ¹	5.00	5.00	7.87	n/a	n/a	✓
Total engineering learners in the system, number	391	2 007	1 962	2 144	2 273	✗
Total technician learners in the system, number	652	780	815	835	844	✓
Total artisan learners in the system, number	1 434	2 619	2 383	2 847	2 598	✗
Youth programme, number	–	5 000	4 325	5 701	5 159	✗

Figure 2-3: Eskom key performance indicators for development (Eskom 2014b)

From the data above it can be seen that the organisation had set itself up to receive engineering graduates through pipelines such as bursary programmes. However, what is important here is what the organisation does with the learners it receives, after they have graduated, given that these young individuals are still highly impressionable in this early stage of their career. Notwithstanding his or her strong analytical and engineering background, the young engineer enters the maintenance engineering environment of the power station where this theoretical knowledge amounts to little without guidance from those more experienced.

In order for the organisation to extract the maximum return on its investment in the young engineer, the company would want to make use of this resource to the companies benefit as soon as possible, but in order for this to occur the organisation first needs to train the individual in the ways of the organisation. The organisation also needs to keep the individual in the

organisation as long as possible in order to reap maximum benefits from the time, money and training that has been invested in the individual by the organisation.

2.3 Responsibilities of the appointed engineer

In order to gauge the effectiveness of the training programmes for young engineers, one needs to appreciate the 'end product' that development and training programmes strive to develop, this 'end product' being the creation of a fully capable appointed engineer. In the case of Eskom, this fully appointed engineer is the System Engineer. For the purpose of this research, it was assumed that the generic responsibilities of the maintenance engineer across the industries discussed are based on the generalised responsibilities of an Eskom System Engineer.

The following roles and responsibilities are a condensed version that can be applied to the maintenance engineer in any industry. This formed the basis of the expectations of the appointed young engineer as based on the Eskom Roles and Responsibilities Guideline (Mukuwiri 2012).

To completely, yet briefly, summarise the task of the plant maintenance engineer, the description 'custodian' or 'owner' of the plant is used. What this implies is that the System Engineer for a given plant area is wholly responsible for the function, reliability and availability of that plant or sub-system. It therefore follows that the System Engineer is accountable for that plant's performance, availability, reliability and any unsafe operating condition that is allowed to persist. (MUKUWIRI 2012) lists this as well as the following duties, as the key responsibilities of the System Engineer:

- Approval and development of maintenance strategies and plans
- Performance monitoring
- Proposal and implementation of plant modifications
- Functional design
- Component specification
- Ensuring technical compatibility between plant and documents

From the above responsibilities the following general responsibilities of the System Engineer can be derived:

- Medium- to long-term plant optimisation and continued technical and economic performance

- Resolution of maintenance and operation associated problems
- Implementation of plant upgrades (modifications)
- Project input at each stage from concept to finalisation
- Development of opportunity outage and philosophy outage scope of work
- Allocation of accountability for performance of plant systems and components
- Custodian of the design of the plant in so far as the design influences plant operation or maintenance

From this general description of the engineer's responsibilities one can begin to gauge the weight of the responsibility placed on the young engineer. Due to the open ended nature of the responsibilities stipulated by the organisations own guideline, the highly qualified engineer can be assumed by other departments to be responsible for any and all aspects related to his designated plant, and is thus ultimately turned to for the final decision or go ahead regarding operating of the plant.

This accountability is further amplified by the engineer's responsibilities in relation with the production, maintenance and outage departments. In all these cases, the engineer is often the final decision maker when it comes to shutting down or delaying the return of the plant as a result of planned or unplanned maintenance.

Given all this, it is clear that a graduate engineer straight out of university is certainly not equipped to deal with such serious and stressful decisions on his or her own, all of which could have a significant financial impact on the organisation and, in the case of Eskom, on the supply of electricity to the nation. Beside the negative impact that the stress of poor decision making has on the financial performance of the organisation, there are also the long-term psychological effects that all this has on the engineer. The psychological factors involved, as well as other factors (e.g. the generation gap) will be discussed in more detail in later chapters of this dissertation. Before this, however, this dissertation will discuss and analyse the existing training programmes in place at Eskom and other large industrial organisations.

2.4 Engineer training programmes and mentorship policies

The aim of this sub-chapter is to examine and compare the training programmes for EITs or assistant engineers at:

- Eskom Grootvlei Power Station

- Eskom Kendal Power Station, Eskom head office (Megawatt Park) and Centre of Excellence
- Transnet Freight Rail
- Transnet Pipelines
- Sasol (Secunda)

In this chapter, the above documents were analysed and compared. The implementation and effectiveness of these various training programmes, in preparing the young engineer for his or her responsibilities, were then measured and determined using the research methodology conducted in chapter 3 and 4. The data collected was used as the basis for the proposed management framework.

Eskom SOC Ltd

The Eskom Grootvlei Training Programme (Eskom 2014c) is an extract from the EIT training programme used at Kendal Power Station (Openshaw 2010). The EIT training manual used at Kendal Power Station is an extensive 52-page document that details the particular focal points for the EIT throughout his or her training period. The basic structure of the EIT training programme is as follows:

Table 2-1: Extract from plant exposure training (Eskom 2014c)

Number	Module Title	Duration
1	Induction / On-boarding	5 Days
2	GSDP and Operating / Production	6 Months
3	Maintenance	4 Months
3.1	C & I	
3.2	Auxiliary	
3.3	Electrical	
3.4	Boiler	
3.5	Turbine	

4	Engineering Department (INO`s, Modifications, Technical Investigations)	8 Months Plus
4.1	Plant Performance STEP / Airpol / water balance	
4.2	Risk & Environment and Outage	
4.3	Procurement	
4.4	Allocated Project	
Estimated duration for assistant engineer development programme		18 - 24 Months

The Generation Student Development Programme (GSDP) is a 10-week course run at Eskom's Witbank premises, Eskom Park. This programme consists of theoretical classes and practical exposure at Kendal Power Station; it is designed to introduce the graduate to the basic appearance and operating principles of a coal fired power station. Following this programme, the EIT returns to his or her business unit (specific power station) to commence the operating/production segment of his or her training. This is done by the EIT joining one of the operating shifts and experiencing the routine of the operating department for the balance of the programme (i.e. six months).

At the end of the six-month period, the EIT is required to undergo his or her first formal evaluation. The evaluation process in the training programme for Eskom EITs takes the form of three 'star gradings.' Each 'star grading' is a visually assisted oral presentation to the engineering line managers, engineering manager and HR representatives. The presentation consists of what the EIT learned in the preceding months, followed by a question-and-answer session. Each 'star grading' is evaluated by means of an evaluation sheet (Annexure A1-A3). Achievement of a final score greater than 3 out of 5 permits the EIT to progress to the next phase of training. The evaluations occur after Ops/GSDP, then again after maintenance training and finally, after engineering training respectively. Upon successful completion of the third evaluation, the EIT is eligible for promotion and appointment as a System Engineer.

What was apparent from reviewing both the Grootvlei Power Station and Kendal Power Station training programmes was that these programmes require significant human intervention from a mentor or, at a minimum, someone who is familiar with the workings of the power station (i.e.

someone who can guide the EIT in the right direction). The power station is a large, complex industrial environment in which equipment from multiple disciplines is integrated. The EIT cannot realistically be expected to learn every single component of every system in the allotted time. Indeed, a new EIT will have no clear idea about what needs to be focused on; furthermore, his or her lack of experience dictates that the EIT cannot possibly begin to guess what he or she will need to know in future. Whilst in a specific phase of training, the EIT's productivity could be increased with guidance from a dedicated mentor from the department in which he or she will ultimately be working. For example take the following extract from the Grootvlei Power Station training programme:

Demonstrate Knowledge of Plant/Activity:

Boiler Plant

- *Feed Water System*
 - *Feed Regulation Station*
 - *Economiser*
 - *Drum*

Extract from page 3 of (Eskom 2014c) reads:

Whilst on shift (operating training), without further elaboration than what is given above, the above statement does not clearly indicate what the time on shift should be used to learn about those specified systems. If this were explained in the context of intended future use as a System Engineer, the EIT could focus on the aspects of the above system that he will use in making the decisions that will be required of him as a System Engineer.

The same could be said of the maintenance and engineering phases of the Grootvlei and Kendal Power Station training programmes. The Kendal Power Station training programme contained more detail than did Grootvlei Power Station's training programme, where in the applicable section not included in the extract used by Grootvlei, the Kendal document included ECSA alignment as well as a more detailed elaboration of the expected outcomes for each section. These inherent differences indicate a lack of consistency in the way in which training is implemented at different sites within Eskom.

When comparing the training programmes used at power stations to the type applied at Eskom's head office or at the Eskom COE - Centre of Excellence (a support department that focusses on design rather than maintenance engineering), the most noticeable difference was the discipline-specific nature of the head office/COE document (Van Den Berg 2014). At power station level, all EITs follow the same training programme, regardless of discipline. In the case of head office and COE the training programme, the training was tailored to the EIT's specific discipline and was also developed by a Senior Engineer rather than by an HR or training practitioner. This meant that the training programme was more detailed, and also meant that less human intervention was required. Another significant improvement was the inclusion of the competency level to which a particular phase of the training was to be attained and the means by which this competency could be obtained. While it can be argued that this discipline specific approach limits the EIT's exposure to various other aspects of the entire power generation process, the following question needs to be asked: Which is more beneficial: to know small amounts of an entire process or to be a specialist in one discipline and a specialist who will seek assistance from other specialists when faced with a multidisciplinary task? The limited capacity of the human mind or, indeed, the fact that individuals tend to be interested in one area rather than another tends to favour a specialist approach. Eskom has a formal procedure for the assignment of mentors (Turner 2010). However, whether this is followed at present at power station level or not is to be determined by the research that forms the basis of this dissertation.

Transnet

Shifting focus to another South African parastatal, namely Transnet, this dissertation analysed the training programmes of two different divisions within Transnet. Transnet's Freight Rail division (TFR) has an elaborate Engineering Development Programme (Transnet 2014) that spans the same time frame as that of Eskom. However, the assessment method in Transnet Freight Rail appears to be more stringent. This is not surprising, given that the TFR training programme is recognised by ECSA. The assessments include monthly project reports, bi-annual performance reviews and compilation of a portfolio of evidence. The programme also includes a distinction between two career paths, thus separating the developmental requirements for those who want to become technical specialists and those who want to progress into a management position. Early distinction of one's career path allows the individual to work toward a specific goal within the company. This is beneficial to both parties. To supplement this, the programme also provides the option of a *Trainee Depot Engineering Manager Fast Tracking Programme*, which allows for improved efficiency of development for those with this career path in mind.

TFR's training programme is contrasted to that of Transnet's Pipelines division (TPL), whose current EIT training programme was developed in 2011 by an EIT at the time simply because there was no formal training programme (Raman 2011). This is a basic training programme that outlines the formal training, on-job training and certain aspects of project training on which the EIT should focus. This programme requires significant input from a mentor or another experienced engineer. It should be noted that as at 01 May 2015, since 2011, TPL has retained 100% of its young engineers, whereas Eskom Grootvlei Power Station has lost 37.5% of its young engineers (from its 2012 intake).

Sasol

Looking at a non-parastatal organisation, Sasol Secunda's engineer training programme is less formally documented throughout the organisation as a whole. Instead, the implementation of the training programme is left to the discretion of the department or line manager in charge of the EIT. Sasol's training programme requires extensive senior intervention, but it also allows the manager to tailor the EIT training programme to suit the needs of a specific department. Sasol's evaluation calls for oral presentation and questioning by a panel of senior engineers and managers at six, 12 and 18 months, along with the submission of an ECSA compliant report at 12 and 18 months. The typical structure of the process engineer training programme includes [extract from training compiled for an EIT in the Solvents Department at Sasol Secunda (Sasol 2013)]:

"Phase 1 – Operate/optimize plant, Phase 2 – Develop a process, Phase 3- Design and commission a plant"

The development programme provides a detailed elaboration of the requirements for each phase, as well as an ECSA compliant report template for the 12 and 18 month report submission.

Apart from training programmes, certain other factors as to be discussed in chapter 2.5, that contribute to engineer development and retention will be considered with a view to incorporating these factors into the proposed management framework.

2.5 Factors contributing to the retention of young engineers

One must also consider certain other factors, such as behavioural or psychological factors, that may contribute to the retention of young engineers. This was done so that these factors may be taken into consideration in the proposed management framework, factors which may contribute significantly to young employee retention, however are overlooked or not prioritised. Furthermore, by assessing what drives or motivates the young engineer of today, a manager

may be able to extract maximum productivity out of the individual at no additional monetary cost to the company.

Bridging the generation gap

A study conducted (Marais 2013) concludes that generation Y engineers (those born between 1980 and 2000) require a substantially different approach from the well dressed, subservient and punctual generation X employee whose goal it is to work hard, follow instructions, make money and go home on time (Lions 2008). In the context of managers from generation X, now dealing with generation Y young engineers whose drivers for retention are very different from what it used to be when the generation X managers were young engineers, a different approach to developing generation Y engineers is required. Generation Y engineers tend to focus more on work-life balance, and regard work simply as a means to fund life rather than life itself. Generation Y engineers are driven by opportunities to grow and develop rather than simply by promotion; they are more accustomed to open dialogue, feedback and communication and they have a greater sense of corporate responsibility. This generation is dedicated to a company based on its governance and social responsibility rather than on its ability to make money (Marais 2013). Apart from discussing the impact of training programmes, this research strives to determine additional drivers that the current crop of young engineers regard as important with respect to their careers, with a view to developing the proposed management framework around these drivers.

Engineering: expectation versus reality

For plant-based engineers, the reality of one's first working experience is as a maintenance engineer at a large corporate entity such as an Eskom, Sasol or Transnet site. Most graduate engineers do not expect their first job to be exactly as their university education led them to believe – this view is partially borne out of their work experiences (i.e. during vacations). Factors contributing to young engineers' first reality shock when entering the working environment include a large deviation in the content of work, the work context, and the degree of supervision or direction they experience (Riodan & Goodman 2007). These factors are duly noted and shall be taken into consideration during this research; however, it would be a mistake to assume that these factors are always contributors to poor retention rates.

Management behaviour and the working environment

A study conducted by Bothma (2010) found that there exists a significant, positive relationship between managerial or leadership recognition, feedback, communication and turnover intention. The study further concluded that there was a correlation between job satisfaction and turnover

intention – a lack of job satisfaction indicated increased levels of turnover intention. Taking this concept further in applying it to the characteristics of generation Y engineers, one could expect that application of the above might differ when applied to generation X as opposed to generation Y. Generally speaking, for most organisations, including Eskom, X generation managers are having to adapt to managing an intake of generation Y engineers. (Reisenwitz & Iyer 2009: pg. 94) postulate that, in contrast to generation X employees, generation Y are “*focussed on more practical issues, specifically, salary and healthcare/retirement, benefits, job stability and career satisfaction.*” This is in agreement with Marais’ findings (2013). Furthermore, Reisenwitz and Iyer discuss a topic that relates directly to retention rate, and one which was taken into consideration in this research. This topic is the loyalty of generation Y toward their employer, which was found to be significantly lower than that of generation X. The level of loyalty of generation Y employees toward their employer was found to be dependent on whether generation Y employees were able to balance life and work goals – again, this supports the findings of Marais (2013). In terms of the working environment, (REISENWITZ and IYER: 2009) have found that the Y generation, tended to follow direction well but required structure in their working environment, as well as guidance from their superiors. Orrell (as cited by Reisenwitz & Iyer 2009) postulates that generation Y employees desire feedback from their managers at least daily, thus alluding to an open, communication-oriented working environment. In terms of management behaviour, the nature of the working environment in any department is significantly influenced by the manager (indirect influence of management behaviour). The manager can however also have a direct influence on the generation Y employee as Hastings (as cited by REISENWITZ and IYER 2009: pg. 95) claims, “*Working with a boss they [generation Y] respect and can learn from was the most important aspect of their work environment.*” These factors were taken into consideration in when the survey instruments of the experiment were being developed.

2.6 Verification and validation

Verification

This process involves checking and proving that the research data collected is a true reflection of the participants’ views or opinions (Ballinger 2013). This also implies ensuring that the data collected was correctly analysed and correlated to provide a true reflection of the participants’ collective input. The manner in which this was applied in this research is discussed in chapter 3.

Validation

This implies checking that the proposed management framework was successfully implemented (i.e. that the recommendations made based on this research fulfilled the expectations set out in the research objectives and thus achieving the benefits proposed in section 1.2). This further implies that validation can be achieved by proving that the outcomes of this research were able to solve the research problem. The manner in which this was applied in this research is discussed in chapter 3.

The processes for verification and validation applied in this research were based on the criteria posited by Lincoln and Guba (1985). That is, in order to ascertain and prove the trustworthiness of research, the following factors need to be taken into consideration:

- Credibility
- Transferability
- Dependability
- Conformability

2.7 Summary of chapter 2

Chapter 2 presented the background information to the organisation that is the focus of the case study, that is, Eskom. The literature analysed provided the background that is applicable for the sake of an appropriate interpretation of this dissertation. This chapter also analysed existing approaches to training and existing training programmes of certain organisations in order to provide a basis for comparison. The theory that was applied in terms of verification and validation of this research was presented on a high level. The application of the above mentioned theory and analysed literature is to follow in the experimental design detailed in chapter 3.

Chapter 3: Research design

This chapter serves to justify the structure of the experiment used to collect the data needed to develop the proposed management framework. Whilst the questions used in the survey and interview exhibit qualitative tendencies (views and opinions), the research design applied was quantitative in that the respondents were given a predetermined set of options based on factors obtained through the literature review. In order to broaden the factors that formed part of the survey, a qualitative approach was considered. However, the time available for this dissertation meant that a purely qualitative approach was not feasible. Furthermore, the quantitative approach adopted enabled a significantly larger sample set to be used.

Whilst the management framework developed was derived for the use by Eskom Holdings SOC Ltd and was primarily based on a case study of this organisation, the contrast with the training regimes applied in other companies makes the single-case nature of this study debatable. This research therefore does not follow a purely case study oriented design, but rather makes use of a cross-sectional design (data was collected from the test groups on one predetermined point in time). This research was not time dependent in the sense that the outcomes of the experiment (the proposed management framework) were not applied and retested, this was however suggested for future research therefore the sample set and changes therein were not observed over time. The management framework was based on the data gathered, no further observation of change in the sample set was made after the implementation of the framework. The sample was selected on the basis of specific attributes that were applicable to this research (i.e. young engineers and senior engineers as defined in the introductory chapter to this dissertation, chapter 1.1); in other words, the sample was not the result of random allocation.

3.1 Management framework requirements

Stating the requirements of the management framework allowed for a precise and clear understanding of the data that the empirical design would need to obtain. The problem statement and research objectives are therefore re-stated:

Problem statement: *The effectiveness of the existing EIT training programme and implementation needed to be evaluated and a management framework developed to optimise the training of EITs and improve overall young engineer retention within the organisation.*

Research objectives:

- Improve young engineer retention rate, thus keeping knowledge and skills in the organisation.

- Improve the young engineers' readiness and sense of judgement with regard to technical decisions.
- Optimise the current EIT training programme by shifting or creating new relevant focal points.
- Analyse the organisation's current management approach.
- Compare the responses of Eskom and non-Eskom engineers in order to determine whether there is link between respective turnover intention and the quality and nature of training offered.

It must be reiterated that the aim of this research was not to derive solutions to the company's major operational challenges, but to propose a framework that addresses the development of young engineers. To this end, this research focussed on factors that current engineers found to be drivers for retention and on factors in the training programme that inhibited retention.

Taking the above into account, the proposed management framework requires the following data to be collected:

- Sample set – respondents age, engineering discipline, years of experience, employment history
- Respondents indication of training received prior to being appointed as a fully-fledged engineer
- Extent of preparedness for being able to fulfil the responsibilities of an appointed engineer
- Level of respondents' confidence in terms of ability to make required engineering decisions
- Level of understanding of procedures and standards (Internal and external)
- Level of understanding of legal or statutory regulations for which the engineer can be held accountable
- Level of satisfaction with current training programme
- Level of engineers' job satisfaction and factors that contribute toward job satisfaction (from engineers' point of view)
- Level of loyalty toward company (level of desire to leave or to remain with the organisation and reasons)
- Respondents view of the factors that motivate and inspire productivity
- Respondents view regarding what is considered to be acceptable manner of interaction between engineers and managers and between peers
- Drivers for retention (psychological or otherwise) as seen by engineers
- Respondents' opinion of hierarchical structure and response to chain of command

- Respondents' view of mentorship, the way it is approached in their organisation, and willingness to be involved in mentoring/being mentored

3.3 Data sampling

For this study, purposive sampling was used. The target population was both specific and narrow, which meant that people who did not fit the stipulated profile were rejected.

The core of this research was the data collected from two independent studies:

Questionnaire 1 (Appendix B1), which was issued to engineering trainees. Eskom subset was separated and analysed comparatively (subset 1.1) against subset 1.2 as well as part of the whole sample set (Subset 1.1 + Subset 1.2), when drawing comparison to respondents of questionnaire 2 where subset 1.2 comprised all non-Eskom respondents to survey 1.

Questionnaire 2 (Appendix B2), which was issued to engineers who had completed their engineer training programme (appointed engineers).

Acceptance criteria for subsets one and two:

Subset 1

Subset 1.1 – Young engineers currently employed by Eskom Holdings SOC Ltd with post-tertiary qualification work experience of five years or less in an engineering environment. Distinction was made as to whether the participant had worked for another organisation within these five years and, if so, whether opinions of the training regime described in his or her response pertained to Eskom or to another organisation. Subset 1.1 comprised those respondents who were trained by Eskom.

Subset 1.2 – Young engineers as defined in subset 1.1 who were trained by an organisation other than Eskom Holdings SOC Ltd.

Senior engineers were defined by the number of years of work experience (as described above) or those engineers who hold professional status (Pr Eng, Pr Cert Eng or Pr Tech Eng) and/or the Government Certificate of Competency (GCC) for factories or mines. Professional status was taken to supersede working experience if the individual had less than five years' working experience.

Subset 2

Subset 2.1 - Senior engineers currently employed by Eskom Holdings SOC Ltd with post-tertiary qualification work experience of more than five years in an engineering environment. Distinction was made as to whether the participant had worked for another organisation within this time and, if so, whether opinions of the training regime described in his or her response pertained to Eskom or to another organisation. Subset 1.2 comprised respondents who were trained by Eskom.

Subset 2.2 – Senior engineers as defined in subset 2.1 but who were trained by an organisation other than Eskom Holdings SOC Ltd.

The data collected pertaining to young engineers (subset 1.1 and 1.2) was extracted from survey 1 and survey 2 by filtering and rejecting the responses of those with more than five years' post-tertiary qualification experience. The data pertaining to subsets 2.1 and 2.2 was extracted entirely from survey 2.

Apart from distinguishing the subset, the respondents were anonymous. All participants were given the right to refuse to participate in this research without having to provide justification for their refusal.

3.4 Data collection

The primary research data was obtained through quantitative data collection in the form of two different surveys. In these cases the research instrument applied was, for each survey, a unique questionnaire consisting of closed-ended multiple choice or multiple response questions (where a ranked response was necessary), as well as open-ended responses when deemed necessary.

Both surveys were compiled using an online questionnaire tool (www.surveymonkey.com). Links to the surveys were sent to the potential respondents via electronic mail. The use of an online tool was chosen over a paper-based survey for the following reasons:

- Respondent anonymity was maintained because there was no need to physically collect completed surveys from individual respondents.
- Distribution to potential respondents around the country was faster and more feasible.
- Electronic format provided options for respondents to easily select chosen answers. Question routing dependant on answers to certain questions, allowed follow up

questions that were not relevant to a particular respondent to be skipped automatically. This presented the survey as being shorter. This, coupled with the existence of a progress bar, allowed respondents to track their progress. The above time-related benefits were significant, since participants were required to sacrifice their time in order to participate in the survey. The shorter time involved in an electronic survey encouraged higher levels of participation.

- Basic analysis (e.g. summation of responses for a question) was automatically computed by the software used, hence reducing any error caused by manual summation.
- The software provided the ability to use filters in order to separate subsets within each survey expediting the data analysis process as well as reducing error that could have been introduced by manual calculation and separation.
- Verification of the survey instrument was facilitated throughout the compilation process via the availability of a 'test survey'; this test survey allowed the compiler to repeatedly run through the survey from a respondent point of view, ensuring that the survey structure, routing and understanding were all correct.

The two surveys were designed for specific target audiences. It was easy for recipients to choose which survey to complete, since there was a clear distinction between appointed engineers and trainees. This minimised any error introduced as a result of the incorrect survey being completed.

3.5 Data analysis

The data collected through the surveys described above was arranged into groups defined by an applicable level of measurement (nominal, ordinal, interval or ratio) to which the relevant data analysis technique was applied.

For each level of measurement, the data collected was tabulated. From this tabulation, a percentage distribution was developed and visually illustrated (in the form of charts and graphs). The data was then disaggregated in order to compare Eskom data with data that of collected from other organisations.

3.6 Verification and validation methodology

Verification was carried out on the survey instruments (both questionnaires) prior to distribution. In order to verify the credibility of the survey instruments used, the following techniques (suggested by Cohen & Crabtree 2006) for qualitative research were applied as follows (Due to the qualitative tendencies of respondents' views and opinions used this was deemed acceptable) :

Prolonged engagement

Prolonged engagement was applied in the development of the questionnaires and this research as a whole. Cohen and Crabtree suggest that the researcher should “*spend sufficient time in the field to learn or understand the culture, social setting or phenomenon of interest*”. This research was undertaken by a young engineer who was himself employed by Eskom: in the year this research was undertaken, the researcher had recently been appointed as a System Engineer (01 January 2015). This meant that the researcher was familiar with context of the experiment and, through prolonged engagement, had developed strong relationships based on trust with the intended research respondents. This meant that any opinions provided by the respondents would be a true reflection of reality.

Persistent observation

Persistent observation over the period of prolonged engagement facilitated the identification of “*those characteristics and elements in the situation that are most relevant to the problem or issue being pursued and focussing on them in detail*” (Lincoln & Guba 1985). Hence the research as a whole focussed on the drivers for retention of engineers as seen by the current generation of young engineers. Therefore the survey instruments were designed in such a manner as to gauge the respondents desire to leave their positions, in order to gauge the importance of specific psychological drivers that the current generation of young engineers at the time valued and contrast this to the response of older engineers. Significantly, this allowed for the survey instruments to be designed to assess whether there existed a generalised correlation between the quality of training and the turnover intention of young engineers. In addition, persistent observation allowed the researcher to pinpoint the specific challenges or deficiencies that young engineers faced, in the environment in which the framework developed from this research was to be applied.

Triangulation

Triangulation (Cohen & Crabtree 2006) was evident in this research in the form of triangulation of sources as identified by Denzin (1978) and Patton (1999): “*Examining the consistency of*

different data sources from within the same method, for example: comparing people with different view points.” As discussed, the viewpoints of young engineers were contrasted with those of senior engineers, as well as the opinions of Eskom engineers being compared to engineers from outside of Eskom. This was then correlated to both their responses in terms of turnover intention as well as the quality of their respective training programs derived from their opinions, as well as analysis of literature surveyed in this research. Part of the literature surveyed reflected the nature of the training programs from the different organisations.

Member checking

Member checking was applied in this research in the development of the surveys, albeit in a slightly different way from that proposed by Cohen and Crabtree. These authors suggest that this form of validation could be performed on those participants from whom the preliminary research data was attained. Instead, in this research, member checking was applied on one random member from each of the survey’s target audience. This was conducted after the survey instruments were developed, based on the literature survey and the use of the techniques described above, and prior to the mass distribution of the survey instruments. The controversial drawbacks and problems associated with member checking as suggested by Cohen and Crabtree pertain mainly to the tainting of respondents’ feedback due to the researcher’s involvement. To minimise this bias, the questionnaires administered to the two test subjects were discarded. Member checking in this manner allowed for linguistic validity to be achieved in that one of the two test respondents was not a first language English speaker. The understanding, interpretation and use of the survey instrument was corrected in order to ensure minimal ambiguity, thus ensuring that the data collected was relevant. The majority of each questionnaire was a repetition of the other in order to provide a basis for comparison. The common sections were observed to have been interpreted the same way by each of the two test participants.

Transferability

In terms of transferability, this research was specifically designed to be applied to and within Eskom, which is why the ‘thick description’ technique was not applied. Since the survey instruments were distributed to various divisions in Eskom, their transferability within the organisation was preserved. This research was specifically designed to be applied to the field of engineering and has no relevance, and is not transferable to, any other field of expertise.

Dependability

External audit was used to substantiate the findings of this research; in other words, external audit was used to ensure that the findings were consistent and could be repeated (as required by Lincoln and Guba's evaluation criteria). The external audit comprised the assessment of the management framework as derived from the interpretation of data collected from the survey instruments used. The data was assessed by a member of the Grootvlei Power Station Engineering Management Team (who did not participate in either of the survey instruments). This external audit was used to validate the management framework and thus this research in its entirety.

Conformability

In terms of neutrality, bias or skewing of the data (by the researcher), certain steps were taken to ensure that undesirable bias was eliminated:

Use of electronic survey instruments ensured that researcher was not present when any of the questionnaires was completed.

All questionnaires received were anonymously completed.

All data, whether supportive or contradictive of the stated research objectives, was taken into account.

Where respondent opinion was required, a scale of no less than five degrees, including two levels of positive response, neutral response and two levels of negative response, was offered to the respondent thus in no way 'guiding a response' or heavily weighting a response toward purely positive or purely negative (ie. completely supportive or completely contradictory).

Data cleaning was conducted; however, only questionnaires which did not meet the stipulated target audience as defined in chapter 3.2, or questionnaires in which an insufficient progress was attained prior to exiting (i.e. no useful contributory data was provided), were rejected. The number of rejections was recorded.

As far as validation of this research is concerned, since the management framework was developed based on the focal points determined to be relevant substantiated by the data collected through the above survey instruments, the external audit conducted in the form of an assessment of the framework as described previously in the Dependability section was applied to ensure that the problem stated was in fact resolved by the framework proposed.

3.7 Summary of chapter 3

Chapter 3 explained the design methodology applied in the development of the research methodology used to collect data (and upon which the proposed management framework was based). The chapter to follow, chapter 4, presents the results of the experiment as well as the data graphically. This graphic presentation is accompanied by an interpretation and discussion of the data, thus creating a link between the data gathered, and the proposed management framework.

Chapter 4: Results and discussion

The preceding chapter described the research methodology that was used in order to derive the correlation between young engineers' desire to leave their current organisation (turnover intention), rate of development and the quality of their training programmes, and a number of other independent variables. This chapter, chapter 4, attempts to gather together and interpret the data obtained via the survey questionnaires. The two dependant variables that were the focal points of this research were:

- **Rate of development** as an engineer (linked to 'accelerated development' aspect of this research).
- **Level of desire to leave** current organisation or turnover intention (linked to 'improved young engineer retention' aspect of this research).

These dependant variables were measured against the following high level independent variables, each of which is discussed in detail throughout this chapter:

- Quality of training (which extends to, and includes, various factors explained in detail throughout this chapter).
- Years of experience (providing contrasting viewpoints of young engineers versus senior engineers).
- Quality of useful engineering experience gained.
- Job satisfaction.
- Drivers for productivity in generation Y engineers applied as drivers for retention <<

4.1 Levels of measurement

The levels of measurement (nominal, ordinal, interval or ratio) were applied as follows in the survey instruments used in this research:

Nominal scales were applied in order to determine the demography examined. Nominal, scale-based questions added no useful value to the opinion based statistical data that was collected. These questions did, however, allow for data cleaning to be executed and for detailed information about the size of the sample sets analysed. This was useful in cases where surveys were not completed fully, but did contain useful data. Nominal, scale-based questions were also used as a basis for progression routing through the questionnaires: the questions that followed would be automatically skipped without the respondent ever seeing them, depending on the respondent's answer to certain questions. (For example, in question 1 of both questionnaires, if the respondent answered 'Eskom', the routing would continue to question 2.

However, if the respondent's answer to question 1 was any of the other options except Eskom, then the survey instrument automatically guided the respondent to question 3.)

Ordinal scales were applied with five degrees of comparison. This refers to any question where the options were: strongly agree, agree, neutral, disagree and strongly disagree or very high, high, neutral, low and very low. Although these questions conveyed the respondent's viewpoint, answers to these questions provided no indication of numerically quantifiable differences from one degree of comparison to the next, nor was a true zero response option provided.

Since this research was largely based on the psychological traits evident in respondents, quantifying precise numerical differences between degrees of comparison was not an easy task. In order to collect useful data, an improvised ratio scale was applied. It can be argued that the level of measurement used was a mixture of interval and ratio scales, since the numerical differences between degrees of comparison has not been scientifically proven to have the exact relationship described. However, specifying a numerical value for the level of the variable being measured as a percentage in intervals of 25%, with a true zero assigned to one of the five options, provided more descriptive data than that which would have been obtained from a purely interval-based scale.

In the case of the ordinal, interval and ratio scales, a Likert scale was used.

4.2 Data cleaning

The first level of data cleaning applied was based on the criteria specified for the sample sets in this research (see chapter 3.2). The following requirements were deemed to be prerequisites:

The participant had to be an engineer or engineering trainee in possession of any of the following qualifications:

- Bachelor of Science in Engineering
- Bachelor of Engineering
- Bachelor of Technology in Engineering

The Participant was required to have approached questions regarding their training period by referring to training that they has completed in an engineering related industry.

Non adherence to the above criteria was grounds for rejection. The number of Questionnaires rejected on this basis was one questionnaire.

The subset of ‘young engineers’ was distinguished from participants who satisfied the prerequisite criteria; young engineers were those who had five years post-qualification engineering work experience or less and who did not hold professional status or GCC.

The subset of ‘senior engineers’ was distinguished from participants who satisfied the prerequisite criteria; senior engineers were those who had more than five years post-qualification engineering work experience and/or who held professional status or GCC.

Questionnaires where no data beyond that provided by the nominal, scale-based questions was submitted were rejected, since such questionnaires contained no useful, opinion-based data. Questionnaires that were incorrectly completed (i.e. where the respondent completed the incorrect questionnaire) were also rejected.

Cleaning by automatic skip patterns was implemented (as described previously – via progression routing).

In the case of open-ended questions or questions with an ‘other’ option, vague and irrelevant responses were rejected. The nature of the responses provided to open-ended questions was also taken into account. If the respondent did not seem to take the questionnaire seriously, or if the respondent used improper language, or gave inappropriate responses, this was duly noted. Questionnaires that fell into this category were reviewed in their entirety and rejected if deemed invalid.

Summary of data cleaning:

Questionnaire 1 – Drivers for Improved Young Engineer Retention – Survey for Trainees
(Appendix B1)

Table 4-1: Summary of data cleaning for Questionnaire 1

Total number of questionnaires received	53
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Number of usable questionnaires	44
Number of usable questionnaires which were 100% complete	34
Number of usable questionnaires that were partially completed, but were deemed to contain sufficient usable data	10

Eight (8) questionnaires were rejected because these questionnaires were seriously incomplete to the point that they contained no useful data. One (1) questionnaire was rejected because the respondent completed the incorrect survey (respondent was not a trainee).

Questionnaire 2 – Drivers for Improved Young Engineer Retention and Training – Survey for Appointed Engineers (Appendix B2)

Table 4-2: Summary of data cleaning for Questionnaire 2

Total number of questionnaires received	45
Number of usable questionnaires	41
Number of usable questionnaires which were 100% complete	35
Number of usable questionnaires that were partially completed, but were deemed to contain sufficient useful data	6

Three (3) questionnaires were rejected because these questionnaires were seriously incomplete to the point that they contained no useful data. One (1) questionnaire was rejected because it was clear that the respondent did not take the questionnaire seriously, to the point that this questionnaire added no value to this research. From this point on, the term 'respondents' is taken to mean those respondents whose questionnaires were deemed usable.

4.3 Data reporting and interpretation

The data reported was collected over the period 20 July 2015 to 30 July 2015 via two electronic online survey instruments through the web site www.surveymonkey.com. All statistical calculations

and interpretations were based on a 90% confidence level. This confidence level was deemed acceptable for this research and a confidence interval of 6% was used (unless otherwise stated). Sample size calculations were performed using the online tool provided by Survey Monkey (2015), which based its calculations on the following formula and a normal distribution of 50% (Survey Monkey 2015):

$$Sample\ Size = \frac{\frac{z^2 \times p(1 - p)}{e^2}}{1 + \left(\frac{z^2 \times p(1 - p)}{e^2 N}\right)}$$

Where:

N = Population size

E = Confidence interval

Z = z-score

Table 4-3: Z-score per desired confidence interval (Survey Monkey 2015)

Desired confidence level	z-score
80%	1.28
85%	1.44
90%	1.665
95%	1.96
99%	2.58

4.3.1 Ex-Eskom engineers – reasons for leaving

Questions 11 and 12 of survey 1 and questions 12 and 13 of survey 2 were used to gauge the reasons why engineers chose to leave Eskom. Of the respondents to survey 1, only one respondent had been previously employed by Eskom; this respondent cited ‘better potential for career development/advancement’ as the most dominant reason for the respondent’s departure.

Of the respondents to questionnaire 2, two appointed engineers had once been employed by Eskom but had since left, one of whom cited family responsibility as the reason for departure.

The other agreed with the trainee (referred to in the preceding paragraph) that had left, in that this respondent, too, had left in favour of better ‘potential for career development/advancement’.

Summary:

Table 4-4: Summary of ex-Eskom employees’ reasons for leaving the organisation

Population name	Population size	Sample size	Percentage of sample applicable to response	Response
Young engineers	72	2	100%	Potential for career development/advancement
Senior engineers	13	1	100%	Family responsibility

Based on the chosen confidence interval and level, it is clear that this sample size for this data was not sufficient to statistically validate the data collected as being reliably representative of the population. It was clear that a sample size of this proportion would lower confidence level or induce such a high margin for error that the data would hold no statistical relevance. However, the factor attributed to the small sample of young engineers leaving was taken into account in the development of the framework.

4.3.2 Desire to leave (turnover intention)

The following subchapter focusses on the improved retention aspect of this research by analysing the dependent variable (desire to leave or turnover intention) against various independent variables.

4.3.2.1 Independent variable 1 – contractual obligation

Many young engineers are bound to their organisations by the obligation to repay bursaries or other debts owed to the organisation. This section of the questionnaire aimed to gauge the psychological state of respondents regarding their level of desire to leave their organisation at the time, with a view to ascertaining whether contractual obligations played a significant role in keeping them in their position. Figure 4-1 indicates the percentage of each respective sample groups’ obligation to work for their organisation as a result of contractual obligations.

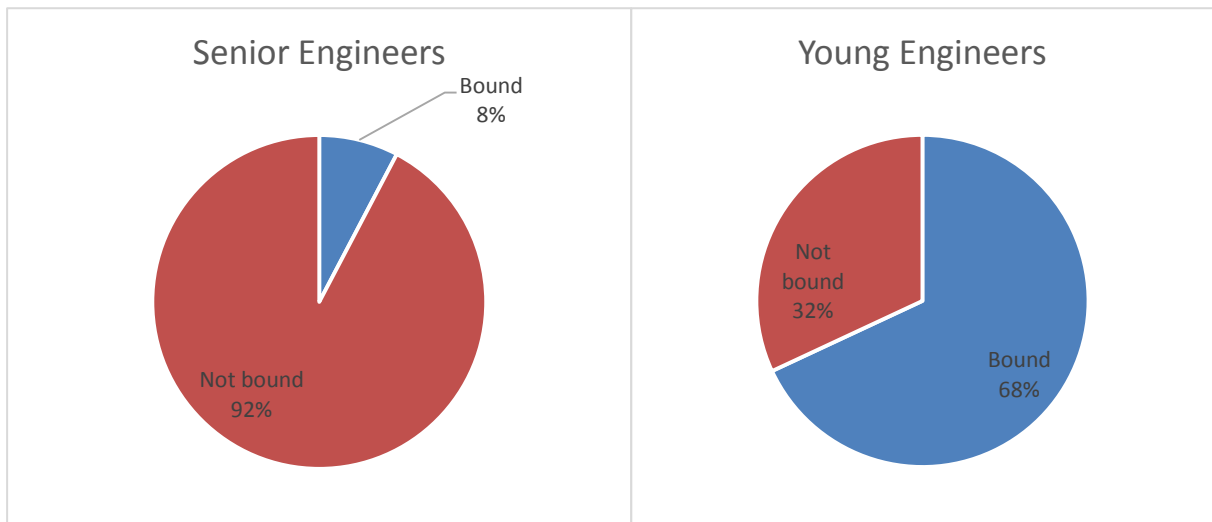


Figure 4-1: Distribution of young engineers and senior engineers bound by contractual obligations

Since the desire to leave was weighed against the respondents' contractual obligation, the senior engineers' feedback was not taken into consideration, given that only 8% of the sample were contractually obliged to remain in their organisation. Furthermore, the focus of this research was on young engineer retention. An analysis of the opinions of young engineers was conducted and is shown in Figure 4-2. This figure shows those young engineers who would like to leave their organisation if the opportunity to join a perceived better training programme were to arise.

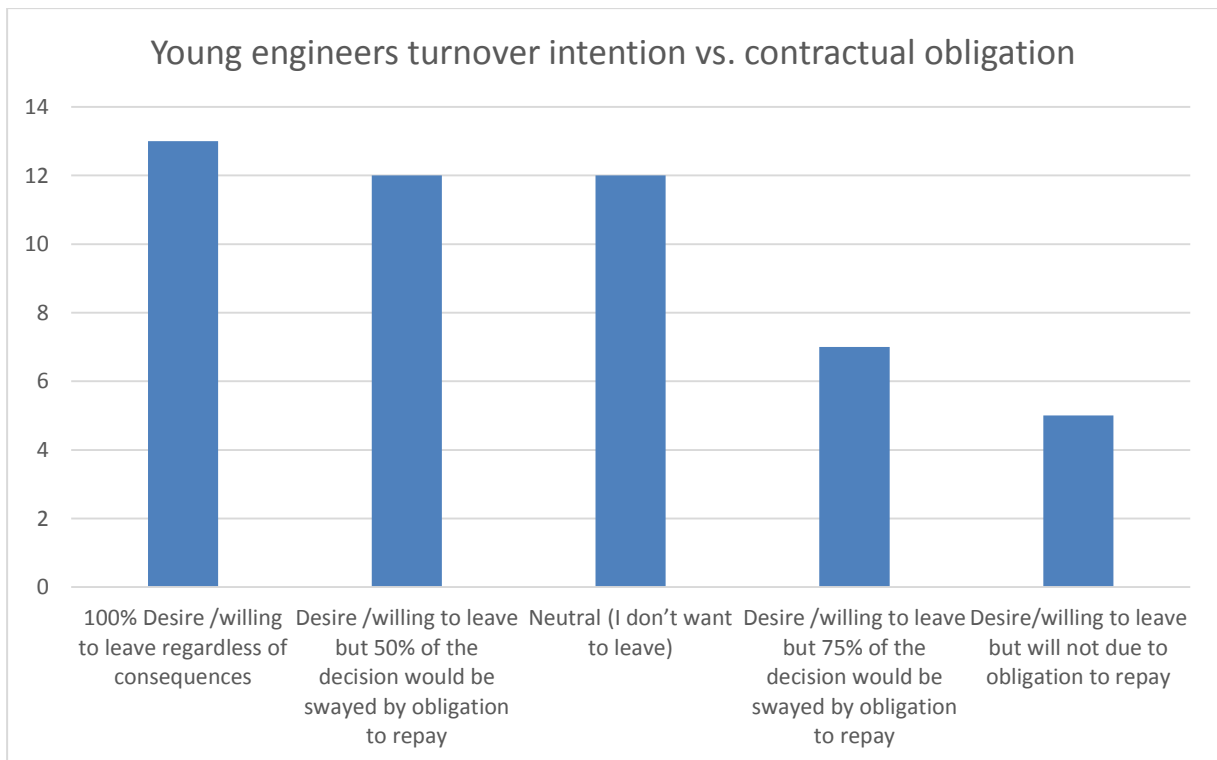


Figure 4-2: Desire to leave weighted against contractual obligations

For those not bound by repayment of any sort, Figure 4-3 indicates young engineers' level of desire to leave their positions if the prospect of a better training programme were to arise.

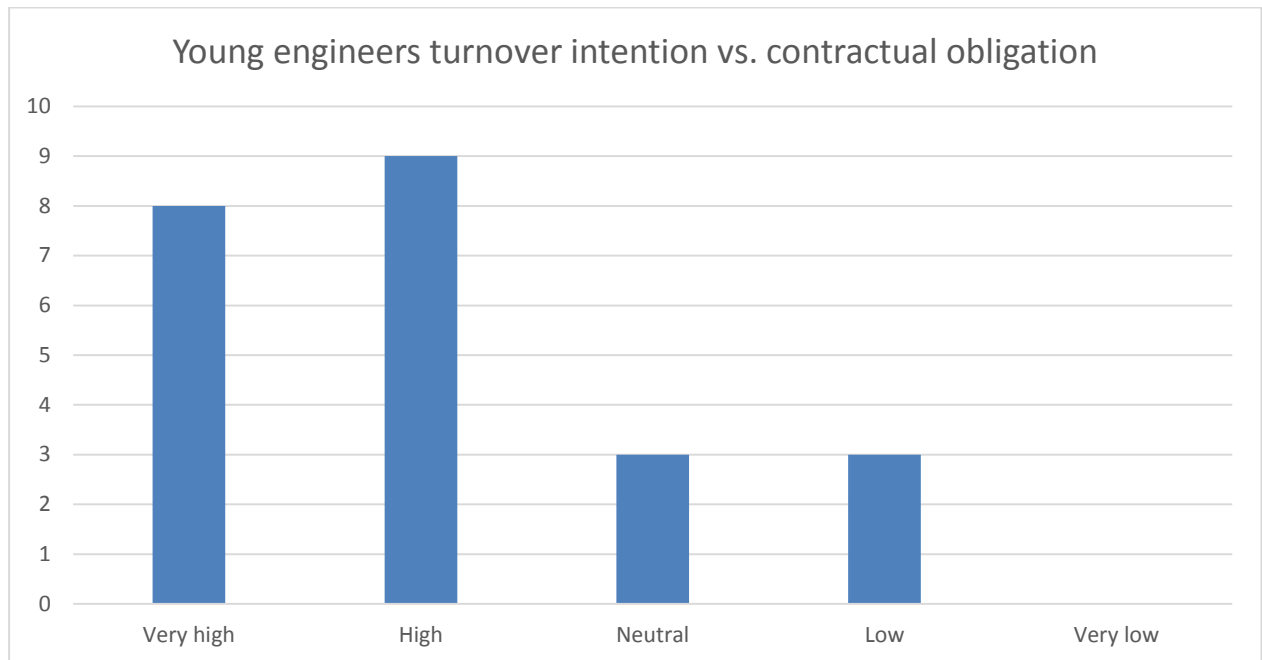


Figure 4-3: Indication of non contractually bound young engineers' level of desire to leave their organisation

The data above shows that there did exist a desire for young engineers to leave their current organisation if they were offered higher quality training programmes. However, it is noticeable that they were tied to their current organisations by contractual obligations (i.e. debt). This is further emphasised by the bias toward a positive response in favour of leaving once contractual obligations are removed.

Ordinal scales were applied in obtaining this data. This data supports the hypothesis that there is a correlation between young engineer turnover intention and the quality of their training: this data indicated that there exists a desire to leave if the prospect of better training were offered.

In addition to the above, Figure 4-4 shows the percentages of young engineers who would be willing to accept a reduction in salary in exchange for employment in an organisation with a training programme of higher quality.

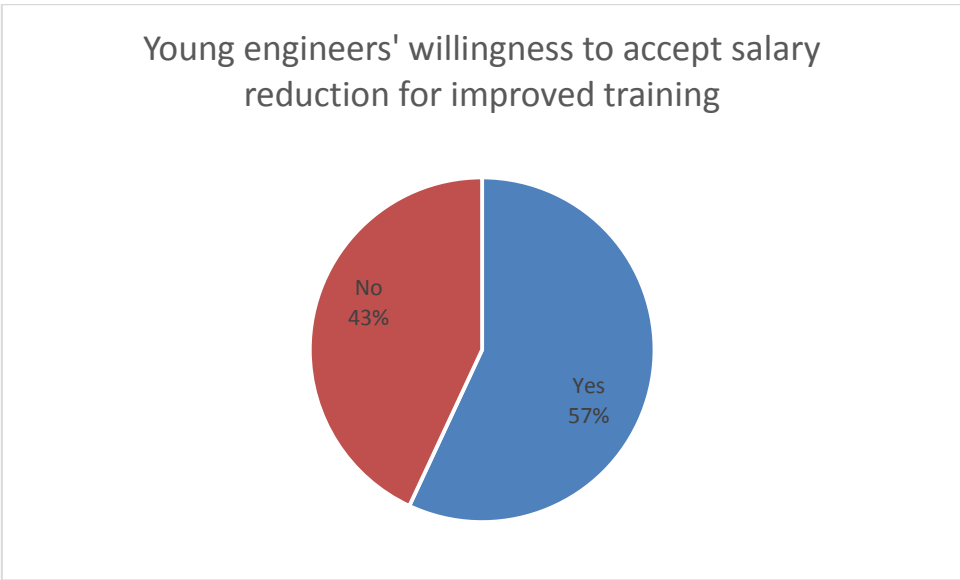


Figure 4-4: Young engineer willingness to accept salary reduction in exchange for improved training opportunities at another organisation

In contrast, Figure 4-5 shows the willingness of senior engineers to leave their position given the same opportunities of improved training with another organisation.

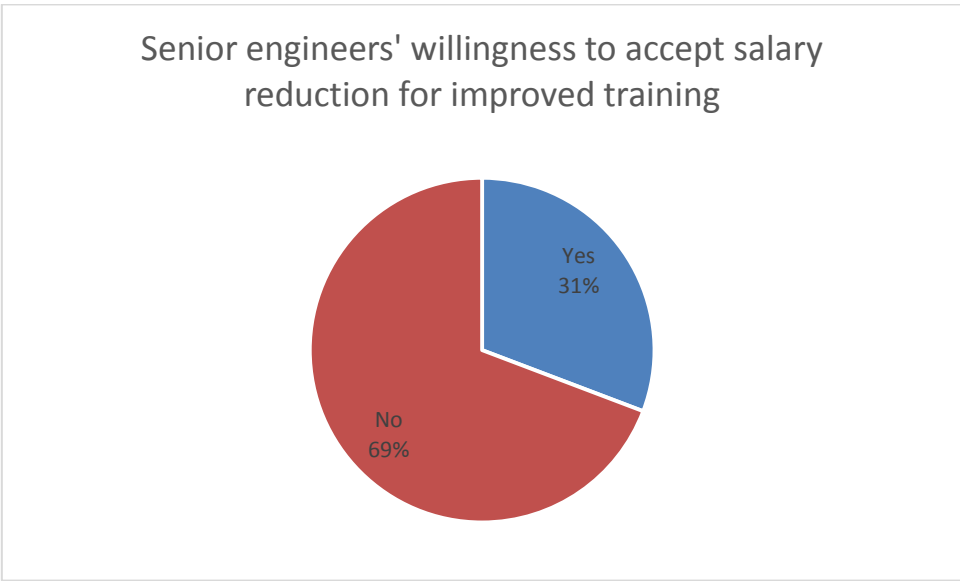


Figure 4-5: Senior engineer willingness to accept salary reduction in exchange for improved training opportunities at another organisation

The contradiction between these two opinions can be attributed to a number of factors: senior engineers had accrued greater amounts of experience (therefore improved training was not a point of attraction), or that they regarded the quality of training was acceptable when they underwent their training programme. Also, of course, it is possible that these people had

reached a stage in their careers where training was no longer a priority. It cannot be explicitly proven through this data, but one cannot rule out the possibility of the drivers for productivity in generation-Y engineers versus those for the older generation, in that money to the younger generation is of lesser importance in ones career than aspects such as personal development and growth. The data presented in Figure 4-4s and 4-5 tends to support this theory.

4.3.2.2 Independent variable 2 – job satisfaction

Analysis of the level of job satisfaction in young engineers indicated in Figure 4-6 showed a tendency toward the positive side of the mean, which implies that there was both an enthusiasm to work and to learn. This was a positive sign for the organisation for which the management framework was developed in that it indicated that, despite existing operational challenges, the morale amongst young engineers was more neutral or positive rather than negative. For this part of the research, a filter was applied to the results to enable the researcher to analyse Eskom young engineers only.

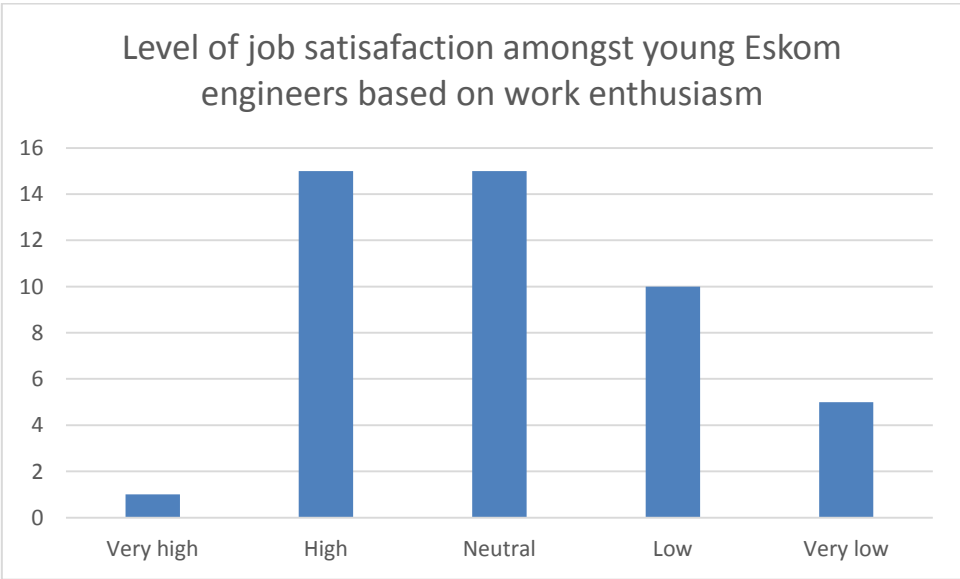


Figure 4-6: Level of job satisfaction amongst Eskom young engineers

4.3.3 Rate of development as an engineer

In this subchapter, the focus is on those parts of the survey instruments that relate to the quality of the training programmes. In this subchapter, the comparison is drawn between the quality of Eskom's training programmes and the training programmes of other organisations. The young engineers' and senior engineers' opinions were collated, but separated by organisation (Eskom versus non-Eskom). For each independent variable assessed, the data was analysed separately for trainees and appointed engineers.

Since the training programmes of Eskom, Sasol, Transnet Pipelines and Transnet Freight Rail were analysed in the literature survey, the filters were applied to the survey as per those divisions.

A note on analysed sample sizes

For both trainees and appointed engineers, in both questionnaires, Eskom respondents were the majority. Eskom respondents represented 63.64% and 70.73% of their respective sample sets, with a total of 28 trainees and 29 appointed engineers' useful responses respectively. This was acceptable for the purpose of this experiment since the resultant framework was proposed for use in Eskom (which was the case study used in this research). The remaining respondents were distributed amongst Sasol, Transnet Pipelines, Transnet Freight Rail and Other. This was sufficient, since the data collected from these organisations was to provide a basis of comparison to Eskom.

Non-Eskom responses were divided as follows:

Table 4-5: Table of sample sizes

	Trainee	Appointed
Eskom	28	29
Sasol	7	5
Transnet Pipelines	0	2
Transnet Freight Rail	6	0
Other	3	5
	Total = 44	Total = 41

The noticeably small sample size for Transnet Pipelines was due to the overall size of the Engineering Department at this organisation, which consisted of two (2) trainees, two (2) appointed engineers, and (2) managers. Given this small sample size, it was noted that true statistically inference could not be made for Transnet Pipelines alone. However, since this data was used in addition to the other non-Eskom responses (i.e. as a basis of comparison), this small data set remained useful.

4.3.3.1 Relevance of training received

Did respondents receive relevant training that would benefit their engineering career progression in their current organisation?

The responses were percentage-based opinions of whether the training received was relevant to the development of their careers within the companies employing them at the time. Figure 4-7 Indicates that the majority of respondents in Eskom found greater than 50% relevance in the training received indicating a positive response to the current training regime. Greater than 50% relevance was noted in the non-Eskom organisations too however it was found that Eskom respondents included a notable percentage whom agree that there is room for improvement. This contrasts with the Non-Eskom respondents who indicated an almost insignificant percentage of the negative response.



Figure 4-7 Response data regarding training program support of career development

4.3.3.2 Link between improved training programme and desire to stay

Did respondents feel that an improved training programme would increase their desire to stay in their current organisation?

The majority of respondents agreed that improved training programmes would increase their desire to stay in their organisation (figure 4-8). It can be seen that, where there was negative response, this data was reflected mostly in the appointed engineers' surveys alluding to the difference in drivers for retention in generation Y versus generation X engineers. As indicated by the dominantly positive response from young engineers, there exists a link between improved training and turnover intention for generation Y engineers. This reinforces the hypothesis that, for generation Y engineers, the training programme should focus on development and growth since these concerns positively influence young engineer retention.

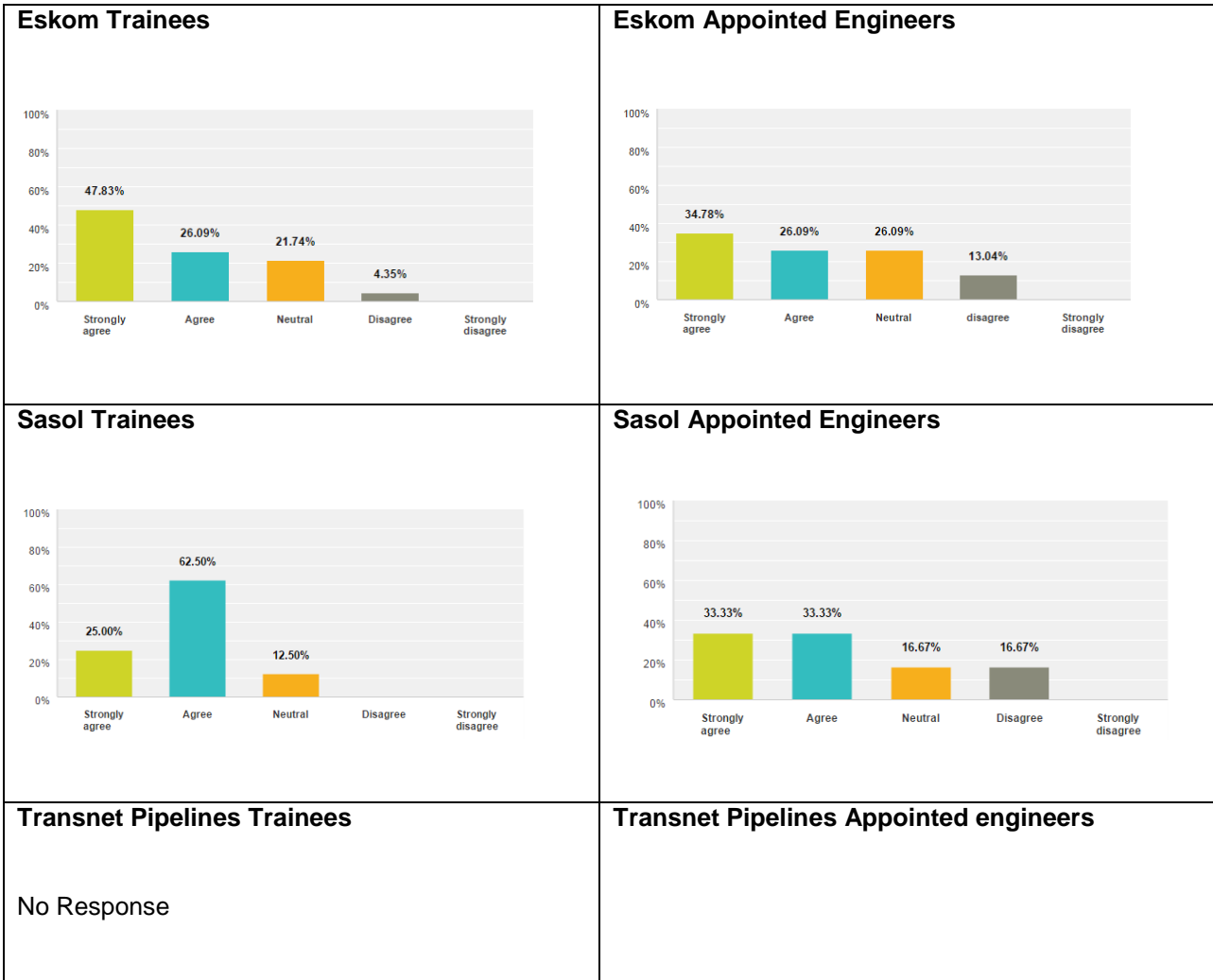




Figure 4-8 Graphs indicating respondents' opinion regarding improvement of training programme and turn over intention

Did respondents feel that their existing training programme contained sufficient relevant engineering content?

The majority found that their training programmes did contain sufficient engineering content (figure 4-9). The negative responses that mainly came from Eskom appointed engineers indicated that there existed room for improvement, in Eskom's training programmes, for the content that was more relevant the field of engineering.

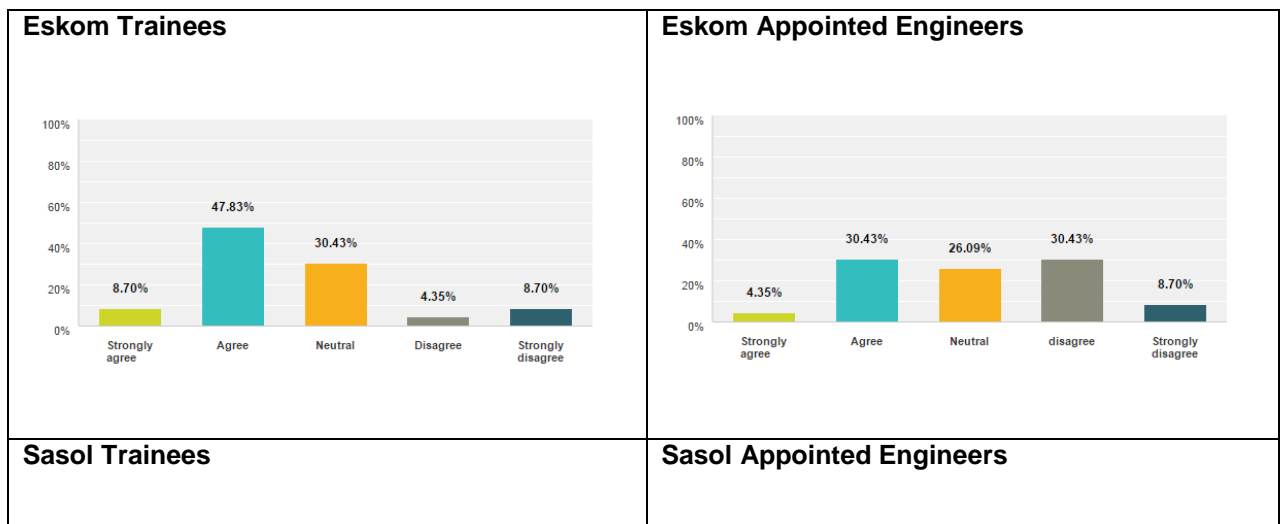
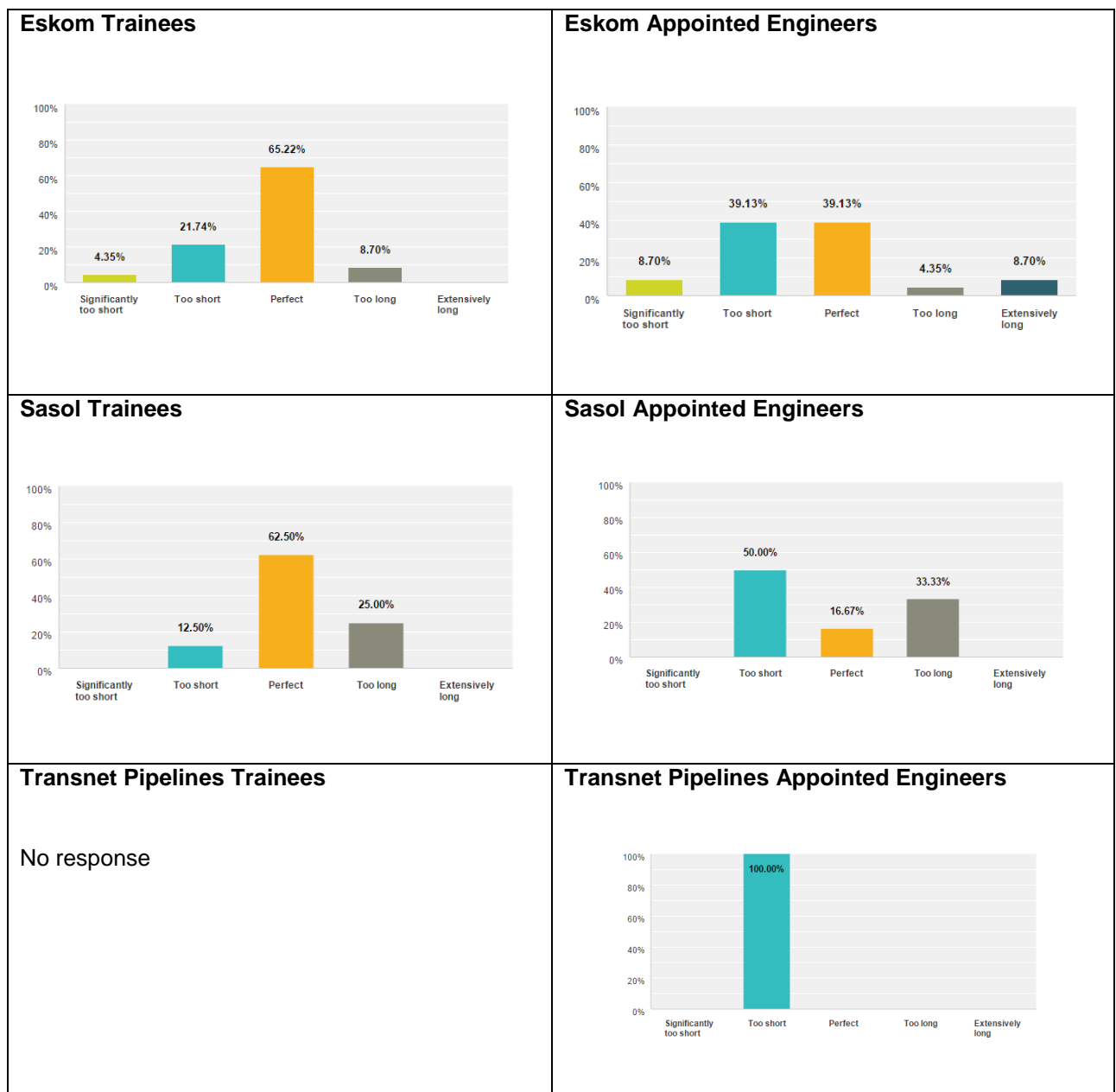




Figure 4-9 Graphs representing opinions of whether training program contained relevant information to benefit respondents' engineering career

Time spent in Engineering Department during training



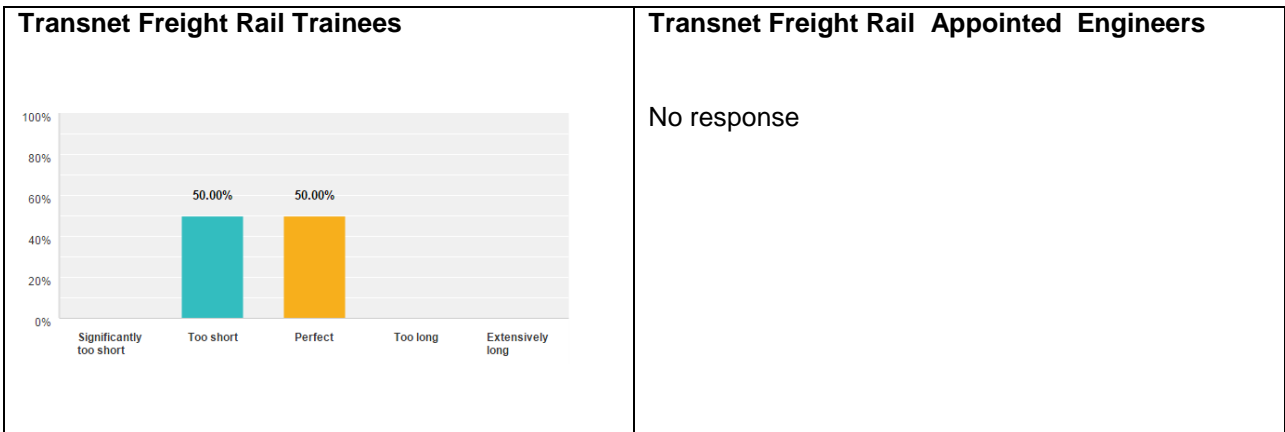
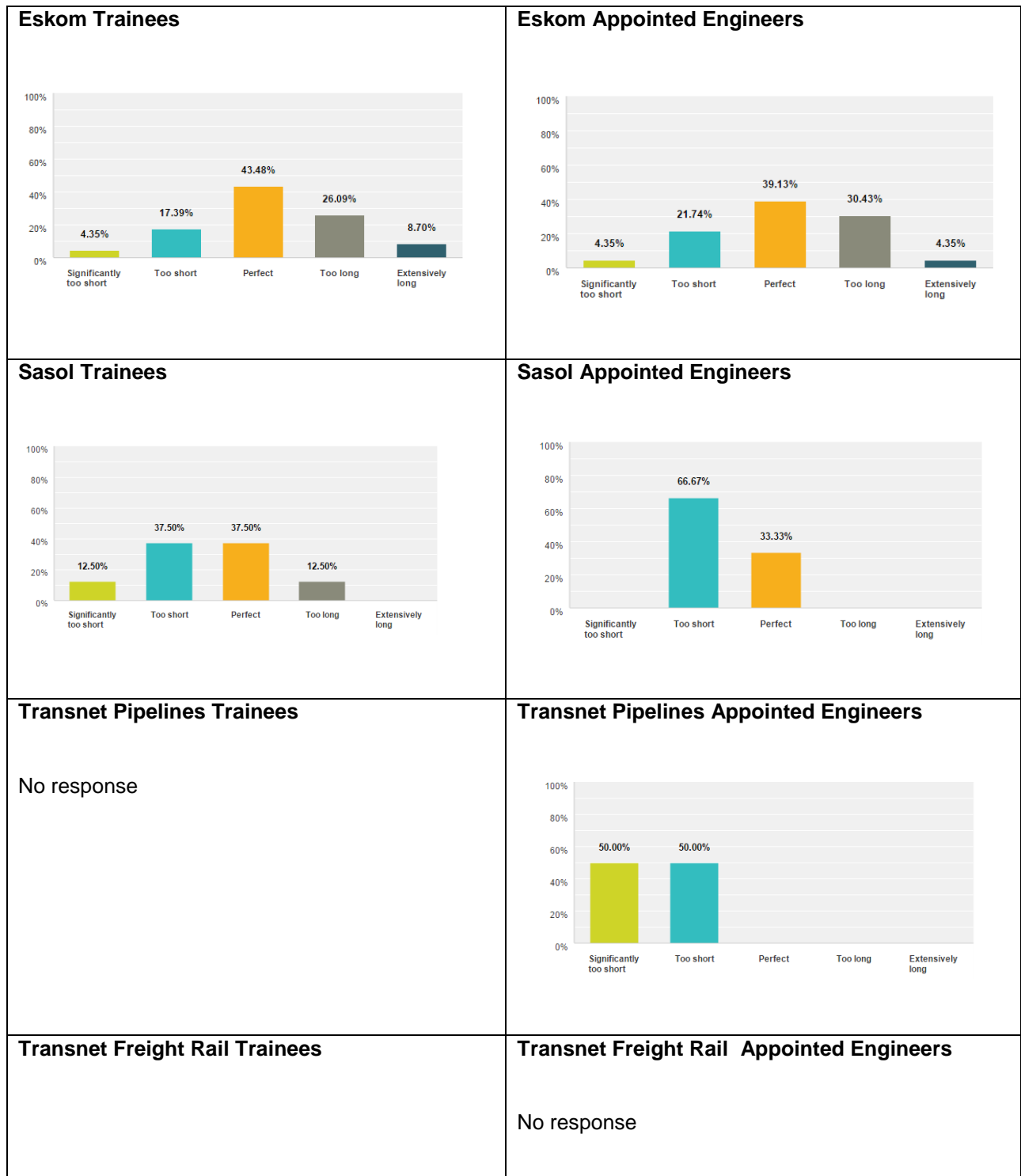


Figure 4-10: Training time spent training in Engineering Department

The data shown in Figure 4-10 indicates that appreciation for time spent training with the Engineering Department changes after appointment, which it must be noted, is too late since the training period has passed. This data shows that after one becomes appointed, they tend to realise the importance of the time spent training with their engineering department thus incorporating this into the management framework would prove to be prudent and forward thinking. The implementation of this is elaborated in the management framework itself

Time spent in non-Engineering departments

As reflected in Figure 4-11, and compared with the data in Figure 4-10, responses tended to follow a normal distribution. The majority of respondents indicated that the training time spent in non-engineering departments was sufficient. It was observed, too, that the views of Eskom engineers regarding training in non-engineering departments were significantly more consistent during the transition from trainee to Engineer.



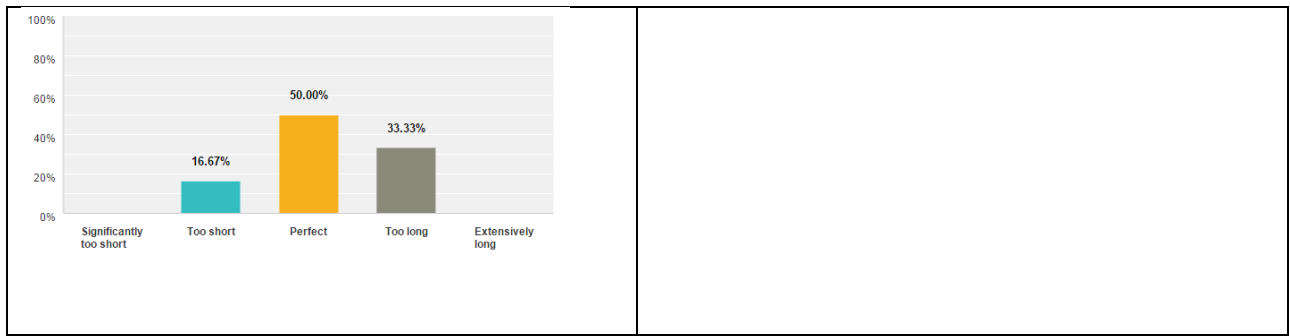


Figure 4-11: Respondents' opinions regarding training time spent in non-engineering departments during training

Was the training programme well structured?

Figure 4-12 provides a link between the of the structure of the training programmes that were analysed in the literature review chapter, particularly chapter 2.4, which discusses the training programmes in place at each organisation. The data collected supports the analysis of the literature survey in that the majority of Eskom respondents and Sasol trainees indicated that there was a lack of structure in their training programmes. Sasol appointed engineers appeared to share a different view from Sasol trainees. However, this was not surprising, given that the training programmes are dependent on the approach and commitment of each section manager (as discussed earlier). The majority of positive responses from Transnet Freight Rail trainees suggest that their training programme was well structured. Linked to this is the data shown in Figure 4-13 and Figure 4-14, which ties in with respondents' awareness of outcomes and expectations of their training programmes, and the extent to which trainees knew where to find relevant information to achieve the outcomes of their training. It is evident from the data collected that there exists a link between the structured nature of a training programme, and its effectiveness in terms of participants achieving its intended outcomes by knowing where to find relevant information. The direct comparison between the primary study case (Eskom) and the data-supported, well structured training programme of Transnet Freight Rail, showed that a well-structured training programme enables trainees to know what they are working to achieve. Such a training programme also provides trainees with the necessary information to achieve their targets. All this suggests that Eskom's training programme needed to adopt such a structured approach in order to be more efficient.



Figure 4-12 Response data pertaining to training programme structure

Were trainees fully aware of the outcomes and expectations of their training programme?

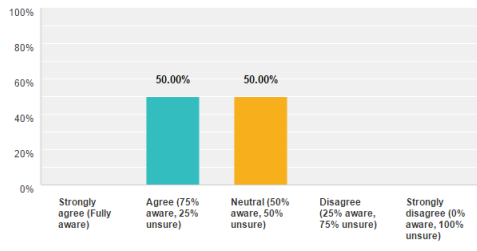


Figure 4-13 Response data regarding trainee awareness in respect to the outcome of their training programs

Did trainees know where to find relevant information that would enable them to meet the outcomes and expectations of their training programme?



Transnet Freight Rail Trainees



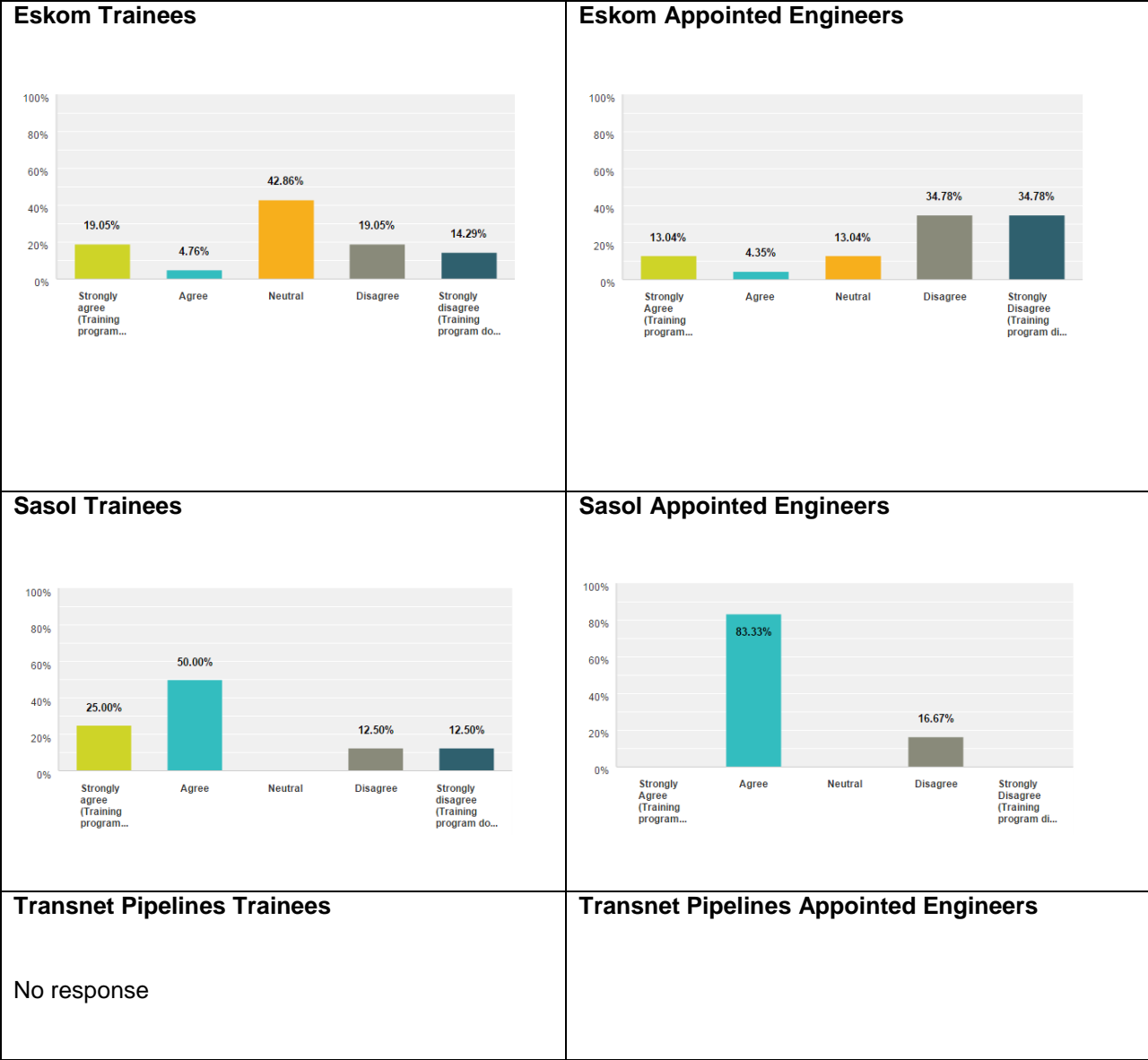
Transnet Freight Rail Appointed Engineers

No response

Figure 4-14 Response data reflecting the extent to which respondents knew where to find relevant data to assist in achieving training outcomes

Was the existing training program oriented in such a way as to guide and assist the trainee toward attaining professional status or GCC?

Figure 4-15 shows a larger indication towards the negative, for Eskom respondents, than any of the other organisations. This highlights a deficit in Eskom’s current training programmes, something that will be addressed in the proposed management framework. Figure 4-16 reinforces the fact that the inclusion of a GCC and Pr Eng oriented training programme would positively influence the turnover intention of engineers across all the organisations surveyed. Further filtering of data focussing on Eskom revealed that there existed a bias in the negative responses. The data showed that the majority of negative responses were from site-based engineers. This indicates that there exists inconsistencies in the training of engineers at power stations as opposed to those based at head office or COE.



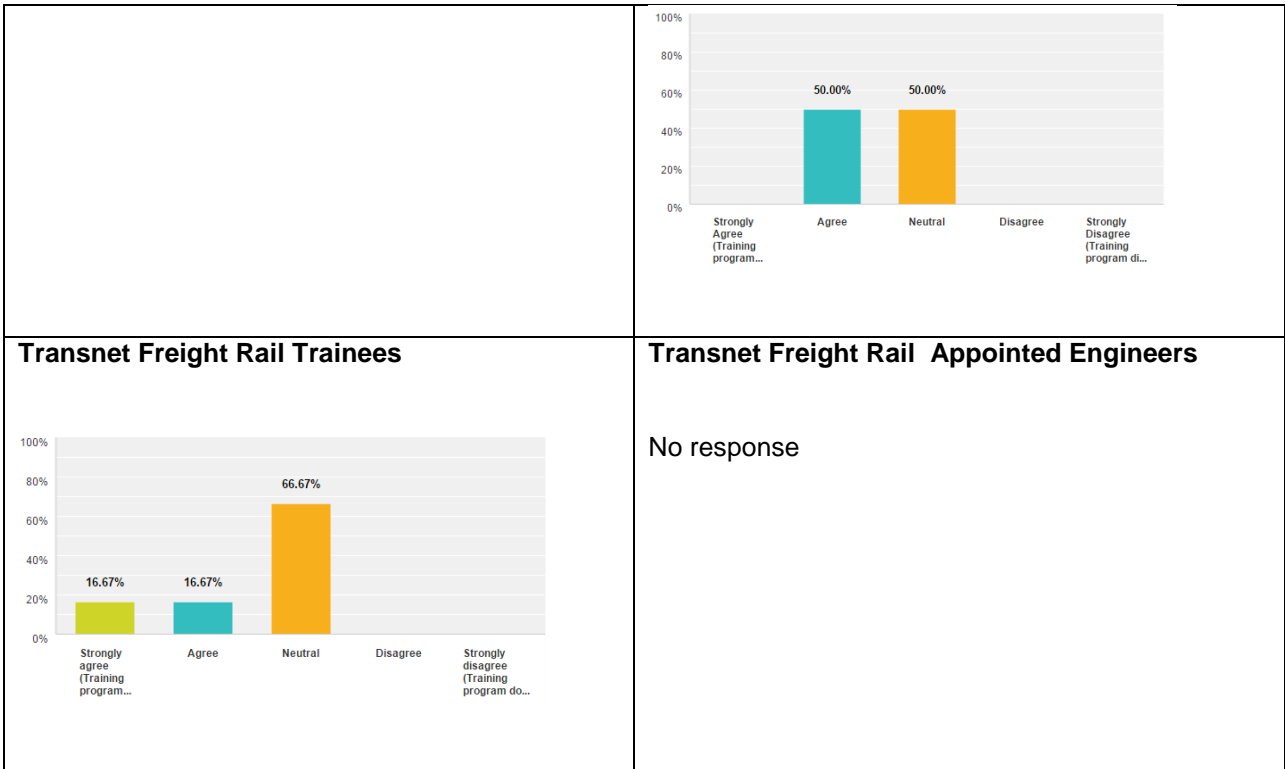


Figure 4-15: Extent to which training programmes focussed on preparation for GCC or Pr Eng

If the training programme was better oriented towards the attainment of Pr. Status or GCC, would this encourage respondents to stay within the organisation?

<p>Eskom Trainees</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree (Yes, it would encourage ...)</td> <td>64.71%</td> </tr> <tr> <td>Agree</td> <td>23.53%</td> </tr> <tr> <td>Neutral (It would have no influence over my...)</td> <td>5.88%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree (No, I would leave regardless)</td> <td>5.88%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree (Yes, it would encourage ...)	64.71%	Agree	23.53%	Neutral (It would have no influence over my...)	5.88%	Disagree	0%	Strongly disagree (No, I would leave regardless)	5.88%	<p>Eskom Appointed Engineers</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree (Yes, it would encourage ...)</td> <td>30.00%</td> </tr> <tr> <td>Agree</td> <td>50.00%</td> </tr> <tr> <td>Neutral (It would have no influence over my...)</td> <td>10.00%</td> </tr> <tr> <td>Disagree</td> <td>10.00%</td> </tr> <tr> <td>Strongly disagree (No, I would leave regardless)</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree (Yes, it would encourage ...)	30.00%	Agree	50.00%	Neutral (It would have no influence over my...)	10.00%	Disagree	10.00%	Strongly disagree (No, I would leave regardless)	0%
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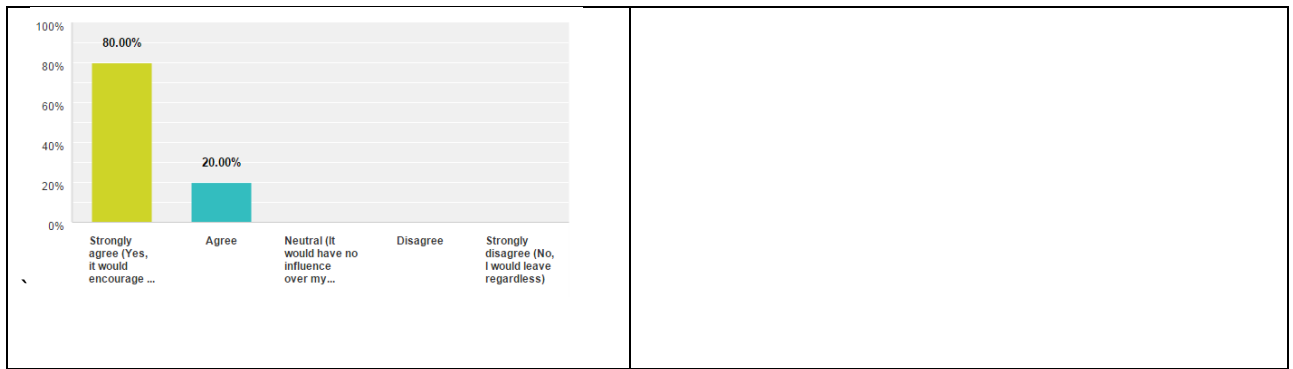


Figure 4-16 Extent to which a training programme that supported the attainment of Pr Eng or GCC would serve as incentive for retention

4.3.3.3 Mentorship

The next part of the research focussed on mentorship, its implementation and its subsequent potential to positively improve Eskom's engineer training programmes. The data shown in Figure 4-17 showed that the majority of respondents had access to some form of guidance. In the case of Eskom, there existed a significant percentage who either possessed no mentor or the guidance received was from informal interaction with co-workers within the engineers' department.

Data collected regarding those respondents who did have a mentor reflected that they received relevant, constructive, work-related, career-development related and soft skill related guidance from their mentors (Figures 4-18 to 4-20), all of which positively influenced their development as engineers. A minority of respondents reflected that their mentors did not positively influence their growth as an engineer. However, when contrasted with the vast majority who did gain positively from a mentor, these responses were interpreted as reflecting the views of a minority who received a poor or unwilling mentor, or who were assigned a mentor with whom a relationship could not be developed (for reasons that exceed the limits of this research).

The survey data collected for those engineers who did not have a mentor (Figure 4-21) revealed that the overwhelming majority responded positively in their desire to have an assigned mentor, believing that this would benefit them in their development as engineers.

One must reiterate that the centre of the discussion, in this dissertation, is Eskom since Eskom is the case study used in this research. The other companies surveyed simply provided a basis for comparison, bearing in mind the nature of their respective training programmes (reviewed in chapter 2).

Indication of number of respondents who had an assigned mentor

<p>Eskom Trainees</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Yes, I have had a formally appointed mentor/coach...</td> <td>19.05%</td> </tr> <tr> <td>Yes, I have had a mentor/coach from the beginning of ...</td> <td>14.29%</td> </tr> <tr> <td>Neutral, anyone in my department helps me (on informal basi...</td> <td>42.86%</td> </tr> <tr> <td>No, at no time did I have a dedicated mentor</td> <td>23.81%</td> </tr> </tbody> </table>	Response	Percentage	Yes, I have had a formally appointed mentor/coach...	19.05%	Yes, I have had a mentor/coach from the beginning of ...	14.29%	Neutral, anyone in my department helps me (on informal basi...	42.86%	No, at no time did I have a dedicated mentor	23.81%	<p>Eskom Appointed Engineers</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Yes, I have had a formally appointed...</td> <td>26.09%</td> </tr> <tr> <td>Yes, I have had a mentor/coach from the...</td> <td>30.43%</td> </tr> <tr> <td>Neutral, anyone in my department helps me (...)</td> <td>21.74%</td> </tr> <tr> <td>No, but as a trainee I did</td> <td>0%</td> </tr> <tr> <td>No, at no time did I have a dedicated...</td> <td>21.74%</td> </tr> </tbody> </table>	Response	Percentage	Yes, I have had a formally appointed...	26.09%	Yes, I have had a mentor/coach from the...	30.43%	Neutral, anyone in my department helps me (...)	21.74%	No, but as a trainee I did	0%	No, at no time did I have a dedicated...	21.74%
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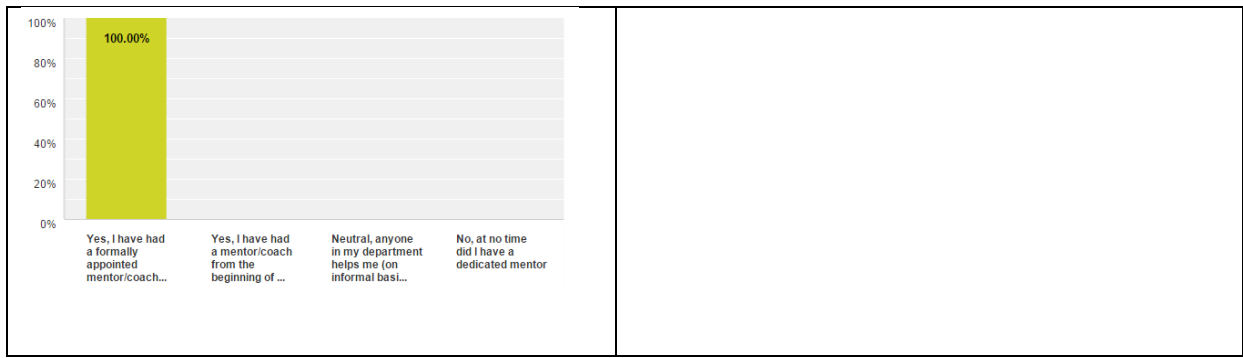


Figure 4-17 Survey data reflecting the portion of engineers who had mentors, and the nature of the mentors assignment

For those respondents who did have a mentor, the following data represents whether they were comfortable in approaching their mentor with work-related questions.



Figure 4-18 Survey data indicating mentors' influence over guidance in terms of work related questions

Did respondents feel comfortable approaching their mentor with career development and soft skills (conduct, how to deal with co-workers, stress etc.), or personal matters?

<p>Eskom Trainees</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree (100% comfortable, no hesitat...)</td> <td>28.57%</td> </tr> <tr> <td>Agree</td> <td>42.86%</td> </tr> <tr> <td>Neutral</td> <td>14.29%</td> </tr> <tr> <td>Disagree</td> <td>14.29%</td> </tr> <tr> <td>Strongly disagree (100% hesitant t...)</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree (100% comfortable, no hesitat...)	28.57%	Agree	42.86%	Neutral	14.29%	Disagree	14.29%	Strongly disagree (100% hesitant t...)	0%	<p>Eskom Appointed Engineers</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree (100% comfortable, no hesitat...)</td> <td>46.15%</td> </tr> <tr> <td>Agree</td> <td>30.77%</td> </tr> <tr> <td>Neutral</td> <td>23.08%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree (100% hesitant t...)</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree (100% comfortable, no hesitat...)	46.15%	Agree	30.77%	Neutral	23.08%	Disagree	0%	Strongly disagree (100% hesitant t...)	0%
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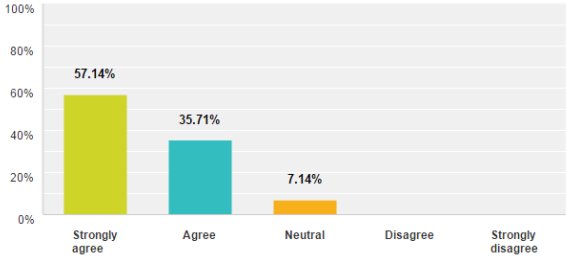
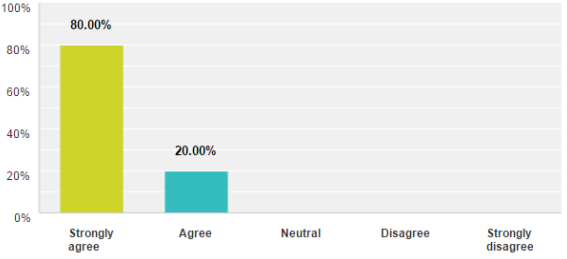
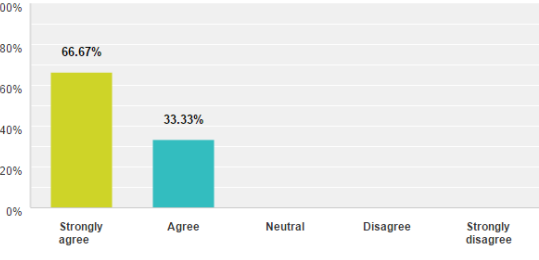
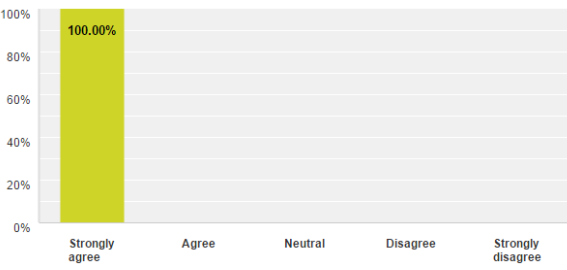
Figure 4-19 Survey data indicating mentors' influence over guidance in terms of soft skills or personal related questions

Did respondents feel that the guidance provided by a mentor/coach had a positive influence on their development and growth as engineers?

<p>Eskom Trainees</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree</td> <td>14.29%</td> </tr> <tr> <td>Agree</td> <td>71.43%</td> </tr> <tr> <td>Neutral</td> <td>0%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree</td> <td>14.29%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree	14.29%	Agree	71.43%	Neutral	0%	Disagree	0%	Strongly disagree	14.29%	<p>Eskom Appointed Engineers</p> <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree</td> <td>53.85%</td> </tr> <tr> <td>Agree</td> <td>38.46%</td> </tr> <tr> <td>Neutral</td> <td>7.69%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree	53.85%	Agree	38.46%	Neutral	7.69%	Disagree	0%	Strongly disagree	0%
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Figure 4-20 Survey data reflecting whether mentorship had a positive influence on mentee engineer development and growth

For those respondents who did not have a dedicated mentor or coach, the following data illustrates the extent to which respondents believed that they would benefit from having a dedicated mentor or coach.

<p>Eskom Trainees</p>  <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree</td> <td>57.14%</td> </tr> <tr> <td>Agree</td> <td>35.71%</td> </tr> <tr> <td>Neutral</td> <td>7.14%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree	57.14%	Agree	35.71%	Neutral	7.14%	Disagree	0%	Strongly disagree	0%	<p>Eskom Appointed Engineers</p>  <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly agree</td> <td>80.00%</td> </tr> <tr> <td>Agree</td> <td>20.00%</td> </tr> <tr> <td>Neutral</td> <td>0%</td> </tr> <tr> <td>Disagree</td> <td>0%</td> </tr> <tr> <td>Strongly disagree</td> <td>0%</td> </tr> </tbody> </table>	Response	Percentage	Strongly agree	80.00%	Agree	20.00%	Neutral	0%	Disagree	0%	Strongly disagree	0%
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interpretation correct? Editor>>

Figure 4-21: Survey data indicating whether respondents without mentors believed mentorship would benefit them

The data that follows (Figures 4-22- to 4-26) provides insight into the drivers for mentorship. by investigating the influence of intrinsic and extrinsic reward on both already appointed mentors and prospective mentors in an effort to substantiate sections of the proposed management framework that addresses mentorship and how it should be incentivised.

From the data in Figures 4-22- to 4-24, it can be seen that already appointed mentors derived a significant amount of their drive to teach/mentor from intrinsic rewards and only a small portion from extrinsic rewards. This was an encouraging statistic, and indicates that the desire to mentor young engineers is self-motivated.

The data contained in Figures 4-25 to 4-26 provided the basis upon which the proposed management framework could ensure the effective implementation of mentorship in a training regime. The data indicated that those appointed engineers who had not as yet been appointed the mentor of a young engineer were willing to become mentors on the basis of both intrinsic and extrinsic rewards. This implied that teaching would be self-motivated, but in order to further incentivise it, teaching should be supported by some sort of extrinsic reward. (For example, providing monetary rewards by incorporating mentorship and teaching into the individual's performance appraisal contract as a KPI (Key performance indicator) target)

The following data indicates the proportion of appointed engineers who were themselves assigned mentors or coaches.

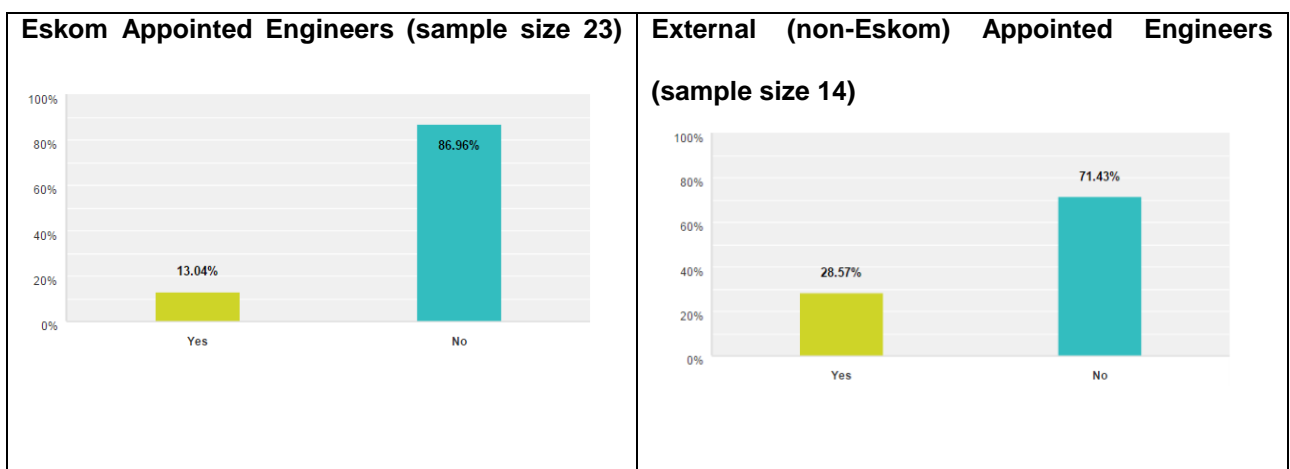


Figure 4-22: Percentage of respondents who were already appointed as mentors

Of those respondents who were assigned mentors/coaches, the following data reflected the mentors' drive to teach based on intrinsic rewards.

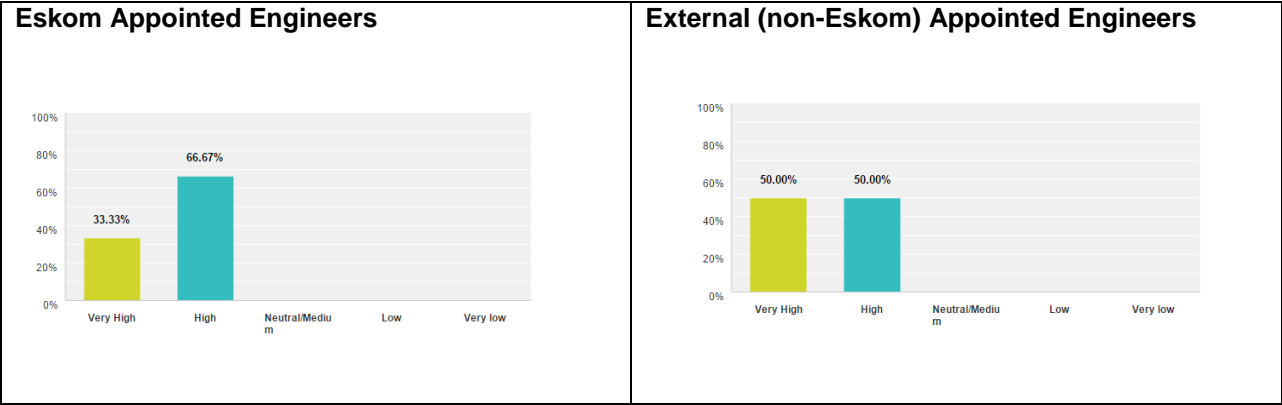


Figure 4-23: Mentors' drive to teach based on intrinsic rewards

Of those respondents who were assigned mentors/coaches, the following data reflected mentor's drive to teach based on extrinsic rewards.

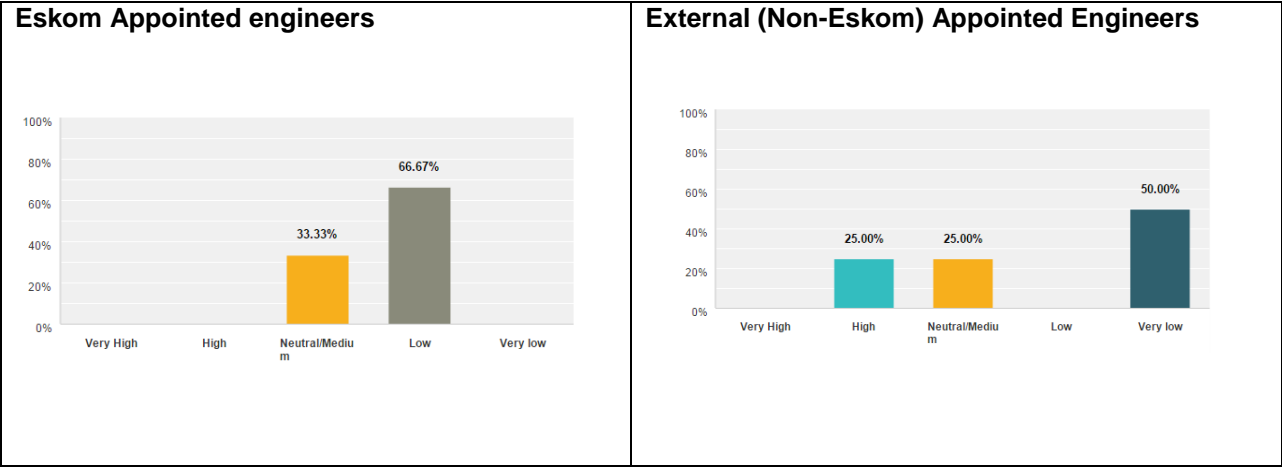


Figure 4-24: Mentors' drive to teach based on extrinsic rewards

Of those respondents who were not as yet assigned mentors/coaches, the following data reflected mentors' willingness to teach based on intrinsic rewards.

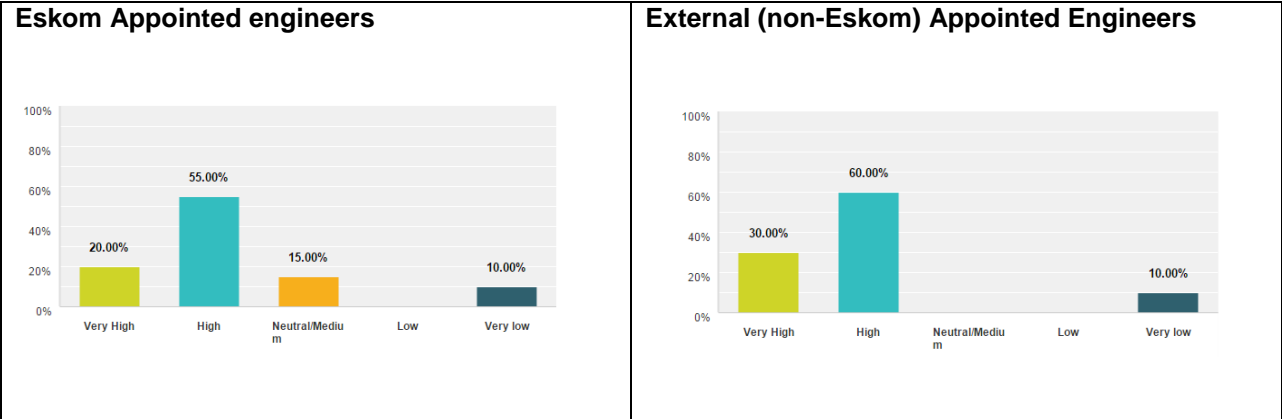


Figure 4-25: Prospective mentors' drive to teach based on intrinsic rewards

Of those respondents who were not as yet assigned mentors/coaches, the following data reflected mentors' willingness to teach based on extrinsic rewards.

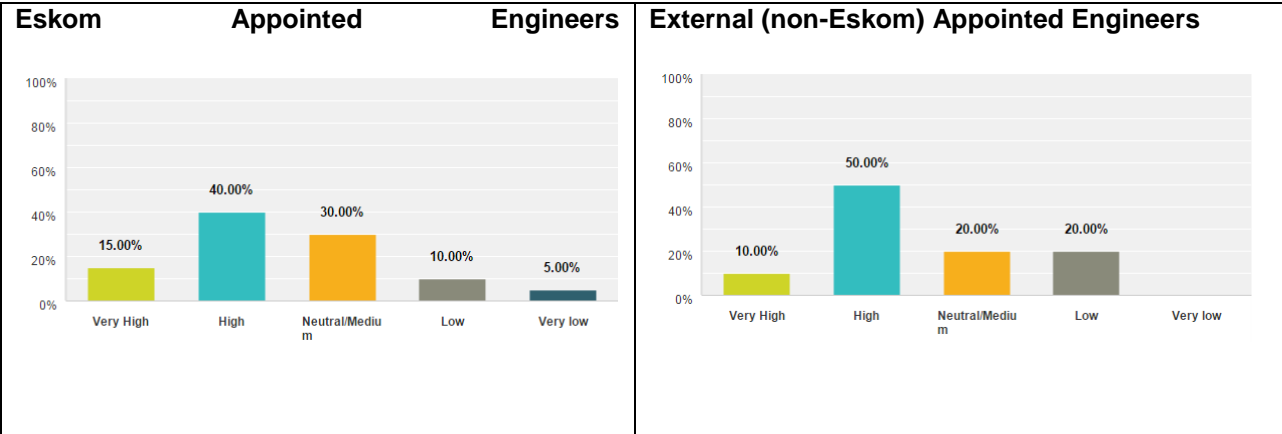


Figure 4-26: Prospective mentors' drive to teach based on extrinsic rewards

4.3.3.4 Extent of preparedness in terms of making engineering decisions

The data which follows (Figures 4-27 to 4-30) was used to ascertain the extent to which engineers felt that they were prepared for their intended tasks upon completion of existing training; this data is based on an analysis of appointed young engineers only. The purpose of this analysis was to reveal those focal points that needed emphasising in the proposed management framework (i.e. by examining those areas of preparedness that are proven to be lacking). Once again, the centre of the discussion was Eskom. The other companies surveyed provide a basis for comparison, bearing in mind the nature of their respective training programmes (reviewed in chapter 2).

The data shown in Figures 4-27 and 4-28 indicated a neutral to negative biased response from Eskom appointed young engineers; this implies that these young engineers had a poor level of confidence in terms of their ability to make decisions. This lack of confidence, in turn, could affect company production and turnover and/or the safety of workers. This lack of confidence could be contrasted with Sasol's appointed young engineers, who indicated higher levels of confidence in terms of their ability to make similar decisions. Contrasts such as these were taken into account when deriving the focal points of the proposed management framework.

Figure 4-29 highlights the fact that Eskom engineers have a low level of confidence regarding their familiarity with engineering codes (BS (British Standards), EN (European Standard), ISO (International Organisation of Standards), ASME (American Society of Mechanical Engineers) etc.) which govern technical engineering design and practices on site. This was therefore an aspect of the proposed management framework that would improve young engineer preparedness for their jobs.

In the same light, Figure 4-30 provides evidence that Eskom engineers also lack familiarity with regard to internal company procedures and certain, relevant engineering standards. By focussing on these internal and external codes, procedures and standards throughout a young engineers training, before his or her mind is occupied by stress and responsibility of burning plant issues, one will provide him or her with the tools that he or she needs to justify every decision that he or she makes. Be it production or safety-related decisions, once fully supported by the relevant standards, these decisions will be made with confidence on the basis that the decision was made according to industry recognised standards or codes.

Based on the training/experience gained from respondents' training programmes, respondents rated their level of confidence in making decisions that have the potential to have a major impact on company production and turnover (for which they could be held responsible).

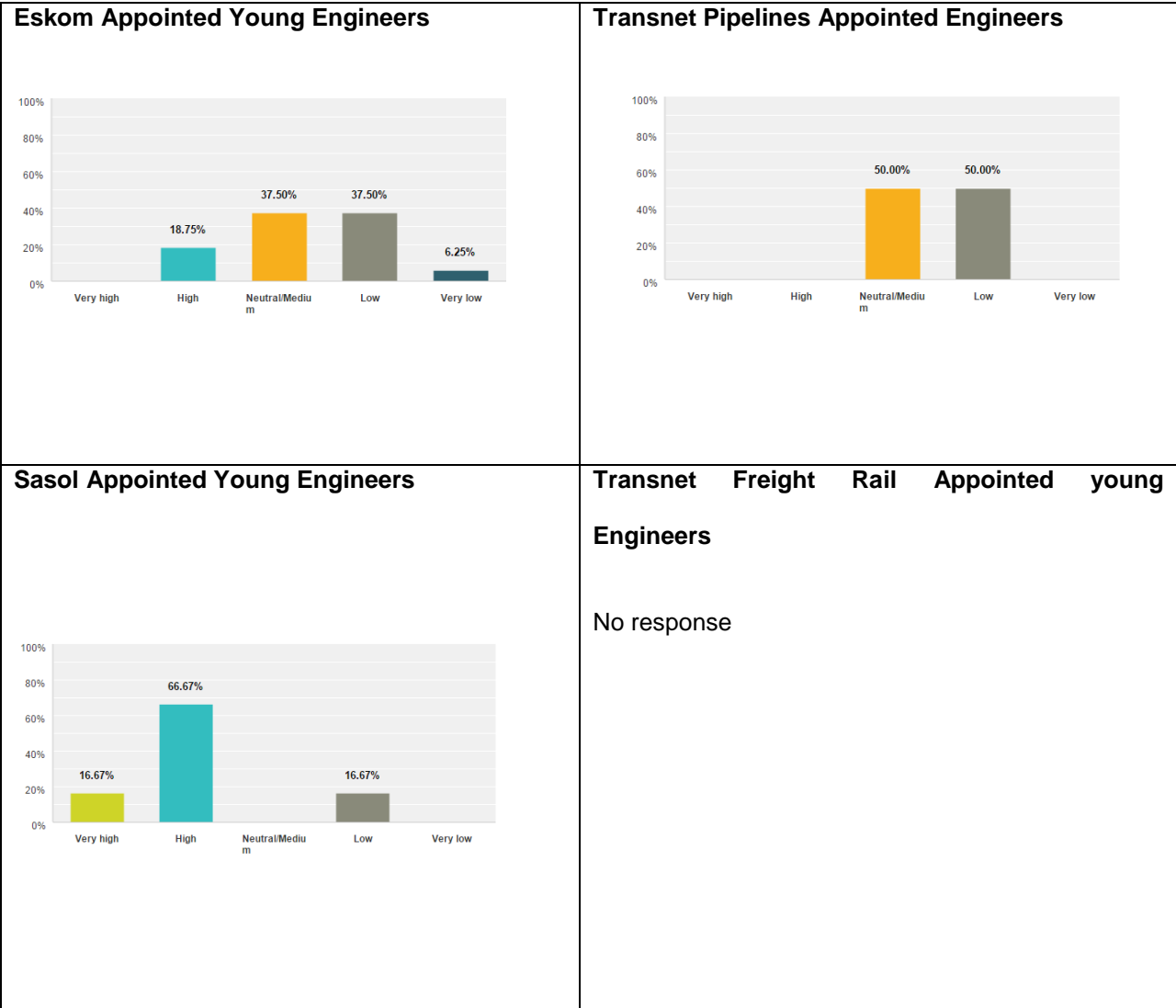


Figure 4-27: Level of confidence possessed by young appointed engineers in making decisions that may impact on production or turnover

Based on the training/experience gained from respondents' training programmes, respondents rated their level of confidence in making decisions that have the potential to have a major impact on the safety of workers in their work environment (for which they could be held responsible).



Figure 4-28 Level of confidence possessed by young appointed engineers in making decisions that may impact on safety of workers

Respondents rated their level of familiarity with the engineering codes (BS, EN, ISO, ASME etc.) by the time they had completed their engineer training programme (relevant to their plant or current position). See below.



Figure 4-29 Survey data indicating the level of familiarity with design standards and codes (BS, EN, ISO, ASME etc.)

The following data shows the extent to which, upon completion of their training programme, respondents were fully aware of, and familiar with all the internal company procedures that apply to them as engineers (and which are necessary for them to do their work).

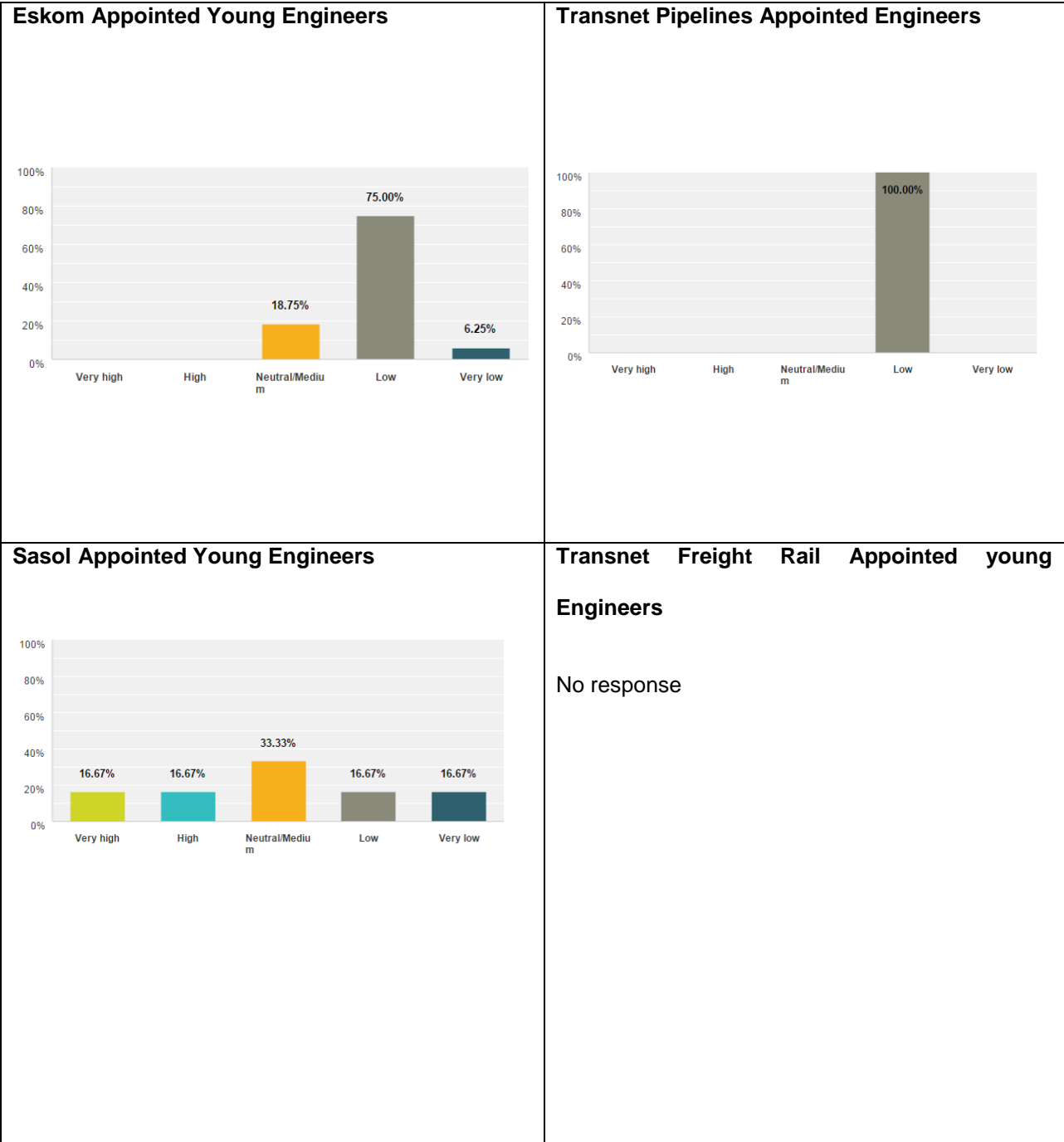


Figure 4-30 Survey data indicating the level of familiarity with internal company procedures

4.3.4 Drivers for retention extrapolated from drivers for productivity in generation Y engineers

For this part of the research, only those engineers falling into generation Y (born 1977 – 1994, age less than 39 years at the time of the experiment) were considered. The questionnaires of two respondents who were older than 39 years were discarded.

A sample size of 44 engineering trainees and 39 appointed engineers was used. In order to maintain a confidence level of 90% with a confidence interval of 6%, a minimum of 36 and 33 responses was maintained respectively.

The following was ascertained from the nature of the responses received from generation Y engineers (Figures 4-31 to 4-39):

- Respectfully challenging or questioning instructions from superiors in an effort to account for as many opinions as possible (Figure 4-31) was supported
- Career development and growth held higher priority than monetary reward or promotion (Figure 4-32).
- Potential for future opportunities for career growth significantly influenced respondent's decision to stay in a given organisation or position (Figure 4-33).
- Maintaining a work-life balance significantly influenced respondent's decision to stay in a given organisation or position (Figure 4-34).
- Salary and wage level were seen as important contributors to the desire to remain in a given organisation or position (Figure 4-35).
- Trainee young engineers indicated higher levels of fear of losing their jobs when faced with decisions that require trade-off between engineering good practice/ethics and production/managements opinion than appointed engineers whose response followed more of a normal distribution than a biased toward either positive or negative (Figure 4-36).
- For both trainees and appointed engineers, negative bias indicated that fear was not seen as a good driver for productivity for the majority of respondents (Figure 4-37).
- The majority of respondents from both groups believed that the workplace should not be a strictly controlled, formal environment where discussion is minimised (Figure 4-38).
- A strong positive bias for both groups showed that they believed that open dialogue with colleagues and seniors was a necessary tool for improving productivity (Figure 4-39).

Respondents rated the extent to which they believed that one should respectfully challenge/question instructions given by superiors in effort to take into consideration as many opinions as possible:

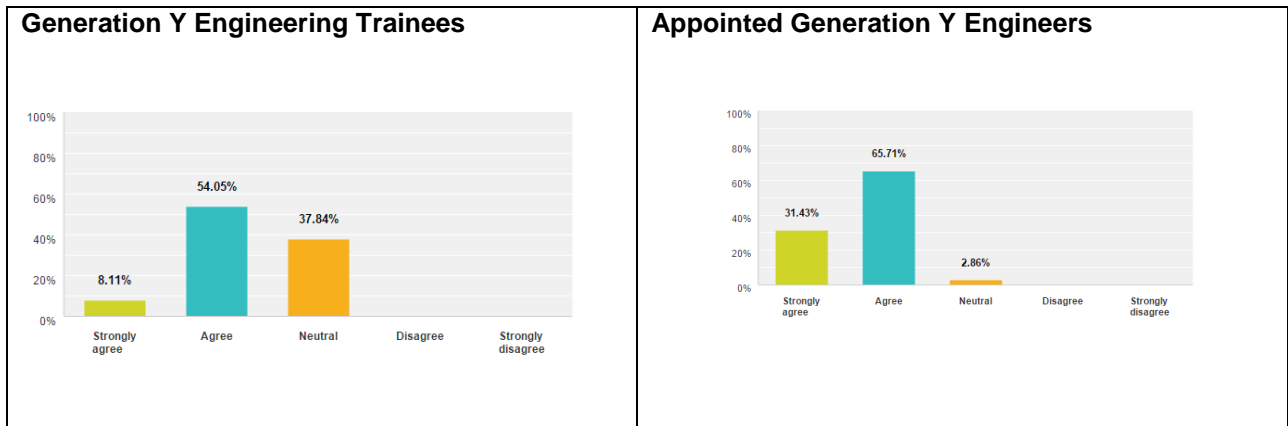


Figure 4-31 Belief that instructions should be respectfully questioned or challenged in order to consider as many opinions as possible

Respondents rated the importance of career development and growth against monetary reward or promotion:

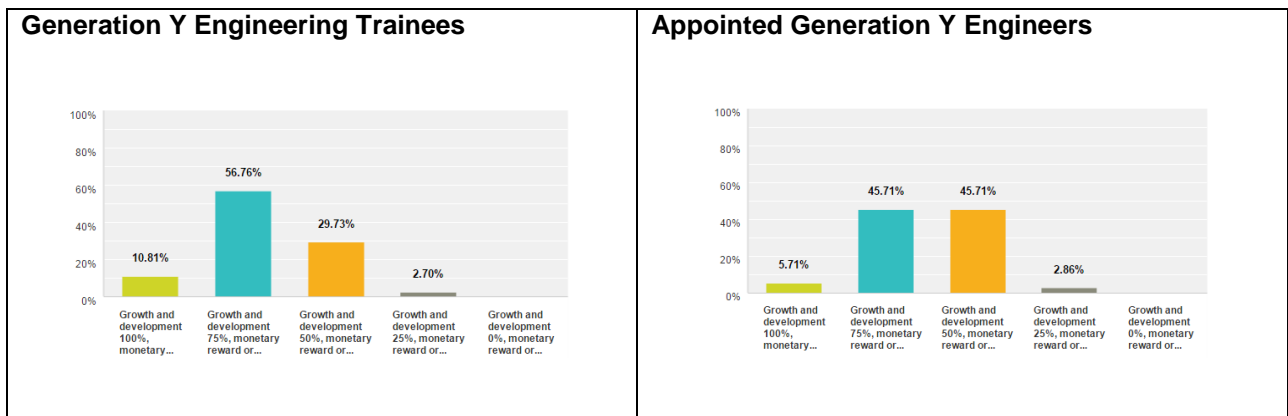


Figure 4-32 Importance of career development and growth versus monetary reward or promotion

With regard to the decision to accept a new position, or continue in a current position, respondents rated the importance of future opportunities for career growth in this decision:

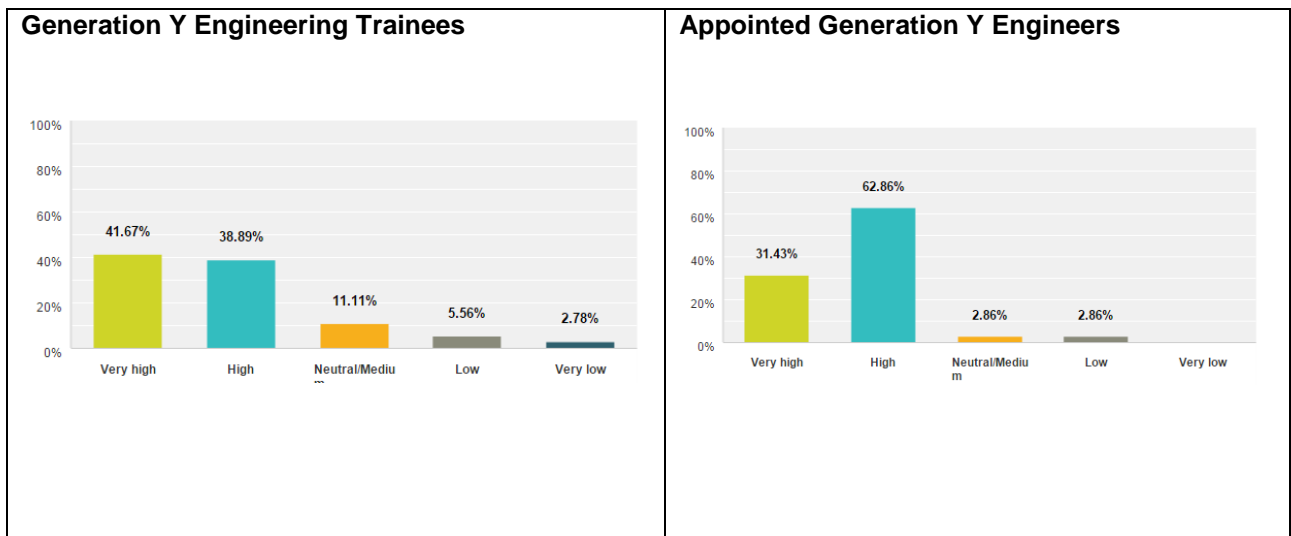


Figure 4-33 Survey data indicating the importance of future opportunities for career growth as a driver for retention

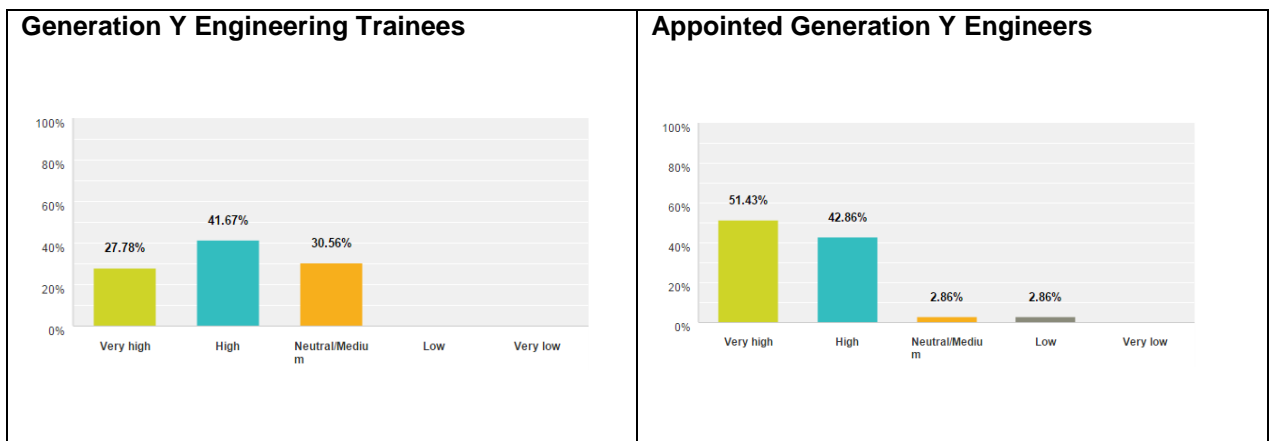


Figure 4-34 Survey data indicating the importance of work-life balance as a driver for retention

With regard to the acceptance of a new position, or continuation in a current position, respondents rated the importance of work-life balance in the decision to accept/remain in their position.

With regard to the acceptance of a new position, or continuation in a current position, respondents rated the importance of salary/wage level in the decision to accept/remain in said position:

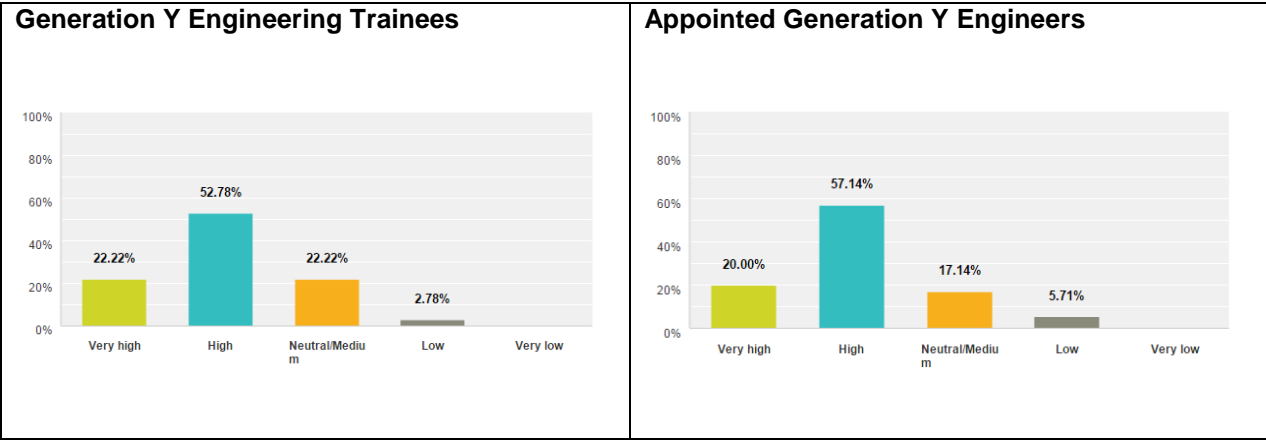


Figure 4-35 Importance of salary or wage level

Respondents rated the extent to which they feared losing their current job, when faced with difficult engineering decisions that required a trade-off between engineering good practice/ethics and production/management’s opinion:

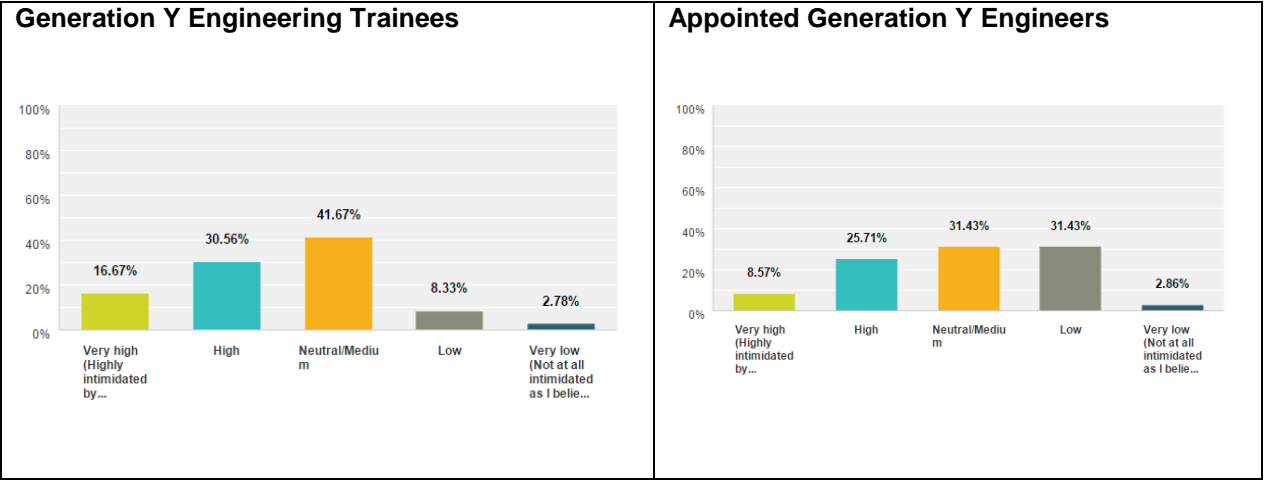


Figure 4-36 Influence of fear of job loss when making decisions that require a trade-off between engineering good practice/ethics and production/management’s opinions

The belief that fear is a good motivator for productivity was gauged by asking respondents if they felt that fear is a good motivator for productivity:

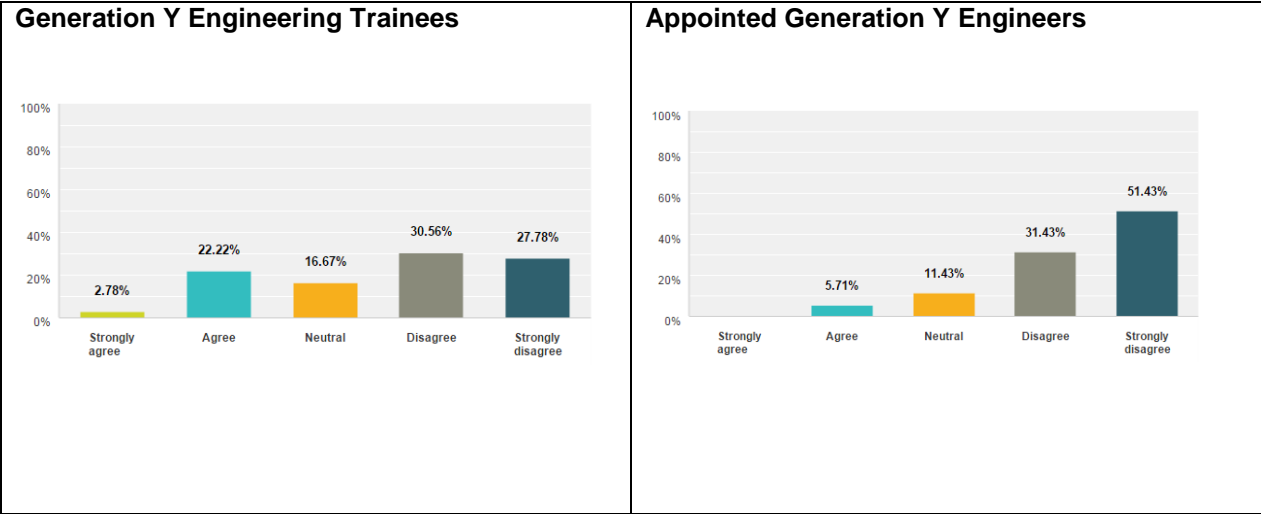


Figure 4-37 Respondents opinions regarding fear as a motivator of productivity

Respondents rated the extent to which they believed that the work place should be a strictly controlled formal environment where discussion is minimised

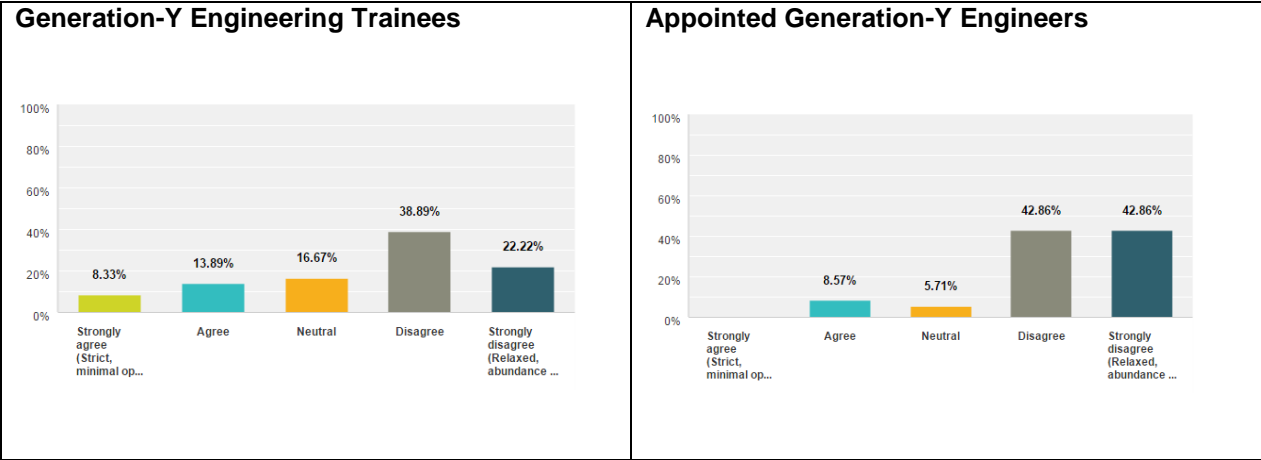


Figure 4-38 Belief that workplace should be a strictly controlled formal environment where discussion is minimised

The extent to which respondents believe that open dialogue with colleagues and seniors is a necessary tool for improving productivity:

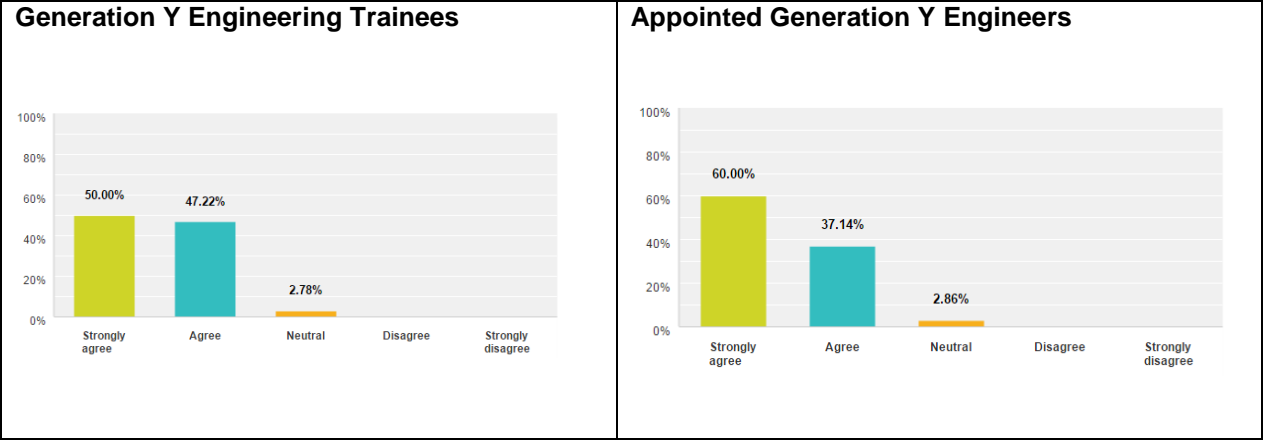


Figure 4-39 Belief that open dialogue with colleagues and seniors is a necessary tool for improving productivity

4.4 Validation of management framework

The Management Framework for Accelerated Development and Retention of Young Engineers presented in chapter 5 was compiled and submitted to an Engineering Line Manager from the Engineering Department at Grootvlei Power Station. The following matrix was used to assess the validity of the proposed framework:

Table 4-6: Validation matrix for management framework

Rate the extent to which the proposed management framework achieves the following:	Score
Suggests a means to improve and accelerate young engineer development	/5
Suggests ways to improve young engineer retention	/5
Suggests a means for optimising the existing training programme	/5
Is feasible to implement in Eskom	/5
Suggestions are supported or justified by research data	/5
Total:	/25

The score was assigned as follows:

- 5 - Excellent (No room for improvement)
- 4 - Good (Objective achieved, but there exists minor room for improvement)
- 3 - Acceptable/Average (Objective achieved, but there exists major room for improvement)
- 2 - Fair (Objective barely achieved, not acceptable)
- 1 - Poor (Objective not achieved at all)

Scores of numerical value ranging from zero (0) to five (5) to a maximum of one decimal place were used. This scoring system was based on the system used in Eskom STAR gradings; thus an average score of 3.0 or higher was deemed necessary for successful validation of the management framework.

The framework and the validation assessment matrix were issued to an engineering line manager at Eskom's Grootvlei Power Station, since this is the level at which the framework

would be implemented. The departmental line managers have the greatest amount of interaction with young engineers when compared with other management levels in the organisation. The performance, development and retention of young engineers is also particularly critical to line managers, given that the abilities of the system engineers who fall under the line manager's responsibility directly impact the performance of his or her department. The above justification made the engineering line manager the relevant person for conducting the assessment.

The assessment was submitted to the manager concerned on 07 October 2015 and was received back by the author on 13 October 2015 during a one-on-one interview session in which the scores assigned were discussed. The assessor (manager) provided critical comment, suggestions and justifications for the scores that were awarded. It must be noted that the scoring was completed without any influence from the researcher to ensure an unbiased validation.

.A total of 19.3 out of 25 was achieved, producing an overall average of 3.86. Refer to the scan of the original document in Appendix C2 for full scores. It was therefore determined that the proposed framework was deemed to be successfully validated for use in Eskom. There were critical comments and suggestions noted that are presented as a part of the recommendations for future research (see chapter 5.3)

4.5 Summary of chapter 4

Chapter 4 contained the results and discussions of these results. In the following chapter, chapter 5, the proposed management frame work was developed, using the data collected and discussed in chapter 4. The interpretation of the data presented in chapter 4 facilitated the development of focal points in the management framework based on relevant data collected from the applicable industry. The content of the management framework is presented in chapter 5, and forms the 'recommendations' section of the chapter, accompanied by the conclusions drawn from the research.

Chapter 5: Conclusions and recommendations

Note that the recommendations in the form of the content of the management framework are presented before the final conclusions are drawn. This is because the proposed framework was based on the research data presented in chapter 4, which was collected as discussed in chapter 3. The outcome of the research will therefore be discussed first (i.e. the management framework), followed by concluding remarks.

5.1 Management framework for accelerated development and retention of young engineers

Since the justification for the focal points detailed in the proposed framework was presented in chapter 4, the framework itself contains a summarised background of the substantiation for each focal point. This was implemented as such for practicality purposes for use of the document in the corporate environment (Appendix C1).

This management framework aims to accelerate the development and improve the retention of young engineers in Eskom by proposing certain factors that should be focussed on during the EIT period (i.e. prior to the EIT's appointment as a fully accountable engineer). The factors proposed were justified by data collected through a research experiment conducted on a test group of Eskom, Sasol, Transnet Pipelines and Transnet Freight Rail appointed engineers and trainees. The research provided data from industry professionals and trainees regarding their training and its effectiveness.

What follows are proposals based on the data collected.

5.1.1 Ex-Eskom engineers – reasons for leaving the organisation

First of all, the training of engineers should be aligned to promote career advancement within the organisation. This would be achieved by involving the young engineer's line manager from the start of the EIT's career in the organisation. The EIT's career progression options (within the organisation) should be visually presented in a document and the EIT's intentions discussed. Training should then be structured in order to work towards the individual's long-term aspirations. This will keep the young engineer motivated, knowing that the organisation is actively involved in his or her growth.

5.1.2 Desire to leave

Data regarding the engineer's desire to leave his or her current organisation (turnover intention) took into account certain issues, including the EIT's willingness to leave despite a reduction in salary, contractual obligations and whether the prospect of improved training or development programmes influenced his or her desire to leave.

The data revealed that contractual obligations were an inhibiting factor for young engineers. It was contractual obligation that kept EITs in the organisation. Once these obligations had been discharged, EITs were free and willing to leave; the data reflected a desire to leave in exchange for improved training and development opportunities, despite the fact that the EIT sometimes faced the possibility of a decrease in salary.

Recommendation: Invest in improving the training opportunities within Eskom. Use existing assets (appointed engineers) to share knowledge and create a learning environment for young engineers. Development as an engineer has been proven to be of great value to current young engineers, which is why the organisation needs to place more emphasis on this factor.

The research data showed a positive response regarding job satisfaction amongst young engineers, despite the existence of organisational challenges. There therefore exists the opportunity for this proposal (the proposed management framework) to be successful, given that engineers' morale remains positive, increasing the probability of success.

5.1.3 Rate of development

The data collected showed that the following issues (focal points) were areas that Eskom needed to improve on. The research data indicates that emphasising these points will contribute positively to young engineer development and retention.

- Training needs to be relevant to the engineers' career progression, both in the organisation and externally. The relevance of the content of the current training programme needs to be improved on, thus nurturing a feeling of growth in EITs. Turnover intention may be inevitable, but getting the most out of an employee while he or she is with an organisation is the most worthwhile course of action for the organisation. An engineer who feels that he or she is growing is more likely to stay or, at the very least, be more productive, than someone who feels the training or work he or she is doing is simply futile.

- Link between improved training programmes and a desire to stay
 - Amongst young engineers there was a positive link between improved training and a desire to remain in the current organisation.
 - The organisation needs to focus more on relevant engineering specific content.
 - Time spent in engineering versus non-engineering – engineers tend to appreciate time spent in the Engineering Department only after they have been fully appointed. Trainees indicated that the time spent training in the Engineering Department was sufficient; however, appointed engineers indicated that this was not the case. The organisation therefore needs to adjust the distribution of training time spent in the Engineering Department. The time spent in non-engineering departments was satisfactory. In order to transform the existing training programme into a more engineering focussed programme will require a sacrifice of time spent in non-engineering departments. However, this sacrifice is justified by the indicated importance of engineering specific growth with regard to both accelerated development and young engineer retention.
 - The training programme structure leads to higher training efficiency by making the trainee aware of what he or she is trying to achieve and by providing the necessary information to achieve these targets. Eskom's training programme needs to improve on its overall structure in order to include the necessary information for trainees to know what they are working towards (outcomes). Eskom's training programme also needs to provide EITs with guidance as far as accessing sources of information that will assist them in achieving the programme's outcomes. This will be mutually beneficial to both the young engineer and the organisation.
 - Positive response that inclusion of Pr. Eng. / GCC oriented training would improve desire to stay. Evidence of lack thereof was found in Eskom. The engineer training programme and the personal development plan should be built around the requirements of Pr. Eng. and GCC. By including evaluated tasks in the EIT programme that are common to those required for Pr. Eng. or GCC (e.g. Design reports, knowledge of OHS act, application of engineering theory to plant calculations etc.), EITs will be able to achieve the outcomes of internal training while, at the same time, working towards Pr. Eng. or GCC. This is beneficial to the organisation in the long term, and also contributes positively to employee

retention, as indicated by the research data. Furthermore, doing this will add to the growth factor discussed previously, which is an additional driver for improved retention.

➤ Mentorship

- Positive response toward the effect of having a mentor and the desire to have an assigned mentor on the grounds that this would improve the EIT's development as an engineer were both reflected in the data. Having a mentor who is willing to help with work-related, soft skills and personal (self-management) guidance is particularly beneficial in terms of the engineer's development and growth. It is recommended that a mentor be formally assigned in writing to each young engineer entering the organisation. This appointment should initially be on a trial basis (3 months) before becoming permanent. This will allow for incompatibility between the mentor and mentee to become apparent. If there is found to be incompatibility, the mentor-mentee combination should be changed and finalised within the three- month trial period.
- Mentorship should be incentivised. The data reflected that appointed engineers expressed a desire to be mentors on the basis of intrinsic rewards, indicating a level of self-motivation. They (appointed engineers) also indicated that extrinsic rewards would be welcomed. It is proposed that mentorship be built into the engineers' performance appraisal contract (5-10% contributor), and a KPI be assigned to mentorship, linking the mentor with his or her mentee's performance and development.

➤ Measure of preparedness in ability to make engineering decisions

- The data showed that EITs experience low levels of confidence in terms of their ability to make decisions that could affect production, turnover and safety.
- Low level of familiarity with engineering codes (BS, EN, ISO, ASME etc.) and internal company procedures were also reflected in the data.
- The above two issues are linked. Increased focus on relevant codes and standards will ensure that engineers will learn to base decisions on internationally accepted standards, thus ensuring that their decisions are justified.

- Engineers should be taught to understand their role in terms of production versus making the technically and ethically correct decision. Young engineers need to be taught where and how to draw the line (based on recognised codes and standards). The organisation needs to develop a support structure from engineering management team that encourages discussion around a topic before decisions are made. The organisation also needs to focus on teaching young engineers how to justify production losses or risks with technical data and documentation (internal procedures and standards as well as international design codes).
 - A comprehensive list of the internal and external codes, standards and legislation relevant to a young engineer, and relevant for his assigned department or intended future plant system, must be provided to the young engineer within the first week of him joining the organisation, accompanied by a guide of references to where relevant codes, standards and legislation can be found (e.g. BS Online for BS EN design codes available on Eskom licence).
- Psychological drivers for retention in generation Y engineers
- Respectfully challenging or questioning instructions from superiors in an effort to account for as many aspects of a given situation and opinions as possible should be accepted and encouraged.
 - Career development and growth held higher priority than monetary reward or promotion as a driver for retention. Eskom should therefore invest in, and place more emphasis on, the career development of its young engineers.
 - Potential for future opportunities for career growth had a significant influence on the decision to stay in a given organisation or position. The organisation therefore needs to focus on career development.
 - Maintaining a work-life balance had a significant influence on turnover intention. The organisation needs to accept and work around the fact that generation Y engineers value work-life balance. The young engineers of generation Y are demotivated if they are forced to work excessively long hours and this, in turn, increases their desire to leave the organisation. The organisation should focus

on using employees for their qualified function maintaining workloads within reasonable limit for that function.

- Salary and wage level were regarded as important contributors in the desire to remain in a given organisation or position. The organisation should maintain a competitive, market-related salary.
- Trainee young engineers indicated higher levels of fear of losing their jobs when faced with decisions that require a trade-off between engineering good practice/ethics and production/managements opinion than appointed engineers whose response followed more of a normal distribution than a bias toward either positive or negative. For both trainees and appointed engineers, negative bias indicated that fear was not regarded as a good driver for productivity as far as the majority of respondents were concerned. An organisation should not attempt to use fear to drive productivity. It is counter-productive in that, for many, it is seen as a sign of poor leadership and it decreases levels of confidence in terms of decision-making. It increases pressure in a decision making situation and this can negatively influence the decision making process. Finally, it causes a reluctance in making decisions, and this in itself can be time-consuming and costly to the organisation.
- The majority of respondents from both groups believed that the workplace should not be a strictly controlled formal environment where discussion is minimised. A strong positive bias for both groups showed that they believed that open dialogue with colleagues and seniors was a necessary tool for improving productivity. Note that generation Y is a generation that is highly accustomed to discussion regarding any issue. This should be encouraged to foster an environment of open discussion where ideas can be shared, rather than an environment in which one is afraid of being wrong, and therefore ideas are simply not shared.

5.2 Conclusions

This research set out to collect the data necessary for the substantiated development of a management framework for accelerated development and retention of young engineers by using Eskom Holdings SOC LTD as a case study. By analysing the existing training programmes in place at Eskom as well as Sasol, Transnet Pipelines and Transnet Freight Rail as a basis for comparison when analysing the research data, the following objectives were achieved:

A management framework was developed based on experimental data from respondents to surveys performed on appointed and trainee young engineers. This proposed management framework uses the data collected from the research to determine the effectiveness of Eskom's existing training programme. The implementation of existing training programmes was assessed through the research surveys and the proposed framework contains suggestions on how to optimise these training programmes. Recommendations were made in the management framework with regard to young engineer retention. All recommendations made via the proposed management framework (presented in chapter 5.1) were substantiated on the basis of the research data.

In respect of objective 1, to *improve young engineer retention rate thus keeping knowledge and skills in the organisation*, sections 5.1.1 and 5.1.2, which focus on reasons for ex-Eskom engineers' leaving and level of desire, achieved this objective. The contents of section 5.1.3, specifically those areas that focussed on the psychological drivers for retention and the link between training and retention rate supported the fulfilment of research objective 1.

With regard to research objective 2, to *improve the young engineers' readiness and sense of judgement with regard to technical decisions which ultimately effects the performance of the organisation as a whole and improves the engineer's decision making confidence*, as well as objective 3, to *optimise the current EIT training programme by taking into account the factors revealed through this research*, the contents of chapter 5.1.3 achieved these objectives, which then formed part of the management framework. The sections that discussed mentorship and the measure of preparedness in making engineering decisions were particularly relevant in achieving research objectives 2 and 3.

In terms of research objective 4, to *recommend changes that can be made to improve engineer development through analysis of the current management approach that may be contributing negatively to employee retention*, the latter section of chapter 5.1.3 specifically addressed this objective. This section used the psychological drivers for retention in generation Y engineers to determine the working environment and cultures instilled by management that would most positively influence employee retention.

It can therefore be concluded that the research objectives set out in chapter 1.3 were successfully fulfilled. The data collected facilitated the development of a justified management framework that provides a means for the organisation to improve young engineer retention. The data collected also facilitated the inclusion of focal points in the management framework that would improve young engineer readiness for decision-making, which ultimately impacts on the performance of the organisation. This implies acceleration in the development of young engineers in that they are better prepared to make the necessary decisions, with the necessary

justification and confidence, at the earliest post-training stage. The implementation of the abovementioned focal points or key focus areas forms the basis for optimisation of existing training programmes. Attached to the psychological drivers for retention, the current management approach was addressed, which includes the suggestions for development of a working environment which is more conducive to productivity and growth, and consequently, improved young engineer retention.

5.3 Recommendations for further research

Further validation and development of this research would be achieved by implementing the proposed suggestions over a minimum period of two years. The framework should be applied in conjunction with the start of the yearly intake of trainee engineers and be allowed to run for the period of their training, and six months into their careers as appointed engineers (total of 24 months). At that point this research should be revisited. The surveys should be modified as necessary and the experiment conducted again under the same controlled parameters. This will facilitate the evaluation of the effectiveness of the proposed framework, and provide the opportunity for optimisation of the framework.

Based on the feedback received during the validation process, the following should be taken into consideration for future research on the subject:

- Interfacing between departments – research should include questions relating to the extent to which respondents' training provides them with a platform to learn the importance of interfacing between engineering and non-engineering departments. One criticism that was made of the proposed framework is that it is not necessarily that the time spent in engineering is insufficient versus that spent in non-engineering departments during training, but that the focus should be better oriented toward the young engineer knowing what he needs to take away from his time spent in the non-engineering departments. Future research should aim to gauge the extent to which young engineers are able to empathise with, and thus interface with, non-engineering departments when they have to make decisions which affect both parties.
- Feasibility of implementation in Eskom – Future research should take into account and increase focus on the operational challenges of the organisation that may be inhibiting the implementation of training and development initiatives. It was found that feasibility of implementation of this framework was at the time (October 2015) also a point that was open to criticism as at that time the organisation was not freely granting training opportunities on the basis of cost due to financial challenges being faced by Eskom at

the time. This issue should be revisited in the future to determine which operational challenges impact on the training of young engineers; future research should strive to substantiate suggestions that can be put forward on how to work around these challenges.

5.4 Summary of chapter 5

In the final chapter of dissertation, the proposed management framework was presented, along with the conclusions drawn from this research. This chapter also looked at the areas of improvement (limitations) of this research, and put forward recommendations for future research.

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Appendices

Appendix A1: Eskom Ops and GSDP Training Evaluation

ENGINEER IN TRAINING 1st PANEL ASSESSMENT											
Name of Candidate: _____	Learner Advisor: _____										
Unique Number: _____	Assessor Name: _____										
Qualification: _____	Date: _____										
Department / Section: _____	Signature: _____										
Foundational and Applied Competence (Attitudes and Values)					Assessment Guidelines					Rating	
1	Safety Awareness	Ability to: Apply zero tolerance safety	Promotes safety	Assess risks and Hazards	Complies to legislation	Safety topic build into presentation	1	2	3	4	5
2	Communication Skills (Clear, concise and accurate)	Ability to: Generate accurate & meaningful reports	Convey technical concepts clearly	Interact acceptable on an interpersonal level	1	2	3	4	5		
3	Sense of Responsibility (Reliability first)	Display an attitude appropriate with respect to:	Positive	Sense of discipline	Take own responsibility	Acceptance of tasks & challenges	1	2	3	4	5
4	Leadership (The ability to think laterally)	The degree to which the EIT:	Judgement	Shows initiative	Searches for learning opportunities	Shows ability to set an example	1	2	3	4	5
5	Presentation	Presentation skills with reference to:	Focus on immediate goals	Shows appreciative of support	Influence others positively	Display willingness	1	2	3	4	5
			Presenting in a logical sequence	Quality of slides	Corporate Identity	Layout of presentation used	1	2	3	4	5
Technical Knowledge and Skills											
1	Knowledge and understanding of Operating, Plant Philosophies and Specifications	Ability to: Explain the basic principles of Operating	Understand technical concepts clearly	Apply theory and practical knowledge to achieve outputs independently	1	2	3	4	5		
2	Knowledge and understanding of equipment, plant, procedures, processes, standards and documentation.	Display knowledge and understanding with respect to:	Practical training on Plant, Standards, Procedures, Processes	Verify information against approved standards	Find and select relevant information	1	2	3	4	5	
3	Technical Understanding & Impact of business processes	Ability to understand:	Instructions and the theoretical application thereof	Identifying of Plant Components	Drawings	KS Coding	1	2	3	4	5
4	Knowledge and Understanding of Inter- Relationships between Operating, Maintenance and Engineering	Have appreciation for:	Inter-dependency of all departments and the importance of team concept in Eskom's business	How an Engineer's outputs & competencies contribute to the Department's objective & overall Business's performance	Description of specific technology	1	2	3	4	5	
5	Knowledge and understanding of Occurrences within Operating	Display an attitude appropriate with respect to:	The effective and efficient use of lessons learned from work	business practices, plant incidents, safety, plant reliability/availability and customer service	Investigated one or more occurrences	1	2	3	4	5	
6	Problem Solving / Occurrences / Risk Assessments	Ability to:	Identifies & defines problem	Gather and select relevant information using investigations	Verify information against approved standards, legislation etc	1	2	3	4	5	
			Interpretation of results	Evaluate	Use initiative to establish improvement	Answer technical questions with confident					
Awareness											
1	SHEQ	Ability to:	Focus on outcomes and needs	Measures the results according to standards	Applies best practices	Use initiative to establish continuous improvement	1	2	3	4	5
2	Reports (Monthly and Consolidated after completion of 1st phase training)	Display adherence and responsibility to:	Submission of monthly reports	completion of Ops training	Contents based on quality	Signed off by Manager	1	2	3	4	5

- 1 **Poor** Little or no understanding or ability / Cannot work alone or under supervision / Limited theory no practical
- 2 **Fair** Has the understanding and ability but fails to put into practice and to apply the principles / Has the ability to work under supervision
- 3 **Acceptable** Good understanding and ability / Is able to put into practice and apply principles / Work with little supervision / Limited integration of theory and practical
- 4 **Good** Good understanding and ability / Is able to put into practice, apply principles, plan and design / Work with no supervision / Good integration, theory and practical
- 5 **Excellent** Integrates excellent understanding with practical application / Demonstrate applied competence over several conditions / Exceeds standard requirements / Done additional research / Theory and practical beyond expected level

Appendix A2: Eskom Maintenance Training Evaluation

ENGINEER IN TRAINING 2nd PANEL ASSESSMENT																													
Name of Candidate:	Line Manager:	Assessment:	Assessment Period:	Assessment Date:	Location of Assessment:	Learner Advisor:	Signature:	Date:																					
Unique Number:	Assessor:	Date:	Signature:																										
Qualification:																													
Department / Section:																													
Foundational and Applied Competence (Attitudes and Values)					Assessment Guidelines					Rating																			
1	Safety Awareness	Apply zero tolerance	Promotes safety	Assess risks and Hazards	Complies to legislation	Safety topic build into presentation	Apply knowledge on the reason for completing a workers register	1	2	3	4	5																	
2	Communication Skills (Clear, concise and accurate)	Generate accurate & meaningful reports		Convey technical concepts clearly			Interact acceptable on an interpersonal level	1	2	3	4	5																	
3	Sense of Responsibility (Reliability first)	Acceptance of tasks & challenges	Shows ability to set an example	Quality of slides	Possitiveness	Take own responsibility	Sense of discipline	1	2	3	4	5																	
4	Leadership (The ability to think laterally)	Exercising Independent	Influence others positively	Corporate Identity	Focus on immediate goals	Shows	Shows Appreciative of	1	2	3	4	5																	
5	Presentation	Technical Judgement	Presenting in a logical sequence	Layout of presentation	Shows Initiative	Eye Contact	Good Time Involvement Audience	1	2	3	4	5																	
Technical Knowledge and Skills										Assessment Guidelines										Rating									
1	Knowledge and understanding of Maintenance, Plant Philosophies and Specifications	Explain the basic principles of Maintenance	Understand technical concepts clearly	Apply knowledge and skills to practically complete a task				1	2	3	4	5																	
2	Knowledge and understanding of equipment, plant, procedures, fundamental policies, standards and documentation	Verify information against approved standards and Legislation	Dangerous hazards associated with test equipment	Find and select relevant information	Practical training on Plant, Standards, Procedures, Policies & Processes	Focus on	Apply best	1	2	3	4	5																	
3	Technical Understanding & Impact of business systems and processes (Mods, Procurement, Occurance Management)	Instructions and the theoretical application thereof	Description of specific technology	Business's performance	How an Engineer's outputs & competencies contribute to the Department's objective & overall systems	BU needs, Display knowledge, understanding and ability to answer questions related to business		1	2	3	4	5																	
4	Knowledge and Understanding of Inter-Relationships between Ops, Maintenance and Engineering	Inter-dependency of all departments and the impotnacy of team concept in Eskom's business	Apply knowledge and skills of processes associated before performing maintenance task	What's needed before performing Maintenance Tasks	Associate processes with task performed by Maintenance			1	2	3	4	5																	
5	Knowledge and understanding of the Work Management Process	Define Emergency Work	Know how is Emergency Work classified	Apply criteria used to classify Emergency Work for Emergency Work				1	2	3	4	5																	
5.1	Knowledge, understanding and Definition of Emergency Work							1	2	3	4	5																	
5.2	Knowledge and understanding of theoretical and practical plant training in Maintenance	Understand how history is captured and how it can be recalled within Maintenance	Apply knowledge of critical areas to consider and be included on a PM	RPO Process (SAP PM)				1	2	3	4	5																	
6	Knowledge and understanding of SAP Maintenance / SAP History	Apply knowledge and understanding of the spares management process	Apply knowledge and understanding of the difference between minimum and maximum, strategic and critical spares					1	2	3	4	5																	
7	Knowledge and understanding of Spares Management Process	Identifies & defines problem	Gather information	Evaluate information	Interpret results			1	2	3	4	5																	
8	Problem Solving							1	2	3	4	5																	

Awareness		Assessment Guidelines					Rating				
1	Quality Awareness ("Do it right the first time")	Ability to: <i>Display knowledge and understanding to:</i>	Focus on outcomes and needs Complies to Business ethics	Measures the results according to standards Define and Adherence to PFMA measures	Applies best practices Understand the commercial processes	Use initiative to establish continuous improvement Adhere to commercial processes	1	2	3	4	5
2	Financial Awareness ("Add value cost effectively")						1	2	3	4	5

- 1 **Poor** Little or no understanding or ability / Cannot work alone or under supervision / Limited theory no practical
- 2 **Fair** Has the understanding and ability but fails to put into practice and to apply the principles / Has the ability to work under supervision
- 3 **Acceptable** Good understanding and ability / Is able to put into practice and apply principles / Work with little supervision / Limited integration of theory and practical
- 4 **Good** Good understanding and ability / Is able to put into practice, apply principles, plan and design / Work with no supervision / Good integration, theory and practical
- 5 **Excellent** Integrates excellent understanding with practical application / Demonstrate applied competence over several conditions / Exceeds standard requirements / Done additional research / Theory and practical beyond expected level

Questions:	Correct Answer	
	YES	NO

Feedback of Learner's overall performance / assessment

PRESENTATION	
TECHNICAL	
CHALLENGES AND / OR PROPOSALS	

Appendix A3: Eskom Engineering Training Evaluation

ENGINEER IN TRAINING 3rd AND FINAL PANEL ASSESSMENT

Name of Candidate: _____ Line Manager Name: _____ Learner Advisor: _____
 Unique Number: _____ Assessor Name: _____ Signature: _____
 Qualification: _____ Date: _____ Date: _____
 Department / Section: _____ Signature: _____

Foundational and Applied Competence (Attitudes and Values)

		Assessment Guidelines				Rating						
1	Safety Awareness	Ability to:	Promotes safety	Apply zero tolerance	Assess risks and Hazards	Complies to legislation	Safety topic build into presentation	1	2	3	4	5
2	Communication Skills (Clear, concise and accurate)	Ability to:	Generate accurate & meaningful reports	Convey technical concepts clearly	Interact acceptable on an interpersonal level			1	2	3	4	5
3	Sense of Responsibility (Reliability first)	Display an attitude appropriate with respect to:	Sense of discipline	Take own responsibility	Acceptance of tasks & challenges			1	2	3	4	5
4	Leadership (The ability to think laterally)	The degree to which the EIT:	Judgement	Shows initiative	Shows ability to set an example	Searches for learning opportunities	Shows willingness	1	2	3	4	5
5	Presentation	Presentation skills with reference to:	Focus on immediate goals	Quality of slides	Layout of presentation	Influence others positively	Information used	1	2	3	4	5

Technical Knowledge and Skills

1	Knowledge and understanding of Engineering, Designs, Drawings, Plant Philosophies and Specifications.	Ability to:	Explain the basic principles of Engineering	Understand technical concepts clearly	Apply theory and practical knowledge to achieve outputs independently			1	2	3	4	5
2	Knowledge and understanding of equipment, plant, procedures, processes, configuration and standards	Display knowledge and understanding with reference to:	Plant, Standards, Procedures, Processes	Verify information against approved standards	Find and select relevant information			1	2	3	4	5
3	Technical Understanding & Impact of business processes as well as Inter- Relationships between Ops, Maintenance, Engineering and the integration of all non-technical departments and Projects & Outages	Ability to understand and appreciation for:	Instructions and the theoretical application thereof	How an Engineer's outputs & competencies contribute to the Department's objective & overall Business's performance	To apply best practices			1	2	3	4	5
4	Business Processes (Molds, Procurement, Configuration, etc)	Display knowledge, understanding and Ability to:	Answer questions related to Business processes	Apply knowledge to Occurance Management (INOS)	Corrective Action			1	2	3	4	5
5	Problem Solving, Risk Assessments, Investigations, Research & Testing	Have the ability to:	Identifies & defines problem	Conducts investigations	Engineering principles	Research, Test and Evaluate information using accepted Engineering principles	Interpretation of results	1	2	3	4	5
6	Plant Life Cycle (Plant and/or Project Responsibility)	Ability to:	Apply theory and practical knowledge and skills to achieve outputs independently	Understand and apply technical concepts clearly by using the basic principles of Engineering				1	2	3	4	5
7	Generation Technical Life Cycle Management	Ability to:	Understand the balance between Technical Effectiveness and Acceptable Cost within time constraints	Exercising Independent Technical Judgement				1	2	3	4	5

Awareness

1	Quality Awareness ("Do it right the first time")	Ability to:	Focus on outcomes and needs	Measures the results according to standards	Use initiative to establish continuous improvement			1	2	3	4	5
2	Financial Awareness ("Add value cost effectively")	Display adherence and responsibility to:	Complies to Business ethics	Adhere to PFMA	Take cost effective measures			1	2	3	4	5

- 1 **Poor** Little or no understanding or ability / Cannot work alone or under supervision / Limited theory no practical
- 2 **Fair** Has the understanding and ability but fails to put into practice and to apply the principles / Has the ability to work under supervision
- 3 **Acceptable** Good understanding and ability / Is able to put into practice and apply principles / Work with little supervision / Limited integration of theory and practical
- 4 **Good** Good understanding and ability / Is able to put into practice, apply principles, plan and design / Work with no supervision / Good integration, theory and practical
- 5 **Excellent** Integrates excellent understanding with practical application / Demonstrate applied competence over several conditions / Exceeds standard requirements / Done additional research / Theory and practical beyond expected level

Correct Answer	Correct Answer	
	YES	NO
Feedback of learner's overall performance / assessment:		
PRESENTATION		
TECHNICAL		
CHALLENGES AND / OR PROPOSALS		

Appendix B1: Questionnaire 1 (Engineering Trainees)

Thank you for taking the time to participate in my survey!

The data collected here will be used to develop a management framework to improve young engineer retention and training.

In the early stages of our engineering careers, the quality of development programs and training play a major role in the rate at which we develop as engineers, ultimately affecting our career progression.

Management of large corporate entities, where many engineers start out, don't have the time to be consumed by personally training their new recruits, or are simply too tied up in operational and financial challenges to commit to training.

My goal is to develop a framework to be applied in such organisations, that takes into account the organisational challenges and works around them by focus on key areas relevant to engineers to improve the companies retention of engineers and simultaneously improve the quality of the training offered to young engineers, ultimately aiming to improve their sense of engineering judgment and boost their confidence in the decisions they have to make.

* 1. Please provide the organisation/company name of your current employer. (at minimum please state

whether it is Eskom or non-Eskom)

- Eskom
- Sasol
- Transnet - Pipelines
- Transnet - Freight Rail
- Other (please specify)

* 2. Indicate the Eskom division to which you are currently assigned. (ie. Generation, Sustainability, COE etc)

* 3. Is your current employment site based or office based. (If site based, please describe nature of site eg.

power station, refinery etc. (compulsory) and name of site (optional).

- Head office
- Satellite office
- Site (please specify)

4. How old are you (years)?

* 5. Please select all tertiary level qualifications held by you currently. (Multiple response allowed)

- BEng/BSc Engineering
- MEng/MSc Engineering
- BTech
- Other (please specify)

6. Please select the engineering discipline in which you are qualified.

- Mechanical
- Chemical/Process
- Electrical
- Electronic
- Computer/Software
- Civil
- Industrial
- Other (please specify)

* 7. Choose the option which best describes the nature of your job or the job which you are currently

training for.

- Design Engineering
- Maintenance Engineering
- Other (please specify)

* 8. How many months of post-qualification experience in an engineering position (including training) do you possess?

9. What is your current job title?

10. Briefly describe your intended job function (the job for which you are currently training).

* 11. Were you at any point in time in the past, employed by Eskom in an engineering related role?

- Yes, but am no longer an Eskom employee
- No
- Yes, currently employed by Eskom

* 12. What was the most dominant reason for you leaving Eskom?

- Better financial reward
- Better training opportunities
- Better potential for career development/advancement
- Better working culture/environment
- Family responsibility
- Other (please specify)

* 13. Are you bound to working for your current employer due to repayment of a bursary, scholarship or other such debt owed?

- Yes
- No

* 14. Being bound by repayment, indicate your level of willingness or desire to leave your current organisation, despite requiring to pay back the monies owed, if an opportunity with perceived better quality training program, were presented to you.

100% Desire /willing to leave regardless of consequences

-
- Desire /willing to leave but 50% of the decision would be swayed by obligation to repay
- Neutral (I don't want to leave)
- Desire /willing to leave but 75% of the decision would be swayed by obligation to repay
- Desire/willing to leave but will not due to obligation to repay

* 15. Not bound by repayment, indicate your level of desire to leave your current position if the opportunity to join a perceived better training program were to arise.

- Very high
- High
- Neutral
- Low
- Very low

* 16. Would you be willing to accept a reasonable reduction in salary in exchange for a position in another organisation which offers a better training program?

- Yes
- No

* 17. Is your current job/training program reflective of, and aligned to the field of study in which you are qualified?

- Highly aligned/reflective of my qualified field of study (100% focused on my field, 0% focus on fields other than my own)
- Moderately aligned/reflective of my qualified field of study (75% focused on my field, 25% focus on fields other than my own)
- Neutral (50% focused on my field, 50% focus on fields other than my own)
- Moderately not aligned/reflective of my qualified field of study (25% focused on my field, 75% focus on fields other than my own)
- Highly not aligned/reflective of my qualified field of study (0% focused on my field, 100% focus on fields other than my own)

* 18. Rate your level of job satisfaction based on your enthusiasm/willingness to be at work.

-
- Very high (I am excited to go to work every morning)
- High
- Neutral/Medium (I go to work because I have to)
- Low

Very low (I hate my working environment , and would be better off working somewhere else)

* 19. Please indicate to whom (company/organisation) the following questions regarding your training will apply (company name preferable, however at minimum please indicate Eskom or non-Eskom):

- Eskom
- Sasol
- Transet - Pipelines
- Transet - Freight Rail
- Other (please specify)

* 20. Indicate Eskom division to which your answers regarding training shall apply. (ie. Gx, COE, Sustainability etc.)

* 21. What is the planned maximum duration of your training program (months)?

* 22. Do you feel that by the end of your training period you will be equipped with the tools to do your intended future job based on the quality of training received thus far?

- 100% Equipped with the necessary tools for by job
- 75% Equipped with the necessary tools for by job
- 50% Equipped with the necessary tools for by job
- 25% Equipped with the necessary tools for by job
- 0% Equipped with the necessary tools for by job

* 23. Are you receiving relevant training that will benefit you in your engineering career in your current company?

- 100% relevant to career development in my current company
- 75% relevant to career development in my current company
- 50% relevant to career development in my current company
- 25% relevant to career development in my current company
-

0% relevant to career development in my current company

* 24. Are you receiving relevant training that will benefit you in your engineering career if you were to move to another company?

- 100% relevant for use in career development at a company other than my current employer
- 75% relevant for use in career development at a company other than my current employer
- 50% relevant for use in career development at a company other than my current employer
- 25% relevant for use in career development at a company other than my current employer
- 0% relevant for use in career development at a company other than my current employer

* 25. Do you feel that an improved training program would increase your desire to stay in your current organisation?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 26. Do you feel that your current training focuses on sufficient content that is/will be applicable to you as an engineer?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 27. Do you feel that the time spent training in the engineering department is:

- Significantly too short
- Too short
- Perfect
- Too long
- Extensively long

* 28. Do you feel that the time spent training in with the on-engineering departments is:

- Significantly too short
- Too short
- Perfect
- Too long
- Extensively long

* 29. Do you feel you that your current training program is well structured?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 30. Are you fully aware of the expectations and outcomes expected of you in your training program?

- Strongly agree (Fully aware)
- Agree (75% aware, 25% unsure)
- Neutral (50% aware, 50% unsure)
- Disagree (25% aware, 75% unsure)
- Strongly disagree (0% aware, 100% unsure)

* 31. Do you know what to do and where to get relevant information to fulfil the outcomes and expectations of your training program?

- Strongly agree (Fully aware)
- Agree (75% aware, 25% unsure)
- Neutral (50% aware, 50% unsure)
- Disagree (25% aware, 75% unsure)
- Strongly disagree (0% aware, 100% unsure)

* 32. Is your current training program oriented to assist and guide you toward Pr. status or GCC?

- Strongly agree (Training program assists and guides toward Pr. Status/GCC)
- Agree
- Neutral
-
-

Disagree

Strongly disagree (Training program does not assist or guide toward Pr. Status/GCC in any way)

* 33. If your training program were more aligned to assisting you in attaining Pr. Status/GCC would you be more encouraged to stay in your current organisation?

- Strongly agree (Yes, it would encourage me to stay)
- Agree
- Neutral (It would have no influence over my decision to leave/stay)
- Disagree
- Strongly disagree (No, I would leave regardless)

* 34. Do you have an assigned mentor/coach?

- Yes, I have had a formally appointed mentor/coach from the beginning of my training
- Yes, I have had a mentor/coach from the beginning of my training, not formally appointed
- Neutral, anyone in my department helps me (on informal basis) when I ask
- No, at no time did I have a dedicated mentor

* 35. Do/Did you feel comfortable approaching your mentor with work related questions/challenges in an effort to learn?

- Strongly agree (100% comfortable, no hesitation to ask at any time)
- Agree
- Neutral
- Disagree
- Strongly disagree (100% hesitant to ask)

* 36. Do/Did you feel comfortable approaching your mentor with career development and soft skills (conduct, how to deal with co-workers, stress etc.) or personal related questions/challenges in an effort to learn/develop?

- Strongly agree (100% comfortable, no hesitation to ask at any time)
- Agree
- Neutral
- Disagree
-

Strongly disagree (100% hesitant to ask)

* 37. Does/Did your mentor provide good quality and useful advice/guidance in response to your inquiries?

- Very good/useful
- Good/useful
- Neutral
- Poor/little use
- Very poor/useless

* 38. Do/Did you feel that the guidance provided by your mentor/coach has/had a positive influence on your development and growth as an engineer?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 39. Do you feel that you would benefit from having the guidance of a dedicated mentor?

-
- Strongly agree
- Agree
- Neutral
- Disagree

Strongly disagree

* 40. Rate the extent to which you believe that you should respectfully challenge/question instructions given by superiors in effort to take into consideration as many views as possible in a situation.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree



* 41. Rate the importance to you, of career development and growth, against monetary reward or promotion.

Growth and development 100%, monetary reward or promotion 0%

Growth and development 75%, monetary reward or promotion 25%

Growth and development 50%, monetary reward or promotion 50%

Growth and development 25%, monetary reward or promotion 75%

Growth and development 0%, monetary reward or promotion 100%

* 42. With regard to acceptance of a new position, or continuation in your current position, rate the importance of future opportunities for career growth in your decision to accept/remain in said position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 43. With regard to acceptance of a new position, or continuation in your current position rate the importance of work-life balance in your decision to accept/remain in said position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 44. With regard to acceptance of a new position, or continuation in your current position rate the importance of salary/wage level in your decision to accept/remain in said position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 45. Rate the extent to which you fear losing your current job, when faced with difficult engineering decisions that require a trade-off between engineering good practice/ethics and production/managements opinion.

- Very high (Highly intimidated by possibility of losing my job)
- High
- Neutral/Medium
- Low
- Very low (Not at all intimidated as I believe that I will find another or other reason)

* 46. Do you believe that fear is a good motivator for productivity?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 47. Rate the extent to which you believe that the work place should be a strictly controlled formal environment where discussion is minimised

- Strongly agree (Strict, minimal open dialogue over issues)
- Agree
- Neutral
- Disagree
- Strongly disagree (Relaxed, abundance of open dialogue over issues)

* 48. Rate the extent to which you believe open dialogue with colleagues and seniors is a necessary tool to improve productivity.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 49. Based on the training/experience you have accrued thus far, rate your level of confidence in making decisions that have the potential majorly affect company production and turnover, for which you will be held responsible.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 50. Based on the training/experience you have accrued thus far, rate your level of confidence in making decisions that have the potential to majorly affect safety of workers in your work environment, for which you will be held responsible.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 51. Rate your level of familiarity with the engineering codes (BS, EN, ISO, ASME etc.) relevant to your plant or current position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 52. Do you feel that through training/experience accrued thus far, you are fully aware of, and familiar with all the internal company procedures that are applicable to you as an engineer.

- Very high
- High
-
-
-

Neutral/Medium

Low

Very low



Your time is greatly appreciated!

Appendix B2: Questionnaire 2 (Appointed Engineers)

Thank you for taking the time to participate in my survey!

The data collected here will be used to develop a management framework to improve young engineer retention and training.

In the early stages of our engineering careers, the quality of development programs and training play a major role in the rate at which we develop as engineers, ultimately affecting our career progression.

Management of large corporate entities, where many engineers start out, don't have the time to be consumed by personally training their new recruits, or are simply too tied up in operational and financial challenges to commit to training.

My goal is to develop a framework to be applied in such organisations, that takes into account the organisational challenges and works around them by focusing on key areas relevant to engineers to improve the companies retention of engineers and simultaneously improve the quality of the training offered to young engineers, ultimately aiming to improve their sense of engineering judgment and boost their confidence in the decisions they have to make.

- * 1. Please provide the organisation/company name of your current employer. (at minimum please state whether it is Eskom or non-Eskom, however company name is preferable)

- Eskom
- Sasol
- Transnet - Pipelines
- Transnet - Freight rail
- Other (please specify)

- * 2. Indicate Eskom division to which you are currently assigned. (ie. Generation, sustainability etc.)

* 3. Is your current employment site based or office based. (If site based, please describe nature of site eg.

power station, refinery etc. (compulsory) and name of site (optional).

- Head office
- Satellite office
- Site (please specify)

4. How old are you (years)?

* 5. Please select all tertiary level qualifications held by you currently. (Multiple response allowed)

- BEng/BSc Engineering
- MEng/MSc Engineering
- BTech
- Other (please specify)

6. Please select the engineering discipline in which you are qualified.

- Mechanical
- Chemical/Process
- Electrical
- Electronic
- Computer/Software
- Civil
- Industrial
- Other (please specify)

* 7. Do you currently possess any of the following registrations/accreditation? (Multiple response

permitted)

- Pr. Eng.
- Pr. Cert. Eng.
- Pr. Tech. Eng
- GCC (Government Certificate of Competency)
- ECSA Candidate Engineer
- Other - ECSA Accredited (please specify)

* 8. Choose the option which best describes the nature of your job.

- Design Engineering
- Maintenance Engineering
- Other (please specify)

* 9. Please indicate the number of years and months of post qualification experience in an engineering inclusive of related position you have, your time as a trainee.

Years

Months

10. What is your current job title?

11. Briefly describe your job function.

* 12. Were you at any point in time, employed by Eskom in an engineering related role?

- Yes, but I have since left Eskom
- No
- Yes, currently still employed by Eskom

* 13. What was the most dominant reason for you leaving Eskom?

- Better financial reward
- Better training opportunities
- Better potential for career development/advancement
- Better working culture/environment
- Family responsibility
- Other (please specify)

* 14. Are you bound to working for your current employer due to repayment of a bursary, scholarship or other such debt owed?

- Yes
- No

* 15. Being bound by repayment, indicate your level of willingness or desire to leave your current organisation, despite requiring to pay back the debt owed, if an opportunity with a company with perceived better quality training program/development plan were presented to you.

- 100% Desire /willing to leave regardless of consequences
- Desire /willing to leave but 50% of the decision would be swayed by obligation to repay
- Neutral (I don't want to leave)
- Desire /willing to leave but 75% of the decision would be swayed by obligation to repay
- Desire/willing to leave but will not due to obligation to repay

* 16. Being bound by repayment, indicate your level of willingness or desire to leave your current organisation, despite requiring to pay back the debt owed, if an opportunity with a company with prospect of better engineering experience, were presented to you.

- 100% Desire /willing to leave regardless of consequences
- Desire /willing to leave but 50% of the decision would be swayed by obligation to repay
- Neutral (I don't want to leave)
- Desire /willing to leave but 75% of the decision would be swayed by obligation to repay
- Desire/willing to leave but will not due to obligation to repay

* 17. Not bound by repayment, indicate your level of desire to leave your current position if the opportunity to join a company with perceived better training program/development plan were to arise.

- Very high
- High
- Neutral
- Low
- Very low

* 18. Not bound by repayment, indicate your level of desire to leave your current position if the opportunity to join a company with the prospect of better engineering experience were to arise.

-
- Very high
- High
- Neutral
- Low

Very low

* 19. Would you be willing to accept a reasonable reduction in salary in exchange for a position in another organisation which offers better training/development opportunities?

- Yes
- No

* 20. Would you be willing to accept a reasonable reduction in salary in exchange for a position in another organisation which offers better engineering experience?

- Yes
- No

* 21. Is your current job function reflective of, and aligned to the field of study in which you are qualified?

- Highly aligned/reflective of my qualified field of study (100% focused on my field, 0% focus on fields other than my own)
- Moderately aligned/reflective of my qualified field of study (75% focused on my field, 25% focus on fields other than my own)
- Neutral (50% focused on my field, 50% focus on fields other than my own)
- Moderately not aligned/reflective of my qualified field of study (25% focused on my field, 75% focus on fields other than my own)
- Highly not aligned/reflective of my qualified field of study (0% focused on my field, 100% focus on fields other than my own)

* 22. Rate your level of job satisfaction based on your enthusiasm/willingness to be at work.

- Very high (I am excited to go to work every morning)
- High
- Neutral/Medium (I go to work because I have to)
- Low
- Very low (I hate my working environment , and would be better off working somewhere else)

The following questions relate to your time as an engineering trainee. If you were a trainee with Eskom at any point in time but have since left, please answer the training related questions based on your time as an Eskom employee.

* 23. Indicate the company/organisation with which you participated in an engineering training program to which the following questions will apply (Company name preferable, minimum indication of Eskom or non-

Eskom)

- Eskom
- Sasol
- Transnet - Pipelines
- Transnet - Freight Rail
- Other (please specify)

* 24. Indicate the Eskom division in which you participated in an engineering training program, to which the following questions will apply (ie. Gx, COE, Sustainability etc.)

* 25. Was the majority of your training site or office based? (If site based, please indicate nature of site

[compulsory] and name [optional])

- Head office
- Satellite office
- Site (please specify eg. Power station - Grootvlei)

* 26. What was the duration of your training program (months)?

* 27. Was your training reflective of, and aligned to the field of study in which you are qualified?

own)

Highly aligned/reflective of my qualified field of study (100% focused on my field, 0% focus on fields other than my own)

Moderately aligned/reflective of my qualified field of study (75% focused on my field, 25% focus on fields other than my own)

Neutral (50% focused on my field, 50% focus on fields other than my own)

Moderately not aligned/reflective of my qualified field of study (25% focused on my field, 75% focus on fields other than my

Highly not aligned/reflective of my qualified field of study (0% focused on my field, 100% focus on fields other than my own)

* 28. Do you feel that by the end of your training period you were equipped with the tools to do your intended job based on the quality of training received?

100% Equipped with the necessary tools for my job

75% Equipped with the necessary tools for my job

50% Equipped with the necessary tools for my job

25% Equipped with the necessary tools for my job

0% Equipped with the necessary tools for my job

* 29. Did you receive relevant training that will benefit you in your engineering career in your current company?

100% relevant to career development in my current company

75% relevant to career development in my current company

50% relevant to career development in my current company

25% relevant to career development in my current company

0% relevant to career development in my current company

* 30. Did you receive relevant training that will benefit you in your engineering career if you were to move to another company?

100% relevant for use in career development at a company other than my current employer

75% relevant for use in career development at a company other than my current employer

50% relevant for use in career development at a company other than my current employer

25% relevant for use in career development at a company other than my current employer

0% relevant for use in career development at a company other than my current employer

-
-
-
-
-
-
-
-
-

* 31. Do you feel that an improved training program/development plan would increase your desire to stay in your current organisation?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 32. Do you feel that your training focused on sufficient content that is/will be applicable to you as an engineer?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 33. Do you feel that the time spent training in the engineering department was:

- Significantly too short
- Too short
- Perfect
- Too long
- Extensively long

* 34. Do you feel that the time spent training in the on-engineering departments was:

- Significantly too short
- Too short
- Perfect
- Too long
- Extensively long

* 35. Do you feel you that your training program was well structured?

Strongly agree

Agree

-
-
- Neutral
- Disagree
- Strongly disagree

* 36. Were you fully aware of the expectations and outcomes expected of you in your training program?

- Strongly agree (Fully aware)
- Agree (75% aware, 25% unsure)
- Neutral (50% aware, 50% unsure)
- Disagree (25% aware, 75% unsure)
- Strongly disagree (0% aware, 100% unsure)

* 37. Did you know what to do and where to get relevant information to fulfil the outcomes and expectations of your training program?

- Strongly agree (Fully aware)
- Agree (75% aware, 25% unsure)
- Neutral (50% aware, 50% unsure)
- Disagree (25% aware, 75% unsure)
- Strongly disagree (0% aware, 100% unsure)

* 38. Was your training program oriented toward assisting you in attaining Pr. status/GCC?

- Strongly Agree (Training program significantly assisted/guided toward Pr. status/GCC)
- Agree
- Neutral
- Disagree
- Strongly Disagree (Training program did not assist/guide toward Pr. status/GCC at all)

* 39. If your training program, and thereafter, development program were more aligned to assisting you in attaining Pr. Status/GCC would you be more encouraged to stay in your current organisation?

- Strongly agree (Yes, it would encourage me to stay)
- Agree
-
-
-

Neutral (It would have no influence over my decision to leave/stay)

Disagree

Strongly disagree (No, I would leave regardless)

- * 40. Do you have an assigned mentor/coach?
- Yes, I have had a formally appointed mentor/coach from the beginning of my training
 - Yes, I have had a mentor/coach from the beginning of my training, not formally appointed
 - Neutral, anyone in my department helps me (on informal basis) when I ask
 - No, at no time did I have a dedicated mentor
- * 41. Do/Did you feel comfortable approaching your mentor with work related questions/challenges in an effort to learn?
- Strongly agree (100% comfortable, no hesitation to ask at any time)
 - Agree
 - Neutral
 - Disagree
 - Strongly disagree (100% hesitant to ask)
- * 42. Do/Did you feel comfortable approaching your mentor with career development and soft skills (conduct, how to deal with co-workers, stress etc.) or personal related questions/challenges in an effort to learn/develop?
- Strongly agree (100% comfortable, no hesitation to ask at any time)
 - Agree
 - Neutral
 - Disagree
 - Strongly disagree (100% hesitant to ask)
- * 43. Does/Did your mentor provide good quality and useful advice/guidance in response to your inquiries?
- Very good/useful
 - Good/useful
 - Neutral
 - Poor/little use
 -

Very poor/useless

* 44. Do/Did you feel that the guidance provided by your mentor/coach has/had a positive influence on your development and growth as an engineer?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 45. Do you feel that you would benefit from having the guidance of a dedicated mentor?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 46. Are you a mentor/coach to another engineer, young engineer or trainee?

- Yes
- No

* 47. As a mentor/coach, rate your drive to teach based on intrinsic reward (eg. Feeling of fulfilment, personal reward, meaning, own satisfaction etc.)

- Very High
- High
- Neutral/Medium
- Low
- Very low

* 48. As a mentor/coach, rate your drive to teach based on extrinsic reward (eg. Tangible rewards, money, bonus, pay raise etc.)

- Very High
- High
-
-
-

Neutral/Medium

Low

Very low

- * 49. Not currently a mentor/coach, rate your level of willingness to teach based on intrinsic reward (eg. Feeling of fulfilment, personal reward, meaning, own satisfaction etc.) if you were to be appointed as a mentor/coach.

- Very High
- High
- Neutral/Medium
- Low
- Very low

- * 50. Not currently a mentor/coach, rate your willingness to teach based on extrinsic reward (eg. Tangible rewards, money, bonus, pay raise etc.) if you were to be appointed as a mentor/coach.

- Very High
- High
- Neutral/Medium
- Low
- Very low

- * 51. Rate the extent to which the quality of training offered affects/effected your desire to stay in the organisation.

- Very high
- High
- Neutral/Medium
- Low
- Very low

- * 52. Rate the extent to which you believe that you should respectfully challenge/question instructions given by superiors in effort to take into consideration as many views as possible in a situation.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 53. Rate the importance to you, of career development and growth, against monetary reward or promotion.

- Growth and development 100%, monetary reward or promotion 0%
- Growth and development 75%, monetary reward or promotion 25%
- Growth and development 50%, monetary reward or promotion 50%
- Growth and development 25%, monetary reward or promotion 75%

Growth and development 0%, monetary reward or promotion 100%

* 54. With regard to acceptance of a new position, or continuation in your current position, rate the importance of future opportunities for career growth in your decision to accept/remain in said position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 55. With regard to acceptance of a new position, or continuation in your current position rate the importance of work-life balance in your decision to accept/remain in said position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

* 56. With regard to acceptance of a new position, or continuation in your current position rate the importance of salary/wage level in your decision to accept/remain in said position.

Very high

-
- High
- Neutral/Medium
- Low
- Very low

* 57. Rate the extent to which you fear losing your current job, when faced with difficult engineering decisions that require a trade-off between engineering good practice/ethics and production/managements opinion.

- Very high (Highly intimidated by possibility of losing my job)
- High
- Neutral/Medium
- Low
- Very low (Not at all intimidated as I believe that I will find another or other reason)

* 58. Do you believe that fear is a good motivator for productivity?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* 59. Rate the extent to which you believe that the work place should be a strictly controlled formal environment where discussion is minimised

- Strongly agree (Strict, minimal open dialogue over issues)
- Agree
- Neutral
- Disagree
- Strongly disagree (Relaxed, abundance of open dialogue over issues)

* 60. Rate the extent to which you believe open dialogue with colleagues and seniors is a necessary tool to improve productivity.

- Strongly agree
- Agree
- Neutral
-
-

Disagree

Strongly disagree

- * 61. Based on the training/experience gained from your training program, rate your level of confidence in making decisions that have the potential to majorly affect company production and turnover, for which you will be held responsible.

- Very high
- High
- Neutral/Medium
- Low
- Very low

- * 62. Based on the training/experience gained from your training program, rate your level of confidence in making decisions that have the potential to majorly affect safety of workers in your work environment, for which you will be held responsible.

- Very high
- High
- Neutral/Medium
- Low
- Very low

- * 63. Rate your level of familiarity with the engineering codes (BS, EN, ISO, ASME etc.) by the time you had completed your engineer training program, relevant to your plant or current position.

- Very high
- High
- Neutral/Medium
- Low
- Very low

- * 64. Do you feel that upon completion of your engineer training program, you were fully aware of, and familiar with all the internal company procedures that are applicable to you as an engineer necessary for you to do your job?

- Very high
- High
-
-
-

Neutral/Medium

Low

Very low



Your time is greatly appreciated!

Appendix C1: Proposed management framework

Management Framework for Accelerated Development and Retention of Young Engineers

**By
Neolen Pillay**

November 2015

It all starts here™



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

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1. Introduction

1.1 Purpose

This framework was conceived in response to the decreasing retention rate of young engineers in Eskom. The loss of critical skills has substantial production and financial implications for the organisation therefore a framework was developed to optimise the manner in which the organisation's existing training programs are implemented with the aim of improving the rate at which young engineers develop in terms of knowledge of engineering standards, knowledge of internal procedures and the ability to make decisions under pressure with confidence justified by industry standards. The framework further strives to improve young engineer retention by revealing focal points that influence productivity and retention in generation-y engineers.

The recommendations proposed in the framework are based on experimental data gathered, analysed and presented in the mini dissertation "*A Management Framework for Accelerated Development and Retention of Young Engineers: Eskom as a Case Study*" by Neolen Pillay in partial fulfilment of the requirements for the degree Master of Engineering in Development and Management at the Potchefstroom Campus of the North-West University.

1.2 Applicability

This document is applicable to any and all persons employed by Eskom Holdings SOC Limited in an engineering department, or persons holding a tertiary level qualification in engineering (BSc Engineering, BEng or BTech) currently employed by Eskom Holdings SOC Limited inclusive of trainees, appointed engineers and engineering departmental managers.

Note: The masculine gender shall refer to and include the feminine gender and vice versa throughout the entirety of this document.

2. Abbreviations

BEng – Bachelor of Engineering

BSc – Bachelor of Science

BTech – Bachelor of Technology

ECSA – Engineering council of South Africa

EIT – Engineer In Training

GCC – Government Certificate of Competency

OHS – Occupational Health and Safety

Pr. Eng – Professional Engineer registered with ECSA

3. Management Framework for Accelerated Development and Retention of Young Engineers

3.1 Ex-Eskom Engineers – Reasons for Leaving

Based on data collected from engineers who have left Eskom's service the training of engineers should be aligned to promote career advancement within the organisation. This shall be achieved by involvement of the young engineer's line manager from the start of his career in the organisation. His (internal to organisation) career progression options should be visually presented in a document and his intentions discussed. Training shall thereafter be structured in a biased manner so as to work toward the individual's long term aspirations. This will keep the young engineer motivated, knowing that his organisation is actively involved in his growth.

3.2 Desire to Leave

Data regarding the engineers' desire to leave their current organisation (turnover intention) took into account aspects including willingness to leave despite reduction in salary, willingness to leave despite contractual obligation and whether the prospect of improved training or development programs influenced the engineers' desire to leave.

The data revealed that contractual obligation was an inhibiting factor for young engineers, keeping them in their organisation until such a time as they were free to leave at which juncture the data reflected a desire to leave in exchange for improved training and development opportunities, despite facing the possibility of salary reduction.

Recommendation: Invest in improving the training opportunities within the organisation. Use existing assets (appointed engineers), to share knowledge and create a learning environment for young engineers. Development as an engineer has been proven to be of great value to current young engineers hence it should be emphasised more in the organisation.

It must be noted that research data showed a positive response regarding job satisfaction amongst young engineers despite organisational challenges thus there exists the opportunity for this proposal to be successful as engineer moral remains positive, increasing the probability of success.

3.3 Rate of Development

The data collected showed that the following aspects (focal points) were areas that could be improved on in Eskom. Emphasis on these points will contribute positively to young engineer development and retention as indicated by the research data collected.

3.3.1 Relevance of Contents of Training Program

Training needs to be relevant to the engineers' career progression in the organisation and externally. The relevance of the content of the current training program needs to increase thus nurturing a feeling of growth. Turnover intention may be inevitable, however extracting the most that an organisation can whilst an employee is with them is the most fruitful course of action for any organisation. An engineer who feels that they are growing is more likely to stay, or at minimum give off higher productivity, than one who feels the training or work he is doing is futile.

3.3.2 Link Between improved Training Program and Desire to Stay

- Amongst young engineers there was a positive link between improved training and desire to remain in current organisation
- More focus should be placed on engineering relevant content
- Time spent in engineering versus non-engineering – Engineers tend to appreciate time spent in engineering department only after appointment. Trainees indicated that the time spent training in engineer department was sufficient however appointed engineers indicated that it was not. Therefore distribution of time spent in engineering department adjustment should be made. Time spent in non-engineering departments was satisfactory as is. In order to transform the existing training program into a more engineering focussed program will require sacrifice of time spent in non-engineering departments however this is justified by the indicated importance of engineering specific growth with regard to both accelerated development and young engineer retention.
- Training program structure leads to higher training efficiency by making trainee aware of what he is trying to achieve and providing the necessary information to achieve those targets. Eskom's training program should seek to improve the overall structure of the program to include the necessary information for trainees to know what they are working toward (outcomes) as well as provide them with the guidance toward the sources of information that will assist in achieving the outcomes. This will be mutually beneficial to the young engineer and organisation alike.

- There as a positive response that inclusion of Pr. Eng / GCC oriented training would improve desire to stay. Evidence of lack thereof was found in Eskom. The engineer training program and thereafter, personal development program should be built around the requirements of Pr. Eng and GCC. By including evaluated tasks in the EIT program that are common to those required for Pr. Eng or GCC (Eg. Design reports, knowledge of OHS act, application of engineering theory to plant calculations etc.) the young engineer would be achieving the outcomes of his internal training whilst simultaneously working toward Pr. Eng or GCC. This is beneficial to the organisation in the long term, and also contributes positively to employee retention as indicated by the data collected. Furthermore this adds to the growth factor discussed previously, which is an additional driver for improved retention.

3.3.3 Mentorship

- Positive response toward the effect of having a mentor as well as the desire to have an assigned mentor on the basis of improved development as an engineer was reflected in the collected data. Having a mentor who is willing to help with work related, soft skill and personal (self-management) guidance is most beneficial in terms of development any growth as an engineer. It is recommended that a mentor be formally assigned in writing to each young engineer entering the organisation. This appointment should initially be on a trial basis (3 months) before becoming permanent. This will allow for and incompatibility between mentor and mentee to be eliminated. If there is incompatibility, the mentor-mentee combination should be changed and finalised within the 3 month trial period.
- Mentorship should be incentivised. The data reflected that appointed engineers expressed desire to be mentors on the basis of intrinsic reward indicating a level of self-motivation. They (appointed engineers) also indicated that extrinsic reward would be welcomed. It is proposed that mentorship be built into the engineers' existing performance appraisal contract (5-10% contributor), and a KPI be assigned to it linking the mentor with his mentees performance and development.

3.3.4 Measure of Preparedness to make Engineering Decisions

- Low levels of confidence in terms of decisions that could affect production and turnover as well as safety, were observed from the collected data.
- Low level of familiarity with engineering codes (BS, EN, ISO, ASME etc.) and internal company procedures was reflected in the collected data.
- The above two aspects are linked. Increased focus on relevant codes and standards ensures that engineers will learn to base decisions on internationally accepted standards thus ensuring that decisions are firmly justified.
- Engineers should be taught their place in terms of production versus making the technically and ethically correct decision. Teach engineers where and how to draw the

line (based on recognised codes and standards). Develop a support structure from engineering management team that encourages discussion around a topic before decisions are made. Focus on teaching young engineers how to justify production losses or risks with technical data and documentation (internal procedures and standards as well as international design codes).

- A comprehensive list of the internal and external codes, standards and legislation relevant to a young engineer, relevant for his assigned department or intended future plant system must be provided to the young engineer within the first week of him joining the organisation, accompanied by a guide of references to where he relevant codes, standards and legislation can be found (eg. BS Online for BS EN design codes available on Eskom licence).

3.3.5 Psychological drivers for retention in generation-Y engineers

The following was derived from the nature of the responses received from generation-Y (born 1980 to 2000) engineers:

- Respectfully challenging or questioning instructions from superiors in an effort to account for as many aspects of a given situation as possible should be accepted and encouraged.
- Career development and growth held higher priority than monetary reward or promotion as a driver for retention was reflected in collected data therefore the organisation should invest and place more emphasis in the career development of their young engineers
- Experimental data showed that potential for future opportunities for career growth had significant influence in the decision to stay in a given organisation or position, hence career development should be focused on as discussed previously.
- Maintaining a work-life balance had significant influence on turnover intention. The organisation needs to accept and work with the fact that generation-Y engineers value work-life balance. The young engineers of generation-Y are demotivated by being forced to work excessive over-time hours unnecessarily which in turn increases their desire to leave the organisation if this is occurring. The organisation should focus on using employees for their qualified function.
- Salary and wage level was seen as an important contributor to the desire to remain in a given organisation or position. The organisation should maintain a competitive market related salary offering.
- Trainee young engineers indicated higher levels of fear of losing their jobs when faced with decisions that require trade-off between engineering good practice/ethics and production/managements opinion than appointed engineers whose response followed more of a

normal distribution than a bias toward either positive or negative. For both trainees and appointed engineers, negative bias indicated that fear was not seen as a good driver for productivity for the majority of respondents. The organisation should not attempt to use fear to drive productivity. It is counter-productive in that for many it is seen as a sign of poor leadership and it decreases levels of confidence with regard to decision making. It induces increased pressure in a decision making situation which can negatively affect the decision making process. It induces reluctance toward decision making which can be time consuming and costly to the organisation.

- The majority of respondents from both groups (trainees and appointed engineers) believed that the work place should not be a strictly controlled formal environment where discussion is minimised. A strong positive bias for both groups showed that they believed that open dialogue with colleagues and seniors was a necessary tool to improve productivity. It can be observed that generation-Y is a generation highly accustomed to discussion regarding issues. This should be encouraged to foster an environment of open discussion where ideas can be shared as opposed to an environment wherein one is afraid of being wrong, and therefore keeps his ideas only to himself.

4. References

Mini-dissertation "A Management Framework for Accelerated Development and Retention of Young Engineers: Eskom as a Case Study," by Neolen Pillay in partial fulfilment of the requirements for the degree Master of Engineering in Development and Management at the Potchefstroom Campus of the North-West University.

Appendix C2: Validation assessment matrix

Validation Assessment Matrix

The matrix herein assesses the validity of the following document:

Management Framework for Accelerated Development and Retention of Young Engineers
by Neolen Pillay

The score is to be assigned as follows:

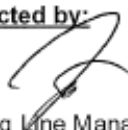
- 5 - Excellent (No room for improvement)
- 4 - Good (Objective achieved, but there exists minor room for improvement)
- 3 - Acceptable/Average (Objective achieved, but there exists major room for improvement)
- 2 - Fair (Objective barely achieved, not acceptable)
- 1 - Poor (Objective not achieved at all)

Scores of numerical value ranging from zero (0) to five (5) to a maximum of one decimal place are to be used. This scoring system was based on the system used in Eskom STAR gradings thus an average score of 3.0 or higher was deemed necessary for successful validation of the management framework.

Rate the extent to which the proposed management framework achieves the following:	Score
1. Suggests a means to improve and accelerate young engineer development	4.5
2. Suggests ways to improve young engineer retention	3.5/5
3. Suggests a means for optimising the existing engineer training program	4/5
4. Is feasible to implement in Eskom	3.8/5
5. Provides suggestions that are well supported or justified by experimental data	4.15
Total (To be completed by requestor) :	/25
Total Average: (To be completed by requestor):	/5

Assessment conducted by:

Signature:



Date: 13/10/2015.

Position: Engineering Line Manager, Grootvei Power Station, Eskom Holdings SOC LTD